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Governor Doug Burgum

December 13, 2023

Mr. Michael L. Connor, Assistant Secretary of the Army
Headquarters, U.S. Army Corps of Engineers
441 G. Street NW
Washington, DC 20314-1000

RE: USACE Draft Environmental Impact Statement on the Dakota Access Pipeline

Dear Assistant Secretary Connor,

The State of North Dakota submits the enclosed comments regarding the U.S. Army Corps of Engineers' Draft Environmental Impact Statement, conveying our support for reinstating the easement that will allow the Dakota Access Pipeline to continue to operate safely 93 feet below the bottom of Lake Oahe. We urge the Corps to follow the law, facts, science and common sense and put an end to this prolonged, unnecessary and highly politicized process.

DAPL is an essential part of North Dakota's and the nation's energy infrastructure. It plays a pivotal role in ensuring energy security and affordability for the entire nation while providing enormous positive economic impact that touches every North Dakota citizen.

The enclosed document represents the collective outcome of extensive efforts spanning over three months, involving the collaboration of more than 10 executive branch agencies and five independently elected statewide officials. These submitted comments reaffirm that the safest, most efficient and most environmentally friendly means of transporting all liquids is by pipeline – especially when that pipeline is already in place and has been operating safely for over six years. Of the more than 18,000 pipeline water crossings in the United States, it is absurd that the Corps continues to fixate on one of the most modern crossings in the country.

Therefore, the State of North Dakota urges the Corps to stick to the facts, do the right thing for national security, and select the continued operation of DAPL at its current location as the only proper and reasonable alternative.'

Regards,

Doug Burgum
Governor

600 East Boulevard Avenue | Bismarck, ND 58505-0001 | 701.328.2200 | governor.ND.gov

cc:
The Honorable John H. Hoeven, U.S. Senator for North Dakota
The Honorable Kevin J. Cramer, U.S. Senator for North Dakota
The Honorable Kelly M. Armstrong, U.S. Representative for North Dakota
The Honorable Doug Goehring, ND Agriculture Commissioner
The Honorable Drew Wrigley, ND Attorney General
The Honorable Julie Fedorchak, ND Public Service Commissioner
The Honorable Randy Christmann, ND Public Service Commissioner
The Honorable Sheri Haugen-Hoffart, ND Public Service Commissioner
The Honorable Kirsten Baesler, ND Superintendent of Public Instruction
The Honorable Dennis E. Johnson, Speaker of the ND State House of Representatives
The Honorable Michael Lefor, ND House Majority Leader
The Honorable Zachary Ista, ND House Minority Leader
The Honorable Donald G. Schaible, Senate President Pro Tempore
The Honorable David J. Hogue, ND Senate Majority Leader
The Honorable Kathy L. Hogan, ND Senate Minority Leader
General Scott Spellmon, Chief of Engineers, U.S. Army Corps of Engineers
Colonel Robert J. Newbauer, Commander, U.S. Army Corps of Engineers, Omaha District
Brent J. Cossette, DAPL EIS Project Manager, U.S. Army Corps of Engineers, Omaha District

December 13, 2023

State of North Dakota Comments Concerning Draft Dakota Access Pipeline (DAPL) Environmental Impact Statement (EIS) dated September 2023

North Dakota submits the following comments to the U.S. Army Corps of Engineers' (the "Corps" or "USACE") Draft Environmental Impact Statement ("DEIS") addressing Dakota Access, LLC's request for an easement allowing the Dakota Access Pipeline ("DAPL") to cross under Corps-managed federal land at Lake Oahe.

The Corps made the DEIS available for public review and comment on September 8, 2023 and is accepting comments through December 13, 2023. The State and its expert agencies reviewed the DEIS and prepared these comments for the Corps' consideration as it contemplates its final action on the DEIS. The State has also provided declarations in support of its comments as Attachments A, B, C, D, E, F, G, H, I, J, L, and O.

North Dakota recommends the Corps selects Alternative 3, grants the federal easement across Lake Oahe, and keeps DAPL fully operational. The safest, most environmentally friendly, most efficient, most effective, and most reliable method of transporting crude oil from North Dakota to out-of-state refining facilities is through the existing pipeline infrastructure that has operated under Lake Oahe without incident for more than six years, and maintaining this effective status quo is therefore the optimal path forward.

DAPL transports over 50% of the crude oil produced in North Dakota. Any reduction in available pipeline capacity will increase risk and the cost of transporting North Dakota crude oil to refining facilities. Any increase in the transportation cost of crude oil lowers the basis of the North Dakota tax and correspondingly lowers the amount of tax revenues available to the State to serve its citizens.

North Dakota crude oil plays a central role in the nation's energy independence, and in the face of rising inflation and gas prices, every viable option is needed to safely and efficiently generate and transport energy that citizens can afford. North Dakota accounted for 8.9% of the crude oil produced in the U.S. during calendar year 2022. Over half of North Dakota's crude oil production is transported to coastal markets via DAPL where it competes with other domestic and international crude oil.

DAPL serves as the only cost-effective method to ship most North Dakota crude oil to markets that were not available to the North Dakota oil industry before DAPL—markets that subsequently would be lost to North Dakota oil and gas producers in the event DAPL is shut down.

Shutting down DAPL, as proposed in Alternatives 1, 2, and 5, would cost the State of North Dakota $1.2 billion in the first year and $116 million annually thereafter. It would cost North Dakota taxpayers an estimated $375 million annually in direct oil tax revenue, $23 million in interest costs to the Bank of North Dakota, $30 million annually in Trust Lands revenue, $102 million in losses annually to the Legacy Fund, and $3 million losses in profits by the ND State Mill.

Additionally, the estimated regional economic impact would be over $1.6 billion annually in increased costs of production and loss of production. Shutting down DAPL would result in an estimated immediate loss of 600 to 750 full-time jobs. Due to consequent disruption in long-term oil drilling, production, and transportation, closing down DAPL would mean the permanent loss of an estimated 2,000 to 3,000 North Dakota jobs.

The resulting substantial increase in roadway transport of oil would depreciate North Dakota's highway system by approximately $46 million per year. Due to the resulting lack of rail transport for agricultural commodities, North Dakota grain producers could lose up to $285 million, with the average annual loss per farming operation of approximately $7,600. Throughout the Midwest, a transportation shift from DAPL to rail would result in over $3 billion in estimated annual losses to the Midwest agricultural sector.

Moreover, closing down DAPL, and the subsequent construction of a new pipeline, would cause unnecessary soil damage, create circumstances in which noxious weeds would thrive, and result in exorbitant land reclamation costs along the new pipeline corridor. Closing down DAPL would result in an increase in air emissions, negatively impact State water resources, and result in significantly greater environmental, public health, and safety risks. It would cause North Dakota unnecessary and irreparable harm.

Shutting down DAPL, either temporarily or permanently, is not in the national interest. Rather, continued safe, sustained DAPL operations is in the national interest. Shutting down DAPL would negatively impact, to some degree, national energy security, national economic security, and national food security.

Consequently, North Dakota supports the selection of Alternative 3 in the final EIS. Alternative 3 would maintain the status quo by allowing authorization of the requested easement with the same conditions as the previously granted easement for crossing under Lake Oahe and the continued operation of DAPL. Selecting Alternative 3 is the correct action, would safely maintain the amount of oil that is transported in DAPL, and it is fully supported by the thorough EIS process conducted by the Corps and the comprehensive administrative record developed throughout the process.

Alternative 3 is further supported by the thorough original siting of DAPL by the North Dakota Public Service Commission ("NDPSC" or "Commission") during an exhaustive 18-month public and multi-stakeholder review process, and the subsequent and current operation of DAPL at that crossing with no environmental incidents.

Compared to all possible options, allowing DAPL to continue operating in its present location will minimize the risks to water quality in the State, reduce the safety risks to North Dakota's citizenry, and be more beneficial from an environmental and socioeconomic perspective. Alternatives 3 and 4 have significant positive impacts on the State, including increasing economic prosperity, reducing environmental pollution and the risk of spills or leaks from the gas and oil industry into North Dakota's water resources, and reducing risk of death and bodily injury to North Dakota's residents.

Alternatives 1, 2, and 5 (involving combinations of shutting down and/or re-routing DAPL) are not acceptable as these alternatives would cause significant negative environmental, socioeconomic, and safety impacts to the State of North Dakota and its citizens. As such, the State recommends the Corps approve Alternative 3. While Alternative 4 is not North Dakota's preferred Alternative, it potentially may nonetheless be acceptable; however, only if the corresponding additional regulatory oversight is not unnecessarily burdensome, and the underlying reasons for the additional regulations and requirements are wholly based upon sound engineering principles and practices.

I. The current DAPL route is best for public health and safety, the environment, and the economy of North Dakota, and USACE should select Alternative 3 to maintain the status quo.

One of the most compelling reasons for approving Alternative 3 is that DAPL has operated under Lake Oahe for over six years without environmental incident in the State of North Dakota. Unlike a typical EIS that occurs before a project is constructed, the impacts and safety record of Alternative 3 are already established and persuasively support its selection over Alternatives 1, 2, and 5 which are not acceptable because they would cause significant negative environmental, socioeconomic, and safety impacts to the State of North Dakota and its citizens. Moreover, the NDPSC evaluated the current route and found it to be superior to the alternatives.

A. North Dakota Public Service Commission evaluated alternatives and determined the current route is best.

North Dakota's interests in the DEIS are substantial and encompass both its sovereign and economic interests. The NDPSC was the primary permitting authority for DAPL in North Dakota and has exclusive jurisdiction over siting crude oil pipelines within the State's borders. The Commission, a State constitutional agency, is statutorily charged with the siting of energy transmission facilities under the North Dakota Siting Act, Chapter 49-22 and 49-22.1 of the North Dakota Century Code ("Siting Act").

The Commission's role under the Siting Act is to ensure that the location, construction, and operation of transmission facilities like DAPL will cause minimal adverse effects on the environment and the welfare of the citizens of North Dakota. No transmission facility can be located, constructed, and operated in North Dakota without a certificate of site compatibility or a route permit issued by the Commission based on an extensive public review process.[1] *See* Attachment A, Declaration of Julie Fedorchak, NDPSC Commissioner (Dec. 11, 2023), ¶ 2. And any alternative considered by the Corps that would result in rerouting the pipeline in a manner that conflicts with the State's determination would be an infringement on its sovereign authority.

The Commission's permitting process for DAPL spanned 18 months and included extensive evaluations of alternative routes across the state as well as alternative transportation technologies. This review was conducted transparently and publicly and included participation

[1] While the Corps issued a permit and an easement for the 1.73 miles of pipeline crossing under Lake Oahe, it was the NDPSC that issued permits for 358 miles of the remaining 1,172 miles of underground pipeline that passes through North Dakota.

by and input from a wide and diverse group of stakeholders. From the initial filing of the application and through the construction process (including any post-construction restoration or remediation), the Commission has had jurisdiction over DAPL for over eight years. Fedorchak ¶¶ 4, 9.

In December 2014, Dakota Access, LLC ("Dakota Access") filed applications for a certificate of corridor compatibility and a route permit concerning approximately 358 miles of 12-, 20-, 24-, and 30-inch diameter crude oil pipeline and associated facilities within the State proposed to carry half a million barrels of North Dakota oil per day. NDPSC scheduled three public hearings in May and June of 2015. The three public hearings were held as scheduled, and hundreds of interested persons participated, including numerous State and federal agencies and intervening parties (which included several public interest non-governmental organizations). Everyone who wished to testify was allowed to do so with no time restrictions. More than 30 hours of testimony was received during the public hearings. Fedorchak ¶¶ 5-8.

The Commission heard and evaluated expert and citizen testimony regarding the environmental, health, recreation, soil, water, wildlife, and cultural and historic preservation consequences of DAPL. The Commission evaluated the Lake Oahe crossing under the Missouri River and other possible alternative routes through the state. Among the alternatives, the Commission considered the use of third-party infrastructure, other methods of transporting oil, including trucking and rail, and alternative routes of operation. Fedorchak ¶ 9.

The Commission issued its Order Granting Dakota Access its Certificate of Corridor Compatibility and Route Permit ("Certificate Order") on January 20, 2016, pursuant to the Siting Act. In reaching its decision, the Commission considered: (1) whether the location, construction, and operation of the proposed facilities produce minimal adverse effects on the environment and upon the welfare of the citizens of North Dakota; (2) whether the proposed facilities were compatible with environmental preservation and the efficient use of resources; and (3) whether the proposed facility locations minimized adverse human and environmental impact while ensuring continuing system reliability and integrity and ensuring that energy needs are met and fulfilled in an orderly and timely fashion. Fedorchak ¶ 7.

With respect to the chosen Lake Oahe crossing, the Commission heavily evaluated the route and considered its location relative to existing utility lines and pipelines. To minimize disruptive construction and enhance efficient operation, the approved route was based upon the opportunity to locate DAPL in proximity to existing infrastructure, minimize safety concerns, avoid environmentally sensitive areas, avoid indigenous and federally owned lands and other high consequence areas as defined by the federal Pipeline and Hazardous Materials Safety Administration ("PHMSA") and state law.

Paralleling DAPL with existing utility lines and pipelines throughout the route, including in an existing crossing under the Missouri River, minimized the amount of ground and area that would be newly disturbed, thereby reducing the risk of disturbing sites of historic and cultural significance or causing adverse environmental impacts. Other major points of discussion on the crossing were the depth of the crossing 64 feet below the reservoir bottom, the location of automatic block valves, worst-case spill scenarios and emergency response plans including the staging of equipment near the river crossing, and the Corps' evaluation of the preferred southern route. The final route also avoided the Standing Rock Sioux Tribe's reservation. Fedorchak ¶ 10.

The Commission found that the location, construction, and operation of DAPL would best minimize adverse human and environmental impacts and that the proposed route was suitable because it followed the route of existing utility lines and pipelines, thus minimizing the amount of ground that would be newly disturbed. Fedorchak ¶ 11. The Commission docket reflecting this extensive process is highly relevant to the DEIS, and the State hereby incorporates the contents of the entire docket, Case No. PU-14-842, by reference into this comment letter and the administrative record for this matter.[2]

On June 20, 2019, Dakota Access filed an application to optimize and upgrade DAPL ("Optimization") by installing a new pump station in Emmons County to meet a need for additional transportation capacity beyond the initial application for 500,000 barrels per day. The Optimization added a new pump station to allow transportation of up to 1,100,000 barrels per day. The Commission issued a notice of public hearing, and the Standing Rock Sioux Tribe requested that the Commission hold a hearing on the Optimization. The Commission issued a Notice of Hearing, and the Standing Rock Sioux Tribe formally intervened in the proceeding. Fedorchak ¶¶ 14-16.

On November 15, 2019, the Commission held a hearing on the Optimization lasting over 13 hours with testimony and public comment. Much of the hearing concerned measures to mitigate impacts, leak detection, safety, emergency response training, and response plans that would be implemented by DAPL to ensure that the operations meet or exceed industry standards or requirements set forth by PHMSA.

On February 19, 2020, having allowed all interested persons an opportunity to be heard and having heard, reviewed, and considered all testimony and evidence presented during the State's additional siting evaluation, the Commission issued its Third Amended Certificate of Corridor Compatibility and Third Amended Route Permit approving the construction, operation, and maintenance of the pump station. Fedorchak ¶ 18.

Based upon the evidence and comments provided by numerous agencies, intervening parties, and the interested public, the Commission determined that there would be minimal adverse effects from the location, construction, and operation with the Optimization. The Corps was notified about the project and was allowed to confer with the State and the Commission on the Optimization of DAPL. Fedorchak ¶ 18.

Cumulatively, the Commission held four public hearings on DAPL with an opportunity for full participation by intervenors, state and federal agencies, and the public. The Commission provided multiple additional opportunities for public hearings which received no requests to be heard. Pursuant to North Dakota's Administrative Practices Act, N.D. Cent. Code. § 28-32-01,

[2] The complete Public Service Commission docket for Case # PU-14-842 is available here: https://www.psc.nd.gov/database/docket_view_list.php?s_dept=PU&s_year_case=14&s_seq_num=842&s_company_name=Dakota+Access%2C+LLC&docket_viewPage=1

the Commission's initial and Amended Certificates of Corridor Compatibility and Route Permits were subject to judicial review if, among other things, any order was not issued in accordance with law; did not afford a fair hearing; was not supported by the evidence and findings; or did not sufficiently address the evidence presented by a party. Tellingly, none of the Commission's Certificates of Corridor Compatibility or Route Permits relating to DAPL have been judicially challenged. Fedorchak ¶ 19.

The Commission's decisions have also been affirmed by subsequent events. DAPL has operated under the Commission's jurisdiction for over six years and, in that time, has transported more than half a billion barrels of oil without incident or violation within the State of North Dakota. This is due in no small part to the stringent safety standards applied to pipeline operations that exceed legal standards and standards applied to other pipelines.

DAPL is constructed with numerous layers of safety protections and implements multiple redundant safety measures. For example, DAPL has main line valves that can quickly stop flow in an emergency. These valves are automatic or remote-controlled and can be controlled manually if needed on both sides of the Lake Oahe crossing. DAPL operators perform real-time 24/7/365 monitoring by a sophisticated computerized leak detection system. Attachment B, Declaration of Doug Goehring, Agriculture Commissioner (Dec. 6, 2023), ¶ 10.

In addition to the Commission's evaluation, the Corps' evaluation documented in its 2016 Environmental Assessment ("2016 EA") corroborated the current route as the superior route. The 2016 EA evaluated an alternative crossing north of Bismarck against DAPL's current route crossing at Lake Oahe. The results revealed the current DAPL route to be preferred in nearly every aspect. The current route and crossing results in a 10.6% reduction in mileage, a 38% increase in corridor collocation with other infrastructure, and cumulatively less impact in nearly every other assessment factor including waterbodies, floodplains, agriculture, and transportation crossings.

The State Historical Society of North Dakota and the State Historic Preservation Office ("NDSHPO") provided expertise and input into both the NDPSC permitting process and the 2016 EA. The NDSHPO recommended surveys, reviewed survey reports, recommended testing of potentially impacted sites, highlighted mitigation of significant sites that could not be avoided, and reviewed all testing and mitigation reports. One hundred percent of the pipeline corridor was surveyed. The current pipeline route was moved 140 times to avoid impacting these resources, and over 500 identified cultural resources were addressed through reroutes, mitigation, or other measures. The NDSHPO approved the current pipeline route after extensively reviewing all submitted documents and findings of three cultural resource consulting firms. *See* Attachment C, Declaration of William Peterson, North Dakota State Historic Preservation Officer (Dec. 12, 2023), ¶¶ 3-4.

The North Dakota Department of Environmental Quality ("NDDEQ") coordinated with the Department of Water Resources on pipeline crossing of sovereign lands to provide the maximum amount of protection and efficiency of regulation. NDDEQ also worked with multiple outside agencies, the Corps, and the applicant to ensure waters of the state were protected through the permitting and certification process.

The extensive and comprehensive environmental and safety analyses performed by the State are directly relevant to the EIS process now underway. The federal Council on Environmental Quality ("CEQ") regulations implementing NEPA require the Corps to consider these prior environmental analyses and address any inconsistencies between them in any decision the Corps may make. Specifically, the Corps must "discuss any inconsistency of a proposed action with any approved State, Tribal, or local plan or law," and "[w]here an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law." 40 C.F.R. § 1506.2(d).

Relatedly, the "environmental consequences" section of the DEIS must discuss any "[p]ossible conflicts between the proposed action and the objectives of Federal, regional, State, Tribal, and local land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(a)(5). Failure to adequately consider and address any such conflicts can render the approval of an environmental impact statement "arbitrary and capricious and in violation of NEPA." *Openlands v. Dep't of Transp.*, 124 F. Supp. 3d 796, 810 (N.D. Ill. 2015) (finding the agency's failure to acknowledge that population growth resulting from a project conflicted with local governments' long-range plans violated NEPA).

Shutting DAPL down and/or re-routing it under Alternatives 1, 2, and 5 would each conflict with the prior analyses and conclusions of the NDPSC and the State's judgment as to what is best for its own citizens and environmental quality; it would infringe upon the State's sovereign authority over the siting of pipelines within its borders; and it would conflict with the Corps' own determination in the 2016 EA.

The DEIS does not adequately acknowledge the conflicts posed by these alternatives, much less offer an explanation of how the Corps would attempt to reconcile those conflicts. The Corps must thoroughly consider and adequately address the conflicts between Alternatives 1, 2, and 5 and the State's and the Corps' own conclusions regarding the proper site and operation of DAPL. The mere fact that these conflicts exist demonstrates that Alternatives 3 and 4 are the optimal courses of action in the DEIS.

B. The State of North Dakota and the United States rely on the safe and efficient transport of North Dakota oil by DAPL.

North Dakota

North Dakota is a small state in terms of both population (47th out of 50 states, 2022 population estimates, U.S. Census Bureau) and economic output (45th out of 50 states, calendar year 2021, Gross Domestic Product by State, Bureau of Economic Analysis) but ranks third out of the 50 states in terms of oil production (1.3 million barrels per day in Sept. 2023). North Dakota is highly dependent upon revenues from taxes on the extraction and production of oil and natural gas to fund government operations and essential services to the State's citizens. Continued oil production in North Dakota is dependent upon safe and reasonable methods of transporting crude oil produced in the State to out-of-state refining facilities.

The operation of DAPL has generated billions of dollars in revenues and other benefits annually for the State and has provided tens of thousands of jobs. Native American Tribes in North Dakota also rely upon DAPL to the ship oil they produce. For example, DAPL transports about 60% of oil production by the Mandan, Hidatsa, and Arikara Nation ("Three Affiliated Tribes"), the receipts of which comprise a substantial amount of their annual budgets. *See* Attachment D, Declaration of Susan Sisk, Director of the North Dakota Office of Management and Budget (Dec. 13, 2023), ¶ 5.

Over 10% of North Dakota's general fund revenues are derived directly from oil and gas taxes, and nearly 60% of the total of all tax and fee revenue received by the State comes from oil and gas extraction and production. Sisk ¶ 6. The 2023-25 biennium legislative forecast (March 2023) assumes general fund revenues, excluding oil and gas taxes, of approximately $4 billion. Total oil and gas tax revenues during that same time are expected to total $7.5 billion. *Id.* These revenues support programs from which all State residents benefit including education, healthcare, water resource management, law enforcement, roadways, libraries, veterans' services, public housing, parks and recreation, and other public services. Sisk ¶ 6.

In addition to oil and gas taxes contributing heavily to the State's general fund, the State also receives revenues from oil and gas production in other ways. For example, in the 2023-25 biennium, the North Dakota Department of Trust Lands ("NDDTL") will distribute nearly $500 million to support North Dakota K-12 public schools from revenues obtained from oil and gas and mineral leases on approximately 2.6 million acres of State lands. Over the last decade, NDDTL has distributed over $1.8 billion to help educate North Dakota school children, including children educated in public schools located within North Dakota Indian reservation. *See* Attachment E, Declaration of NDDTL Commissioner Joseph A. Heringer (Dec. 8, 2023), ¶ 7.

During the most recent legislative session, the legislature appropriated $2.38 billion in state aid to local schools over two years, of which $1.7 billion will come from the oil and gas tax-dependent general fund. Nearly $500 million in educational funding will also be provided by the Common Schools Trust Fund ("CSTF") administered by NDDTL from fees and royalties on oil and gas leases held by the State. Attachment F, Declaration of Kirsten Baesler, North Dakota Superintendent of Public Instruction (Dec. 8, 2023), ¶¶ 6-8; Heringer ¶¶ 6-7.

Any disruption in oil and gas production, as would occur under Alternatives 1, 2, or 5, would reduce revenues to the general fund and the CSTF, thereby reducing funding available to provide instruction to public school students, weaken efforts to increase teacher pay and relieve teacher shortages, damage efforts to support students with special needs, and limit the ability of local schools to provide and maintain a bus transportation network for families that are not able to bring their students to school. Baesler ¶¶ 10-13. It will also shift the responsibility for supporting local schools away from the State, which now provides over 70% of local education expenditures, and onto local property taxpayers. Baesler ¶ 14.

The North Dakota Mill & Elevator Association ("NDM"), which is the only state-owned flour mill in the United States, is the largest single location of wheat flour production in North America and the eighth largest wheat milling company in the United States. It has revenues over

$500 million per year. NDM is legislatively mandated to transfer 5% of its yearly profits to the Agricultural Product Utilization Fund and 50% of the remaining yearly profits to the State of North Dakota General Fund. *See* Attachment G, Declaration of Vance Taylor, NDM President and Chief Executive Officer (Dec. 11, 2023), ¶ 5. As discussed below, these revenues would be greatly impacted by an increase in transportation costs if grain had to compete with oil for rail transportation.

United States

Shutting down DAPL would impact national security. Data from the U.S. Energy Information Administration ("EIA") indicates that U.S. crude oil exports to our allies are at record levels and are increasing. While liquid fuel demand bottomed out in 2020, the EIA forecasts that the balance of both global liquid fuels consumption and production will exceed 2019 levels by year end 2024. *See* Attachment H, Declaration of Director Lynn D. Helms, Director of the North Dakota Department of Mineral Resources (Dec. 12, 2023), at 4. Demand for North Dakota oil therefore will continue to increase. Fortunately, crude oil production is recovering from the COVID-19 pandemic and is projected to grow for the next 15 years. Specifically, North Dakota crude oil production is rapidly recovering with an average 3.2% per month increase from January 2023 to date to keep up with demand. Helms, at 2.

Data from EIA indicate that U.S. private storage and Strategic Petroleum Reserve crude oil stocks are at 5-year and 40-year low levels, respectively. DAPL constitutes the only pipeline link between North Dakota production and these critical national security destinations, providing an important resource to replenish reserves. Helms, at 4.

North Dakota accounted for 8.9% of the crude oil produced in the United States during calendar year 2022, but there is limited in-state capacity for refining. Consequently, continued oil production in North Dakota is dependent upon reasonable methods of transporting crude oil produced in the State to out-of-state refining facilities. Sisk ¶ 7. DAPL is the only cost-effective transportation method to get North Dakota crude oil to markets that did not exist before DAPL. Helms, at 4. If DAPL is shut down, the North Dakota oil currently available to meet global demand is likely to be displaced by oil from other global sources including nation states such as Venezuela or Saudi Arabia.

II. Alternatives 1, 2, and 5 would have significant adverse socioeconomic impacts in North Dakota—the DEIS does not fully reflect them.

Shutting DAPL down and/or re-routing it under Alternatives 1, 2, and 5 are not acceptable because they would cause significant negative environmental, socioeconomic, and safety impacts to the State of North Dakota and its citizens, which are unreasonable outcomes given that DAPL has operated for over six years at its current crossing (Alternative 3) without incident and with substantial benefits to the State and its citizens.

The DEIS acknowledges that shutting down DAPL would cause North Dakota to lose tax revenues and suffer economic consequences, but it does not give due consideration to the magnitude and significance of those harms. The DEIS narrowly limits its substantive analysis of the adverse socioeconomic effects of Alternatives 1, 2, and 5 to direct job loss/creation and decreases in State tax revenues, and there is minimal discussion of the wide-reaching additional indirect effects on North Dakota's oil production, transportation, and agriculture industries.

The DEIS must fully recognize and detail that the harms resulting from Alternatives 1, 2, or 5 would cause significant negative socioeconomic impacts to the State of North Dakota, Tribes in North Dakota, and North Dakota citizens.

A. North Dakota and Tribes in North Dakota would lose significant tax revenue under Alternatives 1, 2, or 5.

North Dakota has substantial economic and environmental interests in the continued operation of DAPL through the currently approved route. As discussed above, North Dakota depends heavily on revenues from taxes on the extraction and production of oil and natural gas to fund government operations and provide essential services to its citizens. North Dakota's revenues derived from oil and gas production rely on the operation of DAPL, and any change to the current route, including the Lake Oahe crossing, would be extremely detrimental to North Dakota.

State Revenues

Over 50% of North Dakota's crude oil production flows through DAPL. The oil and gas tax revenues collected by the State depend in part on the cost of transporting the oil. This is because oil and gas severance taxes in North Dakota are calculated under a formula that subtracts transportation costs from revenue. N.D. Cent. Code. § 57-51-02.3. As a result, any increase in the cost to transport oil results in a decrease of revenue to the State. Sisk ¶ 8.

Due to North Dakota's geographic location with significant distance to crude oil refining facilities, a certain level of "discount" from the West Texas Intermediate crude oil benchmark price is expected to allow for the transportation cost that is deducted before the North Dakota tax is calculated. For the 12-month period prior to the operation of DAPL (June 2016 through May 2017) when crude was transported by rail and truck, the transportation discount averaged $7.15 per barrel. For the 12-month period after DAPL began operations (June 2017 to May 2018), the transportation discount averaged $4.75 per barrel, a reduction of $2.40, or 34%, due to DAPL's lower transport cost. Sisk ¶ 9.

Closing DAPL or otherwise changing the already properly sited route of DAPL will result in the loss of the tax revenue gained through DAPL's efficient operations because the increased costs of the non-pipeline transportation alternatives will reduce the revenue subject to taxes. North Dakota has revised its revenue impact calculations, and these figures should be updated in the final EIS.

Current projections for the State of North Dakota assume oil production will average 1.3 million barrels per day through June 30, 2025, the end of the current two-year budget period. Sisk ¶ 10. The closure of DAPL would reduce state revenues for the first 12 months by approximately $1.2 billion assuming an approximate decrease in oil production of 50% for three months then gradually ramping up from DAPL to rail, until production is back to **1.3 million barrels per day** over nine months, and an increase in transportation costs of **$2.40 per barrel**. This also assumes an average projected North Dakota price of **$85.50** (EIA outlook) less North Dakota transportation costs.[3] Sisk ¶ 11.

After the first year, the estimated decrease in revenue resulting from increased transportation costs is conservatively estimated to be $2.40/barrel, which is $113.9 million per year until DAPL is up and running again. Over a four-year period, using these assumptions, the estimated reduction to the State would be $1.5 billion. Using these assumptions over a 10-year period, the estimated reduction to revenue for the State of North Dakota is $2.2 billion, which equates to 13% of the current biennium on-going appropriation. This would be a substantial negative financial hit to the State of North Dakota and would adversely impact virtually every industry and citizen. Sisk ¶ 12.

These estimates are conservative as oil prices are likely to go higher considering recent world events, and they assume that rail can be ramped up to handle the additional capacity over a 12-month period. At the time DAPL opened in 2017, rail capacity in North Dakota had grown to accommodate the increase in production. Since then, rail capacity has transitioned largely to agriculture. It would likely take several months or more for rail capacity available for oil transportation to be restored, which could significantly increase the transportation discount during that period. Sisk ¶ 14.

Another factor that could further decrease tax revenues to the State if DAPL is closed relates to oil production contracts in North Dakota. Much of the crude oil that is transported through DAPL is subject to binding contracts committing that production to being transported through DAPL and no other means of transportation. If this occurs, the loss of tax revenue to the State would be much higher. Sisk ¶ 15; Helms, at 6.

Bank of North Dakota

The Bank of North Dakota ("BND") is the only bank owned by a state in America. BND was incorporated in 1919 with the mission of delivering quality, sound financial services that promote agriculture, commerce, and industry in North Dakota. BND serves as the financial repository for state funds, and this funding forms the basis of BND's investment and loan portfolio. Today, BND's $5.6 billion loan portfolio represents North Dakota taxpayer dollars and public funds supporting business, agriculture, and students in North Dakota. *See* Attachment I, Declaration of Todd Steinwand, President and CEO of BND (Nov. 30, 2023), ¶ 4.

In 2022, BND studied the economic impact of BND on the State's economy. The study found that, in 2022, BND supported over 16,000 jobs and $2.48 billion of North Dakota's GDP. BND also supported over $1.5 billion in personal income to North Dakota residents. In addition to supporting the State's economy, BND supports the State's general fund and other legislatively directed programs through appropriation of its earnings by the legislature. Since its founding in

[3] These figures and assumptions stated in this paragraph will be utilized throughout this section for projecting financial impacts of shutting down DAPL.

1919, the State has used over $1 billion in dividends from BND to support priorities of the State. Steinwand ¶ 6-7.

Based on the figures above relating to transportation costs, barrel price, and production, if DAPL is shut down, BND estimates its June 2025 ending deposits would be reduced from $8,039,000,000 to $7,616,000,000, a reduction of deposits to BND by $423 million. Based on the reduced deposits, BND would be required to replace these deposits through borrowings with an estimated interest rate of 5.5%. Due to loss of liquidity, an additional interest cost of $23,265,000 would be incurred by BND. Steinwand ¶ 9.

North Dakota Trust Lands

In 1889, Congress granted to North Dakota approximately 3.2 million acres of land and minerals to be used for the support and maintenance of common schools, colleges, universities, and other public institutions. NDDTL currently manages approximately 2.6 million mineral acres, with approximately 8,400 associated oil and gas leases, and over 700,000 surface acres, with approximately 8,400 associated agricultural leases. Heringer ¶¶ 4, 6.

Revenues generated from these leases, along with funds received from other revenue sources such as oil and gas lease bonus payments and easements granted for uses such as pipelines, roads, and well pads, are deposited into 13 permanent trust funds ("Trusts") and two special funds (collectively, together with the Trusts, the "Funds") and invested to promote the permanency of distributions sufficient to support and maintain public institutions as beneficiaries of the Funds. Heringer, ¶ 6.

In the 2023-25 biennium, NDDTL will distribute $528 million from these trusts to benefit public institutions, nearly $500 million of which will come from the CSTF to support North Dakota K-12 public education. Over the last decade, NDDTL has distributed more than $1.8 billion from the CSTF to help educate North Dakota school children. This includes children educated in public schools located within North Dakota Indian reservations. Heringer ¶ 7.

NDDTL reviewed potential impacts of a DAPL disruption or shutdown resulting from Alternatives 1, 2, or 5 and found that, based on the figures above relating to production, barrel price, and resulting market price differential, a disruption in DAPL would reduce NDDTL royalty revenues for the current biennium by approximately $171 million. Heringer ¶ 10. Using the same assumptions, the reduction in royalty revenue to the Funds over a four-year disruption period equals $211 million. For each year of disruption thereafter, royalty revenues would be reduced by an additional $13.6 million. Thus, a 10-year disruption period would reduce NNDTL royalties by $293 million and a 20-year disruption period would reduce NNDTL royalties by $430 million. This would cause a substantial reduction in future Fund distributions, the largest beneficiary of which is K-12 public schools in North Dakota. Heringer ¶ 11.

Pursuant to the fiduciary duties of the Board of University and School Lands ("Board") established by the 1889 Enabling Act and the North Dakota Constitution, revenue generated from the management of Board managed lands is prudently invested to generate further income for Fund beneficiaries. When accounting for lost investment growth opportunity (assumed annual 7% rate of return), the estimated reduction in royalty revenues caused under DEIS

Alternatives 1, 2, or 5 would cost the Funds a total of approximately $416 million if there is a 10-year DAPL disruption. Under a 20-year disruption scenario, the cost to the Funds balloons to $886 million due to the loss of compounded investment growth. Heringer ¶ 11.

North Dakota Investment Income

The North Dakota Retirement and Investment Office ("NDRIO") is an agency of the State of North Dakota created to capture administrative and investment cost savings in the management of two state programs–the retirement program of the Teachers' Fund for Retirement ("NDTFFR") overseen by the NDTFFR Board, and an investment program overseen by the State Investment Board ("NDSIB"). The NDSIB is responsible for setting policies and procedures guiding the investment of more than $19 billion in assets on behalf of 28 client funds. The largest of these client funds is the Legacy Fund. *See* Attachment J, Declaration of Janilyn Murtha, NDRIO Executive Director (Dec. 11, 2023), ¶ 2.

The North Dakota Legacy Fund was created in 2010 by constitutional amendment to provide that 30% of oil and gas gross production and oil extraction taxes on oil and gas production be transferred to the fund. The investment goal for the Legacy Fund is principal preservation while maximizing total return for an appropriate level of risk. At the end of each biennium, the Legacy Fund's accrued earnings are transferred to the State's general fund where they are used to finance a portion of State operations and projects as allocated by the legislature. Murtha ¶ 3-5.

Based upon the tax revenue assumptions discussed above relating to transportation costs, barrel price, and production, NDRIO has estimated that the closure of the DAPL is expected to create an accumulated loss of tax revenue to the Legacy Fund of approximately $303 million for a two year shutdown, a loss of tax revenue of approximately $362 million of a four year shutdown, and a loss of tax revenue of about $539 million for a 10-year shutdown. Murtha ¶ 7.

Using the same assumptions, NDRIO further estimates that the closure of the DAPL would have an estimated accumulated negative economic impact to the Legacy Fund investment return of about $12 million for a two-year shutdown, $57 million for a four-year shutdown, and $280 million for a ten-year shutdown. This estimate is based on a shutdown date of May 2024 with the economic impact of a shutdown being realized beginning in June 2024. Murtha ¶ 7.

A compound investment return of 6.3% is used which is based on the capital market assumptions and investment allocation relied on in the most recent Legacy Fund asset allocation study produced by RVK, Inc. (2023). The estimate assumes that the shutdown results in reduced production and transport of about 600,000 barrels a day of oil that will take time to recover as alternative transportation is secured. The lost revenues result from the reduction of production as well as lower selling price per barrel from a larger transportation cost estimated at $2.40 per barrel. Murtha ¶ 7.

Loss of tax revenue will result in lower Legacy Fund earnings which in turn will reduce the amount of earnings available for transfer to the general fund in future biennia for use in financing state operations and projects. Murtha ¶ 8.

North Dakota Mill & Elevator Association

As noted above, the North Dakota Mill & Elevator Association ("NDM") is a state-owned flour mill that generates over $500 million in yearly revenues, a portion of which is transferred to the Agricultural Product Utilization Fund ("APUF") and the General Fund. During the last fiscal year ending June 30, 2023, NDM earned $17.2 million in profits. In the past 53 fiscal years, NDM has transferred well over $150 million to APUF and the General Fund. Taylor, ¶ 5.

NDM ships approximately 80% of the milled products it produces by rail. In 2013 and 2014, before DAPL became operational, NDM experienced many rail service disruptions caused by rail traffic congestion between Fargo, ND and Chicago, IL due to large amounts of the Bakken region's crude oil outputs being shipped by railcar. As a result of these rail service disruptions, NDM had to slow down production and, in many cases (25-30 occasions), completely shut down flour production because of the increased transit times of its railcar fleet. The fleet cycle times increased 10% over normal conditions, which equated to an average of four days per round trip on each railcar. Taylor ¶¶ 6-7.

Based on NDM's assessment of similar impacts from a disruption or shutdown of DAPL, NDM determined that it would have to lease 96 additional railcars due to a 10% increase in cycle time caused by increased rail congestion. Leases for railcars are signed for five- to 10-year terms, and the annual cost to lease 96 additional railcars is estimated to be $1,113,840 based on current interest rates.

Increased rail cycle times may also cause NDM production shutdowns due to a lack of rail cars to ship NDM products. Taylor ¶ 8. The cost associated with plant shutdowns for NDM is estimated at $10,000 per lost production hour. Increased rail congestion would lead to increased freight rates on inbound durum and spring wheat railcars. This will add costs to NDM to bring in the durum and spring wheat needed to grind into flour products. Taylor ¶ 8.

Truck freight rates will increase due to increased demand for trucks. Slower rail services will require more products to be shipped by trucks, adding more demand and higher costs within the trucking industry. All these added costs and corresponding lost revenues incurred by NDM will decrease the amount of revenue to be transferred to APUF and the General Fund. NDM estimates additional costs of $2.5 million annually, thus reducing transfers to the State of North Dakota by $1,312,500 annually. Taylor ¶ 8.

Oil Industry Impacts

From an industry perspective, a shift back to transporting crude by rail and truck, and the resulting $2.40 per barrel increase in transportation costs, would cause direct revenue impacts to the oil extraction industry estimated at $1.14 billion annually based on the current production of 1.3 million barrels per day (bpd). For the EIA forecasted production in 2024, the estimated regional economic impact is estimated at $1.34 billion in 2023 dollars. For the 10-year period from 2024-2033, the estimated regional economic impact is estimated at $16.3 billion in 2023 dollars. For the 20-year period from 2024-2044, the estimated regional economic impact is $32.3 billion in 2023 dollars. *See* Attachment K, North Dakota State University Economic Impact Analysis ("NDSU").

It is also possible that ceasing DAPL operations could result in a reduction in production from current EIA forecasted levels due to transportation costs and capacity. To estimate the direct revenue impacts to the oil industry, the current production level of 1.3 million bpd was subtracted from the EIA annual forecasts. This difference represents the potential production that may not be realized. Under this scenario, in 2024, the estimated direct economic impact of reduced production relative to the EIA forecast is $4.95 billion. The regional economic impact of the reduced production in 2024 was estimated to be $5.3 billion in 2023 dollars. The 10-year regional economic impact was estimated at $76.3 billion, and the 20-year regional economic impact was estimated at $154.3 billion, both in 2023 dollars. NDSU, at 2.

MHA Oil and Gas Revenues

The economy of the Three Affiliated Tribes ("MHA Nation") is heavily dependent on oil and gas development, as over 60 percent of the oil resources produced on the Reservation is transported to market on DAPL. The MHA Nation generates significant tax and royalty revenues from this oil and gas activity, including royalty revenue for individual tribal members from three active drilling rigs, 2,659 active oil and gas wells, and 164 approved drilling permits. Daily production is 142,984 barrels of oil. Helms, at 6.

The DEIS must adequately account for the negative impacts on the MHA Nation of shifting oil transport to truck and rail in the event of a DAPL shutdown. Chairman Fox of the Three Affiliated Tribes previously prepared a declaration stating that revenue losses from shutting down DAPL would exceed $160 million in one year alone. *See* Attachment L, Declaration of Mark N. Fox, Chairman of the Mandan, Hidatsa & Arikara Nation, also known as the Three Affiliated Tribes, *Standing Rock Sioux Tribe v. U.S. Army Corps of Eng'rs,* No. 16-cv-1534 (D.D.C. April 19, 2021), ¶ 10. It also would lead to more fatalities on the reservation from increased truck and rail traffic. Fox ¶ 12 (explaining that after DAPL went online, traffic fatalities on the reservation went down by five per year). Chairman Fox's declaration underscores negative impacts Alternatives 1, 2 or 5 could have on the MHA Nation.

Revenues from Federal Lands

The United States Treasury would also incur revenue losses if there was an interruption in oil and gas production on federal lands. Information from the Natural Resources Revenue Data website indicates that, for the calendar year 2022, the aggregate oil royalty revenue paid to the United States Treasury from all federal lands situated in North Dakota, inclusive of Indian land, amounted to a sum exceeding $450 million.[4] A shutdown of DAPL would adversely affect this oil royalty figure by diminishing production volumes and imposing additional operational costs on producers. This reduction would lead to a decline in the overall financial contributions directed to the United States Treasury from oil and gas royalties. The indirect economic impact could extend beyond production constraints, influencing employment, infrastructure development, and regional economic stability.

[4] *See* https://revenuedata.doi.gov/downloads/federal-revenue-by-company/

B. North Dakota's economy would suffer job losses and decreased productivity under Alternatives 1, 2, or 5

In addition to severe tax-revenue shortfalls, ceasing DAPL operations under Alternatives 1, 2 or 5 would also result in unrecoverable losses of employment in the oil and gas and related industries in North Dakota. North Dakota provides herein revised information related to predicted job impacts from a DAPL shutdown, which should be incorporated int the DEIS. While the DEIS narrowly addresses direct job impacts, it must be revised to adequately reflect both direct and indirect statewide job impacts of a DAPL shutdown.

If DAPL is shut down, a number of oil and gas operators in North Dakota will likely reduce their planned drilling activities in North Dakota. Operators currently operate 37 drilling rigs that generate approximately 5,550 full time jobs. In previous years, when pipelines were full and crude oil had to be shipped by rail, operators reduced drilling activity approximately 15% and when DAPL began operations they increased drilling activity 20%. Shutting down DAPL is expected to result in the loss of at least four to five drilling rigs and the associated loss of 600 to 750 full-time jobs. Helms, at 7.

In addition, loss of those drilling rigs will result in seven to nine fewer new wells drilled per month and the associated loss of nine to 12 new full-time jobs per month. The job loss estimate was derived from a study done by the North Dakota Department of Mineral Resources in conjunction with North Dakota State University's Department of Agribusiness and Applied Economics, and the Vision West project. This study looked at the average number of jobs per drilling rig and producing well in North Dakota. Helms, at 7-8.

Shutting down DAPL would also cause extensive disruption in the long-term drilling, completion, production, and transportation sectors resulting in permanent job losses. This would mean the permanent loss of 2,000 to 3,000 full-time jobs. Helms, at 8.

Based on information available during the open season for DAPL, 75% to 90% of DAPL crude oil transportation is subject to binding contracts so it must be produced and transported in accordance with those commitments or be shut-in, meaning 550,000 to 600,000 barrels of oil per day will likely remain shut-in until economically viable alternate transportation can be secured. This would result in an estimated temporary job loss of 8,450 to 9,300 full-time jobs and a permanent loss of 1,700 to 2,200 full-time jobs. Helms, at 6.

Lower oil production from the shut-in of wells in North Dakota would have an immediate negative financial and operational impact on third-party oil gathering companies and local natural gas gathering, processing, and transmission providers. Natural gas from the Bakken formation cannot be produced independently if oil transportation options are constrained. Attracting the necessary infrastructure investments to expand natural gas capture in North Dakota would become increasingly difficult in the event DAPL ceases operations because third-party providers would face even greater uncertainty as to the ability of producers to keep wells operating.

For oil production, the DEIS acknowledges the "likely" shut-in of crude oil wells should DAPL be shut down under Alternatives 1 and 2, yet it fails to account for the likely reductions in planned future drilling activities and the accompanying job and tax revenue losses that would arise if DAPL is shut down even temporarily. The DEIS must evaluate and consider the existing jobs that would be eliminated and the resulting foregone jobs that would have been generated in connection with new wells.

These foreseeable effects should be incorporated in the DEIS' discussions of Alternatives 1, 2, and 5, and the Corps should address the comments and data demonstrating these effects. The DEIS must take into account these devastating consequences to North Dakota from the Alternatives that would stop the flow of oil through the pipeline. Even a temporary shutdown pending a reroute could have significant negative economic consequences for the State.

C. A Shift from DAPL to rail and truck would have severe negative impacts to the State and beyond.

If DAPL operations cease under Alternatives 1, 2, or 5, North Dakota oil will have to be transported out of the state by rail and truck. Rail and trucking are crude oil transportation methods that are less environmentally friendly, less safe, and more expensive than DAPL. If 50% of North Dakota's oil production must be transported by rail and truck, North Dakota's railways and roadways through our communities and rural areas will be subject to significant additional congestion, and this will result in greater environmental risks, more pollution, and a cascade of negative impacts to the oil and agriculture industries in North Dakota.

1. Environmental, Health, and Safety Impacts

Safety

A transition of crude oil transport from DAPL to rail and truck would result in increased risks of accidents from the trucks and railcars which would be used to transport crude oil if DAPL were unavailable. The DEIS observes that the number of traffic fatalities more than doubled between 2005 and 2012 in conjunction with the increase of oil transported by truck during the oil industry boom in North Dakota. DEIS, at 2-5. The DEIS also recognizes that truck transportation of hazardous liquids accounts for more than five times the fatalities per year as pipeline or rail transportation. *Id.*

As a percentage of material moved, pipelines are much less likely to experience an accident or fatalities. A 2013 study from the Manhattan Institute found road transportation to have an annual accident rate of 19.95 incidents per billion-ton miles and rail transportation had 2.08 incidents per billion-ton miles, compared to 0.89 incidents per billion-ton miles for natural gas transmission and 0.58 hazardous liquid pipelines. These incidents had corresponding fatality rates of 0.93 (road), 0.100 (rail), 0.004 (natural gas pipeline), and 0.003 (hazardous liquid pipeline) per billion-ton miles.[5]

The DEIS nonetheless suggests that rail and truck are feasible alternative means to transport oil in the event of a DAPL shutdown. While the DEIS recognizes some of the downsides of using

[5] David Biello, *Are Pipelines Safer than Railroads for Carrying Oil?,* Scientific American (July 10, 2013); Dianna Furchtgott-Roth, Manhattan Institute Police Research, No. 23 (June 2013).

these alternative methods, its analysis of the feasibility and impacts of rail and truck transport is inadequate and inaccurate. As required by NEPA, the EIS must include a complete assessment and recognition of the logistical, environmental, and safety impacts associated with these alternatives. *See*, *e.g.*, Jennifer Smith, *Where Are All the Truck Drivers? Shortage Adds to Delivery Delays*, Wall Street Journal, Nov. 3, 2021; *Truck Driver Shortage Analysis 2019*, American Trucking Association (July 2019) (Noting long-term shortage of long-haul transport drivers, estimating a loss of 50,000 drivers in 2019).

For example, while the DEIS concedes that there are "substantially higher" rates of accidents from railroad transportation of oil than pipeline transport, it fails to note that railroads have far less rigorous requirements for response plans than pipelines, specifically only having to plan for a spill of 15% of their largest rail load of oil. The draft also suggests that, based on human consequences, the incident rate of transportation by rail compares favorably to pipelines. DEIS, at 2-6. This sentence is flat wrong, particularly since, as the DEIS states, "[f]or oil transported by pipeline, an incident occurred approximately once every 720 million gallons of crude oil shipped; for rail, an incident occurred approximately once every 50 million gallons of crude oil shipped—a 14-fold difference." DEIS, at 2-6.

The State also disagrees with the Corps' decision to discuss rail and truck transportation as indirect effects of only Alternative 5. Since any alternative that would result in the shutdown of DAPL for any appreciable length of time will necessarily cause significant portions of the oil currently moving on DAPL to shift to rail or truck transport, any discussion of Alternatives 1 and 2 must also fully address the impacts of shifting capacity to rail and truck transport during the years DAPL would have to be shut down for re-routing.

The Corps should also clarify that the environmental impact of continued pipeline operation would be preferable to the environmental hazards which would inevitably result from the use of truck and rail during construction in Alternatives 1, 2, and 5.

Environment & Health

A shift in oil transport from DAPL to rail and truck will also necessarily result in greater air emissions resulting from an increase in trips by diesel locomotives and semi-trucks. Air emissions would include traditional criteria air pollutants with local and regional impacts, as well as greenhouse gas emissions with potentially broader impacts. Rail and truck transport of crude oil would also increase risks to waters and sensitive ecological systems from spills and human life from vehicle accidents and train derailments (including vulnerable and socially and economically disadvantaged populations).

A recent study confirmed that the greatest environmental damage from Bakken oil transport comes from locomotive emissions which have high NOx emissions. *See* Attachment M, Thomas R. Covert and Ryan Kellogg, *Environmental Consequences of Hydrocarbon Infrastructure Policy* (October 2023). The study further found that disrupting DAPL operations would result in greater local air pollution, particularly in local communities near railroad corridors, which raises environmental justice issues for those communities. *Id.*

Studies have also shown that pipelines generate less GHG emissions than rail on a per barrel basis. The University of Alberta compared the energy consumption in construction and operation for both rail and pipeline transportation methods. This research found that pipelines produced between 61% and 77% fewer greenhouse gas emissions than rail.[6] Another research project from Carnegie Mellon University and the University of Pittsburgh found that the air pollution and greenhouse gas costs of shipping crude by rail are nearly twice as large as those for oil pipelines. Further, their estimates of air pollution and greenhouse gas costs are much larger than estimates of spill and accidents costs more than twice as big for rail and more than eight times as big for pipelines.[7]

While the DEIS mentions increased emissions and other negative environmental impacts of changing transport methods, the Corps has failed to study these effects and quantify their impacts, as is it obligated to do. *See*, *e.g.*, *City of Bridgeton v. Slater*, 212 F.3d 448, 455 (8th Cir. 2000) ("[NEPA] forces the agency to take a 'hard look' at environmental consequences and inform the public that environmental concerns have in fact been considered."); *Kern v. Bureau of Land Mgmt.*, 284 F.3d 1062, 1075 (9th Cir. 2002) ("Consideration of cumulative impacts requires some quantified or detailed information that results in a useful analysis….") (internal quotations omitted). The Corps should correct and update the DEIS to address these shortcomings.

The DEIS does not quantify the environmental effects from increased rail and truck transport of oil required under Alternatives 1, 2, and 5, such as air quality impacts, noise effects, and groundwater. Truck and rail transport creates higher air emissions, a bigger risk of spills, rail and traffic accidents, and increased damage to infrastructure that must be evaluated and addressed in the DEIS. The Corps must fully recognize, study, quantify, and explain in the DEIS these significant negative health, safety, and environmental impacts related to Alternatives 1, 2, and 5. *See City of Bridgeton*, 212 F.3d at 455; *Kern v. Bureau of Land Mgmt.*, 284 F.3d at 1075. By contrast, allowing DAPL to continue operating in its current location at its current level would avoid these dramatic consequences.

2. Agriculture Industry Impacts

North Dakota Agriculture Industry

A shift of crude oil transport from DAPL to rail would also adversely impact the agriculture industry in North Dakota and throughout the Midwest due to competition for rail capacity. North Dakota has approximately 26,000 farms and ranches, comprising nearly 39.3 million acres, or approximately 90% of the total land area in North Dakota. North Dakota agriculture contributes considerably more than $30 billion in economic activity annually to the State.[8] North Dakota is

[6] Balwinder Nimana, et al., *Life Cycle Analysis of Bitumen Transportation to Refineries by Rail and Pipeline*, Environ. Sci. Technol. 2017, 51, 1, 680–691, University of Alberta.

[7] Karen Clay, Akshaya Jha, Nicholas Muller, Randall Walsh, *The External Costs of Transporting Petroleum Products by Pipelines and Rail: Evidence From Shipments of Crude Oil from North Dakota*, NBER Working Paper No. 23852 doi: 10.3386/w23852 (2017).

[8] North Dakota produces over 50 different agricultural commodities. Soybeans, wheat, corn, cattle & calves, and canola are North Dakota's top commodities in terms of cash receipts. North Dakota farmers lead the nation in the production of more than a dozen important commodities, among them spring and durum wheat, rye, food grains,

our country's 10th largest agricultural-exporting state. As a prime exporter of agricultural products, North Dakota is often cited as the "breadbasket of the world." Goehring ¶ 4.

Agriculture and energy, North Dakota's two largest industries, are tied intrinsically together. The availability and cost of energy directly impact the ability of farmers to produce food. Modern agriculture in North Dakota requires substantial energy inputs at all stages of agricultural production such as direct use of energy in farm machinery, water management, irrigation, cultivation, and harvesting. Goehring ¶ 6.

Post-harvest energy use in North Dakota likewise includes considerable energy inputs for food processing, storage, and transportation to waypoints and markets. Disruptions to transportation and availability of energy and energy-derived inputs would significantly diminish the ability of agricultural producers in North Dakota to produce commodities predictably and efficiently and, ultimately, diminish their ability to provide food for consumers. Goehring ¶¶ 6-7.

The importance of dependable and sufficient railcar capacity to North Dakota's agriculture industry cannot be overstated. North Dakota agriculture consistently relies on efficient and cost-effective railcar transportation. For example, many North Dakota grain elevators transport nearly all their commodity inventories by rail. Railcars in North Dakota regularly transport spring wheat, durum, barley, corn, soybeans, animal feed, and fertilizer. Eighty-three percent of North Dakota's total agricultural commodity production is shipped by rail including approximately 90% of North Dakota wheat, 90% of soybeans, and 80% of corn. Goehring ¶ 23.

Each day, DAPL removes from North Dakota's railways the need for the equivalent of over 815 railcars to transport oil that would otherwise restrict capacity and velocity on the State's rail system (or the equivalent of over 3000 commercial semi-trailer tanker trucks). North Dakota has limited refining capacity and as a result most Bakken formation crude oil produced in the State must be shipped and exported out of the State to be refined. Consequently, if DAPL is closed down and no longer operating, North Dakota oil producers will then have an immediate critical need for a replacement transportation method to export approximately 570,000 barrels of crude oil daily out of the State. Goehring ¶ 24.

With very few available practical options, oil producers will be compelled to substantially increase rail and tanker truck transporting. Rail and trucking oil transportation systems, on a volume-distance basis (*i.e.*, per barrel-mile), add more risk and create more expense. Once built, a crude oil pipeline like DAPL is a significantly less expensive option for moving oil than by railcar or tanker truck. Moreover, both these methods are less efficient, more energy intensive, and less environmentally friendly. In addition, the thousands of additional railcars and tanker trucks carrying flammable crude oil throughout the State would lead to additional railway and roadway congestion in North Dakota as they travel through cities, rural communities, and rural areas. Goehring ¶ 25.

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assorted beans, barley, flaxseed, canola, honey, sunflowers, pulse crops and more. North Dakota is also a hotbed for emerging crops like industrial hemp, hops, fava beans, and carinata. Of North Dakota's approximately 780,000 residents, under 3% are farmers and ranchers. Nonetheless, agriculture broadly supports nearly 25% of the State's workforce, which is higher than the national average of 19%. Agriculture remains the leading industry in North Dakota. Goehring ¶ 4 n.2.

If predominantly relying upon rail, because the typical rail tank car carries about 715 barrels, it would take an *additional* projected 815 rail tank cars every single day to transport one way the crude oil that otherwise would be conveyed by DAPL. Then, after these railcars reach their respective destinations and the oil is delivered and offloaded, all these railcars would have to be returned to North Dakota empty and be immediately readied for the next trip. Furthermore, it would take several months or more for railroads within the State to successfully ramp up rail crude oil shipping, and there is no guarantee existing railroads additionally could effectively accommodate DAPL's current operational capacity. Goehring ¶ 26.

If DAPL is shut down, the oil industry–which already competes with the agriculture industry for existing limited rail capacity–would then become a much more formidable competitor within the available rail transport market. Railroads, through local railcar auctions, allocate scarce and limited rail capacity to the customers with the highest willingness to pay. Along these lines, oil producers would suddenly command a considerably greater share of local railcars and railways, inevitably displacing North Dakota agricultural commodities and goods. This could stress short- and long-term local agricultural storage capacity, increase the cost of transporting agricultural commodities, and even, in some cases, potentially strand North Dakota agricultural products. Goehring ¶ 27.

Due to this substantially increased rail transport demand, it would significantly increase the costs North Dakota farmers and ranchers must pay to haul commodities and livestock to market. This would impose unnecessary additional production expenses on North Dakota agricultural producers, processors, and retailers. Ultimately, all these added costs would subsequently be passed onto consumers. Goehring ¶ 28.

A recent study found that North Dakota would be hit particularly hard because it relies heavily on rail transport for grain and, unlike other states, has only one feasible market route—rail transport to the Pacific Northwest for export to Asia. *See* Attachment N, Elaine Kub, *Rail Traffic Congestion: Economic Losses to Agricultural Sectors if Oil Transported by the Dakota Access Pipeline Shifts to Rail* (July 2023), at 11. The study also estimated the high range annual losses to North Dakota grain producers would total $285,596,546, and the average annual loss per farming operation is $7,655. *Id.* at 25.

Midwest Agricultural Sector

The same study concluded that a transportation shift from DAPL to rail would result in over $3 billion in annual losses to the Midwest agricultural sector. *Id*. at 5. The losses are attributed to three sources including (1) freight losses passed back to farmers in the form of weaker grain bids (totaling $1.51 billion), (2) increased freight costs for processed agricultural commodities and a loss of 9% of annual ethanol production, totaling $1.48 billion in losses to the ethanol industry, and (3) higher freight costs to ship agricultural inputs (*e.g.*, fertilizer) by rail, costing agricultural retailers and farmers $45 million annually. *Id.* at 7.

According to the study, the agriculture industry is uniquely dependent on rail systems to transport commodities over long distances. Before DAPL began operating, crude oil transported by rail contributed to rail congestion that caused economic hardship to the agriculture industry. After DAPL came online, the oil-induced rail congestion was relieved and resulted in efficient (and lower cost) functioning of the grain-by-rail supply chain. If DAPL crude oil flows shifted back to rail, the resulting congestion would cause agricultural producers, and ultimately consumers, to suffer the economic losses described above. *Id.* at 7-9.

In summary, a DAPL shutdown would result in railroads in the region transporting much more crude oil and much less food. This would cause a bottleneck in regional rail shipping and consequent record high freight prices. Because so much of the region's agricultural commodities are exported on rail transportation, there is a direct relationship between freight prices and the commodity prices received by farmers. The availability, reliability, and cost of rail transportation inevitably affects commodity prices. Consequently, rail congestion caused by the increase in oil railcars would cost the Midwest regional agriculture industry, which also must rely upon reliable and cost-effective rail transportation, billions of dollars.

Food processers, and ultimately consumers, would pay for the additional costs associated with the increased rail congestion. Farmers and grain shippers would also bear much of the congestion costs due to consequent long shipping delays, increased storage costs, and additional spoilage for some grains. Substantially increased crude oil rail shipments would also result in larger spreads between agriculture commodity prices at regional elevators and market hubs, increases in rail rates, and increases in rail car auction prices. Corresponding significant revenue losses within the regional agricultural industry would likely disproportionately affect Midwestern small farm operations and socially disadvantaged farmers, force some farmers and processors to go out of business, and lead to job losses in rural communities heavily reliant on agriculture.

For agricultural and rail transportation, the DEIS, in discussing Alternative 5, briefly alludes to "competition" between oil and grain "for space in trucks and on railroad cars," yet does little to actually quantify and communicate the detrimental effects this "competition" would have on North Dakota producers and consumers—e.g., stresses on the supply of long-term and short-term grain storage, stranded and potentially spoiling agricultural products, increased food prices and/or food shortages, and increased railway congestion. DEIS, at 3-206. The final EIS must fully incorporate the foreseeable social and economic costs of Alternatives 1, 2, and 5 discussed here.

Moreover, the DEIS "assumes that existing transportation infrastructure would be used" to transport oil in the event of a DAPL shutdown—which the DEIS optimistically estimates to last two to four years.[9] DEIS, at 2-23. However, the DEIS does not demonstrate that existing transportation infrastructure is even available to accommodate DAPL flows plus existing agricultural demand, and the available information and usage history indicates that it is not. And, in any case, the DEIS acknowledges that "a lack of loading and unloading capacity is identified as a substantial constraint to accommodating the current (or optimized) DAPL capacity via trucking or rail." *Id.* This is an issue the DEIS must examine and quantify in more detail for its evaluation of the adverse impacts (*i.e.*, social, economic, and environmental costs) of Alternatives 1, 2, and 5 to the State, the oil, and agriculture industries and energy and food consumers everywhere.

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[9] The estimate of 2-4 years is unrealistic given the time historically taken to permit pipelines, particularly crude oil pipelines that have drawn a lot of public interest.

3. Infrastructure Impacts

The North Dakota Department of Transportation ("NDDOT") designs each roadway for a specific design life. NDDOT does this by looking at the current traffic volumes, projecting the increase in traffic, and calculating the Equivalent Single Axle Load ("ESAL") over the design life for that stretch of roadway. ESALs is a concept used in pavement engineering to quantify the varying destructive potential of different axle loads on a road or pavement structure. It serves as a standardized measure to estimate the cumulative damage caused by various vehicle loads, allowing engineers to assess the overall impact on the pavement's durability and design. Attachment O, Declaration of Ron Henke, NDDOT Director (Dec. 8, 2023), ¶ 4.

ESAL is particularly important in predicting pavement performance over time and is commonly employed in the design and analysis of roads. By converting different axle loads into an equivalent single axle load, engineers can simplify the assessment of pavement life and durability. Henke ¶ 5.

An increase in the number of trucks, particularly those with heavier axle loads, can significantly impact ESAL calculations and, consequently, the overall deterioration and cumulative damage of pavement structures. Each additional truck contributes to a higher ESAL value, which reflects a greater load-induced stress on the pavement, potentially accelerating the wear and tear of the road surface. Henke ¶ 6.

Section 2.4.1. of the DEIS estimates 5,000 loaded trucks would be needed to transport the 1,100,000 bpd of crude oil the pipeline would no longer carry. DEIS, at 2-5. The ND Pipeline Authority estimates that each of the 5,000 trucks can haul 220 barrels of crude oil per trip. Given the typical axle configuration used in western North Dakota and the approximate weight of the loads, each truck load calculates out to be approximately 2.4 ESALs. These additional ESALs from the truck loads of crude oil were not anticipated during the design of the state roadway network and would consume the amount of design ESALs faster than what was anticipated on each segment of roadway where a transload facility exists. [10] Henke ¶ 8.

This would result in an annual state highway system value loss or increased depreciation of approximately $46 million per year from the reduced service life of the roads due to the increase in ESALs. The $46 million per year is a conservative number for the system value loss as it only considers the major state highways that lead to the transload facilities and does not quantify the impact over the entire travel route. For example, the losses to local roadways near the well heads and the full state system routes between the local roads and the transload facilities were not considered in this calculation. Henke ¶ 9.

[10] To estimate the impact of the additional 5,000 loaded trucks, NDDOT assumed the crude oil would be transported to one of the nine transload facilities located in western North Dakota. This was assumed because NDDOT believes the costs to haul the crude oil to one of the transload facilities rather than refineries in the Midwest and Gulf Coast would be more financially beneficial to minimize the number of miles that the crude oil would need to be hauled by trucks. This also aligns with how the industry similarly reacted before the Dakota Access Pipeline was operational, which was to haul to the transload facilities in western North Dakota to access the rail network for long-distance shipment. Henke, ¶ 7.

To ensure a conservative analysis, only the loaded trucks were considered, but empty trucks returning to the well heads would also have an impact on the roadway life to a lesser, but not insignificant, degree. The increased highway impacts would require state and local roadways to be under construction with a more frequent rehabilitation schedule, and this would result in increased delays and other service impacts to the traveling public. The map exhibited with the Declaration of Ron Henke illustrates the major state highways that would be impacted and the location of the nine transload facilities. Henke ¶ 10.

D. The DEIS must be corrected and revised to accurately reflect the statewide negative socioeconomic impacts of Alternatives 1, 2, and 5 to North Dakota.

To the extent the Corps fails to consider statewide negative impacts in the DEIS on the basis that the socioeconomic analysis focuses primarily on the two counties and census tracts where the Lake Oahe crossing occurs, that is error. *See, e.g.*, *Vermont Yankee Nuclear Power Corp. v. Nat. Res. Def. Council*, 435 U.S. 519, 553 (1978) ("NEPA places upon an agency the obligation to consider every significant aspect of the environmental impact of a proposed action."). Under NEPA, an agency "cannot treat the identified environmental concern in a vacuum." *Grand Canyon Trust v. FAA*, 290 F.3d 339, 346 (D.C. Cir. 2002). "The agency need not speculate about all conceivable impacts, but it must evaluate the reasonably foreseeable significant effects of the proposed action." *Dubois v. U.S. Dep't of Agric.*, 102 F.3d 1273, 1286 (1st Cir. 1996) (emphasis added).

The DEIS must take into account the likely economic impacts of its proposed alternatives in the sections analyzing socioeconomic effects and cumulative impacts. The DEIS cannot ignore consequences that are likely to result from an Alternative under consideration by unreasonably limiting the geographic scope of its analysis. *See, e.g.*, *Milwaukee Inner-City Congregations Allied for Hope v. Gottlieb*, 944 F. Supp. 2d 656, 672 (W.D. Wis. 2013) (finding cumulative impacts analysis for highway project deficient where it focused on effects in immediate vicinity rather than across the entire region); *Preserve Our Island v. U.S. Army Corps of Eng'rs*, 2009 U.S. Dist. LEXIS 71198, at *49-56 (W.D. Wash. Aug. 13, 2009) (finding Corps erred by narrowly limiting geographic scope of analysis and failing to consider reasonably foreseeable future impacts).

To the extent the Corps' failure to consider the statewide impacts of the Alternatives is based on the principle that the DEIS should narrowly focus on impacts to the counties and census tracts where the Lake Oahe crossing occurs, that position is neither legally justifiable—as explained above—nor internally consistent with the DEIS given that the Corps has speculated on and even attempted to quantify the social costs of the various alternatives to the *entire world population* based on the purported impact of the Alternatives on *global* climate change, while it has refused to quantify the known adverse impacts to the citizens of North Dakota.

In short, the Corps must consider and quantify the negative impacts (*i.e.*, the economic, social, and environmental costs) that shutting down DAPL would cause to the entire State of North Dakota and its citizens, and any fair consideration of that issue would recognize the significant statewide negative impacts of Alternatives 1, 2, and 5.

The DEIS also fails to properly capture cumulative impacts. The DEIS purports to focus on the geographic extent of the easement; however, the DEIS fails to properly include the actual geographic footprint of the impacts. For example, the DEIS analysis is primarily limited to the sub-watersheds near the Lake Oahe crossing for impacts to water and wildlife resources and within one mile of the Lake Oahe crossing for land use, recreation, cultural resources, and noise. However, this limited focus inappropriately omits 100 miles of pipe abandonment activities under Alternative 5; socioeconomic and environmental justice harms outside Sioux County and the two listed census tracts; and truck and rail transport impacts (traffic congestion, noise, air pollution, wildlife strikes) well beyond these narrow geographic areas.

The DEIS also fails to fully consider that even a temporary shutdown of DAPL, and the slow and uncertain transition to truck and rail transport, may result in North Dakota oil and gas producers being unable to recover the same or similar market share considering market sensitivities to the uncertainty of pipelines in the region. After six years of successful and reliable operations, a DAPL shutdown would have immense known and quantifiable ripple effects that would be difficult to overcome, especially in the near term. The final EIS must acknowledge these potential effects and fully evaluate and quantify them.

III. Alternatives 1, 2, and 5 would have significant adverse health, safety, and environmental impacts in North Dakota that are not adequately reflected in the DEIS.

Shutting down and re-routing DAPL would cause significant negative impacts to the health and safety of the people living in (and adjacent to) North Dakota and the State's environment. Selection of Alternatives 1, 2 or 5 would result in the substantial adverse health, safety, and environmental impacts of a pipeline reroute, in addition to the adverse effects and costs discussed above associated with shifting the transport of a majority of North Dakota's crude oil from DAPL to rail or truck (whether that be permanently or for a period of years during a re-routing of DAPL). By contrast, DAPL has operated without incident for over six years in its current location, an outcome likely to continue under Alternatives 3 or 4. While the DEIS does discuss environmental impacts of the Alternatives, the Corps should consider and incorporate the following information in its discussions of Alternatives 1, 2, and 5.

A. Negative impacts from North Bismarck Route under Alternatives 1, 2, and 5

1. Soil damage, Noxious Weeds, and Pesticides

The DEIS must consider that construction of a new rerouted DAPL pipeline under Alternative 5 would require opening approximately 112 miles of new trench and dramatically exposing healthy settled organic soils in North Dakota to noxious and other weeds. Rerouting the current pipeline would pass through thousands of acres of actively cultivated agriculture fields. The proposed 112-mile reroute north of Bismarck comprises working agricultural lands that are currently generally undisturbed by pipelines. The new pipeline construction would greatly disturb healthy soils in the productive agriculture fields along that route.

Pipeline construction activities include ground disturbance such as grading or the use of vehicles or equipment that could introduce noxious weed seeds or propagules. These activities would directly or indirectly cause the spread of noxious, invasive, and other troublesome weeds. They grow quickly, produce a lot of seeds, are long-lived, and do not require continued disturbance to persist. Goehring ¶ 30.

During the burrowing of the new route, the topsoil rich in organic matter and nutrients would be dug out and removed. It would then be stockpiled along the route as part of the excavation. Compaction of both subsoil and topsoil are necessary to retain soil at the site, but this also makes it difficult for subsequent crop and plant regrowth. This excavation and then stockpiling would significantly dry out both the excavated subsoil and topsoil, causing adverse effects to the existing beneficial microbes and fungi. The unprotected stockpiled soil would also be highly vulnerable to soil erosion from wind and rain. This erosion could compromise air quality, cause fugitive dust emissions, and lead to nutrient pollution concerns in surrounding surface and ground water.

Exposed soil would be highly prone to pest pressures. Disturbing land, such as digging up all the well-established flora would consequently create a desirable landscape for many highly undesirable noxious weed species. When noxious weeds establish themselves in this newly disturbed area before native or desirable plants are established, they would quickly take most of the available resources such as nutrients, sunlight, and water creating a much more challenging environment for much more desirable native species to establish. Without concomitant expensive and effective crop protection measures, the intrusion of noxious weeds would substantially decrease land productivity, its value for forage or other uses, and ultimately its value per acre.

Accordingly, significantly increased pesticide applications would be necessary to control noxious weeds along the construction sites of the new pipeline route. The proposed reroute of the pipeline could lead to thousands of gallons of additional pesticides to be applied to the pipeline corridor that would have otherwise been entirely unnecessary. Additional control treatments to target expected and actual weed infestations may be necessary such as prescribed fire, biomass control, and biological control.

Many pesticides bind tightly to soil particles and, consequently, the inevitable erosion of exposed soils resulting from rerouting the pipeline corridor would then move into adjacent surface water and harm aquatic life and biodiversity. Additionally, it is often very windy in North Dakota during the construction season. Increased pesticide applications during that time will increase the risk for off-target movement or drift of pesticides which would have a negative impact on neighboring crops and vulnerable species.

Increased fertilizer usage along a new pipeline corridor could also pose nutrient pollution risks to adjacent surface and ground water. It would take many years of land management to re-build the soil health to the same level as it was before prior to the pipeline construction.

The maps attached to the Helms declaration reflect the significant geological hazard risks to pipeline operations and important archeological resources associated with Alternatives 1, 2 and 5. The most likely alternate DAPL route under these alternatives intercepts nine active landslides and a highly unstable and erodible east riverbank area, with 608 landslides within a five-mile corridor, and 1,202 landslides within a 10-mile corridor. Helms, at 8.

2. Estimated Fiscal Costs of Land Reclamation

The costs associated with rerouting the pipeline would substantially disrupt agricultural production across over 100 miles of North Dakota cropland and rangeland for a minimum of three to five years. Goehring ¶ 21. Upon completion of any DAPL reroute construction in North Dakota, land reclamation work would necessarily begin. It would take many years of land management to build the soil health to the same level as it was prior to the pipeline construction. It is not uncommon that a construction company would be required to work closely with landowners on a reclamation plan comprising five or more years for the affected lands to reach satisfactory recovery levels. Goehring ¶ 33.

If very favorable conditions occur following the completion of construction, some agricultural lands along the new pipeline corridor soil might recover to a suitable usable level of 50% over two years; however, only if optimum weather and moisture conditions exist. Most likely, for at least the first two years following pipeline installation, crop yields on the new route will be reduced by about 50%. For specific examples, soybean and corn yields will likely be reduced by at least 40% in the first cropping year after installation, and about 25% in in the second year. Smaller, but still significant yield reductions would likely still be apparent at some sites in the fourth year after construction and beyond. Goehring ¶ 34.

The damage costs associated with reclamation would be exorbitant. The reclamation cost per each mile of cropland/pastureland along the reroute are conservatively estimated at $50,000. Actual costs would likely be much higher. Goehring ¶ 35.

Certain pipeline damage payments to landowners in North Dakota in 2022 ranged from $850 to $1,250 per rod with up to $2,500 per rod paid in certain special circumstances. At an average rate of $1,000 per rod, 1 mile or 320 lineal rods of easement would be upwards of $320,000. An easement that is 33-to-66 feet-wide and 1-mile-long is equivalent to approximately 4 to 8 acres per mile of surface area.[11] At that rate, the damage compensation estimate would be $40,000 to $80,000 per acre required to be paid to affected landowners. Goehring ¶ 36.

Regardless of what reclamation calculation or estimate is used, landowner expectation for damage payments from any pipeline reroute would be exceedingly high. The highest costs would likely arise in areas toward the middle of the Bakken formation, the center of North Dakota oil production activity, with decreasing cost amounts moving outward. An average of approximately $1000 per rod across the entire construction reroute is reasonably expected for reclamation costs. Goehring ¶ 37.

By contrast, under Alternatives 3 or 4, DAPL is and will remain fully constructed and in operation. DAPL has operated for over six years without any significant incident, and proper

[11] These figures are conservative, as construction corridors can be 100 to 150 feet wide with ground disturbance occurring within the entire corridor.

reclamation of affected lands along the pipeline corridor has been successfully completed. Goehring ¶ 9.

While the State of North Dakota strongly supports the expansion of all pipeline infrastructure to address the nation's growing energy needs and recognizes the advancements in reclamation practices, it firmly opposes the unnecessary North Bismarck reroute for the Dakota Access Pipeline which would undermine the integrity of an established and secure energy transport system. The pipeline has proven its operational safety for more than six years, and subjecting land to reclamation due to a forced reroute is unacceptable.

3. Air emissions

Changing transport methods to truck and rail under Alternatives 1, 2 or 5 would also increase adverse environmental impacts from increased air emissions (including emissions of criteria pollutants and greenhouse gas emissions).

Constructing a new pipeline, with corresponding soil disturbance, would result in substantial carbon release. Cropland can safely sequester about eight tons of carbon per acre, and that number significantly increases as soil organic matter increases. Upheaval of the organic fertile black soil along the proposed rerouted 112-mile pipeline construction north of Bismarck would result in stripping the topsoil off thousands of acres of currently highly productive and organically rich farmland and thus unnecessarily release potentially hundreds of thousands of tons of safely sequestered carbon into the atmosphere.

Almost all of western North Dakota's farmers and ranchers use no-till conservation farming practices that keep the soil surface sealed to prevent soil erosion, retain moisture, and promote soil health and biological diversity. No-till also substantially mitigates impacts to climate change from cropland agriculture providing a net benefit to the environment. Specifically, no-till farming practices have the added benefit of sequestering an average of about one-third of a ton of carbon per acre per growing season. No-till farming also reduces nitrous oxide emissions. No-till substantially mitigates potential impacts to climate change from cropland agriculture and provides a net benefit. In stark contrast, mandating the rerouting of the pipeline would disrupt the soil, release substantial amounts of carbon into the atmosphere, and consequently result in significant adverse environmental impact.

An average acre of cropland in North America can safely sequester about 8 tons of carbon and that number significantly increases as soil organic matter increases. Upheaval of the organic fertile soil along the 112-mile construction of a rerouted pipeline north of Bismarck would result in stripping the topsoil off thousands of acres of highly productive and organically rich no-till farmland and thus release potentially hundreds of thousands of tons of safely sequestered carbon into the atmosphere.[12]

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[12] *See also* § II.C.1, *supra*, for a discussion of increased air emissions that would result from a shift to rail and truck transport.

4. Water Sources

Relocating DAPL to an alternative route under Alternatives 1, 2, or 5 would cause significant new adverse environmental impacts by opening approximately 112 miles of new trench (11 miles longer than the existing pipeline), placing a greater number of water intakes at risk, and impacting a greater number of wetlands, floodplains, and water crossings than the original route. Moreover, relocating the pipeline to cross the Missouri River upstream of the State's capital and second-largest population center, as required by a North Bismarck route, increases the impacts of a potential spill, as opposed to the lower risk presented by the current downstream crossing.

5. Environmental Justice

Moving the crossing 40 to 50 miles up-river within an uncontrolled section of the river does not meaningfully reduce any risk that might be posed to Standing Rock residents, as a significant release could still reach Lake Oahe, and adds a new risk to the Native American population of Bismarck-Mandan. Thus, Alternative 5 increases the cumulative risk to Native American populations.

The current pipeline location creates a very low risk to 8,553 Standing Rock residents while the North Bismarck route (Alternative 5) creates an almost identical risk to 8,533 Native American Standing Rock residents plus 5,314 Native American Bismarck-Mandan residents. The overall cumulative impact is to expose 13,847 (62% more) Native Americans to the risk. The populations in the Standing Rock area and the Bismarck-Mandan area have higher concentrations of Native Americans below the poverty level than surrounding areas. *See* Attachment P, Map Showing Bismarck-Mandan American Indian Population Below Poverty Level (obtained from USEPA's EJSCREEN (Environmental Justice Screening and Mapping Tool). The added risk to the Bismarck-Mandan population introduced by Alternative 5, while not meaningfully reducing the risk to the Standing Rock population, demands serious scrutiny from USACE from an environmental justice perspective.

The loss of income and adverse economic impacts to the State from shutting down DAPL could potentially have an adverse effect on the SRST and Cheyenne River Sioux Tribe, as well as different Environmental Justice Communities that were not evaluated in the DEIS. Even a temporary shutdown of DAPL would adversely impact Environmental Justice Communities that rely on revenues generated from oil that is transported on the DAPL. The DEIS' narrow focus on Morton and Emmons counties inappropriately disregards revenue losses that will affect education, health and welfare, and other community services throughout the area. The DEIS also fails to appropriately consider financial, environmental, and health and safety impacts to the MHA Nation in its environmental justice analysis.

Additionally, in any alternative where DAPL is either shut down entirely (and so the crude oil it transports is shifted to trucks and rail), or moved to the North Bismarck Reroute, the resulting health, safety, and environmental risks would disproportionately burden low-income and historically disadvantaged communities, including indigenous communities. The Bismarck-Mandan metropolitan area, which would be downstream of the proposed North Bismarck Reroute, is itself home to thousands of indigenous people (along with more than 100,000 other residents). In fact, there is a larger indigenous population in the Bismarck- Mandan area than there is on the Standing Rock Sioux Tribe reservation. *See* N.D. Indian Affairs Comm'n, Statewide Data, https://www.indianaffairs.nd.gov/tribal-nations/statistics. DAPL's current site therefore minimizes harm to a greater portion of the indigenous population, as compared to the North Bismarck reroute.

Finally, the most likely alternate DAPL route passes within approximately 1 mile of the highly significant Double Ditch Indian Village, a large earth lodge village inhabited by the Mandan Indians for nearly 300 years (AD 1490-1785). The Double Ditch site is critical to telling the story of the earth lodge villages that were centers of trade between the Mandan and their nomadic neighbors and the massive smallpox epidemic in the interior of North America about 1781-1782 that is believed to be responsible for the abandonment of Double Ditch and all the other Mandan villages near the Heart River. Helms, at 8.

B. Alternative 1 would be uniquely destructive

The uniquely long duration and destructive nature of Alternative 1 warrants individual attention and comments. The DEIS incorrectly claims some impacts from the excavation required under Alternative 1 would not be significant (DEIS, at ES-11; 3-124), yet the reality that Alternative 1 would require the removal of over 12 million cubic yards of soil from beneath Lake Oahe over six to 20 years belies any such claims. It is inconceivable how this could be characterized as insignificant. The Corps must reevaluate its analysis and acknowledge that the excavation will cause significant impacts.

Alternative 1 would result in adverse environmental impacts due to dewatering a portion of Lake Oahe, building two cofferdams, and stripping 77 acres upland. Ancillary to the environmental impacts of removing 7,500 feet of 30-inch crude oil pipe 95 to 126 feet below the lakebed, there is a natural gas pipeline within the right of way that would likely need to be rerouted as well. This is something the Corps failed to take a "hard look" at, and which should be discussed in greater detail, including quantifying impacts, in the DEIS.

IV. Alternative 5 is an improper Alternative

The DEIS includes Alternative 5 (the so called "North Bismarck" reroute) as a proxy for a DAPL reroute that is presumed to result from selection of Alternatives 1 or 2. The NDPSC (through its comprehensive and public review process) and the Corps have already considered and discarded the North Bismarck route as not a viable route, and it is therefore not a reasonable alternative to the proposed action. Alternative 5 also fails to meet the minimum legal threshold of a "reasonable alternative" capable of satisfying the proposed action's "purpose and need." The Corps' continued inclusion of the new Alternative 5 encroaches on the State's sovereignty and jurisdiction over the siting of crude oil pipelines in North Dakota.

A. Alternative 5 is not a reasonable Alternative

Alternative 5 is not a proper alternative under NEPA because it does not satisfy regulatory requirements and CEQ guidance for a valid alternative and, as a practical matter, poses significantly greater environmental, public health, and safety risks than Alternatives 3 and 4.

When an agency prepares an EIS pursuant to NEPA, it must determine the purpose of the proposed project, as well as the reasonable alternatives to the project in light of that purpose. *See Simmons v. United States Army Corps of Eng*., 120 F.3d 664, 668 (7th Cir. 1997); *City of Carmel–by–the–Sea v. United States Dep't of Transportation*, 95 F.3d 892, 903 (9th Cir. 1996); *City of Grapevine, Texas v. Dep't of Transportation,* 17 F.3d 1502, 1506 (D.C. Cir. 1994). NEPA regulations require a "reasonable alternative" to be "technically and economically feasible, to meet the purpose and need for the proposed action, and, where applicable, meet the goals of the applicant." 40 C.F.R. 1508.1(z).

The Proposed Action here is for the Corps to reissue an easement to cross approximately 1,000 feet of Corps-owned lands at Lake Oahe, and the purpose and need for that action is to allow DAPL "to transport up to 1,100,000 bpd from the Bakken and Three Forks production region in North Dakota to a crude oil market hub located near Patoka, Illinois, and ultimately to refineries located in the Midwest and the Gulf Coast …." DEIS, at ES-4. This is a purpose and need that DAPL has already been safely meeting without incident for over six years. It is not possible for Alternative 5 to meet the purpose and need of the Proposed Action because the time needed to construct that alternative and resume operations would result in a multi-year halt to the efficient and safe transport of up to 1,100,000 barrels per day, and the end result would be less safe.

Additionally, the North Bismarck reroute inherently fails as a reasonable alternative capable of meeting the Proposed Action's purpose and need because the NDPSC has already considered it and rejected it as a viable alternative. The NDPSC reviewed the DAPL project application over the course of 18 months, from December 2014 through May 2016. In that application, Dakota Access discussed route revisions that occurred early in the routing process and which were made primarily due to attempts to avoid tribal and federally owned lands, minimize environmental impacts, avoid environmentally sensitive areas, and maximize collocation. *See* Dkt. 1 (NDPSC Case No. PU-14-842), Application for Corridor Compatibility and Route Permit, at 21.

The application's initial Route 1 (May 19, 2014) is roughly the same as Alternative 5. The application explains that other options were then pursued "to improve constructability and avoidance of features identified during field surveys." *Id.* at 21-22 (Figure 3.1.5-1: Routes Considered for DAPL Project). An alternative route that followed the existing infrastructure of the "Tesoro Pipeline," and was similar to Alternative 5 was then considered during NDPSC's June 2015 public hearings in Killdeer and Williston, North Dakota. That option, now referred to as the North Bismarck reroute, was rejected by the NDPSC. There is no rational basis for the Corps to consider an Alternative that ultimately would require the NDPSC to reverse its prior determination that it is not a viable route.

Based on the NDPSC's prior consideration of the route comprising Alternative 5, Alternative 5 cannot satisfy NEPA's standard for a valid alternative because of the unlikelihood that Dakota Access would propose it. The DEIS candidly explains that "it is unknown exactly what route Dakota Access would seek to permit as a reroute, and any such reroute would require Dakota Access to go through the permitting processes with any applicable permitting agency," DEIS at

2-2, but NEPA does not allow consideration of such an uncertain Alternative because a valid Alternative must be feasible.[13]

Finally, when Alternative 5 is considered in connection with Alternative 1 (removing the pipeline from the existing crossing), the outcome is even more unreasonable because of the infeasibility of Alternative 1. Alternative 1 would require the removal of over 12 million cubic yards of soil from beneath Lake Oahe over six to 20 years. On that basis alone, Alternative 1 fails NEPA's "technically and economically feasible" standard, not even taking into account the environmental impacts of such actions.

B. Alternative 5 is procedurally deficient

The Corps' addition of Alternative 5 improperly resulted from closed-door meetings with the Tribes and did not allow for public comment or participation by other Cooperating Agencies like the State of North Dakota as part of that decision-making. *See Int'l Snowmobile Mfrs. Ass'n v. Norton*, 340 F. Supp. 2d 1249, 1262 (D. Wyo. 2004) (finding NEPA violation where agency failed to involve or consider the input of cooperating agencies on decision to revise proposed alternative). The Corps should reverse course and return to the original list of four alternatives set forth in the Notice of Intent ("NOI"). The substance for the unscoped "Alternative 5" should instead be considered as a negative effect of Alternatives 1 and 2.

The NOI did not include Alternative 5 as a standalone alternative; rather, the NOI listed only four alternatives. *See* Notice of Intent to Prepare an EIS for and Easement to Cross Under Lake Oahe, 85 Fed. Reg. 55843 (Sep. 10, 2020) ("[A]n EIS will analyze the following [four] possible alternatives …."); DEIS at 2-1 ("Four broad alternatives were presented during scoping for input by the public."). It is the State's understanding that following certain closed-door meetings, the Corps unilaterally added the new Alternative 5.

Such closed-door decision-making is anathema to the transparency required by NEPA and the APA, which require that scoping be an "open process," with public notice. 40 C.F.R § 1501.7(a)(1). Indeed, "[f]or an environmental impact statement, bureaus *must* use scoping to engage State, local and tribal governments and the public in the early identification of concerns, potential impacts, relevant effects of past actions and *possible alternative actions*." 43 C.F.R. § 46.235(a) (emphases added); *see also Los Padres Forestwatch v. U.S. Forest Serv.*, 776 F. Supp. 2d 1042 (N.D. Cal. 2011) (agency violated scoping obligations in failing to afford public notice or comment).

Moreover, relocating the negative environmental effects of Alternatives 1 and 2 to a separate, unscoped Alternative 5, artificially and unlawfully obscures the negative environmental effects of Alternatives 1 and 2. Because those negative effects flow directly from, and would not exist

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[13] In fact, approval of the North Bismarck route is less feasible now that the pipeline has already been completed. Unlike when NDPSC considered Alternative 5 the first time, the negative impacts of a reroute to North Bismarck would be compared to a "no construction impacts" option (*i.e.*, using a route that has *already* been built). Further, the State reminds the Corps that the alternatives in an EIS will be judged by the reviewing court according to the information available when the Corps made its decision. As it relates to this EIS, that includes all previous analyses made part of the litigation record and related proceedings involving the routing of the pipeline.

but for Alternatives 1 or 2, the proper course is to consider these negative environmental effects as part of evaluating Alternatives 1 and 2.

V. Alternatives 1, 2, and 5 are not standalone Alternatives

To more effectively and adequately evaluate the relationship between Alternative 5 and Alternatives 1 and 2, the DEIS must combine Alternative 5 into Alternatives 1 and 2 and eliminate Alternative 5 as a separate alternative. Since the Corps is treating Alternative 5 as a "proxy" for what would occur if Alternatives 1 or 2 are selected, the North Bismarck route—if it is evaluated at all—must be evaluated as part of those Alternatives, and not by itself. Similarly, the impacts of Alternatives 1 and 2 can only be adequately evaluated if their necessary consequence, Alternative 5, is included in the analysis.

If the Corps is not willing to do so, the DEIS should be revised to be clear early in its discussions of Alternatives 1 and 2 that selecting either alternative would necessarily be a selection of Alternative 5 as well, because a reroute of the pipeline would be necessary for Alternatives 1 or 2 to meet the stated purpose of the Proposed Action. The DEIS also should present all analyses related to Alternative 5 together with Alternatives 1 and 2. Further, separate discussions of the impacts of Alternative 5 should refer back to and include the impacts of Alternatives 1 and 2.

While the DEIS acknowledges that Alternative 5 is "tied together" with Alternatives 1 and 2 (DEIS, at 2-23), these statements are buried at the end of various sections of the document, do not clearly convey the relationship between Alternative 5 and Alternatives 1 and 2 and, most importantly, do not evaluate the combined and cumulative impacts of those alternatives that are "tied together." If the alternatives are tied together, so must be the evaluation of their impacts. Clarifying statements and necessary evaluations are also missing entirely in key areas of the DEIS. For example, the Executive Summary and Section 2.5 merely state that Alternatives 1 and 2 are "considered throughout [the DEIS] in connection with" Alternative 5. DEIS, at ES-5, 2-9 & 2-12.

VI. The DEIS overstates impacts of Alternatives 3 and 4.

The DEIS overstates likelihood and potential impacts of an oil release under Alternatives 3 and 4. For example, the DEIS asserts that an oil release could require "deep excavation" similar to Alternative 1 to remove contaminated sediment or repair or replace the pipeline if a spill occurred. DEIS, at 3-55 to 3-56. Alternative 1 involves the removal of the entire pipeline under Lake Oahe, an effort requiring the excavation of 12 million cubic yards of soil from beneath Lake Oahe over six to 20 years. As noted above, this significant undertaking itself would be uniquely destructive to the environment. On that basis, it is unlikely that a regulating agency would order a cleanup on the scale of implementing Alternative 1, as such a response would be unnecessary and likely more environmentally damaging than the spill itself.

The DEIS also contains an unwarranted revision recharacterizing the likelihood of a worst case pinhole release from "very unlikely" to "unlikely," without any basis or explanation. DEIS, at 3-48 ("The impacts from this unlikely offshore release would be major"). While these terms are difficult to quantify, there is no apparent reason—and the Corps provided no explanation—for the revision, and this reference should be changed back to the prior language. Additionally, the reference to an "offshore" release is misleading and should be removed.

VII. Improper Consideration of Social Cost of GHGs

The DEIS' discussion of the estimated social cost of GHG emissions ("SC-GHGs") contributes no useful information to the evaluation of Alternatives and is improper under NEPA. "NEPA requires a reasonably close causal relationship between the environmental effect and the alleged cause." *DOT v. Public Citizen*, 541 U.S. 752, 766 (2004). The CEQ has also explained in its NEPA regulations that agencies should not consider effects that are "remote in time, geographically remote, or the result of a lengthy causal chain." 40 C.F.R. 1508.1(g)(2).

The Corps nonetheless inappropriately utilized tools for estimating the costs of GHG emissions by accounting for *global* damages and provided a range of estimated aggregate social costs that recognize the "current range of variability in research related to global social impacts of GHG emissions." The SC-GHG figures included in the DEIS are based on methodologies that consider impacts that are far too attenuated from the project and are improperly based on global impacts far outside the geographic region of the project. The discussion of SC-GHGs is particularly inappropriate considering that other sections of the DEIS fail to account for readily quantifiable cumulative effects on North Dakota's economy and environment of the Alternatives and instead look only at few counties, and even then, incompletely.

Consideration of SC-GHGs is also improper because it fails to satisfy NEPA's inherent "rule of reason" intended to ensure that agencies prepare an EIS based on the usefulness of the information to the decisionmaking. *Public Citizen*, 541 U.S., at 766. include DEIS readily admits that "there is no universally accepted methodology to attribute discrete, quantifiable, physical effects on the environment to the Project's incremental contribution to GHGs." DEIS, at 3-286. The DEIS further concedes that the SC-GHGs associated with end use of the crude oil transported by the Project "would occur with or without the Project," *Id.*, at 3-287, further rendering the SC-GHG analysis of no use to the Corps' evaluation of Alternatives.

The Federal Energy Regulatory Commission ("FERC") has considered and rejected the use of SC-GHGs in NEPA analyses, finding consideration of SC-GHGs neither "appropriate or informative" for three reasons: (1) the lack of consensus on the appropriate discount rate leads to significant variation in output, (2) the tool does not measure the actual incremental impacts of a project on the environment, and (3) there are no established criteria identifying the monetized values that are to be considered significant for NEPA purposes." *EarthReports, Inc. v. FERC*, 828 F.3d 949, 956 (D.C. Cir. 2016) (citing FERC order denying rehearing and stay, Docket No. CP12-113-001 (May. 4, 2015)).

Given the uncertainties and lack of consensus surrounding SC-GHG, the discussion in the DEIS adds nothing of substance or value to the Corps' analysis of the Alternatives and should be removed from the DEIS. At a minimum, the DEIS should explain why the Corps insists on using an unreliable SC-GHG analysis that adds nothing to its evaluation of Alternatives and fails to comply with CEQ regulations.

VIII. Conclusion

North Dakota brings special technical expertise and professional knowledge gained from the public, transparent, and multi-stakeholder process that intensively evaluated the environmental and other impacts of selected and alternative DAPL routes (as well as alternative means of transportation). No other agency, organization, or person has the equivalent depth or breadth of knowledge and experience about the environmental, local geology and terrain, natural resource, energy, public safety, economic, agricultural, regulatory, and other pertinent issues related to the siting of DAPL.

DAPL is technically advanced, solidly constructed to rigorous modern industry standards, and routed correctly. It is dependably operating in an environmentally responsible manner as it efficiently and cost effectively transports approximately 50% of North Dakota's crude oil production. For over six years of sustained operations, DAPL has established a commendable and proven safety track-record.

For the reasons discussed in these comments, North Dakota recommends that the Corps adopt Alternative 3, granting the requested easement to Dakota Access with the same conditions as the previously granted easement for crossing under Lake Oahe. This existing pipeline route has already been extensively studied and has been affirmed as the safest, most efficient route for DAPL. Further, selecting Alternative 3 would avoid the substantial and unnecessary environmental and socioeconomic harms that would result from Alternatives 1, 2, and 5 as discussed in these comments.

Attachments:
Attachment A: Declaration of Julie Fedorchak
Attachment B: Declaration of Doug Goehring
Attachment C: Declaration of William Peterson
Attachment D: Declaration of Susan M. Sisk
Attachment E: Declaration of Joseph A. Heringer
Attachment F: Declaration of Kirsten Baesler
Attachment G: Declaration of Vance Taylor
Attachment H: Declaration of Lynn D. Helms
Attachment I: Declaration of Todd J. Steinwand
Attachment J: Declaration of Janilyn Murtha
Attachment K: NDSU Analysis
Attachment L: Declaration of Mark N. Fox
Attachment M: University of Chicago paper
Attachment N: Elaine Kub paper
Attachment O: Declaration of Ronald J. Henke
Attachment P: EJ Screen map

ATTACHMENT A

Declaration of Julie Fedorchak

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

DECLARATION OF JULIE FEDORCHAK IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

I, Julie Fedorchak, state and declare as follows:

1. My name is Julie Fedorchak. I am a current Commissioner serving on the North Dakota Public Service Commission (the "Commission") and served as chair of the Commission during the siting of the Dakota Access Pipeline ("DAPL") project. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal knowledge and are true and correct.

2. The Commission is a constitutional agency statutorily charged with the siting of transmission facilities under the North Dakota Siting Act, which is codified in Chapter 49-22 and 49-22.1 of the North Dakota Century Code. The purpose of the Siting Act is to ensure that the location, construction, and operation of transmission facilities will produce minimal adverse effects on the environment and upon the welfare of the citizens of this state by providing that no transmission facility shall be located, constructed, and operated within this state without a certificate of site compatibility or a route permit issued by the Commission. Projects such as DAPL fall under the jurisdiction of the Commission's statutory duties regarding the siting of transmission facilities.

3. In my capacity as Commissioner, my responsibilities include utility rate regulation; utility resource adequacy; regional transmission organization engagement; energy

generation, refinement, and transmission infrastructure siting; railroad safety; gas pipeline safety on behalf of the Pipeline and Hazardous Materials Safety Administration ("PHMSA"); coal mine permitting and reclamation; restoration of abandoned mine lands; rail safety, and various other compliance programs. While all Commissioners exercise equal authority and share equal responsibility for every decision, my portfolio assignments include, among other things, overseeing the permitting processes of transmission pipelines. More specifically, I was the portfolio holder for pipeline siting during the permitting of DAPL.

4. I attest that the Commission exercised its statutory and regulatory authority in reviewing and certifying DAPL in accordance with the North Dakota Constitution and statutes that establish the public purposes and duties of the Commission on behalf of the citizens of North Dakota. From the initial filing of the application through the Commission's issuance of its second supplemental order, the siting procedure spanned 18 months and the Commission has had jurisdiction over the construction process (including any post-construction restoration or remediation) for over 8 years.

5. On December 22, 2014, Dakota Access, LLC filed applications with the Commission requesting a certificate of corridor compatibility and a route permit concerning approximately 358 miles of 12-, 20-, 24-, and 30-inch diameter crude oil pipeline and associated facilities within the State for the project ultimately known as the Dakota Access Pipeline or DAPL. The Dakota Access Pipeline would carry half a million barrels of North Dakota oil daily through the Dakotas and Iowa to a distribution point in Illinois. The proposed (and ultimately Commission approved) route avoided the Standing Rock Sioux Tribe's reservation and crossed under Lake Oahe, a Missouri River reservoir in North Dakota. On March 25, 2015, the Commission deemed Dakota Access' applications for a certificate of corridor compatibility and a

route permit complete, conditioned upon receiving additional environmental reports including a wetlands and waterbody field survey report, the wildlife field survey report, the habitat assessment field survey report, and the tree and shrub inventory report.

6. Also, on March 25, 2015, the Commission issued a Notice of Filings and Notice of Hearings, scheduling hearings regarding the applications for a certificate of corridor compatibility and route permit for May 28, 2015; June 15, 2015; and June 26, 2015.

7. The Notice identified three issues to be considered: (1) Will the location, construction, and operation of the proposed facilities produce minimal adverse effects on the environment and upon the welfare of the citizens of North Dakota?; (2) Are the proposed facilities compatible with the environmental preservation and the efficient use of resources?; and (3) Will the proposed facility locations minimize adverse human and environmental impact while ensuring continuing system reliability and integrity and ensuring that energy needs are met and fulfilled in an orderly and timely fashion?

8. The three public hearings on Dakota Access' applications for certificate of corridor compatibility and route permit were held as scheduled. Hundreds of interested persons participated. Everyone who wished to testify was allowed to do so with no time restrictions. More than 30 hours of testimony was received during the public hearings.

9. The Commission heard and evaluated expert and citizen testimony regarding the environmental, health, recreation, soil, water resources, wildlife, and cultural and historic preservation consequences of DAPL. The Commission evaluated the Lake Oahe crossing under the Missouri River and other possible alternative routes through the state. Among the alternatives, the Commission considered the use of third-party infrastructure, other forms of transporting oil, including trucking and rail, and alternative routes of operation. DAPL's

approved route was based upon the opportunity to locate in proximity to existing infrastructure, minimize safety concerns, avoid environmentally sensitive areas, avoid indigenous and federally owned lands and other high-consequence areas as defined by PHMSA and State law, to minimize disruptive construction, and enhance efficient operation.

10. With respect to the chosen Lake Oahe crossing, the Commission heavily evaluated the route and considered its location relative to existing utility lines and pipelines. Paralleling DAPL with existing utility lines and pipelines throughout the route including in an existing crossing under the Missouri River minimized the amount of ground and area that would be newly disturbed, thereby reducing the risk of disturbing sites of historic and cultural significance or causing adverse environmental impacts. Other major points of discussion on the crossing were the depth of the crossing 64 feet below the reservoir bottom, the location of automatic block valves, worst-case spill scenarios and emergency response plans including the staging of equipment near the river crossing, and the Army Corps of Engineers' (Corps') evaluation of the preferred southern route.

11. In addition to the Commission's evaluation, the Corps' evaluation corroborated the current route as superior. The Corps July 2016 Environmental Assessment evaluated an alternative crossing north of Bismarck against DAPL's current route crossing at Lake Oahe. The results revealed the current DAPL route to be preferred in nearly every aspect. The current route and crossing would result in a 10.6% reduction in mileage, a 38% increase in corridor collocation with other infrastructure, and cumulatively less impact in nearly every other of the assessed factors, including waterbodies, floodplains, agriculture, and transportation crossings.

12. On January 20, 2016, having allowed all interested persons an opportunity to be heard and having heard, reviewed, and considered all testimony and evidence presented during

the State's extensive siting evaluation, the Commission issued its order granting Dakota Access its Certificate of Corridor Compatibility and Route Permit ("Certificate Order") pursuant to the North Dakota Century Code Chapter 49-22. Based upon the evidence and comments provided by numerous state and federal agencies, intervening parties, and the interested public, the Commission determined that the location, construction, and operation of DAPL would best minimize adverse human and environmental impacts. Commission's Finding of Fact Number 17 in the Certificate Order states that the Corps was specifically notified about the project and given an opportunity to confer with the State and the Commission on the justifications for the pipeline.

13. In addition to the initial published notices and Certificate Order, the Commission published additional notice of opportunities for hearing regarding requested corridor and route adjustments on September 16, 2015, and April 20, 2016, and issued a supplemental order on May 24, 2016. Many of the adjustments were made for environmental protection and to minimize impacts to affected landowners. The Commission monitored the construction and locational siting of the pipeline and currently continues to monitor the revegetation and remediation of the DAPL construction.

14. On June 20, 2019, Dakota Access, LLC filed an application to optimize and upgrade DAPL ("Optimization") by installing a new pump station in Emmons County to meet a need for additional transportation capacity. The Optimization added a new pump station to allow transportation of up to 1,100,000 total barrels per day.

15. On July 10, 2019, the Commission deemed the application complete and issued a Notice of Opportunity for Hearing. The Commission again considered the issues: (1) Will the location, construction, and operation of the proposed facilities produce minimal adverse effects on the environment and upon the welfare of the citizens of North Dakota?; (2) Are the proposed

facilities compatible with the environmental preservation and the efficient use of resources?; and (3) Will the proposed facility locations minimize adverse human and environmental impact while ensuring continuing system reliability and integrity and ensuring that energy needs are met and fulfilled in an orderly and timely fashion?

16. On July 30, 2019, the Standing Rock Sioux Tribe requested the Commission hold a hearing on the Optimization. The Commission responded on August 21, 2019, by issuing a Notice of Hearing for the issues to be heard. Following the issuance of the Notice of Hearing, the Standing Rock Sioux Tribe formally intervened in the proceeding.

17. On November 15, 2019, the Commission held a hearing on the Optimization. The hearing lasted over 13 hours with testimony and public comment. Much of the hearing discussed measures to mitigate impacts, leak detection, safety, emergency response training, and response plans that would be implemented by DAPL to ensure that the operations meet or exceed industry standards or requirements set forth by PHMSA.

18. On February 19, 2020, having allowed all interested persons an opportunity to be heard and having heard, reviewed, and considered all testimony and evidence presented during the State's additional siting evaluation, the Commission issued its Third Amended Certificate of Corridor Compatibility and Third Amended Route Permit approving the construction, operation, and maintenance of the pump station. Based upon the evidence and comments provided by numerous agencies, intervening parties, and the interested public, the Commission determined that there would be minimal adverse effects from the location, construction, and operation with the Optimization. Again, the Corps was specifically notified about the project and allowed to confer with the State and the Commission on the Optimization of DAPL.

19. Cumulatively, the Commission held four public hearings with an opportunity for full participation by intervenors, state and federal agencies, and the public. The Commission provided multiple additional opportunities for public hearings which received no requests to be heard. The Commission did not receive a request for reconsideration or rehearing from the issuance of any orders related to DAPL. Pursuant to the State's Administrative Practices Act, the Commission's Certificates and subsequent orders were subject to judicial review, if among other things, they were issued not in accordance with the law, did not afford a fair hearing, were not supported by the evidence, and did not sufficiently address the evidence presented by a party. No party, intervenor, or affected person challenged a Commission order granting a certificate or permit in any of the Commission proceedings.

20. DAPL is subject to the continuing jurisdiction of the Commission and has operated under the Commission's jurisdiction for over 6 years without incident or violation.

21. Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 11, 2023.

Julie Fedorchak
Commissioner
North Dakota Public Service Commission

ATTACHMENT B

Declaration of Doug Goehring

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

DECLARATION OF DOUG GOEHRING IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT

I, Doug Goehring, state and declare as follows:

1. My name is Doug Goehring. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

2. I have served as the North Dakota Agriculture Commissioner since 2009. As Agriculture Commissioner, I serve the people of North Dakota. I am the head of the North Dakota Department of Agriculture (Department). I am a member of both the North Dakota Industrial Commission (Commission)[1] and the North Dakota Pipeline Authority (NDPA).[2] Beyond my responsibilities to North Dakota's agriculture industry, my public duties and portfolio as Agriculture Commissioner include oil and gas, water, trade, business development, tax equalization, and infrastructure.

3. I am a third-generation farmer and operate a 2,800-acre, no-till farm with my son near Menoken in south central North Dakota, where we raise corn, soybeans, spring wheat, sunflowers, and barley. In the past, we have also produced winter wheat, durum, canola, mustard, millet, safflower, alfalfa, lentils, and field peas. We have also had a feeder cattle operation. I am very familiar with the agricultural industry, that is quintessential North Dakota and has defined North Dakota since statehood in 1889.

[1] The Industrial Commission (Commission) of North Dakota consists of the Governor, Attorney General, and Agriculture Commissioner. Each is a state-wide elected official. The Commission is tasked with managing industries, certain utilities, enterprises, and certain business projects on behalf of the State. See North Dakota Century Code chapter 54-17. The Commission also has jurisdiction over oil and gas resources, the investigation and publication of geological information, and the regulation of coal exploration, geophysical exploration, geothermal energy, paleontology resources, subsurface minerals, geophysical exploration, underground storage and retrieval of nonhydrocarbons, high-level radioactive waste disposal, and carbon dioxide underground storage in North Dakota through the Department of Mineral Resources Geological Survey and Oil and Gas Division. The Commission appoints the Director of the Department of Mineral Resources, who serves as Director of the Oil and Gas Division, the Assistant Director of the Oil and Gas Division, and the State Geologist. See North Dakota Century Code chapter 54-17.4.

[2] The North Dakota Pipeline Authority (NDPA) consists of the Governor, Attorney General, and Agriculture Commissioner. The NDPA was created in 2007 "for the purpose of diversifying and expanding the North Dakota economy by facilitating development of pipeline facilities to support the production, transportation, and utilization of North Dakota energy-related commodities thereby increasing employment, stimulating economic activity, augmenting sources of tax revenue, fostering economic stability, and improving the state's economy". North Dakota Century Code section 54-17.7-03,

4. North Dakota has approximately 26,000 farms and ranches, comprising nearly 39.3 million acres, or approximately 90 percent of the total land area in North Dakota. North Dakota agriculture contributes more than $30 billion in economic activity annually to the State.[3] North Dakota is our country's 10th largest agriculture-exporting state. As a prime exporter of agricultural products, North Dakota is often cited as the "breadbasket of the world."

5. The Department's mission is to "serve, advocate, protect and promote agriculture to benefit everyone." In furtherance of our mission, we promote agriculture to protect both the value and use of agricultural lands, protect agricultural capacity and output, and promote rural economic development and agricultural industries.[4] Any closure of the Dakota Access Pipeline (DAPL) by the United States Corps of Engineers (Corps) would negatively affect North Dakota agriculture.

6. I am also very familiar with the energy industry. Agriculture and energy, North Dakota's two largest industries, are tied intrinsically together. The availability and cost of energy directly impact the ability of farmers to produce food. Modern agriculture in North Dakota requires substantial energy inputs at all stages of agricultural production such as direct use of energy in farm machinery, water management, irrigation, cultivation, and harvesting. Post-harvest energy use in North Dakota likewise includes considerable energy inputs for food processing, storage, and transportation to waypoints and markets.

7. In addition, there are many indirect energy inputs used in agriculture in the form of mineral fertilizers and crop protection tools such as pesticides, fungicides, insecticides, and herbicides. To that point, in recent years, rising energy prices subsequently have resulted in increased costs in the manufacture and application of farm inputs, such as fertilizer and pesticides, consequently affecting farmers' overhead costs of production. Disruptions to transportation and availability of energy and energy-derived inputs would further significantly diminish the ability of agricultural producers in North Dakota to produce commodities predictably and efficiently and, ultimately, diminish their ability to provide food for consumers.

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[3] North Dakota produces over 50 different agricultural commodities. Soybeans, wheat, corn, cattle & calves, and canola are North Dakota's top commodities in terms of cash receipts. North Dakota farmers lead the nation in the production of more than a dozen important commodities, among them spring and durum wheat, rye, food grains, assorted beans, barley, flaxseed, canola, honey, sunflowers, pulse crops and more. North Dakota is also a hotbed for emerging crops like industrial hemp, hops, fava beans, and carinata. Of North Dakota's approximately 780,000 residents, under 3% are farmers and ranchers. Nonetheless, agriculture broadly supports nearly 25% of the State's workforce, which is higher than the national average of 19%. Agriculture remains the leading industry in North Dakota.

[4] The Department administers well over 100 separate active regulatory and other programs. Among these many programs are: (1) the Pipeline Restoration and Reclamation Oversight Program that connects landowners and tenants experiencing pipeline reclamation and restoration issues with an independent ombudsman pursuant to North Dakota Century Code section 4.1-01-17; (2) the Postproduction Royalty Oversight Program that connects royalty owners and well operators with an independent ombudsman to provide assistance with royalty payment issues pursuant to North Dakota Century Code section 4.1-01-26; and, (3) the North Dakota Mediation Service that may mediate disputes related to easements for oil and gas-related pipelines and associated facilities pursuant to North Dakota Century Code section 38-11.1-09.2.

8. DAPL[5] safely and efficiently carries approximately 50% of North Dakota's crude oil production and possesses the potential functional operational excess capacity to safely transport a great deal more. More specifically, DAPL currently transports considerably over 500,000 barrels daily out of North Dakota – generating billions of dollars of revenues and other economic benefits annually for the State. DAPL has assisted in providing North Dakota tens of thousands of jobs. Of additional note, DAPL transports approximately 60% of all crude oil produced by the Mandan, Hidatsa and Arikara Nation (MHA), known as the Three Affiliated Tribes.

9. In my opinion, the most safe, efficient, reliable, ecologically friendly, and cost-effective means of transporting crude oil within North Dakota is through pipeline infrastructure.[6] Over North Dakota agricultural working lands, DAPL is safely buried 4 feet deep. It is located well under the soil-level of agricultural cultivation and is more than one and a half feet deeper than what is required by U.S. Department of Transportation regulation. 49 CFR § 195.248.[7] DAPL has been fully constructed, and has been in continuous operation, for the past six-plus years without

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[5] DAPL stretches over 1,172 miles, safely and efficiently transporting North Dakota crude oil unidirectionally from the Bakken formation oil fields through South Dakota and Iowa, to the Patoka oil terminal in Patoka, Illinois. DAPL is the primary direct pipeline transportation service for North Dakota crude oil to the Patoka crude oil hub.

[6] According to the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration:

> The nation's pipelines are a transportation system. Pipelines enable the safe movement of extraordinary quantities of energy products to industry and consumers, literally fueling our economy and way of life. The arteries of the Nation's energy infrastructure, as well as one of the safest and least costly ways to transport energy products, our oil and gas pipelines provide the resources needed for national defense, heat and cool our homes, generate power for business and fuel an unparalleled transportation system.
>
> The nation's more than 2.6 million miles of pipelines safely deliver trillions of cubic feet of natural gas and hundreds of billions of ton/miles of liquid petroleum products each year. They are essential: the volumes of energy products they move are well beyond the capacity of other forms of transportation. It would take a constant line of tanker trucks, about 750 per day, loading up and moving out every two minutes, 24 hours a day, seven days a week, to move the volume of even a modest pipeline. The railroad-equivalent of this single pipeline would be a train of 225, 28,000-gallon tank cars.
>
> Pipeline systems are the safest means to move these products. The federal government rededicated itself to pipeline safety in 2006 when the PIPES Act was signed. It mandates new methods and makes commitments for new technologies to manage the integrity of the nation's pipelines and raise the bar on pipeline safety.

Available at https://www.phmsa.dot.gov/faqs/general-pipeline-faqs (last accessed Nov. 27, 2023); *see also* Diana Furchtgott-Roth, *Pipelines are Safest for Transportation of Oil and Gas*, Manhattan Institute for Policy Research, Issue Brief No. 23, June 2013 ("safety and accident statistics provided by the U.S. Department of Transportation for the extensive network of existing U.S. pipelines—including many linked to Canada—clearly show that, in addition to enjoying a substantial cost advantage, pipelines result in fewer spillage incidents and personal injuries than road and rail."). Available at https://manhattan.institute/article/pipelines-are-safest-for-transportation-of-oil-and-gas (last accessed Nov. 27, 2023).

[7] Under 49 CFR § 195.248 – Cover Over Buried Pipeline, agricultural lands in North Dakota are categorized as "any other area". Accordingly, 49 CFR § 195.248 requires any pipeline laid under those agricultural lands to be buried at a minimum of 30 inches deep.

any significant incident. Proper reclamation of affected lands along the pipeline corridor has been successfully completed.

10. Since DAPL became commercially operational on June 1, 2017, six and one half years ago, it has complied with all environmental requirements and all original easement conditions. For example, it has consistently complied with regular regulatory inspections and it has conducted immediate maintenance for any identified technical issue or concern. DAPL is constructed with numerous layers of safety protections inherent within it. Additionally, DAPL implements multiple, redundant safety measures. For example, DAPL has installed main line valves, that are automatic or remote-controlled and can be controlled manually if needed, on both sides of the Lake Oahe crossing.[8] These valves can quickly stop flow in an emergency. Further, it performs real-time 24/7/365 monitoring, by a sophisticated computerized leak detection system.

11. The DAPL Lake Oahe Crossing Project Draft Environmental Impact Statement (DDEIS) says: "Based on the 2016 EA and Remand Analysis, Dakota Access constructed and has operated the pipeline for nearly 6 years with the incorporation of the environmental requirements and original easement conditions into all construction specifications; to date, there has been no release along the pipeline's main line".[9] I agree.

12. In the construction and consequent operation of any infrastructure, risk can never be avoided completely. Instead, risk is properly assessed and then technically mitigated and methodically managed based upon verifiable data and sound engineering principles & practices. No transportation method is without risk. Government regulations for tanker truck, rail, and pipeline transportation operate to properly manage and minimize real potential risk to the public and environment.

13. DAPL remains the lowest safety risk, and therefore is the most manageable and viable method of consistently and efficiently moving the largest amount of product. DAPL is as safe as can be reasonably expected from any crude oil transportation method[10] – and the safest bulk method in North Dakota that is available.

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[8] Lake Oahe, under the Corps' jurisdiction and management, is a manmade impoundment/reservoir behind Oahe Dam on the Missouri River. Notwithstanding that DAPL spans four separate states and is almost 1200 miles long, this entire DDEIS controversy wholly concerns just one very short 1.7-mile DAPL segment, located north of the Standing Rock Reservation border, that is buried underground 95 to 126 feet far beneath the lakebed of Lake Oahe, that has operated safely for the past six and one half years, and that continues to operate safely.

[9] DDEIS, pg 5-1, September 2023.

[10] The Corps already thoroughly assessed DAPL and specifically found no significant environmental impact. The Corps determined "the likelihood of a [spill event] is very low" and that "in the unlikely event of a spill during operations of the pipeline, impacts to water resources would be further mitigated" by the response plans DAPL had in place. U.S. ARMY CORPS OF ENGINEERS, MITIGATED FINDING OF NO SIGNIFICANT IMPACT, ENVIRONMENTAL ASSESSMENT: DAKOTA ACCESS PIPELINE PROJECT (July 25, 2016) pg. 48. Available at https://www.energylawprof.com/wp-content/uploads/2017/03/DAPL-EA-VOL-1.pdf (last accessed Nov. 27, 2023). Since this Corps' 2016 determination of no significant environmental impact in relation to the construction and operation of DAPL, there has been no technically supported material change to this assessment. DAPL has consistently demonstrated safe and efficient performance since it became operational six and one half years ago.

14. If the Corps chooses to unnecessarily mandate the closure of DAPL – a reliable and efficient crude oil pipeline operating safely – by selecting any of the DDEIS Alternatives 1, 2, or 5, it would significantly negatively impact North Dakota's primary agriculture and energy economies. Halting DAPL operations, temporarily or permanently, would adversely affect North Dakota and consequently impact national security.[11] A DAPL shutdown would unnecessarily and irreparably harm North Dakota, North Dakota agriculture, North Dakota energy, the Department, and North Dakota residents including North Dakota farmers and ranchers.

I. DAPL poses no serious safety risk to the drinking water of the Standing Rock Sioux Tribal Nation.

15. Dispel the myth. DAPL poses little, if any, safety risk to the water source of the Standing Rock Sioux Tribal Nation. Notwithstanding that numerous crude oil, natural gas, and refined products pipelines cross the Missouri River upstream of the Standing Rock Reservation,[12] many activist groups and individuals have singled out and stridently oppose DAPL – asserting this one particular pipeline must be stopped to protect the primary potable water source of the Tribal Nation. These groups and individuals, many self-identifying as "water protectors", continue under a mistaken and erroneous belief that the Tribal Nation continues to draw its drinking water from the Fort Yates intake located a short distance downstream from where a very small section of DAPL is located far below the lake bottom of Lake Oahe.

16. This belief continues to be exceedingly wide of the mark. DAPL poses *de minimis* potential threat to the drinking water of the Tribal Nation and the Standing Rock Reservation community. In the first place, DAPL has continually been in safe operation for six and one half years. It has a solid safety history. Secondly, DAPL is located far away from where the Tribal Nation obtains its water. Since 2017, the northern part of Standing Rock Reservation has been supplied with potable water from a new water treatment plant and new water intake that are both located a substantial distance away from DAPL. The new water intake is over 70 mines miles downstream from DAPL in the Lake Oahe Basin.[13]

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[11] *C.f.*, Section 324(b) of the Fiscal Responsibility Act of 2023 ("CONGRESSIONAL FINDINGS AND DECLARATION.—The Congress hereby finds and declares that the timely completion of construction and operation of the Mountain Valley Pipeline is required in the national interest.").

[12] For one example, the Northern Border Pipeline (NBPL), carrying natural and synthetic natural gas and operating over the past four decades, generally follows the same pipeline corridor as DAPL. Additionally, DAPL runs parallel to NBPL for about the last 40 miles leading up to the Missouri River/Lake Oahe. At that point, NBPL crosses Lake Oahe at the same location as DAPL but is positioned underground above DAPL at a much shallower depth beneath the lakebed. DAPL, on the other hand, is buried far deeper under the bottom of Lake Oahe than NBPL. NBPL, in continued operation since 1982, has not had a significant operational incident impacting the quality of water in the region, its local environment, or the Standing Rock Reservation.

[13] Well over a decade before DAPL was constructed, the Fort Yates intake failed requiring it to be eventually replaced. Similarly, the aging Fort Yates Water Treatment Plant also necessitated a replacement system. Consequently, in 2009, the United States Bureau of Reclamation awarded $18.9 million to the Standing Rock Sioux Tribe to construct a new water treatment plant and a new raw water intake over 70 miles downstream near Mobridge, South Dakota. In 2017, the same year DAPL became commercially operational, the water treatment system and water distribution service for the northern region of the Tribal Nation was fully transferred to the Standing Rock Rural Water System Water Treatment Plant. "The Standing Rock Rural Water System (RWS) Water Treatment Plant, located approximately 14 miles north of the community of Mobridge, SD along highway 1806, pumps raw water from Lake Oahe and treats the

17. No part of DAPL crosses or encroaches upon the Standing Rock Sioux Reservation or comes into contact with either Lake Oahe or the Missouri River. The relatively short length of DAPL that is routed deep under Lake Oahe, directionally bored underground far below the lake bottom and buried beneath layers of shale and hard nonporous clay, is over 70 miles upstream from the primary water source of the Tribal Nation. Modern and effective DAPL safety measures, combined with the considerable depth that DAPL is buried underneath the bottom of Lake Oahe and given that the water intake is over 70 miles away, make it readily apparent that DAPL poses little or no threat to the rural water system for the entire surrounding area.

II. DDEIS Alternative 3 is the only common-sense alternative. DDEIS Alternatives 1, 2, or 5 would cause North Dakota and its residents unnecessary and irreparable harm.

18. I recommend the Corps selects Alternative 3 of the five Alternatives the Corps suggests in its DDEIS. Alternative 3 would grant the requested federal easement as it was earlier granted and it would permit the increase in the volume of oil allowed from 570,000 to 1.1 million barrels per day.[14] This capacity increase would support additional energy development and economic growth. I believe Alternative 3 is by far the best, and most rational, apolitical, and science-based Alternative.

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water to regulatory standards". *2020 Confidence Report for the Standing Rock Rural Water System, For communities of Wakpala, Kenel, Little Eagle, Bullhead, Cannonball, Porcupine, Fort Yates, City of Solen, and City of McLaughlin, For all Rural Water Users, PWSID# 084690510*, pg 1. Available at https://standingrock.org/wp-content/uploads/2021/07/2020-Standing-Rock-CCR.pdf (last accessed Nov. 27, 2023); *see also*, *United States Bureau of Reclamation News Release: BISMARCK, N.D. – Standing Rock Rural Water Supply System Delivers Water, For Release: Aug. 21, 2017*:

> "Construction of the Water Treatment Plant, the new water intake, and many miles of pipe, ensures safe, clean and reliable drinking water for the people of Standing Rock," said Standing Rock Sioux Tribal Chairman, Dave Archambault ... "Projects like these demonstrate the benefits of investments in infrastructure to meet the current and future needs of the Tribe," said Bureau of Reclamation Area Manager Arden Freitag. "This project completes a major effort to stabilize the water supply for the communities on the northern part of the reservation, replacing the Fort Yates Intake that failed in 2003 and an aging water treatment plant."

Available at https://www.usbr.gov/newsroom/newsroomold/newsrelease/detail.cfm?RecordID=60316 (last accessed Nov. 27, 2023).

[14] This significant pipeline operational capacity increase would bring the federal easement in alignment with current operating authority granted by the Illinois Commerce Commission (ICC). On September 15, 2022, the ICC entered an Order approving the Dakota Access Pipeline and Energy Transfer Crude Oil Pipeline expansion by authorizing the upgrading of pumping station facilities to increase DAPL's oil throughput capacity from 570,000 barrels to a maximum of 1.1 million barrels daily. The ICC Order found that based on the comprehensive administrative record, Dakota Access, LLC and Energy Transfer Crude Oil Company, LLC established that the expansion project is reasonable and necessary and will be beneficial for and convenience the public. *Dakota Access, LLC and Energy Transfer & Crude Oil Company, LLC Joint Petition for an Order under 19-0673 Section 8-503 of the Public Utilities Act for authority to install additional pumping stations and pumping facilities on existing certificated pipelines in the State of Illinois, State of Illinois, Illinois Commerce Commission, Order on Remand*, Sept. 15, 2022. Available at https://icc.illinois.gov/docket/P2019-0673/documents/328092/files/571105.pdf (last accessed Nov. 27, 2023).

19. If the Corps selects any of the DDEIS Alternatives 1, 2, or 5, it will cause North Dakota and its residents unnecessary irreparable harm and compromise the food security, energy security, and economic security of our country.

20. Both DDEIS Alternatives 1 and 2 are draconian and simply make no sense. DAPL is functioning reliably, effectively, and safely. Both of these proposed Alternatives to close down DAPL are exceedingly unwise. Each would shut down DAPL, cost the State of North Dakota highly substantial losses of tax revenue, negatively affect North Dakota agriculture production, imprudently displace North Dakota crude oil onto less safe and more costly forms of transport, and compel the exceedingly expensive construction of a new pipeline.

21. DDEIS Alternative 5 is also both unnecessary and extreme. Any mandated reroute by the Corps would shut down DAPL for a number of years and significantly, extraneously, and irreparably harm North Dakota and North Dakota agriculture.

a. Rerouting DAPL north of Bismarck, North Dakota as proposed in Alternative 5 would disrupt agricultural production, for approximately three to five years, in an area that spans well over 100 miles of North Dakota existing cropland and rangeland. This would result in aggregate North Dakota agriculture production losses estimated at tens, and potentially hundreds of millions of dollars.

b. Any mandated reroute – as presently proposed by the Corps in DDEIS Alternative 5 – would unnecessarily divert limited available North Dakota railcar capacity from agriculture transport to crude oil transport; needlessly disturb, overturn and damage agricultural soils over thousands of acres of North Dakota cropland and rangeland; create circumstances in which noxious and invasive weeds could thrive along the new pipeline corridor; compel the increased use of pesticides and fertilizer over consequently disturbed land areas; and result in highly exorbitant reclamation costs.

22. DDEIS Alternative 4, with its additional mandated federal regulatory and oversight requirements, would be needlessly onerous and costly. In my opinion, it would serve no useful purpose other than to deftly illustrate unnecessarily burdensome federal government overregulation. There does not appear to be any sound engineering need or valid technical justification for imposing additional layers of federal governmental administrative regulations upon ongoing DAPL sustainment operations.

III. Pipeline reroute construction, resulting from DDEIS Alternative 5, would result in more semi-trailer tanker truck and railcar transport, and would divert limited railcar transport from agriculture to crude oil.

23. The importance of dependable and sufficient railcar capacity to North Dakota's agriculture industry cannot be overstated. North Dakota agriculture consistently relies on efficient and cost-effective railcar transportation. For example, many North Dakota grain elevators transport nearly all their commodity inventories by rail. Railcars in North Dakota regularly transport spring wheat, durum, barley, corn, soybeans, animal feed, and fertilizer. Eighty-three percent (83%) of North

Dakota total agricultural commodity production is shipped by rail including approximately 90% of North Dakota wheat, 90% of soybeans, and 80% of corn.

24. Each day, DAPL removes from North Dakota's railways the equivalent of over 815 railcars that would otherwise restrict capacity and velocity on the State's rail system (or the equivalent of over 3000 commercial semi-trailer tanker trucks). North Dakota has limited refining capacity and as a result most Bakken formation crude oil produced in the State must be shipped and exported out of the State to be refined. Consequently, if DAPL is closed down and no longer operating, North Dakota oil producers will then have an immediate critical need for a replacement transportation method to export approximately 570,000 barrels of crude oil daily out of the State.

25. With very few available practical options, oil producers will be compelled to substantially increase rail and tanker truck transporting. Rail and trucking oil transportation systems, on a volume-distance basis (i.e., per barrel-mile), add more risk and create more expense. Once built, a crude oil pipeline like DAPL is a significantly less expensive option for moving oil than by railcar or tanker truck. Moreover, both these methods are less efficient, more energy intensive, and less environmentally friendly. In addition, the thousands of additional railcars and tanker trucks carrying inflammable crude oil throughout the State would lead to additional railway and roadway congestion in North Dakota as they travel through cities, rural communities, and rural areas.

26. If predominantly relying upon rail, because the typical rail tank car carries about 715 barrels, it would take an *additional* projected 800 rail tank cars every single day to transport one way the crude oil that otherwise would be conveyed by DAPL. Then, after these railcars reach their respective destinations and the oil is delivered and offloaded, all these railcars would have to be returned to North Dakota empty and be immediately readied for the next trip. Furthermore, it would take several months or more for railroads within the State to successfully ramp up rail crude oil shipping, and there is no guarantee existing railroads additionally could effectively accommodate DAPL's current operational capacity.

27. If DAPL is shut down, the oil industry – that already competes with the agriculture industry for existing limited rail capacity – would then become a much more formidable competitor within the available rail transport market. Railroads, through local railcar auctions, allocate scarce and limited rail capacity to the customers with the highest willingness to pay. Along these lines, oil producers would suddenly command a considerably greater share of local railcars and railways, inevitably displacing North Dakota agricultural commodities and goods. This could stress short-term and long-term local agricultural storage capacity and, in some cases, potentially strand North Dakota agricultural products.

28. Due to this substantially increased rail transport demand, it would significantly increase the costs North Dakota farmers and ranchers must pay to haul commodities and livestock to market. This would place unnecessary additional production expenses on North Dakota agricultural producers, processors, and retailers. Ultimately, all these added costs would subsequently be passed onto consumers.

29. A DAPL shutdown would affect the food security of all who depend upon North Dakota agricultural producers, processors, and retailers to ship affordable food through rail transport.[15] That said, every single American citizen also uses petroleum products daily in some capacity. The cost and price of energy is built into nearly everything Americans use and consume. To this point, oil pipelines like DAPL help keep energy prices low. In the end, if DAPL is shuttered, the American consumer would pay more for food, heating, cooling, and transportation, with the most vulnerable in our nation being hurt the worst – those in underserved communities, and the socially and economically disadvantaged.

IV. Pipeline reroute construction, resulting from DDEIS Alternative 5, would result in an increase in noxious and invasive weeds.

30. Construction of a new rerouted DAPL pipeline would dramatically expose healthy settled organic soils in North Dakota to noxious and other weeds. Pipeline construction activities include ground disturbance such as grading or the use of vehicles or equipment that could introduce noxious weed seeds or propagules. These activities would directly or indirectly cause the spread of noxious, invasive, and other troublesome weeds. They grow quickly, produce a lot of seeds, are long-lived, and do not require continued disturbance to persist.

31. The Department prioritizes the following thirteen noxious weeds for control efforts.

- Absinth wormwood (*Artemisia absinthium*)
- Canada thistle (*Cirsium arvense*)
- Dalmatian toadflax (*Linaria genistifolia*)
- Diffuse knapweed (*Centaurea diffusa*)
- Houndstongue (Cynoglossum officinale)
- Leafy spurge (*Euphorbia esula*)

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[15] See generally also Elaine Kub, CFA, Agricultural Economist, *Rail Traffic Congestion: Economic Losses to Agricultural Sectors if Oil Transported by the Dakota Access Pipeline Shifts to Rail*, July 2023, Executive Summary, pg 7:

> If flows on DAPL were to shift to the Midwest rail system, and freight congestion were to occur that was similar (or worse) than what occurred in 2013-2014, the agricultural industry [in the Midwest] should expect to lose over $3 billion per year. The economic losses would come from at least three sources:
>
> 1. Freight costs passed back to farmers in the form of weaker grain bids. May lead to $1.51 billion in annual losses.
> 2. Increased freight costs for processed ag commodities and a loss of 9% of annual ethanol production. May lead to $1.48 billion in annual losses to the ethanol industry.
> 3. Higher freight costs to ship ag inputs (e.g., fertilizer) by rail. May cost ag retailers and farmers $45 million more annually to receive necessary products.

Available at https://elainekub.com/freight-congestion/ (last accessed Nov. 27, 2023); see generally also Elaine Kub, CFA, Agricultural Economist, *Insufficient Freight, An Assessment of U.S. Transportation Infrastructure and Its Effects on the Grain Industry*, July 2015, pg. 7 ("The rail service challenges of 2014 may have cost the average North Dakota corn farmer more than $10,000 off his corn receipts alone, not including other agricultural products that were also affected by freight costs."). Available at https://www.ourenergypolicy.org/wp-content/uploads/2015/07/InsufficientFreight-WhitePaper-D7.pdf (last accessed Nov. 27, 2023).

- Musk thistle (*Carduus nutans*)
- Palmer amaranth (*Amaranthus palmeri*)
- Purple loosestrife (*Lythrum salicaria, Lythrum virgatum*, and all cultivars)
- Russian knapweed (*Centaurea repens*)
- Saltcedar (*Tamarisk* spp.)
- Spotted knapweed (*Centaurea maculosa*)
- Yellow toadflax (*Linaria vulgaris*)

32. Noxious and invasive weeds substantially decrease land productivity, its value for forage or other uses, and ultimately its value per acre. Preventing the intrusion and establishment of all these above noxious weeds, along with other nuisance and invasive weeds not listed above, would have to be effectively controlled with expensive crop protection measures – including the application of thousands of gallons of additional herbicides upon the new pipeline corridor that would have otherwise been unnecessary.

V. Pipeline reroute construction, resulting from DDEIS Alternative 5, would require subsequent extensive and highly costly reclamation efforts occurring over a minimum of three to five years.

33. Upon completion of any DAPL reroute construction in North Dakota, land reclamation work would necessarily begin. It would take many years of land management to build the soil health to the same level as it was prior to the pipeline construction. It is not uncommon that a construction company would be required to work closely with landowners on a reclamation plan comprising five or more years for the affected lands to reach satisfactory recovery levels.

34. If very favorable conditions occur over the next two years following the completion of construction, some agricultural lands along the new pipeline corridor soil might recover to a suitable usable level of 50% – however, only if optimum weather and moisture conditions exist. Most likely, for at least the first two years following pipeline installation, crop yields on the new route will be reduced by about 50%. For specific examples, soybean and corn yields will likely be reduced by at least 40% in the first cropping year after installation and about 25% in in the second year. Smaller, but still significant yield reductions would likely still be apparent at some sites in the fourth year after construction and beyond.

35. The damage costs associated with reclamation would be exorbitant. The reclamation cost per each mile of cropland/pastureland along the reroute would be at least $50,000. This is a conservative estimate. Actual costs would likely be much higher.

36. Certain pipeline damage payments to landowners in North Dakota in 2022 ranged from $850 to $1250 per rod with up to $2500 per rod paid in certain special circumstances. At an average rate of $1000 per rod, 1 mile or 320 lineal rods of easement would be upwards of $320,000. An easement that is 33-to-66 foot-wide and 1-mile-long is equivalent to approximately 4-8 acres of surface area. At that rate, the damage compensation estimate would be $40,000 to $80,000 per acre required to be paid to affected landowners.

37. Regardless of what reclamation calculation or estimate is used, landowner expectation for damage payments from any pipeline reroute would be exceedingly high. The highest costs would likely arise in areas toward the middle of the Bakken formation, the center of North Dakota oil production activity, with decreasing cost amounts moving outward. An average of approximately \$1000 per rod across the entire construction reroute is reasonably expected for reclamation costs.

VI. Conclusion and Recommendation that the Corps selects DDEIS Alternative 3.

38. In my view, DAPL presently well serves our nation and North Dakota. It increases national energy security and energy independence by supporting domestic production and assisting our country to reduce reliance on waterborne foreign and potentially unstable and unreliable sources of oil. DAPL and the product it carries help provide economic growth for communities across North Dakota. It greatly supports North Dakota's predominant agriculture and energy economies, helps generate billions in State tax revenue, and substantially reduces truck and rail congestion on the State's roadways and railways.

39. DAPL is state of the art, highly monitored, and has operated safely and effectively since it went online over six years ago. DAPL construction incorporated and complied with environmental requirements and original easement conditions. DAPL is already solidly constructed to rigorous modern industry standards and routed correctly.

40. DAPL is safely and dependably operating in an environmentally responsible manner as it efficiently transports approximately 50% of North Dakota's crude oil production. It has the potential excess capacity to safely transport substantially more. As I see it, a shutdown of DAPL would inevitably cause North Dakota and its citizenry unnecessary irreparable harm.

41. I remain especially concerned about any reroute of DAPL. A new pipeline corridor would have to be identified over existing North Dakota agricultural working lands, over a hundred miles of permanent and temporary easements would need to be attained, and new State, federal, and local permits would have to be acquired – and then a new pipeline along that new corridor route would have to be constructed. In my view, if the Corps selects an Alternative that necessitates that DAPL is rerouted, this requirement would <u>not</u> be scientifically based upon verifiable data and sound engineering principles & practices.

42. Requiring DAPL to be rerouted would readily appear to be an attempt to kill DAPL operations through political and bureaucratic maneuvering, the imposition of added exorbitant costs, and unacceptable and gratuitous delay. Dictating such an unwarranted reroute requirement consequently would undermine the legitimacy of the National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) regulatory process..

43. The Corps' selection of Alternative 3 will help maintain our national energy security, national economic security, and national food security – and correspondingly will strengthen our overall national security. Keeping DAPL in full continuing safe operation serves both United

States national and North Dakota state interests. The Bakken formation in North Dakota is one of the most important sources of new oil production in the United States.[16]

44. The ability to safely deliver crude oil by pipelines like DAPL is essential to the security of the United States and a fundamental aspect of modern life, with significant positive economic and public health implications. North Dakotans are first and foremost citizens of the United States, and so DAPL – providing our country safe, economical, and ecologically friendly access to a secure, substantial, and dependable energy supply in North Dakota to help meet our country's critical collective energy needs – benefits North Dakota citizens, both directly and indirectly.

45. The Corps' selection of DDEIS Alternative 3 would be pragmatic, balanced, and solidly founded – and North Dakota would not be subjected to entirely unnecessary and irreparable harm. Adopting Alternative 3 and appropriately granting the federal easement would duly recognize the proper management and use of federal jurisdictional lands, such as Lake Oahe, for the public's benefit and would solidly support North Dakota and its citizens.

46. I recommend the Corps selects DDEIS Alternative 3, grants the federal easement, and continues to allow the safe and clean operation of DAPL. The Corps should exercise good governance and rightly dismiss from any further consideration DDEIS Alternatives 1, 2, and 5 that would close down DAPL. Let common sense prevail. Select DDEIS Alternative 3.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 6, 2023.

Doug Goehring
North Dakota Agriculture Commissioner

[16] *E.g., National and Global Petroleum Assessment: Assessment of Undiscovered Continuous Oil Resources in the Bakken and Three Forks Formations of the Williston Basin Province, North Dakota and Montana, 2021,* U.S. Department of the Interior (USDOI), U.S. Geological Survey (USGS) Fact Sheet, December 2021, pg. 1 ("Using a geology-based assessment methodology, the U.S. Geological Survey estimated undiscovered, technically recoverable mean resources of 4.3 billion barrels of oil and 4.9 trillion cubic feet of gas (associated) in the Bakken and Three Forks Formations of the Williston Basin Province, North Dakota and Montana."). Available at https://www.usgs.gov/programs/energy-resources-program/science/assessments (last accessed Nov. 27, 2023).

ATTACHMENT C

Declaration of William Peterson

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

DECLARATION OF WILLIAM PETERSON IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 8, 2023 DRAFT ENVIRONMENTAL IMPACT STATEMENT

I, Bill Peterson, state and declare as follows:

1. My name is William Peterson. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.
2. I am the State Historic Preservation Officer and Director of the State Historical Society of North Dakota (SHSND). The SHSND is the agency within North Dakota responsible for protecting historic properties. As such, the ND SHPO, within the Archaeology and Historic Preservation Division (AHP) of the SHSND, reviews federally proposed, licensed, and/or funded projects and the concomitant historic property identification, evaluation, protection, preservation, and development and/or mitigation efforts. Further, the AHP, through the Director, is responsible for the preservation and interpretation of antiquities on the state level (see North Dakota Century Code [NDCC] 23-06-27, 55-02-03, 55-02-07, 55-02-07.1, 55-03-01, 55-03-01.1, 55-10-01, 55-10-09). Under Section 106 of the National Historic Preservation Act, federal agencies and their delegates must consult with the State Historic Preservation Offices (SHPOs), Tribal Historic Preservation Offices (THPOs), local governments, applicants, and interested individuals and groups. The consultation addresses any potential impacts federal projects may have on historic properties.
3. Since 2014, our agency has been involved in the permitting review process across the entire state and federally regulated Dakota Access Pipeline. Our staff was involved in recommending cultural resource surveys for the project area. One hundred percent of the corridor was either previously surveyed or was surveyed for this project. We reviewed these survey reports, recommended testing of sites to be impacted, highlighted significant sites to

be mitigated that could not be avoided, and reviewed all testing and mitigation reports. Regulators addressed more than 500 identified cultural resource sites through reroutes, mitigation, or other measures. The pipeline was moved 140 times to avoid impacting these resources.

4. Specific to the USACE permit addressed by the current draft Environmental Impact Statement, the USACE started consultation on the existing pipeline river crossing (which would remain under Alternatives 3 and 4) with the ND SHPO in 2014. The ND SHPO reviewed all submitted documents. Based on survey data, known historic properties' location, and avoidance measures, the USACE made a determination of No Historic Properties Affected on 4/22/2016. The ND SHPO concurred with the determination on 4/26/2016. The ND SHPO prefers an alternative that minimizes ground-disturbing activities that have the potential to affect historic properties negatively and is unaware of any efforts to identify historic properties or consult with interested parties as part of NHPA Section 106 compliance for Alternatives 1, 2, and 5. Alternatives 3 and 4 are the only options that have addressed Section 106 of the National Historic Preservation Act. Therefore, Alternatives 3 and 4 are the preferred alternative of the State Historic Preservation Office and its staff.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on December [12], 2023.

William D Peterson

Dr. William Peterson
North Dakota State Historic Preservation Officer and
Director, State Historical Society of North Dakota

ATTACHMENT D

Declaration of Susan M. Sisk

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Preliminary Draft Environmental Impact Statement

DECLARATION OF SUSAN M. SISK IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

I, Susan M. Sisk, state and declare as follows:

1. My name is Susan M. Sisk. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

2. I am the Director of the North Dakota Office of Management and Budget (OMB). Before my appointment as Director, I most recently served as vice president and director of finance for the Bismarck-based engineering firm KLJ from 2015 to 2021. Prior to that, I served as chief financial officer and controller for CHI St. Alexius Health in Bismarck for eight years and as director of finance for the North Dakota Supreme Court from 2001 to 2007. I also served as a tax accountant for a Bismarck accounting firm for nearly six years and as supervisor of fiscal management for the state Retirement & Investment Office from 1990 to 1995. I earned an undergraduate degree in accounting from Minot State University and a Master of Business Administration degree from Troy University in Montgomery, Alabama. I am a past president of the North Dakota Healthcare Financial Management Association and member of the North Dakota Society of CPAs.

3. OMB's mission is to provide innovative leadership and support to state government through five divisions: Fiscal Management, Human Resource Management, Central Services, Facility Management and Risk Management.

4. This declaration describes the extensive, immediate, unnecessary, and irreparable harm that will befall North Dakota and its citizens who did not assume any economic risk when the U.S. Army Corps of Engineers (Corps) approved the Dakota Access Pipeline ("DAPL").

5. North Dakota is a small state in terms of both population (47th out of 50 states, 2022 population estimates, U.S. Census Bureau) and economic output (45th out of 50 states, calendar year 2021 – Gross Domestic Product by State, Bureau of Economic Analysis), but ranks third out of the fifty states in terms of oil production (1.058 million barrels per day, calendar year 2022, U.S. Energy Information Administration). As of September of 2023, oil production had ramped up to $1.3M barrels/day. As a result, North Dakota is extremely dependent upon revenues from taxes on the extraction and production of oil and natural gas to fund government operations and essential services to state citizens. Native Americans in North Dakota also rely upon DAPL to ship oil. The Mandan, Hidatsa, and Arikara Nations (Three Affiliated Tribes). DAPL transports about 60% of their oil production, the receipts of which comprise a substantial amount of their annual budget.

6. Specifically, over ten percent of the State's general fund revenues are derived directly from oil and gas taxes and nearly sixty percent of the total of all tax and fee revenue received by the state comes from oil and gas extraction and production (based on October 2023 general fund forecast and on assumptions outlined in #8 below). The 2023-25 biennium legislative forecast (March 2023) assumes general fund revenues, excluding oil and gas taxes, of approximately $4.0 billion. Total oil and gas tax revenues during that same time are expected to

total $7.5 billion based on the assumptions outlined below. These revenues support programs from which all State residents benefit including education, healthcare, water resource management, law enforcement, roadways, libraries, veterans' services, public housing, parks and recreation, and other public services.

7. North Dakota accounted for 8.9% of the crude oil produced in the United States during calendar year 2022. However, there is limited in-state capacity for refining. Consequently, continued oil production in North Dakota is dependent upon reasonable methods of transporting crude oil produced in the State to out of state refining facilities. The most efficient, safe, and cost-effective method of transporting crude oil is through existing pipeline infrastructure. DAPL transports over 50% of the crude oil produced in North Dakota. Any reduction in pipeline capacity will increase the cost of transporting North Dakota crude oil to refining facilities.

8. The basis of taxation upon which North Dakota oil severance taxes are levied is defined as "the price paid for the oil under an arm's-length contract between the producer and the purchaser, less, when applicable, transportation costs associated with moving the oil from the point of production to the point of sale under the contract." (NDCC 57-51-02.3). Consequently, any increase in the transportation cost of crude oil lowers the basis of the North Dakota tax and correspondingly lowers the amount of tax collected.

9. Due to North Dakota's geographic location with significant distance to crude oil refining facilities, a certain level of "discount" from the West Texas Intermediate crude oil benchmark price is expected to allow for the transportation cost that is deducted before the North Dakota tax is calculated. For the twelve-month period prior to the operation of DAPL (June 2016 through May 2017), the transportation discount averaged $7.15 per barrel. For the twelve-month

period after DAPL opening (June 2017 through May 2018), the transportation discount averaged $4.75 per barrel, a reduction of $2.40, or 34 percent.

10. Based on the actual positive impact of DAPL operations to lower oil transportation costs, it is apparent a corresponding negative impact on tax revenue would result from any action that would close DAPL. Current projections for the State of North Dakota assumes oil production will average 1.3 million barrels per day through June 30, 2025, the end of the current two-year budget period.

11. The closure of DAPL would reduce state revenues for the first twelve months by approximately $1.2 billion assuming an approximate decrease in oil production of 50% for three months then gradually ramping up from DAPL to rail, until production is back to 1.3 million barrels per day over nine months, and an increase in transportation costs of $2.40 per barrel. This also assumes an average projected North Dakota price of $85.50 (Energy Information Administration (EIA) outlook less North Dakota transportation costs.

12. After the first year, estimated decreases in revenue due to the increased transportation costs is conservatively estimated to be $2.40/barrel which is $113.9 million per year until DAPL is up and running again. Over a four-year period using these assumptions the estimated reduction in revenue to the state would be $1.5 billion. Using these assumptions over a ten-year period the estimated reduction to revenue for the State of North Dakota is $2.2 billion, which equates to 13% of the current biennium on-going appropriation. This would be a substantial negative financial hit to the State of North Dakota and would adversely impact virtually every industry and citizen.

13. Shutting down DAPL at a time when crude oil production is rapidly recovering from the pandemic and is projected to grow for the next 15 years will worsen the harm that North

Dakota and its citizens have already endured as a result of the COVID-19 pandemic and the initial, short-term collapse in crude oil demand. It would also cause extensive disruption in the drilling, completion, production, and transportation sectors resulting in permanent job losses. *See* Declaration of Lynn D. Helms.

14. These estimates are conservative as oil prices are likely to go higher considering recent world events, and they assume that rail can be ramped up to handle the additional capacity over a 12-month period. At the time DAPL opened in 2017, rail capacity in North Dakota had grown to accommodate the increase in production. It would likely take several months or more for rail capacity to be restored, which could significantly increase the transportation discount during that period.

15. Another factor that could further decrease tax revenues if DAPL is closed relates to oil production contracts in North Dakota. Much of the crude oil that is transported through DAPL is subject to binding contracts committing that production to being transported through DAPL and not through other means of transportation. *See* Declaration of Lynn D. Helms. If this occurs, the loss of tax revenue to the State could be much higher.

16. As a State with a part-time citizen legislature that meets on a biennial basis, there are few viable options available to deal with a sudden, drastic change in the State's revenue. A long-term, ongoing reduction in state revenues from oil and gas taxes would result in the need to significantly reduce State services or significantly increase taxes on citizens.

17. In my view, any DAPL shutdown would greatly negatively impact the economy of North Dakota. It would cause North Dakota to lose billions in extraction tax revenues and would result in the loss of thousands of North Dakota jobs. It would unnecessarily and irreparably harm North Dakota and its residents.

18. Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 13, 2023.

Susan M. Sisk, CPA Director
North Dakota Office of Management and Budget

ATTACHMENT E

Declaration of Joseph A. Heringer

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Preliminary Draft Environmental Impact Statement

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DECLARATION OF JOSEPH A. HERINGER IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE USACE DRAFT ENVIRONMENTAL IMPACT STATEMENT

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1. I, Joseph A. Heringer, state and declare as follows:
2. My name is Joseph A. Heringer. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal knowledge and are true and correct to the best of my belief.
3. I am the Commissioner of the North Dakota Department of Trust Lands ("NDDTL"). I have been a licensed North Dakota attorney for eighteen years and a Certified Trust & Financial Advisor for twelve years. I have five years' active experience in the private practice of law and fourteen years' experience in the investment, trust, and wealth management industry.
4. In 1889, the United States Congress enacted The Enabling Act "to provide for the division of Dakota [Territory] into two states, and to enable the people of North Dakota, South Dakota, Montana, and Washington to form constitutions and state governments, and to be admitted into the union on an equal footing with the original states, and to make donations of public lands to such states." Through the Enabling Act, Congress granted to North Dakota approximately 3.2 million acres of land and

minerals to be used for the support and maintenance of common schools, colleges, universities, and other public institutions (collectively, "Public Institutions").

5. The Board of University and School Lands ("Board"), as established by the North Dakota Constitution, is charged with overseeing the management of certain lands and mineral rights and investing the revenue generated therefrom to grow as a funding source to support and maintain the Public Institutions. The Board is comprised of the Governor, Secretary of State, Attorney General, State Treasurer, and Superintendent of Public Instruction. NDDTL is the administrative arm of the Board, serving under the direction and authority of the Board.

6. As of the date of this Declaration, NDDTL manages approximately 2.6 million mineral acres, with their approximately 8,400 associated oil & gas leases, and over 700,000 surface acres, with their approximately 4,400 associated agricultural leases. Revenues generated from these leases, along with funds received from other revenue sources such as oil & gas lease bonus payments and easements granted for uses such as pipelines, roads, and well pads, are deposited into thirteen permanent trust funds ("Trusts") and two special funds (collectively, together with the Trusts, the "Funds") and invested to promote the permanency of distributions sufficient to support and maintain the Public Institutions as beneficiaries of the Funds.

7. In the 2023-2025 biennium, NDDTL will distribute $528 million from the Trusts to benefit the Public Institutions, nearly $500 million of which will come from the Common Schools Trust Fund ("CSTF") to support North Dakota K-12 public education. Over the last decade, NDDTL has distributed more than $1.8 billion from

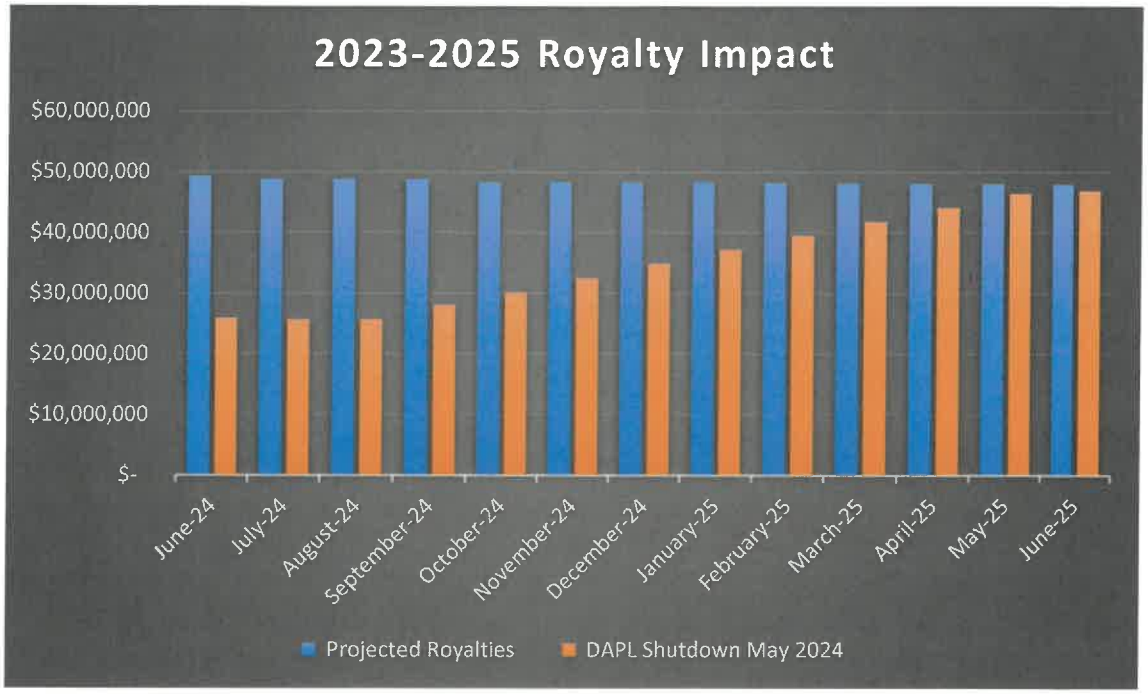
the CSTF to help educate North Dakota school children. This includes children educated in public schools located within North Dakota Indian Reservations.

8. NDDTL has reviewed potential impacts of the disruption or shutdown of the Dakota Access Pipeline ("DAPL") resulting from Alternatives 1, 2, or 5, as contemplated in the United States Army Corps of Engineers' ("USACE") proposed Draft Environmental Impact Study ("DEIS") and has concerns about such impacts as they pertain to Board managed Funds.

9. Alternative 5 contemplates a rerouting of DAPL in connection with Alternatives 1 and 2. The associated construction and downtime of such a reroute, estimated to begin as early as June of 2024, would have a significant adverse impact on revenue generated from Board managed lands. Due to the vast distance between the extraction point of crude oil in North Dakota and refining facilities in other states, a disruption in DAPL would negatively affect access to markets, driving down the price at which North Dakota crude oil can be sold. Accordingly, a conservatively estimated price differential of $2.40 per barrel was used to determine NDDTL's reduction in royalty revenues caused by a DAPL rerouting, but NDDTL expects differentials to be significantly higher until alternative routes of transportation to market are fully developed.

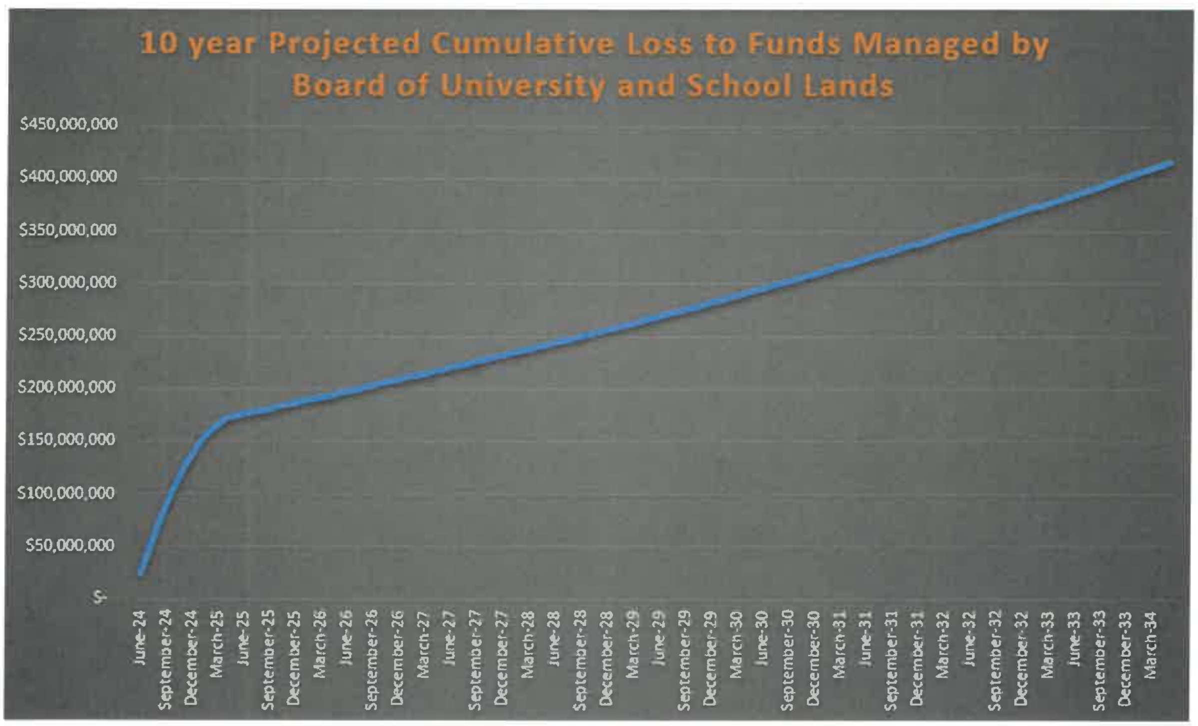
10. Assuming a 600,000 BOPD decrease in North Dakota oil and gas production for the first three months of a DAPL disruption caused by implementation of Alternatives 1, 2, or 5, then a gradual transition over the next nine months from DAPL to rail until production is back to 1.3 million barrels per day, a disruption of DAPL would

reduce royalty revenues to the Funds for the current biennium by approximately $171 million.



11. During the period of disruption, NDDTL estimates a minimum price differential increase of $2.40 per barrel. This also assumes an average projected North Dakota price of $85.50 (Energy Information Administration outlook). Using the above assumptions, the reduction in royalty revenues to the Funds over a four-year disruption period equals $211 million. For each year of disruption thereafter, royalty revenues would be reduced by an additional $13.6 million. Thus, a ten-year disruption period would reduce NDDTL royalties by $293 million and a twenty-year disruption period would reduce NDDTL royalties by $430 million. This would cause a substantial reduction in future Fund distributions, the largest beneficiary of which is K-12 public schools in North Dakota.

12. Pursuant to the fiduciary duties of the Board established by the Enabling Act and the North Dakota Constitution, revenue generated from the management of trust lands is prudently invested to generate further income for trust beneficiaries. When accounting for lost investment growth opportunity (assumed annual 7% rate of return), the estimated reduction in royalty revenues caused under DEIS Alternatives 1, 2, or 5 will cost the Funds a total of approximately $416 million if there is a ten-year DAPL disruption. Under a twenty-year disruption scenario, the cost to the Funds balloons to $886 million due to the loss of compounded investment growth.



13. The implementation of Alternatives 1, 2, or 5 would have a substantial and long-term negative impact on the financial support provided by the Funds to the state's critical Public Institutions, specifically North Dakota public K-12 schools which rely on the CSTF for nearly 20% of their per-student funding.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 8, 2023.

Joseph A. Heringer, J.D., CTFA
Commissioner

ATTACHMENT F

Declaration of Kirsten Baesler

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

DECLARATION OF KIRSTEN BAESLER IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

1. My name is Kirsten Baesler. I am over 21 years of age and am fully competent and duly authorized to make this declaration. The facts contained in this declaration are based on my personal and professional knowledge and are true and correct.

2. I am the North Dakota superintendent of public instruction. The superintendent's position is a statewide, nonpartisan elected office. I was first elected in 2012. I am serving my third term, which ends Dec. 31, 2024. I oversee the education of public and nonpublic school students in grades kindergarten through 12 in more than 480 school buildings across the state. I administer more than $1 billion in state aid payments to public school districts each year.

3. I am on the board of directors of the state Board of University and School Lands, which manages North Dakota's Common Schools Trust Fund. The Common Schools fund is a major source of state support for local schools, and one of its primary sources of income is oil royalty, lease, and bonus payments from state-owned mineral rights.

4. Before I was elected state superintendent, I worked for 24 years in the Bismarck, N.D., school district – the state's largest – as a vice principal, library media specialist, classroom teacher, and instructional assistant. I was also a member of the school board in neighboring Mandan, N.D., for nine years, including seven years as school board president.

5. This declaration describes the extensive, immediate, and irreparable harm that will be caused to more than 130,000 North Dakota public and nonpublic school students and their families, as well as the teachers, administrators, and school staff who support them if the Dakota Access Pipeline (DAPL) is shut down as a result of the U.S. Army Corps of Engineers selecting Alternatives 1, 2, or 5 in the final DAPL Environmental Impact Statement.

6. North Dakota's state Legislature normally meets every two years, and the state runs on biennial budgets. The current budget period began July 1, 2023, and ends June 30, 2025. During the most recent legislative session, which adjourned April 30, 2023, the Legislature appropriated $2.38 billion in state aid to local schools over two years.

7. This aid is heavily dependent on anticipated oil revenues. More than 10 percent of North Dakota's general fund revenues – which are used for K-12 education, higher education, human services, and other services for North Dakota's citizens -- are directly derived from taxes on oil and gas. Almost 60 percent of all state tax and fee revenue comes from oil and gas extraction and production.

8. Of the $2.38 billion in state aid to education I mentioned above, $1.7 billion will come from the general fund, which as I mentioned is reliant on oil and gas taxes. About $157 million will come from a state fund called the "foundation aid stabilization fund," which derives almost all its income from oil taxes. Almost $500 million will be provided by the Common Schools Trust Fund, which is also reliant on income from leasing oil, gas, coal, and other mineral interests on state-owned land.

9. So, a potential shutdown of DAPL would greatly disrupt state aid to local K-12 schools by reducing the revenues available for the Legislature to appropriate for education.

10. It would reduce state revenues available to provide instruction to public school students.

11. It would hamstring initiatives to increase the pay of our classroom teachers, and to relieve our shortages of both teachers and school administrators.

12. It would damage our efforts to support students with special needs.

13. It would limit the ability of our local schools to provide and maintain a bus transportation network for families who are not able to bring their students to school.

14. It will shift the responsibility for supporting local schools away from the state, which now provides more than 70 percent of local education expenditures, to local property taxpayers. This would lead to further inequities of access and opportunities for our students of color and special needs. Our mission in North Dakota K-12 education is to "Graduate all students Choice-Ready, with the knowledge, skills and disposition to be successful." This will severely deter the success of our mission.

15. As mentioned above, I have extensive background and experience at all levels of K-12 education in North Dakota. I can state with confidence that any DAPL would inflict substantial harm on K-12 education in our state.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 8, 2023.

Kirsten Baesler

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Kirsten Baesler
Superintendent
North Dakota Department of Public Instruction

ATTACHMENT G

Declaration of Vance Taylor

State of North Dakota Cooperating Agency Comments Concerning the United States Army Corps of Engineers' Lake Oahe Crossing Project Draft Dakota Access Pipeline Environmental Impact Statement

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DECLARATION OF VANCE TAYLOR
PRESIDENT AND CHIEF EXECUTIVE OFFICER
OF THE
NORTH DAKOTA MILL & ELEVATOR ASSOCIATION

I, Vance Taylor, state and declare as follows:

1. My name is Vance Taylor. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

2. I am the President and Chief Executive Officer (CEO) of the North Dakota Mill & Elevator Association, (NDM). I graduated from Kansas State University with a major in Milling Science and Management and from the University of North Dakota with a Master of Business Administration. My entire career has been spent working in the milling industry. I have managed NDM for over 23 years. I accepted the position of President and General Manager at NDM in 2000. I currently hold the position of NDM President and CEO. Previously, I worked for 19 years with ConAgra Foods at various locations across the United States serving in positions of increasing responsibility. I currently serve on the boards of the North American Millers Association, Dakota Pride Cooperative, the Northern Crops Council, the Wheat Foods Council, and I hold a seat on the Minneapolis Grain Exchange. I have also served on the board of the Grand Forks Chamber of Commerce and advisory boards of the Grand Forks Economic Development Corporation and Altru Hospital.

3. NDM is a state association under N.D.C.C. § 54-18-02, and accordingly may conduct business including "anything that any private individual, corporation, or limited liability company lawfully may do in conducting a similar business." "[A]ll acts of [NDM] are the

acts of the state of North Dakota functioning in its sovereign and governmental capacity. [NDM] is not a separate agency of the sovereign power, but is the state itself functioning." N.D.C.C. § 54-18-02. NDM is a state agency wholly owned by the State of North Dakota. NDM is entirely under the supervision of North Dakota, specifically by the North Dakota Industrial Commission. N.D.C.C. ch. 54-18.

4. NDM is the only state-owned flour mill in the United States. NDM was incorporated in 1919 and became operational in 1922 with the mission to engage in manufacturing and marketing of farm products, through the establishment of a warehouse, elevator, and flour mill system to promote agriculture, commerce, and industry in North Dakota. NDM, located in Grand Forks, ND, is the largest single location wheat flour mill in North America and the 8th largest wheat milling company in the United States with revenues over $500 million per year. The NDM facility includes ten separate milling units producing 60,500 cwt of milled products daily, a terminal elevator with total available storage of 5,000,000 bushels, and a packing warehouse capable of producing, storing, and shipping large quantities of various sized bags of milled products. In addition, NDM produces over 16,500 cwt of food grade bran and wheat midds daily. NDM cleans, processes, and mills 130,000 bushels of top-quality spring and durum wheat daily, adding value to approximately 42,000,000 million bushels annually.

5. NDM generates all its operating funds from its own operations. No legislative appropriation or other funding is received from the State of North Dakota. NDM is legislatively mandated to transfer 5% of its yearly profits to the Agricultural Product Utilization Fund (APUF) and 50% of the remaining yearly profits to the State of North Dakota General Fund (General Fund). Last fiscal year ending June 30, 2023, NDM earned $17.2M in profits, up from $14.6M the previous fiscal year. In the past 53 fiscal years, NDM has transferred well over $150 million to APUF and the General Fund.

6. NDM ships approximately 80% of the milled products it produces by rail. In an average week, NDM ships approximately 170 railcars of bulk flour, bagged flour, and midds to customers located throughout the United States and Southern Canada. NDM leases a

fleet of railcars to ensure consistent and exclusive use of the railcars. Railcars are shipped from NDM full of product and returned to the facility empty and ready to be cleaned and reloaded for the next NDM shipment. The NDM fleet of railcars includes 890 pressure-diffused cars for bulk flour shipments, 108 box cars for bagged flour shipments, and 97 covered hopper cars for midds. In addition to outbound shipments, NDM receives, on average, 60 railcars per month of durum and spring wheat to be processed into durum and spring flour. Depending on crop conditions, the amount of inbound wheat and durum railcars can reach 110 plus railcars per month.

7. In 2013 and 2014, before the Dakota Access Pipeline (DAPL) became operational, NDM experienced many rail service disruptions due to rail traffic congestion between Fargo, ND and Chicago, IL – due to large amounts of the Bakken region's crude oil outputs being shipped by railcar. Due to these rail service disruptions, NDM had to slow down production and in many cases (25-30 occasions) completely shut down flour production because of the increased transit times of our railcar fleet. The fleet cycle times increased 10% over normal conditions, which equated to an average of 4 days per round trip on each railcar.
8. NDM has reviewed and assessed potential impacts of a disruption or shutdown of DAPL. If DAPL is shut down, NDM would reasonably expect the following:
    a. The shipment of oil by rail versus by DAPL would increase the fleet cycle times for our railcars due to rail congestion. A 10% increase in cycle time equated to 4 days of extra transit time for railcars in 2013 and 2014. Using this as a baseline, NDM would need to lease an additional 72 pressure-differential cars for bulk flour, an additional 12 box cars for bagged flour, and an additional 12 covered hoppers for midds. Leases for railcars are signed for 5-to-10-year terms. The annual cost to lease 96 additional railcars is estimated to be $1,113,840 with current interest rates.
    b. Increased rail cycle times may cause NDM production shutdowns due to a lack of rail cars to ship NDM products. The cost associated with plant shutdowns for NDM is estimated at $10,000 per lost production hour.

c. Increased rail congestion would lead to increased freight rates on inbound durum and spring wheat railcars. This will add costs to NDM to bring in the durum and spring wheat needed to grind into flour products.

d. Truck freight rates will increase due to increased demand for trucks. Slower rail services will require more products to be shipped by trucks, adding more demand and higher costs within the trucking industry.

e. All these added costs and corresponding lost revenues incurred by NDM will decrease the amount of revenue to be transferred to APUF and the General Fund. NDM estimates additional costs of $2,500,000 annually, thus reducing transfers to the State of North Dakota by $1,312,500 annually. This reduction in NDM revenue to State coffers will negatively impact the State of North Dakota and the citizens of North Dakota.

9. In my professional opinion, the extensive and immediate adverse impacts resulting from any DAPL closure would reduce NDM's ability to meet NDM customer demands. Moreover, it will negatively impact NDM's mission to support agriculture, industry, and commerce in North Dakota. Consequently, any DAPL closure would unnecessarily and irreparably harm North Dakota and its residents.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 11, 2023.

J. Vance Taylor

Vance Taylor, President and CEO
North Dakota Mill & Elevator Association

ATTACHMENT H

Declaration of Lynn D. Helms

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

DECLARATION OF LYNN D. HELMS IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

I, Lynn D. Helms, state and declare as follows:

My name is Lynn D. Helms. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

I am the Director of the North Dakota Industrial Commission ("NDIC") Department of Mineral Resources ("DMR"). I earned my Bachelor of Science Degree in Engineering from the South Dakota School of Mines and Technology and a master's and PhD in Petroleum Engineering from the University of North Dakota. I have served as Director of the NDIC Oil & Gas Division from July 1998 to June 2005 and as Director of the DMR since it was formed in July 2005.

The mission of the DMR is to encourage and promote the development, production, and utilization of oil and gas in North Dakota in such a manner as will prevent waste, maximize economic recovery, and fully protect the correlative rights of all owners to the end that the landowners, the royalty owners, the producers, and the general public realize the greatest possible good from these vital natural resources without resulting in the loss of North Dakota's vast and valuable landscape.

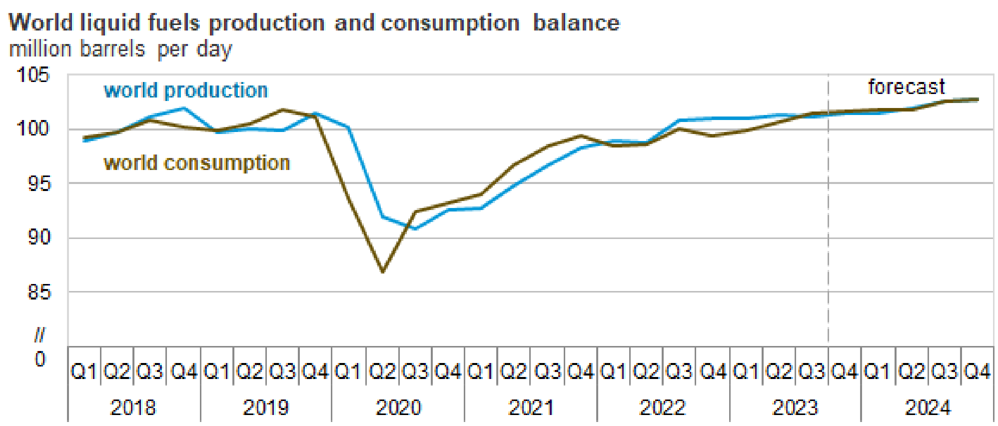
This declaration describes the importance of the oil industry to North Dakota's economy and citizens, and the significant adverse impacts on North Dakota if the Dakota Access Pipeline ("DAPL") is shut down or its use curtailed. I have significant professional knowledge and experience to understand how each of the five different alternatives proposed by the United States Army Corps of Engineers (Corps) in its DAPL Lake Oahe Crossing Project Draft Environmental Impact Statement (DDEIS) would impact North Dakota. Alternative 3 would properly grant the requested easement as earlier granted and increase the volume of oil allowed to 1.1 million barrels per day.

My evaluation of the five Corps' Draft EIS (DEIS) Alternatives shows Alternative 3 to be the alternative that is most solidly grounded upon sound engineering, economic, and environmental principles and practices, and it is by far the most reasonable. Shutting down, suspending, or otherwise obstructing DAPL operations, as proposed in Alternatives 1, 2, and 5, would unnecessarily and irreparably harm North Dakota and its citizens. It would result in congested railways and roadways, billions of dollars of lost tax revenue, and thousands of lost jobs.

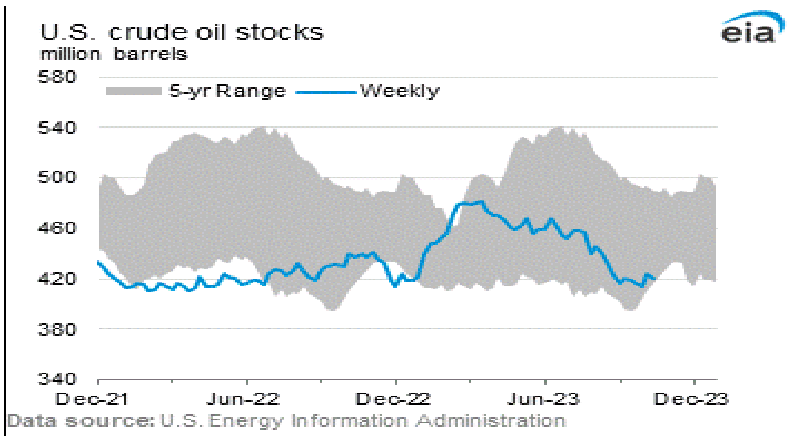
Recent data proves shutting down DAPL at a time when crude oil production is rapidly recovering from the COVID-19 pandemic and is projected to grow for the next 15 years will worsen the harm that North Dakota and its citizens have already endured as a result of the pandemic and the initial, short-term collapse in crude oil demand. North Dakota crude oil production is rapidly recovering with an average 3.2% per month increase January 2023 to date. The oil and gas industry has begun employing 50% longer horizontal laterals and improved hydraulic fracturing designs resulting in initial production rates and recoveries in areas of lower geologic quality that are equal to or better than historical rates and recoveries in the best Bakken and Three Forks geology. North Dakota is the nation's third-largest oil producing state, currently producing 1.3 million barrels per day. September 2023 is the most recent month with complete data as follows:

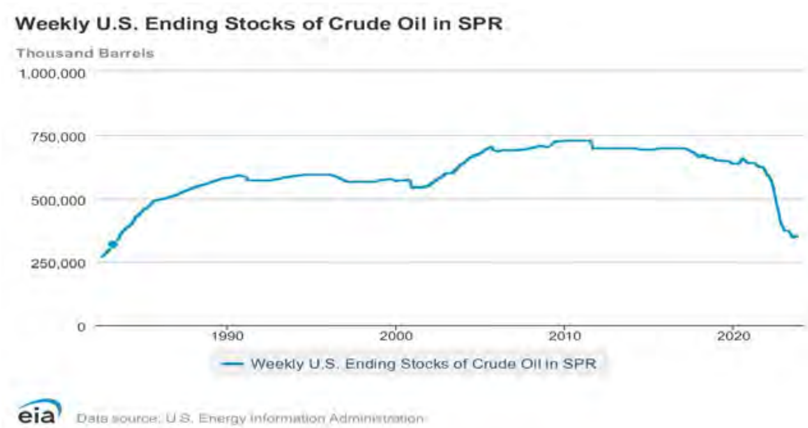
- Daily production of 1.3 million barrels of oil and 3.4 billion cubic feet of natural gas.
- 37 active drilling rigs
- 18,538 active oil and gas wells
- 1,222 approved drilling permits

Data from the U.S. Energy Information Administration ("EIA"), for example, indicates that liquid fuel demand bottomed out in May 2020 and the EIA forecasts that the balance of both global liquid fuels consumption and production will exceed 2019 levels by year end 2024.

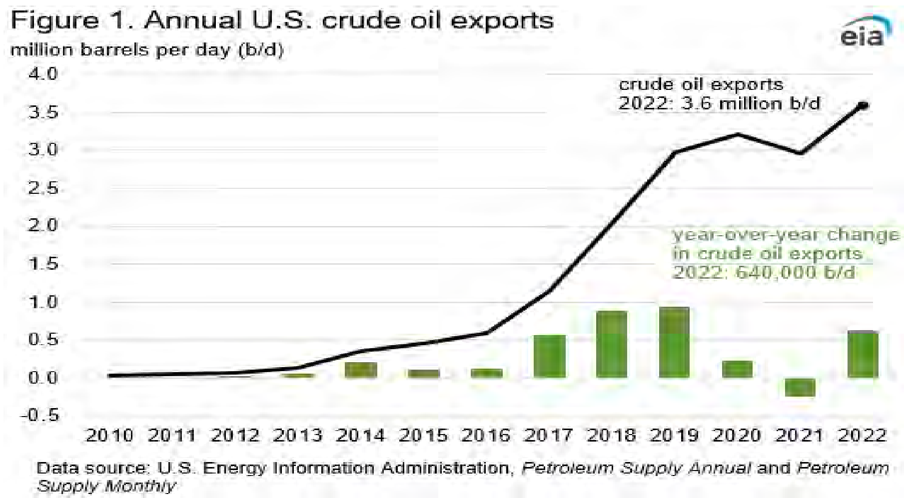


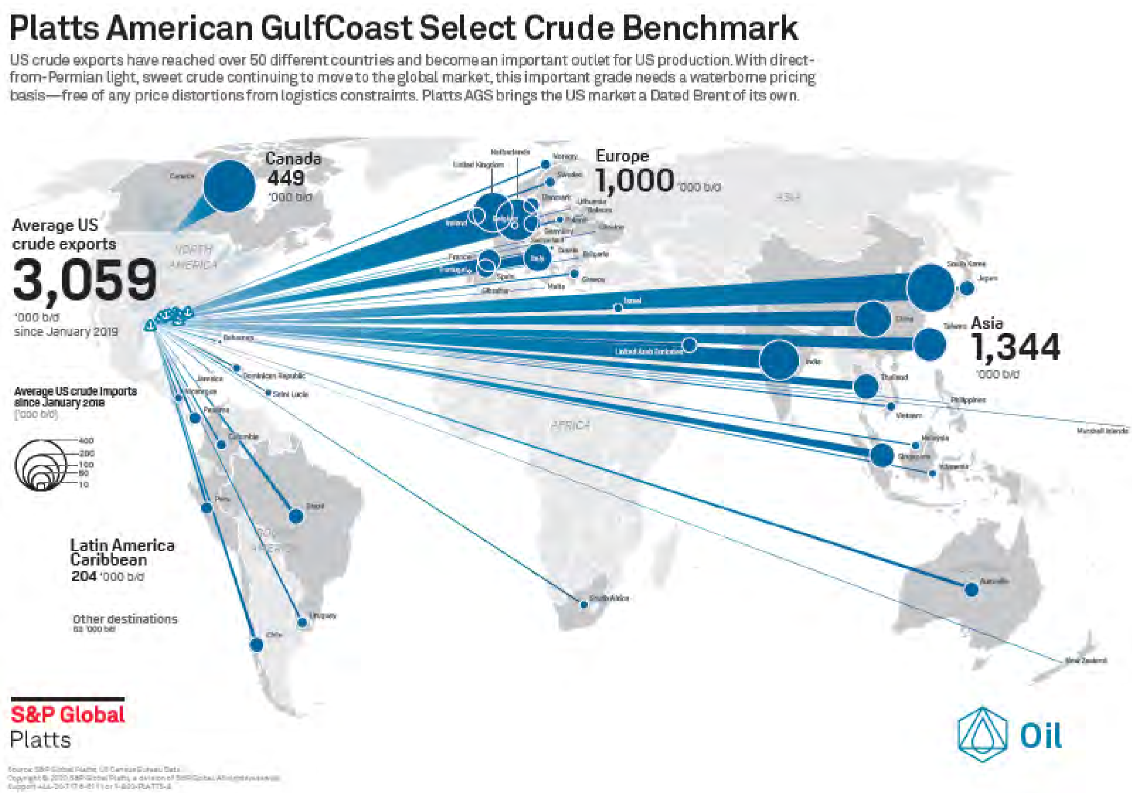
Data from the EIA also indicates that U.S. private storage and Strategic Petroleum Reserve (SPR) crude oil stocks are at or near 5-year and 40-year low levels respectively. DAPL constitutes the only pipeline link between North Dakota production and these critical national security destinations.





In addition, data from the EIA indicates that U.S. crude oil exports to our allies are at record levels and are increasing and a 2020 analysis by Platts illustrates how DAPL serves as the only cost-effective transportation to get North Dakota crude oil to markets that did not exist before DAPL. These markets will be permanently lost to North Dakota oil and gas producers in the event DAPL is shut down.





A substantial portion of the oil produced in North Dakota and oil and gas activity is from development on Fort Berthold Indian Reservation (FBIR) and generates tax and royalty revenue for the Mandan Hidatsa Arikara (MHA) tribe and royalty revenue for individual tribal members as follows:

- Daily production of 142,984 barrels of oil (85,208 trust and 57,776 fee)
- 2 active drilling rigs (2 trust and 0 fee)
- 2,659 active oil and gas wells (2,009 trust and 650 fee)
- 164 approved drilling permits (127 on trust lands and 37 on fee lands)
- 3,893 potential future wells (2,779 on trust lands and 1,114 on fee lands)

The State also expects that North Dakota crude oil production will continue to increase in the coming years with DAPL transporting approximately 50 percent of Bakken production volumes. Crude oil pipelines like DAPL are more efficient, pose less risk, and are more environmentally friendly than other oil transportation methods such as rail transportation and truck transportation. Based on information available during the open season for DAPL, I estimate that 75-90% of this crude oil transportation is subject to binding contracts so it must be produced and transported in accordance with those commitments or be shut in, meaning 550,000 to 600,000 barrels of oil per day will likely remain shut-in until economically viable alternate transportation can be secured. This would result in an estimated temporary loss of 8,450 to 9,300 full time jobs and a permanent loss of 1,700 to 2,200 full time jobs. The estimated time frame to begin securing alternate transportation is three months, and to secure economic alternative transportation of the entire shut-in volume is 12 months. If DAPL is shuttered, North Dakota oil producers will have to shift to less efficient rail and truck shipping, alternative methods that come with increased spill and safety risks, and are less environmentally friendly, emitting about twice the amount of air pollution. Moreover, if 50% of North Dakota's oil production must be transported by rail and truck, it follows that North Dakota's railways and roadways through our communities and rural areas will be subject to significant additional congestion. A DAPL shutdown would also increase transportation costs for shippers, as alternative rail transportation and truck transportation freight rates peak due to substantially increased demand. Margins are already thin, and shippers cannot easily absorb additional costs resulting from more expensive transportation methods and supply chain disruption.

North Dakota oil and gas operators have stated they plan stable or growing drilling and completion activities 2024 - 2037 based in part upon the reasonable assumption of the continued operation of DAPL. capacity. Operators currently operate 37 drilling rigs that generate approximately 5,550 full time jobs. In previous years when pipelines were full and crude oil had to be shipped by rail, operators reduced drilling activity approximately 15% and when DAPL started up they increased drilling activity 20%. Shutting down DAPL is expected to result in the loss of at least four to five drilling rigs and the associated loss of 600-750 full-time jobs. In addition, loss of those drilling rigs will result in seven to nine fewer new wells drilled per month and the associated loss of 9-12 new full-time jobs per month. The job loss estimate was derived from a study done by the North Dakota Department of Mineral Resources in conjunction with North Dakota State University Department of Agribusiness and Applied Economics, and the Vision West project. This study looked at the average number of jobs per drilling rig and producing well in North Dakota.

Shutting down DAPL would also cause extensive disruption in the long-term drilling, completion, production, and transportation sectors resulting in permanent job losses. Using the same study noted above, this would mean the permanent loss of 2,000 to 3,000 full-time jobs.

Finally, I have evaluated the most likely alternate DAPL route identified in Alternatives 1, 2, and 5. The attached maps reflect the significant geological hazard risks to pipeline operations and important archeological resources. The most likely alternate DAPL route intercepts nine active landslides with 608 landslides within a 5-mile corridor, 1,202 landslides within a 10-mile corridor, and a highly unstable and erodible east riverbank area,

In addition, this most likely alternate DAPL route passes within approximately 1 mile of the highly significant Double Ditch Indian Village, a large earth lodge village inhabited by the Mandan Indians for nearly 300 years (AD 1490 - 1785). The Double Ditch site is critical to telling the story of the earth lodge villages that were centers of trade between the Mandan and their nomadic neighbors and the massive smallpox epidemic in the interior of North America about 1781-1782 that was apparently responsible for the abandonment of Double Ditch and all the other Mandan villages near the Heart River.

Consequently, in light of all of the above, in my professional opinion, DEIS Alternative 3 remains the most viable, scientifically sound, and solidly evidence-based alternative.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 12, 2023.

Lynn D. Helms, PhD
Director
NDIC Dept. of Mineral Resources

ATTACHMENT I

Declaration of Todd J. Steinwand

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement

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DECLARATION OF TODD STEINWAND IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

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1. I, Todd J. Steinwand, state and declare as follows:

2. My name is Todd Steinwand. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

3. I am the President and CEO of the Bank of North Dakota, (BND) governed by the North Dakota Industrial Commission. I graduated from the University of Jamestown with majors in Business Administration and History-Political Science. I have spent my entire working career in the banking industry. I joined BND in 2015 as Senior Vice President of the Financial Institutions Market and was promoted to President in July 2021. Prior to joining BND, I spent 33 years working for Wells Fargo, where I started as a trust officer and worked my way up, eventually becoming the Senior Vice President and Business Banking Manager in the Bismarck office. I have served on the boards of directors of many non-profit organizations in the communities I have lived. I currently serve as the Chairman for the board of trustees for the University of Jamestown. I also currently serve on the board of directors of the Tom and Frances Leach Foundation.

4. BND is the only bank, owned by a state in America. BND was incorporated in 1919 with the mission of delivering quality, sound financial services that promote agriculture, commerce, and industry in North Dakota. BND serves as the financial repository for state funds and this funding forms the basis of BND's investment and loan portfolio. Today, BND's $5.6 billion loan portfolio represents North Dakota taxpayer dollars and public funds supporting business, agriculture, and students in North Dakota.

5. Based on its founding documents, BND does very little direct lending and is prohibited with competing with private financial institutions. Thus, the commercial and agriculture loan portfolios are "participated" with local financial institutions that rely upon BND's financial strength to assist them in managing their respective balance sheets, participating in loans over their legal lending limit and as a partner in managing risk. According to Forbes,

> "North Dakota ranks higher than any other state (and Washington, D.C.) when it comes to banks and credit unions per capita. The state has roughly 64 banks and credit unions for every 100,000 residents. In 2021, only 3.20% of households were unbanked in the Peace Garden State, and it ranks 15th-lowest for the number of predatory lending establishments per 100,000 residents. That access can come in extra handy for North Dakotans, considering that an analysis of the best states for saving money from Forbes Advisor found North Dakota to be the friendliest state to savers thanks to its low debt-to-income ratio and housing costs." (Forbes.com/advisor/banking/best-and-worst-states-for-banking, October 19, 2023)

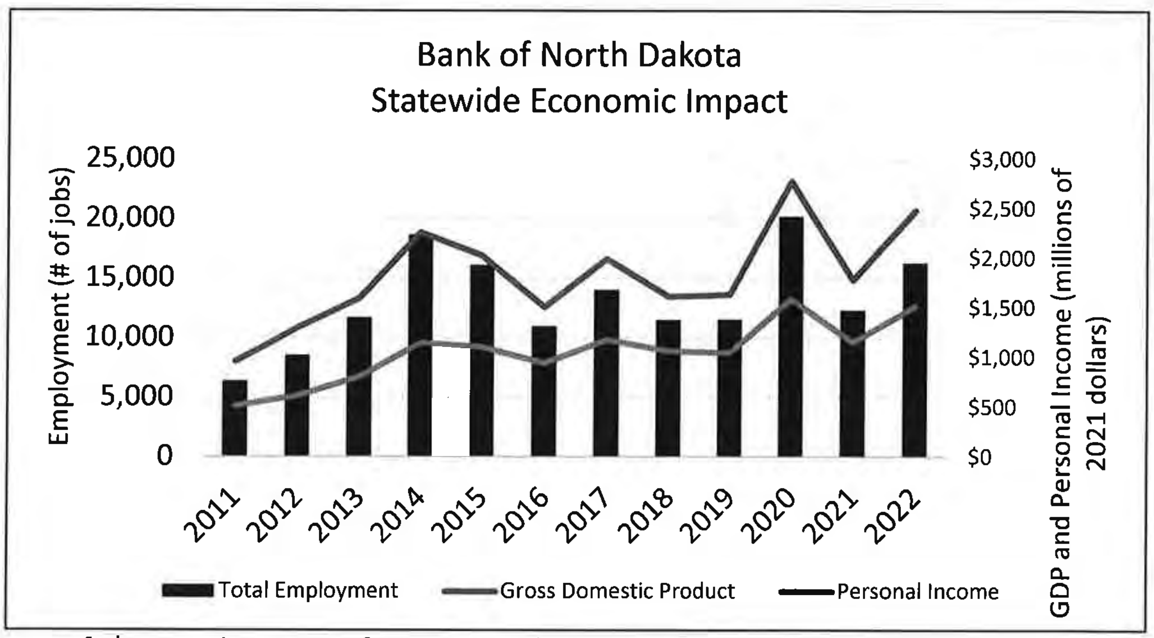
I concur with Forbes above business assessment.

6. In 2022, BND engaged FTI Consulting to evaluate the economic impact of BND on the State's economy. This evaluation with completed using the REMI Tax PI model developed by Regional Economic Modeling, Inc. The result of the study is that in 2022, BND supported over 16,000 jobs and $2.48 billion of North Dakota's GDP. BND also supported over $1.5 billion in personal income to North Dakota residents.

7. In addition to support of the State's economy, BND supports the State's general fund and other legislatively directed programs through appropriation of its earnings by the legislature. Since its founding in 1919, the State has used over $1 billion in dividends from BND to support priorities of the State.

8. Based on the actual positive impact of the Dakota Access Pipeline (DAPL) operations to lower oil transportation costs, a corresponding negative impact on tax revenue would result from any action that would close DAPL.

   a. Current projections for the State of North Dakota assumes oil production will average 1.3 million barrels per day through June 30, 2025, the end of the current two-year budget period. A closure of DAPL would reduce state revenues for the first twelve months by approximately $1.2 billion assuming a 50% decrease in oil production for three months then gradually ramping up from DAPL to rail, until production is back to 1.2 million barrels per day over thirteen months, and an increase in transportation costs of $2.40 per barrel. This also assumes an average projected North Dakota price



of $85.50 (Energy Information Administration (EIA) outlook less North Dakota transportation costs. *See declaration of Susan M. Sisk, Director, North Dakota Office of Management and Budget.*

b. After the first year of a closure, estimated decreases in revenue due to the increased transportation costs is conservatively estimated to be $2.40/barrel which is $113 million per year until DAPL is up and running again. Over a four-year period using these assumptions, the estimated reduction in revenue to the state would be $1.5 billion. Using these assumptions over a ten-year period the estimated reduction to revenue for the State of North Dakota is $2.2 billion, which equates to 13% of the current biennium on-going appropriation. *See declaration of Susan M. Sisk, Director, North Dakota Office of Management and Budget.*

c. This loss of revenue would be a substantial negative impact to the State of North Dakota and would impact virtually every industry and citizen. Shutting down DAPL at a time when crude oil production is rapidly recovering from the COVID-19 pandemic and is projected to grow for the next 15 years will worsen the harm that North Dakota and its citizens have already endured as a result of the pandemic and the initial, short-term collapse in crude oil demand.

It would also cause extensive disruption in the drilling, completion, production, and transportation sectors resulting in permanent job losses. *See declaration of Susan M. Sisk, Director, North Dakota Office of Management and Budget and Declaration of Lynn D. Helms, Department of Mineral Resources Director, North Dakota Industrial Commission.*

9. Based on the above assumptions, if DAPL is shut down, BND estimates the June 2025 ending deposits would be reduced from $8,039,000,000 to $7,616,000,000, a reduction of deposits to BND by $423,00,000. Based on the reduced deposits, BND would be required to replace these deposits through borrowings with an estimated interest rate of 5.5%. Due to loss of liquidity, an additional interest cost of $23,265,000 would be incurred by BND.

10. In my professional opinion, the extensive, immediate harm and loss of State revenues resulting from any DAPL closure would reduce BND's ability to meet its mission of supporting

Agriculture, Industry and Commerce in North Dakota. This closure would unnecessarily and irreparably harm North Dakota and its residents.

11. Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on November 30th, 2023.

Todd J. Steinwand

Todd J. Steinwand, President and CEO
Bank of North Dakota

ATTACHMENT J

Declaration of Janilyn Murtha

In Re:

Dakota Access Pipeline Lake Oahe Crossing Project Preliminary Draft Environmental Impact Statement

DECLARATION OF JANILN MURTHA IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE FEBRUARY 3, 2023 PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT

I, Janilyn Murtha, state and declare as follows:

1. My name is Janilyn Murtha. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

2. I currently serve as the Executive Director of the North Dakota Retirement and Investment Office (NDRIO). Prior to joining NDRIO in 2020, I practiced law beginning in 2002 through 2020 and during that time worked predominantly on behalf of government entities in Wisconsin, Minnesota and North Dakota. I became licensed in North Dakota in 2011. NDRIO is an agency of the State of North Dakota. The agency was created by the 1989 Legislative Assembly to capture administrative and investment cost savings in the management of two state programs: the retirement program of the Teachers' Fund for Retirement (NDTFFR) overseen by the NDTFFR Board and an investment program overseen by the State Investment Board (NDSIB). The NDSIB is responsible for setting policies and procedures guiding the investment of more than $19 billion in assets on behalf of twenty-eight client funds. While the number and account value of funds under management may vary, presently the largest of these client funds is the legacy fund.

3. The North Dakota legacy fund was created in 2010 when the voters of North Dakota approved a constitutional amendment, now Article X, Section 26, of the Constitution of North Dakota, to provide that 30 percent of oil and gas gross production and oil extraction taxes on oil and gas produced after June 30, 2011, be transferred to the legacy fund. The principal and earnings of the legacy fund could not be spent until after June 30, 2017, and any expenditure of principal after that date requires a vote of at least two-thirds ·of the members elected to each house of the Legislative Assembly. Not more than 15 percent of the principal of the legacy fund may be spent during a biennium. The legislative assembly may transfer funds from any source to the legacy fund, and such transfers become part of the principal of the fund. North Dakota Century Code Section 21-10-11 provides that the goal of investment for the legacy fund is principal preservation while maximizing total return for an appropriate level of risk.[1]

4. The Legacy and Budget Stabilization Fund Advisory Board ("Advisory Board") is charged by law under N.D.C.C. 21-10-11 with the responsibility of recommending policies on investment

[1] North Dakota Legacy Fund Investment Policy Statement (2023).

goals and the asset allocation of the legacy fund. The NDSIB is charged with implementing these policies and asset allocation and investing the assets of the legacy fund, in the manner compliant with the prudent institutional investor rule set forth under N.D.C.C. 21-10-07. Both the Advisory Board and the NDSIB act as fiduciaries for the fund and pursuant to the prudent investor rule are expected to exercise the judgment and care, under the circumstances then prevailing, that an institutional investor of ordinary prudence, discretion, and intelligence exercises in the management of large investments entrusted to it, not in regard to speculation but in regard to the permanent disposition of funds, considering probable safety of capital as well as probable income.[2]

5. At the end of each biennium, the fund's accrued earnings, as defined by N.D.C.C. 21-10-12, are transferred to the state's general fund where they are used to finance a portion of state operations and projects as allocated by the legislature, and as set forth under N.D.C.C. 21-10-13.

6. The amount of earnings transferred to the general fund from the legacy fund for the last three biennium are as follows:

Biennium	Amount of earnings transferred in U.S. dollars
2021-2023	$486,568,637
2019-2021	$871,687,384
2017-2019	$455,263,216

7. Based upon the tax revenue assumptions provided by the North Dakota Office of Management and Budget, NDRIO has estimated that the closure of the Dakota Access Pipeline (DAPL) is expected to create an accumulated loss of tax revenue to the legacy fund of approximately $303 million for a two year shutdown, a loss of tax revenue of approximately $362 million for a four year shutdown, and a loss of tax revenue of about $539 million for a ten year shutdown. Using this assumption, NDRIO further estimates that the closure of the DAPL would have an estimated accumulated negative economic impact to the legacy fund investment return of about $12 million for a two year shutdown, $57 million for a four year shutdown and $280 million for a ten year shutdown. This estimate is based on a shutdown start date of May 2024 with the economic impact of the shutdown being realized beginning in June 2024. A compound investment return of 6.3% is used which is based on the capital market assumptions and investment allocation relied on in the most recent legacy fund asset allocation study produced by RVK, Inc. (2023). The estimate assumes that the shutdown results in reduced production and transport of about six hundred thousand barrels a day of oil that will take time to recover as alternative transportation is secured. The lost production also results in lost revenues from the reduction of production as well as lower selling price per barrel from a larger transportation cost estimated at $2.4 per barrel.

8. Loss of tax revenue will result in lower legacy fund earnings which in turn will reduce the amount of earnings available for transfer to the general fund in future biennium for use in financing state operations and projects.

9. Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

[2] North Dakota Legacy Fund Investment Policy Statement (2023).

Executed on December 11, 2023.

____

Janilyn Murtha
North Dakota Retirement & Investment Office Executive Director

ATTACHMENT K

NDSU Analysis

Economic Impact of DAPL Closure in North Dakota

At a request from the State of North Dakota, the Upper Great Plains Transportation Institute (UGPTI) has prepared an analysis of the economic impacts regarding the potential closure of the Dakota Access Pipeline. As part of this study, the direct economic impacts were estimated based upon assumptions of changes in transportation cost and production based upon estimates from the OMB declaration by Susan Sisk.

Two scenarios were analyzed, and under each scenario, the direct and regional economic impacts were estimated. Direct impacts refer to the changes in total revenue or sales to the Oil and Gas Extraction industry in North Dakota. Regional economic impacts refer to the total economic impacts resulting from a significant economic change across the state and are not limited to the Oil and Gas Extraction industry and includes the economic impact on related industries. To estimate the regional economic impacts, UGPTI utilized the REMI TranSight model. In addition to the direct economic impacts estimated in this study, TranSight version 5.1 utilizes Bureau of Economic Analysis personal consumption expenditures by state, real GDP data by county and industry, Congressional Budget Office demographic projections and Bureau of Labor Statistics forecasts of employment to forecast the regional economic impacts within the state of North Dakota.

The two scenarios included in this analysis were: increased transportation costs and decreased production resulting from DAPL closure. The first scenario utilizes the assumption that production will follow the EIA production forecast over the study period and that the primary economic impact would be the decreased revenue to the industry resulting from higher transportation costs. The second scenario utilizes the assumption that statewide production would not increase beyond the current 1.3 million barrel per day level, and the primary economic impacts are the reduction in production relative to the EIA forecast production.

Scenario 1: Increased Transportation Costs

DAPL operations have resulted in lower costs for oil transportation. As cited in the OMB declaration by Susan Sisk, the change in North Dakota transportation discount prior to and following DAPL operations was $2.40/BBL, representing a reduction in and increase transportation cost of $2.40/BBL.

To estimate the direct revenue impacts to the oil extraction industry resulting from an $2.40/BBL increase in the transportation cost, forecasts of oil production were obtained from the Energy Information Administration – Annual Energy Outlook 2022 Report, Table 58. These forecasts were multiplied by the increased transportation cost of $2.40/BBL. The regional economic impacts were estimated using the REMI software package. Direct impacts were used as inputs to the REMI model as a reduction in industry sales for the Oil and Gas Extraction industry in North Dakota. Economic impacts are represented through changes in the Gross Regional Product (GRP) for North Dakota. Results are compiled for a single year (2024) and by 10- and 20-year analysis periods and are presented in 2023 dollars.

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For current production levels of 1.3 million BOPD, the estimated direct impact to the oil extraction industry is $1.14 billion annually. For the EIA forecasted production in 2024, the estimated regional economic impact is $1.34 billion in 2023 dollars. For the 10-year period from 2024-2033, the estimated regional economic impact is $16.28 billion in 2023 dollars and for the 20-year period from 2024-2044, the estimated regional economic impact is $32.30 billion in 2023 dollars.

Scenario 2: Reduction in Production from EIA Forecast

UGPTI was requested to study a second scenario representing a reduction in production from the EIA forecasted levels due to DAPL closure. This scenario compares the EIA forecasted production against the current production level of 1.3 million BOPD. The assumption provided by the Pipeline Authority is that future growth in crude oil production in North Dakota could be limited due to transportation costs and transportation capacity.

To estimate the direct revenue impacts to the oil industry, the current production level of 1.3 million BOPD is subtracted from the EIA annual forecasts. This difference represents the potential production that may not be realized. Oil price forecasts were obtained from the Energy Information Administration – Annual Energy Outlook 2022 Report, Table 58. This annual price forecast was multiplied by the production difference between current production levels and the EIA forecasted production to estimate the direct impacts. The regional economic impacts were estimated using the REMI software package. Direct impacts were used as inputs to the REMI model as a reduction in industry sales for the Oil and Gas Extraction industry in North Dakota. Economic impacts are represented through changes in the Gross Regional Product (GRP) for North Dakota. Results are compiled for a single year (2024) and by 10- and 20-year analysis periods and are presented in 2023 dollars.

In 2024, the estimated direct economic impact of reduced production relative to the EIA forecast is $4.95 billion. The regional economic impact of the reduced 2024 production under this scenario was estimated to be $5.34 billion in 2023 dollars. The 10-year regional economic impact was estimated at $76.28 billion and the 20-year regional economic impact was estimated at $154.3 billion, both in 2023 dollars.

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ATTACHMENT L

Declaration of Mark N. Fox

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

STANDING ROCK SIOUX TRIBE; YANKTON SIOUX TRIBE; ROBERT FLYING HAWK; OGLALA SIOUX TRIBE, Plaintiffs, and CHEYENNE RIVER SIOUX TRIBE; SARA JUMPING EAGLE, ET AL., Plaintiff-Intervenors, v. U.S. ARMY CORPS OF ENGINEERS, Defendant-Cross Defendant, and DAKOTA ACCESS, LLC, Defendant-Intervenor-Cross Claimant.	Case No. 1:16-cv-01534-JEB (and Consolidated Case Nos. 16-cv-1796 and 17-cv-267)

DECLARATION OF CHAIRMAN MARK N. FOX OF THE MANDAN, HIDATSA & ARIKARA NATION

1. My name is Mark N. Fox. I am Chairman of the Mandan, Hidatsa & Arikara (MHA) Nation, also known as the Three Affiliated Tribes. The MHA Nation's address is 404 Frontage Road, New Town, North Dakota 58763.

2. The MHA Nation is located on the Fort Berthold Indian Reservation ("Reservation") in North Dakota. Our Reservation surrounds the Missouri River and Lake Sakakawea and covers over one million acres of land. As of April 8, 2021, the MHA Nation had 16,808 enrolled members.

3. The MHA Nation's oil and gas reserves are held in trust on our behalf by the United States. As trustee, the United States owes the MHA Nation and its members a fiduciary duty to protect, administer, and account for the MHA Nation's trust property and oil and gas resources, and it must do so in a way that ensures the MHA Nation continues to enjoy full use of its trust resources without any diminution in value caused by its trustee's actions.

4. If the Dakota Access Pipeline ("DAPL") is shut down, the MHA Nation will suffer significant financial, environmental and safety harms that will add further injury to the MHA Nation's economy already suffering monumental losses as a result of the COVID-19 pandemic.

5. The MHA Nation has significant oil and gas reserves on our Reservation, with an estimated total of hundreds of millions of barrels of oil. Oil production on our Reservation is likewise significant, currently totaling approximately 300,000 barrels per day. There are currently over 2500 wells on the Reservation. About 25% of North Dakota's current total oil production takes place on our Reservation. Since 2008, the MHA Nation has been engaged in developing its oil and gas resources with the approval of the federal government. There are potentially over 2,000 more new wells to be developed in the future. Each well represents millions of dollars in tax and royalty revenue to the MHA Nation for the benefit of its members.

6. The MHA Nation's economy is heavily dependent on oil and gas development. Oil production on our Reservation is a critical source of governmental revenue for the MHA Nation. More than 80% of our tribal budget in the current fiscal year comes from oil and gas royalties and tax revenue. These funds are used by the MHA Nation to pay for things like health insurance for our members, contractual commitments for ongoing infrastructure projects, tribal courts, law enforcement and drug enforcement, a child safety center and foster home, elder care and assistance,

housing and many other programs and needs on our Reservation. The MHA Nation's cost of health insurance alone exceeds $40,000,000 annually.

7. The MHA Nation uses a significant amount of its oil and gas revenue to construct community buildings like new schools, athletic fields, cultural centers, health clinics, emergency management centers, law enforcement centers, and courthouses. Oil and gas revenue also goes to construct and maintain highways and maintain our regulatory infrastructure. The MHA Nation spends significant revenue to fund tribal regulatory agencies charged with mitigating the environmental and social impacts of oil and gas development, to ensure that our oil and gas resources are developed in a responsible manner, and as well to protect our land, water, air, and species against not just the impacts of energy development but also the very real threats of climate change, so that we may preserve our culture and ways of life for generations to come.

8. The sharp drop in oil prices as a result of the COVID-19 pandemic has already led to a sharp decrease in revenue for the MHA Nation. Federal relief dollars have not come close to making up the difference, and that gaping lost revenue gap has greatly affected our ability to meet our contractual and commitments and fund our planned programs and projects. The MHA Nation can thus not afford further challenges to its ability to get its oil production to market.

9. Over sixty percent of the oil trust resources produced on our Reservation is transported to market on DAPL. If DAPL is shut down by any branch of the U.S. government, much of our Reservation production will be difficult to move to market and future production will be sharply curtailed. Not only would a DAPL shutdown deprive the MHA Nation of any return on substantial investments we have made in planned increases in oil production from our trust resources, it would also deprive us of substantial revenue from existing wells on our Reservation, causing significant additional financial harm both to the MHA Nation and the many people, native and non native

alike, who work in our Reservation's oil and gas industry. We have every reason to believe that the MHA Nation and individual Indian trust royalty owners will suffer significant financial losses as the value of our oil and gas trust resources is diminished by a shutdown of DAPL.

10. I directed MHA Nation staff and consultant experts to provide a study of the financial harm that could be done to the MHA Nation in the event DAPL is shut down. They have estimated that the losses will exceed $160,000,000 over a one year period and exceed $250,000,000 over two years.

11. The MHA Nation will also suffer significant environmental harms if DAPL is shut down. DAPL is the most efficient, environmentally-friendly way to transport to market the trust oil produced on our Reservation. The only alternative to the pipeline transport is to increase use of truck and rail transport. To the extent our Reservation trust oil now carried by DAPL is shifted to either of these more expensive options, the result will be increased truck and rail traffic in and around our Reservation, with increased road damage, more motor vehicle accidents, as well as increased air pollution from dust and and heavy vehicle emissions that pose short-and-long-term risks to the health and safety of MHA Nation members, their livestock and the many species of animals and fish that inhabit our lands and waters.

12. In addition, shutting down DAPL would likely result in increased fatalities among the members of the MHA Nation using the roads on our Reservation. When DAPL began transporting our Reservation trust oil in 2017, it brought a decrease in the reliance on heavy truck and rail to transport oil from the region, and the MHA Nation noticed a significant reduction in traffic-related fatalities on our Reservation. According to state highway statistics, five fewer fatalities occurred annually after DAPL reduced traffic on our Reservation. Shutting down DAPL would likely result in a corresponding increase in fatalities within our MHA Nation.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed: April 19, 2021

Mark N. Fox, Chairman
Tribal Business Council
MHA Nation

ATTACHMENT M

University of Chicago Paper

WORKING PAPER · NO. 2023-138

Environmental Consequences of Hydrocarbon Infrastructure Policy

Thomas R. Covert and Ryan Kellogg

OCTOBER 2023

Becker Friedman Institute
FOR ECONOMICS AT UCHICAGO

5757 S. University Ave.
Chicago, IL 60637
Main: 773.702.5599
bfi.uchicago.edu

ENVIRONMENTAL CONSEQUENCES OF
HYDROCARBON INFRASTRUCTURE POLICY

Thomas R. Covert
Ryan Kellogg

September 2017, Revised October 2023

We are grateful to the Sloan Foundation for generous financial support, and we are grateful for thoughtful suggestions from many conference and seminar participants. We thank Nathan Lash for valuable research assistance. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Environmental Consequences of Hydrocarbon Infrastructure Policy
Thomas R. Covert and Ryan Kellogg
NBER Working Paper No. 23855
September 2017, Revised October 2023
JEL No. L13,L71,L95,Q35

ABSTRACT

We study policies that aim to "keep carbon in the ground" by blocking fossil fuel infrastructure investment. Our analysis relies on a model of hydrocarbon production and transportation, incorporating substitution between pipeline infrastructure and flexible alternatives, like crude-by-rail. We apply the model to the Dakota Access Pipeline (DAPL), which moves oil from North Dakota to Texas and was controversially completed in 2017. Had DAPL's construction been enjoined, we estimate that 81% of the blocked pipeline flows would move by rail instead. This substitution induces both private costs and local environmental damage, since rail transport imposes greater local externalities than pipelines.

Thomas R. Covert
Booth School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637
and NBER
thomas.covert@chicagobooth.edu

Ryan Kellogg
University of Chicago
Harris School of Public Policy
1307 East 60th Street
Chicago, IL 60637
and NBER
kelloggr@uchicago.edu

1 Introduction

For more than a decade, environmental advocates and climate-focused regulators have argued for restrictions on fossil fuel development. Some "keep it in the ground" proposals would prevent the use of, or raise the price of, public lands in new fossil fuel development (Prest and Stock, 2023). Others would have governments or NGO's directly acquire and sequester fossil resources *in-situ*, as explored in Harstad (2012). In parallel, a growing number of investment funds have tried to raise the cost of capital for fossil fuel extraction through ESG efforts (Giglio, Maggiori, Stroebel, Tan, Utkus and Xu, 2023). These strategies all have limitations, however: U.S. public lands contain only a small fraction of undeveloped fossil fuels, ESG policies may reduce investment funds' returns, and it is hard for buyers of fossil fuel resources who plan to never develop them to outbid those who would develop.

An alternative "keep it in the ground" strategy is to block the construction of specialized fossil fuel transportation infrastructure, so that the fuels that would have been transported might instead never be developed. Infrastructure foreclosure policies have appeal because they can arguably stop fossil fuel production, even on private land, without the need to pay off investors or mineral rights holders. Activism for, and in some cases enactment of, such policies has become commonplace. Four major U.S. oil and gas pipeline projects—the Dakota Access Pipeline, Mountain Valley Pipeline, Atlantic Coast Pipeline, and Keystone XL—have been the subject of vociferous opposition, and it is unlikely that the latter two will ever be built (Tabuchi and Plumer, 2020). The U.S. Federal Energy Regulatory Commission (FERC) has been debating whether its natural gas pipeline permitting procedures should account for CO_2 emissions from the new gas production that each pipeline might induce (Wilson, 2022). Similarly, new coal export terminals on the U.S. West Coast have faced local opposition (McClure, 2021). These debates are not confined to the United States. Internationally, the East African Crude Oil Pipeline, Eastern Mediterranean Pipeline, and Canadian Trans Mountain Pipeline projects have all been opposed over their potential climate impacts (Dahir, 2023; Dalton, 2020; CBC, 2019).

Our goal in this paper is to improve our understanding of the economics of, and the trade-offs induced by, the foreclosure of fossil fuel infrastructure. Our analysis can be seen as the flip side of recent work that has explored how investments in electric transmission can reduce carbon emissions by inducing the production of renewable power (Fell, Kaffine and Novan, 2021; Davis, Hausman and Rose, 2023; Gonzales, Ito and Reguant, 2023). Here, we are instead interested in how *preventing* construction of infrastructure designed to transport fossil fuels might reduce carbon emissions by inhibiting production of those fuels.

The core trade-off in our analysis arises from the availability of alternative transportation technologies. In the absence of a pipeline, crude oil can move over land via railroad or over water via ship, natural gas can be transported over water by liquefied natural gas carriers and potentially even over land by rail (Funk, 2023), and propane can move both by ship and by land on specialized vehicles. Policies that block oil and gas pipelines potentially induce increased usage of these alternatives, all of which have their own environmental externalities. Inspired by this dilemma, we develop and quantify a model of fossil fuel production and transportation mode choice, informing the policy question of whether blocking pipelines keeps resources in the ground or merely shifts their transport to other modes, and quantifying the net change in externalities.

We apply this model to the case of the Dakota Access Pipeline (DAPL), which was completed in June, 2017 and moves more than 500,000 barrels per day (500 mbbl/d) of oil from the Bakken Shale of North Dakota to the U.S. Gulf Coast. DAPL's construction faced substantial opposition from activists and policy-makers, and its operation remains under litigation today.[1] At the same time, railroads have played an important role in transporting Bakken oil production, with volumes peaking above 700 mbbl/d in 2015. Crude-by-rail has well-known safety externalities in the form of train derailments, such as the Lac-Megantic disaster in 2013 that killed 47 people, and it also generates local air pollution (Clay, Jha, Muller and Walsh, 2019). In this paper, we therefore use our model to ask: (1) had DAPL not been constructed, how much of the pipeline's oil flows would have stayed in the ground versus continued to flow, but by railroad instead of pipe; and (2) what would have been the environmental and economic surplus consequences of these counterfactual oil flows?

We begin in section 2 with a stylized model of crude oil production and transportation that develops intuition. Oil can flow through either fixed infrastructure (i.e., a pipeline) that has high up-front sunk costs and no ongoing marginal costs, or through an alternative that is more flexible but involves substantial ongoing marginal costs (i.e., railroads). In this environment, a continuum of oil shippers decides whether to use pipelines or rail to physically arbitrage price differences between a price-sensitive upstream supply source (North Dakota) and downstream markets (the Gulf Coast).[2] Given a fixed pipeline capacity, in equilibrium shippers will only use crude-by-rail when downstream oil prices are sufficiently high that the pipeline is operating at full capacity. At such times, the demand for rail shipping will drive a wedge between upstream and downstream oil prices that is equal to rail's marginal cost. This wedge depresses upstream production relative to a case in which more pipeline capacity were available and crude-by-rail shipping was not needed; it is by this mechanism

[1] In an analysis related to ours, ICF (2020) evaluates the potential oil production, price, and employment impacts of an abrupt, court-ordered 16-month DAPL shutdown.

[2] Throughout this paper, we follow transportation industry terminology by referring to pipeline and rail customers as "shippers". The pipelines and railroads themselves are known as *carriers*, not shippers.

that blocking pipeline construction can keep some oil in the ground.

We also use our model to endogenize pipeline capacity investment, capturing the institutional fact that pipeline shippers must make long-term capacity commitments to the pipeline before construction and before future oil prices are realized. We show that the equilibrium pipeline capacity balances the pipeline's tariff against the margin between the upstream and downstream oil prices that shippers expect to realize during the commitment period.

In section 3, we quantitatively apply our model to Bakken oil transportation. First, we estimate crude-by-rail costs using the history of crude-by-rail flows and price differentials from the Bakken to downstream markets. Here, we enhance our model by allowing for adjustment costs that dampen the response of rail flows to changes in price differentials, which better matches the data and aligns with institutional features of rail transport. Second, we estimate a model of Bakken upstream oil supply using data on drilling and production. Following Anderson, Kellogg and Salant (2018) and Newell and Prest (2019), our upstream model incorporates dynamics in which the drilling of new wells is price-responsive, but wells' subsequent production stream is not. Finally, we assume that shippers' beliefs about the long-run distribution of future oil prices as of June, 2014, when they made firm capacity commitments to DAPL, are consistent with historic oil price volatility. We then validate our estimated model in section 4 by assessing how well its predicted flows match actual flows given realized downstream oil prices, and by comparing the model's expected returns to (committed) pipeline shipment to DAPL's tariff.

We present our main counterfactual analysis in section 5, characterizing what would have happened if DAPL had not been built. We primarily evaluate our counterfactuals from the perspective of June, 2014, integrating over the distribution of possible future downstream oil prices during the 2017–2027 period during which DAPL's shippers are committed to pay for pipeline capacity. We find that if DAPL's construction had been enjoined, expected crude-by-rail flows would increase by 81% of the decrease in expected pipeline flows. Blocking DAPL would therefore have kept some crude oil in the ground, but by an amount considerably less than DAPL's capacity.

We then quantify the normative implications of these changes in oil production and transportation flows by evaluating firms' lost producer surplus and the changes in local pollution emissions associated with both pipeline and rail transport. We use per-barrel damage estimates from Clay et al. (2019) that account for spill risks, air pollution from diesel railroad locomotives, and air pollution from electricity generators that power pipeline pumping stations. These estimates highlight that NO_x emissions from locomotives are the dominant factor, and accordingly we find that foreclosing DAPL would increase local pollution damages on net. Dividing these impacts by the quantity of carbon that the policy would "leave in the ground," we find costs per tonne of CO_2 abated of \$28 from decreased producer surplus and \$17 from increased local emissions, so that a significant portion of the abatement cost of blocking DAPL is an increase in local pollution damages.

We extend and discuss our results in section 6. First, we evaluate an alternative policy of directly regulating upstream production by considering a production tax that would reduce CO_2 emissions by the same amount as foreclosing DAPL. Such a policy is analogous to the idea of "royalty adders" that have been considered for oil production on federally-owned oil and gas estates (Prest, 2022; Prest and Stock, 2023). Unlike blocking pipeline construction, this policy leads to a reduction in local pollution and overall imposes a small cost per tonne of CO_2 abated of between \$1.01 and \$2.68 (combining the loss of producer surplus with gains from reduced local pollution). We also discuss the possibility that the counterfactual reductions in Bakken oil production might be offset by increases in production from other basins, per Prest (2022) and Prest, Fell, Gordon and Conway (2023). This production "leakage" would increase the cost per tonne of CO_2 estimates of both our DAPL foreclosure and upstream production tax counterfactuals. Finally, we discuss the possibility that the Bakken production reductions are merely production delays rather than long-term reductions.

We conclude in section 7 by discussing how our analyses inform the trade-offs of policies that enjoin the construction of fossil fuel infrastructure. We find that blocking DAPL would indeed have reduced Bakken production, but at a cost per tonne of CO_2 abated that is an order of magnitude greater than what could have been achieved by directly targeting upstream supply. Of course, such an upstream policy may not be feasible, in which case the relevant question is whether incurring the costs of blocking infrastructure is acceptable relative to doing nothing at all. Our paper highlights that these costs include not just reductions in producer surplus but also increases in local pollution damages from crude-by-rail flows. This trade-off between global and local pollution is not typical of environmental policies—local pollution reductions are often a co-benefit of CO_2 abatement—but it is not unprecedented. Other situations in which CO_2 emissions trade off against local pollution exposure include urban densification (Carozzi and Roth, 2023) and the operation of post-combustion emissions controls in fossil fuel boilers (Electric Power Research Institute, 2009).

Finally, while this paper focuses on crude oil transportation, the intuition that we capture is applicable to other settings in which a low-cost but inflexible investment competes with alternatives that involve high marginal costs but little commitment. For instance, our modeling framework can be used to evaluate and understand the trade-offs between urban light rail, which requires investments in dedicated tracks and passenger loading stations, and passenger buses that can be flexibly re-routed (Glaeser, 2020). It can also apply to investments in baseload and renewable power sources, which involve high up-front sunk costs and low marginal generation costs, versus investments in more flexible gas-fired peaker units (Borenstein, 2005). These trade-offs between cost and flexibility also have a parallel in the finance literature that examines the returns of investments in illiquid versus liquid assets (Amihud and Mendelson, 1986; Pástor and Stambaugh, 2003).

2 Conceptual model of crude-by-rail flows, pipeline flows, and pipeline investment

We begin with a conceptual model that captures the most important economic forces that we believe govern how policies that limit pipeline capacity would affect crude oil flows, and how policies that target upstream supply directly would affect pipeline investment and subsequent oil flows. This simplified model delivers intuition; when we apply it to the case of DAPL in section 3 we will enrich it to better match the data and additional institutional features.

Consider a setting with one upstream oil-producing location and one downstream oil-consuming location. Upstream, consumption is zero, and firms produce a quantity Q of oil according to a strictly increasing supply function $Q = S(P_u)$, where P_u is the upstream price. The downstream market is "large" in the sense that changes in deliveries from the upstream location do not alter the downstream price P_d.[3]

Oil moves from the upstream to downstream location by pipeline or railroad. "Shippers" are the agents who own the oil that is moved and pay for transportation services. We assume that shippers are atomistic and able to freely enter and exit the industry. This assumption is motivated by the large number of potential parties who may act as shippers: upstream producers, downstream refiners, and speculative traders.[4] Shipping decisions take place in two periods. In period 1, shippers decide whether to commit to pipeline capacity. In period 2, committed shippers use the pipeline up to the committed capacity K, and the remainder use the railroad to transport oil. We solve the model backwards, starting with period 2.[5]

2.1 Oil flows with an exogenously given pipeline capacity

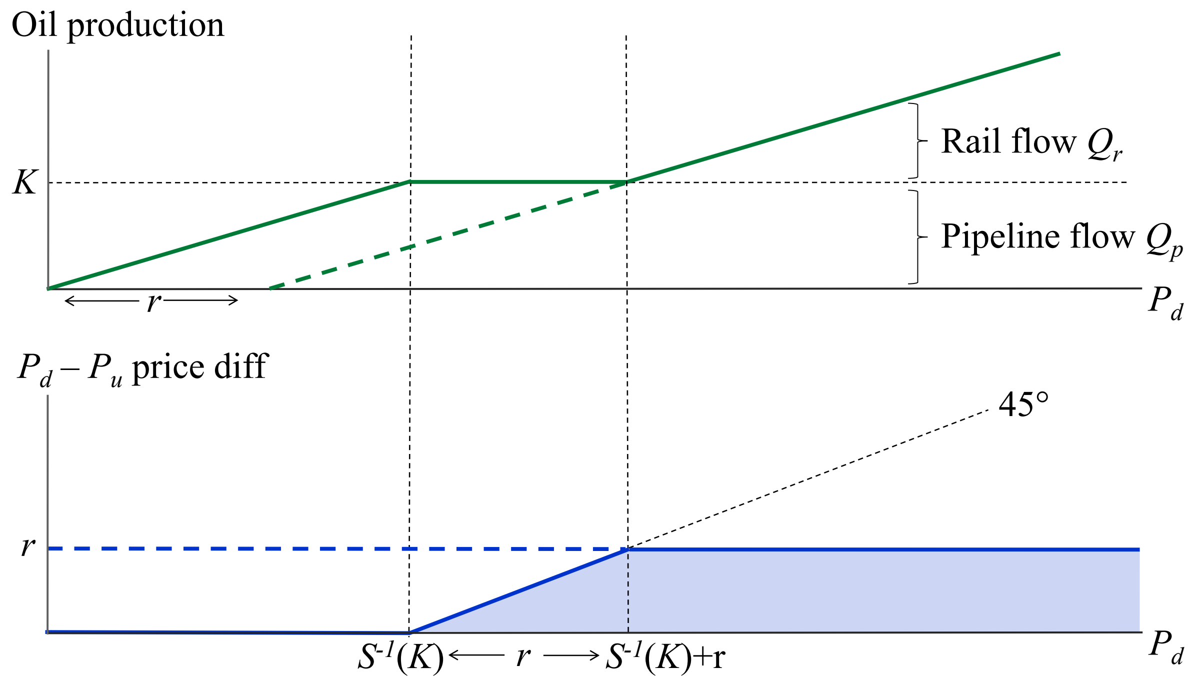
Shippers who committed to the pipeline in period 1 can use it in period 2 to move oil at zero marginal cost. Let Q_p denote the volume of pipeline shipments, where $0 \leq Q_p \leq K$.

[3]We take this perfect elasticity of downstream demand assumption as a reasonable representation because DAPL's terminus is on the Gulf of Mexico, with access to the global waterborne crude oil market.

[4]Covert (2015) documents that Bakken upstream production is not a concentrated industry.

[5]We ignore discounting here for expositional clarity. The enriched model that we take to the data in section 3 incorporates discounting and allows the pipeline to be used for many periods.

Figure 1: Simple model for production, pipeline and rail flows, and the price differential, given a downstream crude price P_d and pipeline capacity K



Top panel: solid line shows oil production as a function of the downstream oil price P_d when there is a pipeline with capacity K. Dashed line shows production when pipeline capacity is zero. Bottom panel: solid line shows the downstream minus upstream price differential as a function of the downstream price P_d when there is a pipeline with capacity K. Dashed line shows the price differential when pipeline capacity is zero.

Let Q_r denote the volume of rail shipments. The sum $Q_p + Q_r$ is total upstream production Q. There are no limits to crude-by-rail "capacity," but there are marginal costs $r > 0$.[6]

The pipeline capacity K and downstream price P_d determine Q_p and Q_r. For very low values of P_d, little crude oil is supplied by upstream producers, and the pipeline is not filled to capacity ($Q = Q_p < K$). Arbitrage then implies that $P_u = P_d$, and no crude flows by railroad. Q_p is increasing in P_d because the upstream supply curve is strictly upward-sloping, eventually filling the pipeline to capacity once $P_d = S^{-1}(K)$. Beyond this point, higher values of P_d cannot increase Q_p. Pipeline flows as a function of P_d and K are then given by $Q_p(P_d, K) = \min\{S(P_d), K\}$ and illustrated in the top panel of figure 1.

For downstream prices above $S^{-1}(K)$, Q_p is fixed, but rail may be used. Crude oil will move by rail only to the extent that the difference between P_d and P_u covers the marginal

[6]Railroads potentially exert market power, such that there may be a wedge between the true economic marginal cost of shipping crude by rail and the marginal cost paid by shippers (i.e., the freight rate) that is represented in our model by r. We do not take a stand on the extent to which r is true marginal costs versus market power rents.

cost r of railroad transport. When P_d lies in the interval $[S^{-1}(K), S^{-1}(K)+r]$, pipeline flow will be fixed at capacity K, rail flow Q_r will be zero, and the upstream price will be fixed at $S^{-1}(K)$. But for $P_d > S^{-1}(K)+r$, railroad volumes will be strictly positive and determined by the arbitrage condition $S^{-1}(K+Q_r) = P_u = P_d - r$. The function $Q_r(P_d, K)$ that governs rail flows as a function of P_d and K is $Q_r(P_d, K) = \max\{0, S(P_d - r) - K\}$ and is depicted in the top panel of figure 1.

The rail arbitrage condition ensures that rail shippers cannot earn economic profits in equilibrium. Pipeline shippers can, however, earn profits on the upstream versus downstream price differential when the downstream price P_d is large enough that the pipeline is constrained. Their per-barrel profits $\pi_p(P_d, K)$ are given by equation 1 and depicted in the bottom panel of figure 1, capturing the feature that pipeline shippers' profits are capped, for high P_d, by the cost of railroad shipping.

$$\pi_p(P_d, K) = \begin{cases} 0 & \text{if } P_d \leq S^{-1}(K) \\ P_d - S^{-1}(K) & \text{if } P_d \in (S^{-1}(K), S^{-1}(K)+r) \\ r & \text{if } P_d > S^{-1}(K)+r \end{cases} \tag{1}$$

Figure 1 also shows outcomes in the case that pipeline capacity is set to zero. For $P_d \geq S^{-1}(K)+r$, prices, production, and flows are unchanged from the case with a pipeline of capacity K because rail transport is on the margin in both cases, and therefore $P_u = P_d - r$ in both cases. For $P_d < S^{-1}(K)+r$, however, the upstream price is lower without the pipeline than with it, since rail is the only way to ship, and the cost of rail shipment induces a wedge r between P_u and P_d. The depressed upstream price causes oil production to fall relative to the case in which the pipeline was available; this decrease is depicted in the top panel of figure 1 by the gap between the solid and dashed lines to the left of $P_d = S^{-1}(K)+r$. The magnitude of this fall in oil production is an empirical question which depends on the cost of crude-by-rail transportation r and the elasticity of the upstream supply function $S(P_u)$.

2.2 Equilibrium pipeline capacity investment

We now analyze the equilibrium pipeline capacity commitments that occur in the first period. Two institutional details drive the assumptions we make in this analysis. First, because pipelines are irreversible investments that are subject to ex-post holdup, construction financing requires firm, up-front commitments from shippers that they will pay for the pipeline's capacity whether they ultimately use that capacity or not (these commitments are therefore known as "ship-or-pay" agreements in the industry). These contracts imply that the most important risk associated with the project—the uncertainty about future price differentials between the upstream and downstream locations—is borne primarily by shippers, not the pipeline owner. Second, pipelines could potentially exert market power over shippers, so their maximum tariffs are subject to cost-of-service rate regulation by FERC.

In period 1, shippers make K mbbl/d of firm pipeline capacity commitments before knowing P_d. They make these commitments on the basis of rational beliefs about the distribution of downstream prices $F(P_d)$. Committed shippers pay the regulated tariff τ for each barrel per day of capacity reserved. These committed shippers can then use their capacity in period 2 at zero marginal cost.

The equilibrium level of pipeline investment is then governed by an indifference condition in which shippers' expected per-barrel return from having pipeline access equals the tariff τ, which in turn is regulated to equal the pipeline's average per-barrel cost.[7] Taking expectations over the distribution $F(P_d)$, the equilibrium capacity investment K^* must satisfy equation 2:

$$\int \pi_p(P_d, K^*) dF(P_d) = \tau \tag{2}$$

The left-hand-side of equation 2 is strictly decreasing in K^*, since a larger capacity pipeline is less likely to be fully utilized, and it goes to zero as $K^* \to \infty$. It is also depicted in the bottom panel of figure 1 as the shaded area under the line representing pipeline shippers' returns $\pi_p(P_d, K)$, weighted by the probability distribution $F(P_d)$. Assuming that the cost of pipeline construction is not so large that not building the pipeline at all is optimal, equation 2 will then identify an interior solution for K^*.

3 Empirical model of Bakken oil production, pipeline transport, and rail transport

We now apply the intuition introduced in section 2 to DAPL and the production and movement of crude oil out of the Bakken region of North Dakota. Sections 3.1 through 3.4 describe the components of the model needed to quantitatively simulate Bakken production, transportation choices, and upstream prices, given a time series of downstream prices. Then,

[7] Note that this equilibrium condition for K^* potentially differs from that which would maximize total surplus to the extent that there are economies of scale in pipeline capacity. Total surplus is maximized when the expected per-barrel return to pipeline shippers equals the marginal cost of capacity, not its average cost. The two conditions coincide only when pipeline costs are constant returns to scale. The divergence between market equilibrium and surplus-maximizing investment in the presence of increasing returns to scale is driven by average-cost regulation of pipeline tariffs and is emblematic of rate regulation in natural monopoly settings. We assume constant returns to scale here; allowing for increasing returns would involve replacing the fixed tariff τ with a decreasing function $\tau(K)$. See footnote 33 for a discussion of how allowing for increasing returns would affect our counterfactual simulations involving an upstream production tax.

section 3.5 discusses how we model firms' beliefs—as of June, 2014 when shippers made firm commitments to DAPL—about the distribution of future downstream prices.

3.1 Price differentials, and crude-by-rail flows and costs

We begin with an empirical model for crude-by-rail flows and costs. Unlike the simpler model we developed in section 2, here we recognize that rail can move crude oil from the Bakken to not just the U.S. Gulf Coast (where DAPL terminates), but also the East and West Coasts. To infer crude-by-rail's cost structure, we use data on crude-by-rail flows and oil price differentials for each downstream location. We summarize these data here and provide additional detail in appendix B.1.

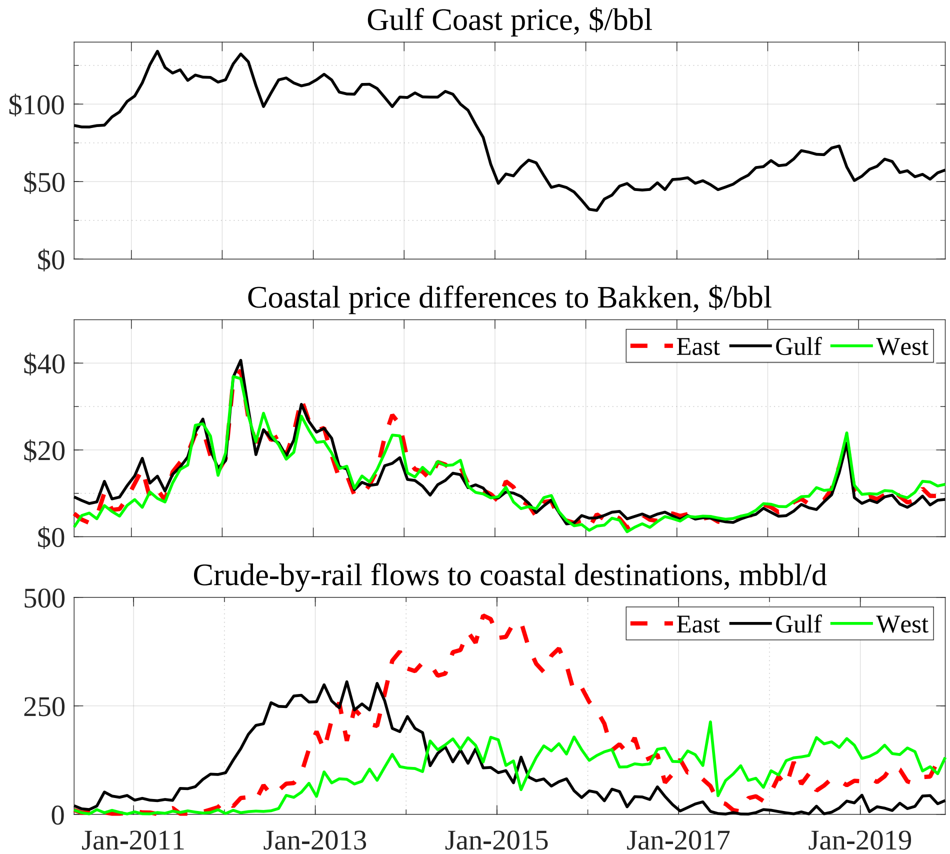
We obtain monthly oil prices at the three coastal destinations from Bloomberg (2023). We use the price of Light Louisiana Sweet (LLS) crude as the Gulf Coast price, Brent crude as the East Coast price, and a grade-adjusted version of Alaska North Slope (ANS) crude as the West Coast price. For the price of crude in the Bakken, we use data from S&P Global (2021), which publishes a Bakken "local" price that producers receive when they sell locally. We convert the raw nominal price data to real dollars as of June, 2014 using a CPI from Bureau of Labor Statistics (2023).

We obtain monthly data on Bakken oil production from U.S. Energy Information Administration (2021b) (hereafter "EIA"). To infer the volumes of oil that leave the Bakken by pipeline and rail, we multiply monthly production by monthly transportation mode share estimates from North Dakota Pipeline Authority (2023a) (hereafter "NDPA"). Then, to infer the share of rail shipments flowing to each coastal destination each month, we use the EIA's "Movements of Crude Oil and Selected Products by Rail" report, which provides estimates of rail flows that the EIA infers from the Surface Transportation Board's (STB's) waybill sample.

We display our price and crude-by-rail volume data together in figure 2, spanning May, 2010 (the earliest date for which we have upstream price data) through 2019. The top panel shows the time series for the crude oil price at the U.S. Gulf Coast. The most prominent feature of this series is the substantial price decrease that occurred during the second half of 2014. Baumeister and Kilian (2016) attributes this price decrease primarily to a decrease in global demand for crude oil, with a smaller role played by global production shocks.

The middle panel of figure 2 shows the difference, for each coastal destination, between the downstream oil price and the upstream price in the Bakken. This panel reveals three facts about these prices. First, the the three coastal prices are tightly correlated, typically differing by no more than a few \$/bbl. Overall, the West Coast price increased, and the

Figure 2: Oil prices, price differentials, and crude-by-rail flows



Note: The top panel shows the price for crude oil delivered to the Gulf Coast, measured by the Light Louisiana Sweet (LLS) price. The middle panel shows the difference between prices at coastal markets and in the Bakken, where we use Brent for the East Coast price and grade-adjusted Alaska North Slope (ANS) for the West Coast Price. The bottom panel shows crude-by-rail flows to each coastal destination in thousands of barrels of oil per day (mbbl/d). All prices are real June, 2014 dollars and aggregated to the monthly level.

Gulf Coast price decreased, relative to the East Coast price during 2010–2019, but overall no destination held a persistent price advantage over another. Second, the upstream Bakken price is substantially discounted relative to the coastal destinations. Third, the upstream price discount contracted following the decrease in the coastal prices in late 2014.

Finally, the bottom panel of figure 2 shows crude-by-rail flow volumes from the Bakken to the East, Gulf, and West Coasts. Total shipments rise substantially beginning in 2012, peak in late 2014, and generally decrease thereafter. Comparing the middle and bottom panels, the increase and subsequent decrease in crude-by-rail volumes follows the increase and decrease in price differentials that were realized by rail shippers, though it is clear that rail volumes do not respond to price differentials immediately but rather with a lag. Changes in the share of rail flows going to each destination also evolve gradually rather than respond instantly to changes in relative prices.

The sluggish response of crude-by-rail flows to price changes rejects the simple model posed in section 2, in which rail transport just involves a constant marginal cost $r > 0$. Moreover, a multi-destination version of this simple model would imply that all rail volumes should flow each month to the destination that offers the highest downstream price net of shipping costs, and that total rail flows should be zero if, for all locations, the price differential less the shipping cost is strictly negative. The rail flow data shown in figure 2 defy both of these predictions: every destination has strictly positive rail flows in every month from 2012 onward, including 2015–2018 when the price differential to all locations hovered around \$5/bbl, considerably lower than industry reports of crude-by-rail costs of \$8 to \$15/bbl (Frittelli, Parfomak, Ramseur, Andrews, Pirog and Ratner, 2014; ICF, 2020).

To reconcile our model with these facts, marginal rail shipping costs must vary over time and differ across destinations. We assume that period-to-period adjustment costs are the key time-varying force in shipping costs. In practice, these adjustment costs take the form of investments (and dis-investments) in capital such as rail cars, loading facilities in North Dakota, and unloading facilities in downstream locations.[8] Thus, while rail shipping is not as frictionless in practice as assumed by our simple model from section 2, it is still considerably more flexible than shipping by pipeline.

We model crude-by-rail frictions with a quadratic adjustment cost specification in the spirit of Hall (2004), which we interpret as a reduced form for the process of making multiple small discrete investments or dis-investments in crude-by-rail capacity. Our model's marginal cost of shipping oil to destination i in month t therefore includes a dynamic term $\gamma(Q_{rit} - Q_{ri,t-1})$ that is linear in the difference between the current and previous months' rail volumes to destination i, with $\gamma \geq 0$.

The total marginal cost of shipping to destination i in month t is then given by the sum $r_i + \gamma(Q_{rit} - Q_{ri,t-1})$, where r_i is a destination-specific static marginal cost. We allow this cost to be destination-specific because each of the three coastal destinations is a different distance from the Bakken area, and because there may be other route-specific factors that impact costs. For instance, rail traffic through the U.S. to the East Coast will typically pass through the congested Chicago area.

Our assumption that shippers are atomistic and can freely enter and exit then implies

[8] These investments are reported to be substantially cheaper, per unit of capacity, than pipeline investments. For example, at the low end, Fielden (2018) documents that the Plains All American loading facility in Manitou, ND cost \$40 million for 65,000 bbl/d of capacity, or roughly \$600 per bbl/d of capacity. At the higher end, Area Development News Desk (2018) documents that Enbridge spent \$145 million on an 80,000 bbl/d facility, or \$1,813 per bbl/d of capacity. Both of these figures lie substantially below the \$9,200 per bbl/d of capacity invested for DAPL (Energy Transfer Partners LP, 2017).

that in equilibrium, the price differential to location i must equal $r_i + \gamma(Q_{rit} - Q_{ri,t-1})$ whenever rail flows are strictly positive.[9] Letting P_{it} and P_{ut} denote the destination i price and upstream price in month t, this arbitrage condition is given by equations 3 and 4:

$$P_{it} - P_{ut} - r_i - \gamma(Q_{rit} - Q_{ri,t-1}) \leq 0 \tag{3}$$

$$Q_{rit}(P_{it} - P_{ut} - r_i - \gamma(Q_{rit} - Q_{ri,t-1})) = 0. \tag{4}$$

To estimate γ and the r_i cost parameters, we rearrange equation 4 and add a disturbance term ε_{it} to obtain equation 5:

$$Q_{rit} - Q_{ri,t-1} = \frac{-r_i}{\gamma} + \frac{1}{\gamma}(P_{it} - P_{ut}) + \varepsilon_{it}. \tag{5}$$

The disturbance term accounts for two types of unobservables. First, rail flows Q_{rit} are measured with error because the EIA estimates these flows from the STB's sample of waybills rather than from the universe of actual rail flows. Second, there may be unobserved shocks to the cost of rail shipping. These shocks would affect both current period rail flows Q_{rit} and the upstream price P_{ut}, which would lead an OLS estimate of equation 5 to be inconsistent. We therefore estimate equation 5 via 2SLS, instrumenting for the $(P_{it} - P_{ut})$ term using the first three lags of the East Coast (Brent) oil price. These instruments have strong first stage predictive power, and they will also satisfy an exclusion restriction if changes in crude oil flows out of the Bakken do not affect the global Brent benchmark price of oil. We estimate equation 7 using data from August 2012 (when rail shipments to the West Coast first exceeded 10 mbbl/d) through December 2019 (the end of our sample).

We present the 2SLS estimates of equation 5 in table 1. The estimated marginal cost intercepts for shipping to the East, Gulf, and West Coasts are \$9.49/bbl, \$12.64/bbl, and \$8.69/bbl, respectively. These estimates are in line with industry reports (Frittelli et al., 2014; ICF, 2020) and reflect the fact that the West Coast is the shortest distance to travel from the Bakken (Clay et al., 2019). Our estimate of γ is \$1.28/bbl per mbbl/d, which implies that increasing rail flows to a destination by 10 mbbl/d from one month to the next increases the marginal shipping cost by \$12.76/bbl. Thus, adjustment costs are a substantial portion of total rail shipping costs.

[9]The assumption that shippers are atomistic implies that they will be price takers both upstream and downstream. The free entry and exit assumption implies that the arbitrage condition given by equations 3 and 4 holds, rather than a classic Euler equation that would include a forward-looking term. That is, in our model free entry and exit compete away current-period railroad shipping rents, rather than the sum of current and expected future rents.

Table 1: Rail cost function estimates

	Rail cost intercepts r_i			
	East Coast	**Gulf Coast**	**West Coast**	**Friction parameter γ**
Point estimate	9.49	12.64	8.69	1.28
Standard error	(3.32)	(2.05)	(2.87)	(0.29)
Units	\$/bbl	\$/bbl	\$/bbl	\$/bbl per mbbl/d

Table shows estimates of equation 5 via 2SLS. Standard errors on the structural parameters are computed using the delta method and Driscoll and Kraay (1998), which allows for both spatial and temporal correlation in the residuals, using the plug-in bandwidth per Newey and West (1994). The first-stage F-statistic is 23.08 ($p < 0.001$). "mbbl/d" denotes units of thousands of barrels per day. All costs are in real June, 2014 dollars.

3.2 Model of upstream oil production

We next estimate a model of upstream supply in the spirit of Anderson et al. (2018). This framework makes the physically realistic assumption that "new" production, from newly drilled wells, is sensitive to crude oil prices, while "old" production, from pre-existing wells, is not.[10] Thus, in the short run, total upstream crude oil production is highly inelastic with respect to the oil price, since "old" production is a large share of total production. In the long run, however, production can respond significantly to persistent price shocks as changes in the rate of drilling affect production rates. Thus, the model we implement allows for considerably richer production dynamics than the simple static model from section 2.

Let Q_{ot}, Q_{nt}, and Q_t denote old, new, and total Bakken oil production each month. Per section 3.1, data on Q_t come from U.S. Energy Information Administration (2021b). To compute Q_{ot} and Q_{nt}, we use the EIA's "Drilling Productivity Reports" (DPRs), which estimate the contribution of new drilling to oil production each month (U.S. Energy Information Administration, 2021a). We derive Q_{nt} from the DPR data (details in appendix B.3) and then compute Q_{ot} as $Q_t - Q_{nt}$.

Following Anderson et al. (2018), we model the evolution of production from old wells as following equation 6, which specifies an exponential decline with a decay parameter $\beta \in (0, 1)$:

$$Q_{ot} = \beta Q_{t-1}. \tag{6}$$

[10]Anderson et al. (2018) explains that this behavior can be rationalized by the combination of low per-bbl marginal extraction costs once a well has been completed with the existence of a geologic production capacity constraint that is a function of the remaining reserves. Anderson et al. (2018) only studies conventional wells, but Newell and Prest (2019) shows that the price non-responsiveness of production from existing wells is also a feature of shale oil production.

We estimate equation 6 by projecting Q_{ot} onto Q_{t-1}, with no constant. We estimate $\beta = 0.955$, with a standard error of 0.002.[11]

Unlike production of old wells, the drilling of new wells is price-responsive. We follow Newell and Prest (2019)—which estimates the price-responsiveness of drilling across all major U.S. shale oil plays—by modeling new production Q_{nt} as a constant elasticity supply function of current and lagged upstream prices per equation 7. As discussed in Newell and Prest (2019), lagged prices are important because planning and executing the drilling of a new well can take several months. We also allow the productivity of Bakken drilling to evolve over time, which we capture with time-varying intercepts θ_t.

$$\log Q_{nt} = \theta_t + \sum_{\ell=0}^{L_n} \theta_{P\ell} \log P_{u,t-\ell}, \tag{7}$$

To estimate the elasticity parameters in equation 7, we follow Newell and Prest (2019) by taking first differences so that we have stationary series on both the left and right-hand sides of our estimating equation. We set the maximum lag L_n equal to nine months, since we find that longer lags do not significantly impact drilling. We also pool the monthly price coefficients to the quarterly level in order to avoid over-fitting the data, resulting in the following estimating equation:[12]

$$\Delta \log Q_{nt} = \alpha_1 + \alpha_{P0} \sum_{\ell=0}^{2} \Delta \log P_{u,t-\ell} + \alpha_{P1} \sum_{\ell=3}^{5} \Delta \log P_{u,t-\ell} + \alpha_{P2} \sum_{\ell=6}^{8} \Delta \log P_{u,t-\ell} + \varepsilon_{nt}. \tag{8}$$

The disturbances ε_{nt} correspond to shocks to the productivities θ_t in the supply function given by equation 7. These shocks may be simultaneously determined with the contemporaneous upstream price P_{ut}, which would bias downward our estimate of α_{P0}. While the inclusion of the α_1 parameter controls for linear technical progress over time, our main strategy for addressing this simultaneity is to instrument for $\sum_{\ell=0}^{2} \Delta \log P_{u,t-\ell}$ with the sum of the first three differences of the logged Brent oil price. As was the case when we estimated our crude-by-rail cost model in section 3.1, this instrument will be valid if shocks to Bakken production do not materially influence the global oil price.

We present the estimates of equation 8 in table 2. The total elasticity of new Bakken oil production to a permanent price change, given by three times the sum of α_{P0}, α_{P1}, and α_{P2},

[11]The estimated standard error is robust to heteroskedasticity and autocorrelation in the residuals per the Andrews (1991) HAC estimator.

[12]That is, we set $\theta_{P0} = \theta_{P1} = \theta_{P2} = \alpha_{P0}$, with similar expressions holding for the longer lags. If we instead estimate each monthly coefficient $\theta_{P\ell}$, the overall long-run elasticity we estimate is similar to what we obtain from estimating equation 8, but a few of the coefficients have negative point estimates.

Table 2: Upstream supply function estimates

		Upstream price elasticities α_P		
	Trend parameter α_1	**Current quarter** α_{P0}	**Lagged quarter** α_{P1}	**Second lagged quarter** α_{P2}
Point estimate	0.017	0.13	0.20	0.11
Standard error	(0.005)	(0.04)	(0.03)	(0.04)

Table shows estimates of equation 8 via 2SLS. Standard error estimates are robust to heteroskedasticity and autocorrelation in the residuals per the Andrews (1991) HAC estimator. The first-stage F-statistic is 210.17 ($p < 0.001$).

is 1.32. This value is comparable to the supply elasticity of 1.1 to 1.2 estimated in Newell and Prest (2019) using data from all of the major U.S. shale plays. Thus, even though the inelasticity of production from old wells limits the price-responsiveness of Bakken production in the short-run, the long-run price elasticity of production is substantial.

Finally, we solve for the monthly productivity intercepts θ_t by inverting equation 7 for each period t. Because the imputed θ_t are noisy (owing to noise in the raw production data), when we simulate the model we use smoothed values obtained from fitting a sixth-degree polynomial fit to the imputed θ_t.[13] Both the imputed and smoothed θ_t series are shown in appendix figure A.2.

3.3 Bakken pipeline capacity and the Dakota Access Pipeline

The Dakota Access Pipeline (DAPL) was put into service in June, 2017 with a capacity to move 520 mbbl/d from the Bakken to the Gulf Coast.[14] Our empirical model also accounts for pipelines other than DAPL that export crude oil from the Bakken. North Dakota Pipeline Authority (2023a) reports 763 mbbl/d of non-DAPL pipeline capacity, including the Double H Pipeline that was completed in February, 2015 with a capacity of 84 mbbl/d and expanded in January, 2016 to 108 mbbl/d. However, some of this capacity was not actually able to move oil all the way to the U.S. Gulf Coast due to downstream capacity constraints (ICF, 2020).[15] We therefore take total non-DAPL capacity to be equal to the average rate of

[13]The production data Q_t are sufficiently noisy that there are 4 months during 2011–2019 in which we impute $\exp(\theta_t) = 0$. This outcome occurs when βQ_{t-1} exceeds Q_t in the data.

[14]DAPL itself moves oil to Patoka, IL. Its completion was coincident with the completion of the Energy Transfer Crude Oil Pipeline (ETCO) from Patoka, IL to Nederland, TX on the Gulf Coast. For brevity, in the rest of this paper we refer to DAPL and ETCO jointly as just DAPL.

[15]Pre-existing pipelines out of the Bakken connect to other pipeline systems to the east and south (in particular the Enbridge Mainline, Platte, and Pony Express pipelines) to move oil onward to demand centers, but these pipelines have been constrained because they also carry oil from western Canada. In contrast,

Bakken pipeline exports from January, 2016 through February, 2017. We compute this value to be 586 mbbl/d, based on multiplying total Bakken production (per the EIA) by the share of production exported by pipeline (per the NDPA) each month.[16]

We also account for the fact that, unlike our analytic model from section 2, there is non-zero, albeit small, local demand for oil in the Bakken area. Per North Dakota Pipeline Authority (2023a), existing local refining capacity in June, 2014 was 88 mbbl/d. The NDPA also reports small volumes of oil that are trucked north from the Bakken and injected into spare capacity on the Canadian pipeline network. We model local Bakken oil demand as inframarginal—and therefore perfectly inelastic—at a quantity equal to the average combined local refining and trucking volumes during June, 2017 (when DAPL went into service) through December, 2019 (the end of our sample period): 139 mbbl/d.

3.4 Forward simulation of the full model

This section characterizes our model's equilibrium Bakken oil production, pipeline flows, and rail flows in each month t, given contemporaneous downstream prices and available pipeline capacity (DAPL and non-DAPL) K_t. Let P_{Et}, P_{Gt}, and P_{Wt} denote the East, Gulf, and West coast prices, respectively. Pipeline shipments of oil can only access the Gulf Coast market, but rail shipments can access any of the three markets. Let P_u^t denote the history of upstream prices at t (not including P_{ut}), and let Q_L denote local Bakken area oil consumption.

Equilibrium in our model in each period t is then defined by the following conditions:

1. Upstream production Q_t equals decayed old supply plus new supply: $Q_t = \beta Q_{t-1} + Q_{nt}(P_{ut}, P_u^t, \theta_t)$, where the function $Q_{nt}(P_{ut}, P_u^t, \theta_t)$ is given by equation 7.

2. Pipeline flows Q_{pt} are given by:

$$Q_{pt}(P_{Gt}, P_{ut}, K_t) \begin{cases} = 0 & \text{if } P_{Gt} < P_{ut} \\ \in [0, K_t] & \text{if } P_{Gt} = P_{ut} \\ = K_t & \text{if } P_{Gt} > P_{ut} \end{cases}$$

3. Rail flows Q_{rit} to each destination i are given by $Q_{rit} = \max\{0, Q_{ri,t-1} - \frac{r_i}{\gamma} + \frac{1}{\gamma}(P_{it} - P_{ut})\}$

DAPL, together with the ETCO pipeline, carries oil directly to the U.S. Gulf Coast.

[16] January, 2016 was the month the Double H pipeline was expanded, and February, 2017 was the last month before oil began to flow into DAPL to fill and commission the pipeline before it came fully into service in June, 2017. The difference of 177 mbbl/d between nameplate and effective non-DAPL capacity that we find is similar to the value of 243 mbbl/d reported in ICF (2020).

4. Upstream production equals the sum of local consumption and all pipeline and rail flows: $Q_t = Q_L + Q_{pt} + Q_{rEt} + Q_{rGt} + Q_{rWt}$

Given K_t, P_u^t, the downstream prices P_{it}, the lagged rail flows $Q_{ri,t-1}$, and the supply intercept θ_t, these four equilibrium conditions determine Q_{pt}, the Q_{rit}, Q_t, and P_{ut} each period. We prove the existence and uniqueness of this equilibrium in appendix C. Thus, starting from the initial conditions and the upstream price history in June, 2014 (when shippers committed to DAPL), we can use our estimated model to forward simulate Bakken production, pipeline flows, and rail flows given time series for P_{it} and K_t. Formally, letting $\mathbf{P_t}$ denote the vector of downstream prices $[P_{Et}, P_{Gt}, P_{Wt}]$ and letting $\mathbf{Q_{r,t-1}}$ denote the vector of lagged rail flows $[Q_{rE,t-1}, Q_{rG,t-1}, Q_{rW,t-1}]$, we can forward simulate:

$$P_{ut} = P_u(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_t, \theta_t) \tag{9}$$

$$Q_{pt} = Q_p(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_t, \theta_t) \tag{10}$$

$$Q_{rit} = Q_{ri}(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_t, \theta_t) \text{ for } i \in \{E, G, W\} \tag{11}$$

$$Q_t = Q_t(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_t, \theta_t) \tag{12}$$

Relative to the equilibrium in the simple model from section 2, the dynamics from the upstream supply function and crude-by-rail adjustment costs in this model cause crude oil flows to respond to downstream price shocks gradually rather than immediately. Thus, if downstream prices are rising quickly, the price differential can exceed the baseline rail shipping cost r_i. Alternatively, following a decrease in downstream prices rail flow can be strictly positive even if the price differential is strictly less than r_i.

3.5 Shippers' beliefs and equilibrium pipeline capacity

Thus far, we have described and estimated a model that allows us to forward simulate oil production and transportation flows given time series inputs of pipeline capacity and downstream prices. We next describe a model of pipeline capacity commitment and investment that builds on the framework introduced in section 2.2, wherein shippers' capacity commitment equates the shipping margin they expect to realize from having pipeline access to the pipeline's tariff τ. Applying this framework to DAPL requires us to specify shippers' beliefs about the distribution of future downstream oil prices as of June, 2014, when they executed binding ten-year "ship-or-pay" contracts with DAPL (Energy Transfer Partners LP, 2014). Quantifying this part of the model has two payoffs. First, doing so allows us to simulate equilibrium pipeline investment in the upstream production tax counterfactual discussed in section 6.1. Second, by specifying shippers' future price beliefs we gain the ability to evaluate all of our policy counterfactuals from the perspective of June, 2014, when the future path of oil prices was not yet known.

Let $t = 0$ denote June, 2014, let $t_c = 37$ denote June, 2017 (when DAPL went into service following its construction), and let $T = 156$ denote May, 2027 (the last month of shippers' ten-year commitment period). Let $\delta = 0.9919$ denote the monthly discount factor.[17] Let K_{nt} denote the time series of non-DAPL capacity, and let K_d denote DAPL's capacity. Finally, let $\mathcal{P}$ denote a time series of downstream prices, $\mathcal{P} = \{\mathbf{P_1}, \mathbf{P_1}, ..., \mathbf{P_T}\}$, and let $F(\mathcal{P} \mid \mathbf{P_0})$ denote shippers' beliefs about the distribution of $\mathcal{P}$ at $t = 0$. The equilibrium condition for K_d is then given by equation 13, which is the analog to equation 2 from the simpler model in section 2.2, now enriched to accommodate multiple periods, multiple rail destinations, and dynamics in rail transport and upstream production:

$$\tau = \frac{1}{\sum_{t=t_c}^{T} \delta^t} \int \left(\sum_{t=t_c}^{T} \delta^t \left(P_{Gt} - P_u(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_{nt} + K_d, \mathbb{E}[\theta_t]) \right) \right) dF(\mathcal{P} \mid \mathbf{P_0}). \tag{13}$$

To compute the right-hand side of equation 13, we need to specify the distribution $F(\mathcal{P} \mid \mathbf{P_0})$, the expected intercepts $\mathbb{E}[\theta_t]$ of the Bakken upstream supply function, and the volume of capacity K_d that shippers committed to. Given these ingredients, we compute the right-hand side of equation 13 by Monte Carlo simulation, where for each draw of $\mathcal{P}$ from $F(\mathcal{P} \mid \mathbf{P_0})$, $P_u(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_{nt} + K_d, \mathbb{E}[\theta_t])$ is solved for constructively for periods $t = 1$ through $t = T$ using the per-period equilibrium conditions from section 3.4, starting from the initial conditions $\mathbf{P_0}$, P_u^1, and $\mathbf{Q_{r0}}$.

To specify and estimate $F(\mathcal{P} \mid \mathbf{P_0})$, we first focus on the process for the Gulf Coast price P_G, since this price is most relevant to pipeline shippers. We adopt a parsimonious approach and assume that $\log P_{Gt}$ follows the AR(1) process in equation 14, where the innovations ϵ_{Gt} are iid normal with mean zero and variance σ_G^2:

$$\log P_{Gt} = \phi_0 + \phi_1 \log P_{G,t-1} + \epsilon_{Gt}. \tag{14}$$

When estimating the parameters ϕ_0, ϕ_1, and σ_G^2, we target two objects: the long-run expected value of P_G, denoted $\mathbb{E}[P_G]$, and the evolution of its variance from the short-run (one month ahead) through the long-run (156 months ahead).[18] We summarize our

[17] The monthly discount factor δ is based on an annual nominal discount rate of 12.5% (Kellogg, 2014) and a June, 2014 annual inflation forecast of 2.0% (Federal Reserve Bank of Atlanta, 2014).

[18] An alternative strategy would be to estimate equation 14 directly via OLS, using the monthly LLS price series. We eschew this strategy both to make use of the known June, 2014 futures price and because we want to target long-run oil price volatility directly, and modeled volatility is very sensitive to ϕ_1 for $\phi_1 \approx 1$.

estimation procedure here and provide more detail in appendix B.4. For $\mathbb{E}[P_G]$, we use the June, 2014 three-year Brent crude future price of \$93.47/bbl (Quandl, 2017).[19] Note that this expected price is higher than prices that were realized through the rest of the 2010s, since oil prices fell in late 2014 (see figure 2). For the variance, at each horizon $t \in [1, 156]$ we target the historic variance of log oil prices, computed as the variance of t-month differences in logged Brent prices.[20]

We fit our AR(1) model to the historic variances using a minimum distance estimator and obtain estimates of ϕ_1 and σ_G equal to 0.9925 and 0.098, respectively. Intuitively, the short-run variance identifies σ_G^2, and the long-run variance identifies ϕ_1 (the long-run variance is larger the closer is ϕ_1 to 1). These estimates imply that future oil price volatility increases from 10.3% at a one month horizon, to 69.0% at 37 months, and to 114% at 13 years, closely matching historic volatilities (see appendix figure A.3). Finally, the expected price $\mathbb{E}[P_G] =$ \$93.47/bbl pins down the estimate of $\phi_0 = 0.0293$.

We next specify and estimate the processes for the East and West Coast prices P_E and P_W. We assume that differences between these prices and P_G follow the joint AR(1) process given by equations 15 and 16.

$$P_{Et} - P_{Gt} = \phi_E + \phi_{EE}(P_{E,t-1} - P_{G,t-1}) + \phi_{EW}(P_{W,t-1} - P_{G,t-1}) + \epsilon_{Et} \tag{15}$$

$$P_{Wt} - P_{Gt} = \phi_W + \phi_{WE}(P_{E,t-1} - P_{G,t-1}) + \phi_{WW}(P_{W,t-1} - P_{G,t-1}) + \epsilon_{Wt} \tag{16}$$

We assume that ϵ_{Et} and ϵ_{Wt} are bivariate normal with mean zero. We estimate all the parameters of equations 15 and 16 by OLS, using price data from the same August, 2012 to December, 2019 sample period that we used when estimating the rail cost function in section 3.1. The estimates are consistent with strong mean reversion of spatial price differences: the eigenvalues of the matrix formed by the ϕ_{EE}, ϕ_{EW}, ϕ_{WE}, and ϕ_{WW} parameters are 0.72 and 0.79.[21] The estimates overall imply that the long-run coastal price differences are positive but small: $\mathbb{E}[P_E - P_G] =$ \$0.91/bbl and $\mathbb{E}[P_W - P_G] =$ \$0.84/bbl. These positive estimates increase the value of crude-by-rail and diminish DAPL's value to pipeline shippers.

Next, we estimate a time series of expected Bakken upstream supply function intercepts

When we estimate 14 directly, we obtain an estimate of $\phi_1 = 0.9852$, similar to the value of 0.9925 that we estimate from long-differenced oil price volatility.

[19]We use the three-year future because this is the longest horizon at which contracts are liquidly traded, and we use Brent rather than Louisiana Light Sweet (LLS) because there is no LLS futures market and because the Brent and LLS prices have historically been quite close (see figure 2). We equate the futures price with the price expectation because Anderson et al. (2018) finds a CAPM beta for oil of nearly zero using data through April, 2015, implying little risk premium or discount in oil futures.

[20]We use Brent rather than LLS to be consistent with our use of Brent to measure $\mathbb{E}[P_G]$.

[21]The point estimates are $\phi_{EE} = 0.60$, $\phi_{EW} = 0.23$, $\phi_{WE} = -0.10$, and $\phi_{WW} = 0.91$. The jointly normal distribution of ϵ_{Et} and ϵ_{Wt} has $\sigma_E =$ \$1.36/bbl, $\sigma_W =$ \$1.25/bbl, and $\sqrt{\sigma_{EW}} =$ \$0.93/bbl.

$\mathbb{E}[\theta_t]$ for $t \in [1, 156]$. We do not use our intercepts estimated in section 3.2 from realized production data because we are interested in specifying firms' expectations of production as of June, 2014, and because we need to estimate these expectations through 2027. We estimate the $\mathbb{E}[\theta_t]$ using a June, 2014 production forecast from North Dakota Pipeline Authority (2014). This forecast is discussed in more detail in appendix B.4 and plotted in appendix figure A.4. Average expected production during DAPL's ten-year contract period is 1620 mbbl/d. This production forecast, combined with $\mathbb{E}[P_G]$ and the estimated supply parameters from section 3.2, pins down the expected supply intercepts $\mathbb{E}[\theta_t]$.[22]

Finally, we specify shippers' capacity commitment K_d. DAPL's capacity when it opened in June, 2017 was 520 mbbl/d, and we use this value for K_d when we compute equation 13. However, as discussed in more detail in appendix B.4, it is difficult to be certain of the total capacity to which Bakken pipeline shippers committed in June, 2014. We therefore test the sensitivity of our results to alternative values of 320, 450, and 570 mbbl/d.

4 Validation

We conduct two validation exercises to assess how well our model "fits the data" and can match some data features that we haven't used in estimation. First, starting from initial conditions in June, 2014, we forward simulate the model through 2019 given the time series of realized downstream (but not upstream) oil prices, pipeline capacity, and estimated upstream supply intercepts. We then compare the model's simulated oil flows to actual flows observed in our data. This comparison tests how well the full set of equilibrium conditions in our model, given in section 3.4, can rationalize observed flows, given limited input information.

The simulated pipeline flows and aggregate rail flows from this simulation are shown in figure 3.[23] The model overall captures several salient features of actual pipeline and rail flows over 2014–2019. First, both simulated and actual rail flows decline gradually from June, 2014 through June, 2017, driven by the decline in oil prices that occurred in late 2014 (recall figure 2). Pipeline flows, in contrast, do not decrease during this time. Second, the model captures the gradual increase in pipeline flows following DAPL's completion in June, 2017. Actual pipeline flows initially increase more quickly than our simulated flows, potentially reflecting anticipatory effects that are not present in our model.[24] Finally, our

[22] In an alternative specification, we allow for uncertainty in upstream supply by letting the supply intercept be stochastic, using a conservative production forecast from the NDPA. See appendix B.4 for details, and see appendix tables A.2 and A.3 for simulation results that allow for supply uncertainty.

[23] Appendix figure A.5 presents alternative simulations that use simplified versions of our model that include only a single rail destination and shut down the dynamics of upstream production and crude-by-rail flows. These models fit the data less well.

[24] Figure 3 shows that pipeline flows actually start to increase a few months prior to June, 2017. These flows

Figure 3: Simulated and actual pipeline and rail flows, June, 2014 through 2019

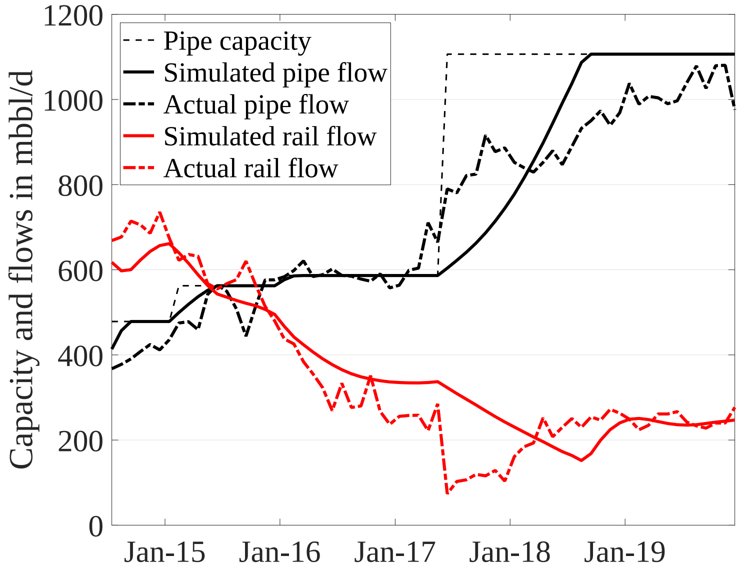


Figure shows actual and forward simulated pipeline flows and aggregate rail flows from the Bakken, using realized downstream prices through 2019. The simulation uses the model discussed in sections 3.1 through 3.4, starting from initial conditions as of June, 2014.

model captures the modest increase in crude-by-rail volumes that started in 2018 following a rebound in oil prices.[25]

In our second validation exercise, we test the equilibrium condition that the expected return for DAPL's committed shippers as of June, 2014 should equal DAPL's tariff, per equation 13. This exercise serves two purposes. First, it informs how well our model would predict pipeline investment under counterfactual policies that directly regulate upstream production. Second, it informs how well our estimated distribution of future oil prices $F(\mathcal{P} \mid \mathbf{P_0})$ matches shippers' beliefs, which in turn speaks to our policy evaluations that take expectations as of June, 2014, integrating over $F(\mathcal{P} \mid \mathbf{P_0})$.

The actual DAPL tariff for committed shippers is \$5.50–\$6.25/bbl (Gordon, 2017), with

may reflect DAPL's "line fill": the filling of the pipeline with oil before it was formally placed into service. The total line fill for DAPL is nearly 2 million barrels, given the pipeline's 1,872 mile length (including ETCO) and its 30 inch diameter (Dutta and Huchzermeyer, 2017).

[25]In appendix figure A.6, we break out the simulated and actual crude-by-rail flows by destination. Although our model does a good job of matching the decline of crude-by-rail volumes to the Gulf Coast, it does less well at capturing the divide between flows to the East versus West Coasts, potentially reflecting a delayed build-out of West Coast crude-by-rail terminal capacity (Fielden, 2013). In appendix B.2, we show an alternative specification of our model that better fits destination-specific rail flows by changing the r_E and r_W cost parameters. Our counterfactual simulations are qualitatively unchanged when we use this alternative specification.

shippers committing higher volumes paying a tariff at the lower end of this range. When we compute the right-hand-side of equation 13 using our model and our estimate of $F(\mathcal{P} \mid \mathbf{P_0})$, we obtain an expected return of \$6.17/bbl.[26] We view this result as a close match to the actual DAPL tariff.

Appendix table A.1 shows that the expected shipper returns that we would calculate under alternative specifications match the DAPL tariff less well. These specifications use a random walk model for the evolution of the Gulf Coast oil price P_G, or they simplify the model by assuming only a single rail destination and shutting down dynamics.[27]

5 Counterfactual simulations: what if DAPL had not been constructed?

5.1 Bakken oil production and transportation without DAPL

We now use our estimated model to evaluate Bakken oil production and transportation in a counterfactual in which DAPL's construction had been foreclosed. Figure 4 shows simulated counterfactual flows given realized downstream oil prices through 2019. In this counterfactual, pipeline volumes stay fixed at the non-DAPL pipeline capacity of 586 mbbl/d from mid-2016 onward. Unlike our baseline simulation that includes DAPL's capacity starting in June, 2017, rail flows in our counterfactual increase rather than decrease after this date. By December, 2019, simulated crude-by-rail flows without DAPL are 595 mbbl/d, compared to 247 mbbl/d with DAPL. Thus, by December, 2019, 348 mbbl/d (67%) of the 520 mbbl/d of pipeline oil flows that would have been eliminated by foreclosing DAPL would still be produced, but moved out of the Bakken by railroad rather than by pipeline.

Actual downstream oil prices after June, 2014 were unknown when DAPL shippers signed firm transportation agreements that month. Recognizing this uncertainty, we focus in the remainder of the paper on evaluating counterfactuals from the perspective of shippers and policy-makers in June, 2014, taking expectations over the distribution of downstream prices $F(\mathcal{P} \mid \mathbf{P_0})$ that we estimated in section 3.5.

Table 3 presents simulated expected pipeline, rail, and production volumes of Bakken oil, both with and without DAPL. In either scenario, expected Bakken production is greater than

[26] The simulation error from our 10000 draw Monte Carlo simulation of the integral in equation 13 implies a 95% confidence interval of $\pm$\$0.15/bbl around our expected return estimate of \$6.17/bbl.

[27] Appendix table A.2 then presents expected returns using the baseline model with alternative values for DAPL's committed capacity. For commitments of 450 mbbl/d or 570 mbbl/d, the expected return is similar to our value of \$6.17/bbl that uses the actual installed DAPL capacity of 520 mbbl/d. The expected return is substantially higher, however, if one assumes that only 320 mbbl/d of new Bakken pipeline capacity were committed to in June, 2014.

Figure 4: Simulated pipeline and crude-by-rail flows, with and without DAPL

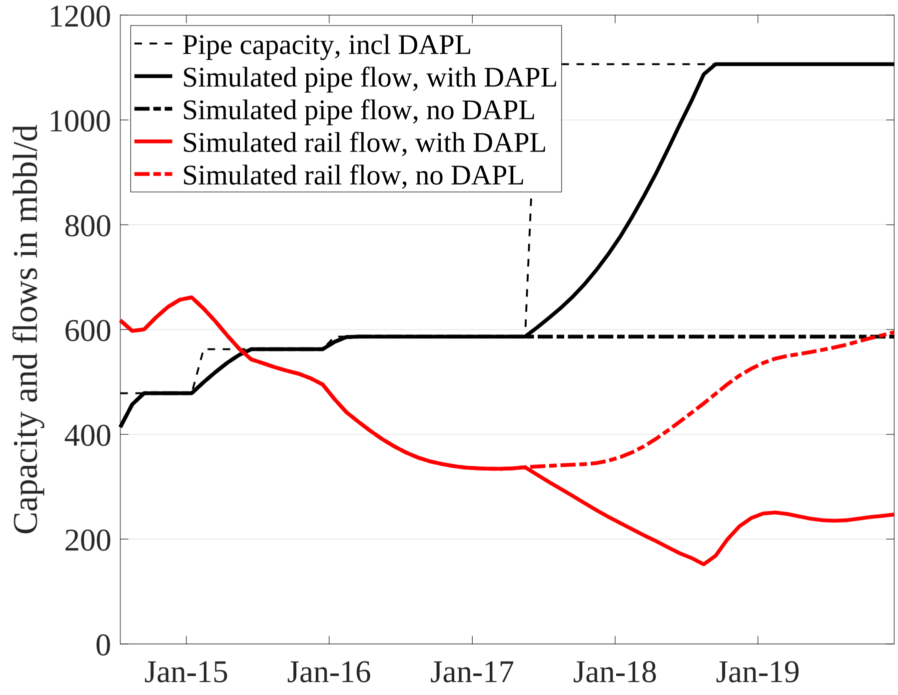


Figure shows forward simulations using the full model discussed in section 3, starting from initial conditions as of June, 2014 and using realized downstream prices through 2019, both with and without the addition of 520 mbbl/d of DAPL capacity in June, 2017. Simulated flows "with DAPL" are identical to those shown in figure 3.

what was realized over 2014–2019 because expected downstream prices, as of June, 2014, were higher than realized prices. In expectation, removing DAPL reduces pipeline flows by 306 mbbl/d. This magnitude is smaller than DAPL's 520 mbbl/d capacity because for very low downstream price realizations, DAPL is not fully utilized. Expected rail flows increase by 248 mbbl/d, offsetting 81% of the decrease in pipeline flows.[28] Bakken oil production decreases by 58 mbbl/d (4%). Thus, railroads' ability to effectively, even if incompletely, substitute for Bakken pipeline transportation implies that blocking pipeline construction would cause most of the precluded pipeline oil flow to divert to the railroads rather than "stay in the ground."

[28]Appendix table A.3 shows that the share of reduced pipeline flows that is offset by the increase in crude-by-rail flows is nearly invariant across alternative specifications that use different values for DAPL's committed capacity, allow for a random walk belief for future oil prices, or allow for supply uncertainty.

Table 3: Simulated flows with and without DAPL, in expectation

	Volume with DAPL mbbl/d	**Volume without DAPL mbbl/d**	**Change in volume mbbl/d**	**Percent change in volume**
Pipeline flows	827	521	-306	-37%
Rail flows	702	950	248	35%
Local Bakken consumption	139	139	0	0%
Bakken production	1529	1471	-58	-4%

All expectations are taken as of June, 2014 and are averages over 10000 Monte Carlo draws of possible downstream price paths. For each simulated price path, we compute average discounted volumes (pipeline, rail, local, total) during DAPL shippers' ten-year commitment period (June, 2017 - May, 2027).

5.2 Environmental and economic surplus impacts

5.2.1 Pollution emission factors and damages

To assess the environmental consequences of transporting Bakken crude, we rely primarily on emissions factors and damages estimates from Clay et al. (2019). This paper estimates: (1) emissions of CO_2, NO_x, and SO_x associated with pipeline transportation from the Bakken to the USGC, based on pipeline pumping stations' electricity consumption and on marginal generators' emissions factors; (2) emissions of CO_2, NO_x, VOCs, and particulate matter associated with railroad transportation from the Bakken to each of the three coastal destinations, using locomotive emissions factors; (3) pollution damage valuations from the AP3 integrated assessment model (Muller, 2014), which uses an EPA 2014 VSL of \$8.5 million; and (4) expected damages from spills and accidents for both pipeline and rail transport. Because Clay et al. (2019) provides pipeline emissions factors for 2011 and rail emissions factors for 2014, we adjust its reported values to account for changes in the electric generation and locomotive fleets over time using data from U.S. Environmental Protection Agency (2023) and U.S. Department of Transportation (2018). Details are provided in appendix B.5.

We present the \$/bbl damage estimates for 2019 in table 4; appendix figure A.7 shows the evolution of these damages over time. As in Clay et al. (2019), the greatest environmental damage from Bakken oil transport comes from railroad NO_x emissions, owing both to locomotives' high NO_x emissions factors and to the fact that these emissions often occur in densely populated areas. At a social cost of carbon (SCC) of \$100 per metric ton (tonne) of CO_2, monetized local pollution damages exceed CO_2 damages for rail transport to all three destinations, but for pipeline transportation CO_2 damages exceed costs from local pollution.

Our analysis also considers the CO_2 emissions associated with the oil itself. Each pro-

Table 4: Estimated damages from pipeline and rail transit of Bakken crude in 2019, \$/bbl

	Local air pollution	**Spills**	**CO_2 (at \$100/tonne)**
Pipeline	\$0.35	\$0.11	\$0.83
Rail to East Coast	\$3.00	\$0.73	\$0.79
Rail to Gulf Coast	\$1.66	\$0.73	\$0.79
Rail to West Coast	\$0.76	\$0.52	\$0.57

Estimates computed from Clay et al. (2019), U.S. Environmental Protection Agency (2023), and U.S. Department of Transportation (2018). Values are in real 2014 dollars. See text for details.

duced barrel of oil emits 0.432 tonnes of CO_2 when it is consumed (U.S. Environmental Protection Agency, 2022a). Thus, at a SCC of \$100/tonne, the avoided climate damages from preventing the production (and consumption) of oil are \$43.22/bbl, significantly greater than the per-barrel damages from oil transportation shown in table 4.

5.2.2 Producer surplus calculations

Private surplus losses in our model are borne entirely by oil producers. With exogenous downstream prices (an assumption that changes in Bakken oil exports are too small to affect the global oil market), consumer surplus impacts of any quantity change are zero. Similarly, because we assume rail shippers arbitrage away rail shipping profits, they too earn zero surplus. Finally, our pipeline commitment equilibrium implies that committed pipeline shippers earn zero rents in expectation.

To compute producer surplus, we take advantage of the fact that there are no economic distortions other than environmental externalities in our model. Thus, we can compute the private surplus loss from foreclosing DAPL by evaluating a hypothetical pipeline tax that would have been sufficient to cause no shippers to commit to DAPL. More precisely, let λ be a \$ per bbl/d tax on pipeline capacity, and let $K_d(\lambda)$ denote committed DAPL capacity as a function of the tax. The $K_d(\lambda)$ function is implicitly defined by a modification of the original equilibrium condition 13 that now includes the tax λ:

$$\tau + \lambda = \frac{\int \left(\sum_{t=t_c}^{T} \delta^t \left(P_{Gt} - P_u(\mathbf{P_t}, P_u^t, \mathbf{Q_{r,t-1}}, K_{nt} + K_d(\lambda), \mathbb{E}[\theta_t]) \right) \right) dF(\mathcal{P} \mid \mathbf{P_0})}{\sum_{t=t_c}^{T} \delta^t}. \tag{17}$$

Let $\lambda_0 > 0$ be the value of the pipeline capacity tax such that $K_d(\lambda_0) = 0$; in our

Table 5: Changes in environmental and private surplus from foreclosing DAPL, in expectation

	Expecations over 10-year DAPL contract
Δ Pipe flows (mbbl/d)	-306
Δ Pipe local pollution damage ($1000/d)	-$144
Δ Pipe CO_2 emissions (mtonnes/d)	-2.5
Δ Rail flows (mbbl/d)	248
Δ Rail local pollution damage ($1000/d)	$588
Δ Rail CO_2 emissions (mtonnes/d)	1.8
Decrease in producer surplus ($1000/d)	$716
Δ CO_2 from combustion (mtonnes/d)	-25.2
Local damages per tonne CO_2 abated ($/tonne)	$17
Lost PS per tonne CO_2 abated ($/tonne)	$28
Damages + lost PS per tonne CO_2 abated ($/tonne)	$45

All expectations are taken as of June, 2014 and are averages over 10000 Monte Carlo draws of possible downstream price paths. For each simulated price path, we compute average discounted outcomes during DAPL shippers' ten-year commitment period (June, 2017 - May, 2027). All monetary values are in real June, 2014 dollars. "mtonnes/d" denotes thousands of metric tons per day.

estimated model we find $\lambda_0 = \$3.03/\text{bbl}$.[29] We then evaluate the change in producer surplus $\Delta(PS)$ as the following Harberger triangle:[30]

$$\Delta(PS) = \int_0^{\lambda_0} s(K_d(s) - K_d(0))ds. \tag{18}$$

5.2.3 Welfare impacts of foreclosing DAPL

Table 5 presents our estimates of the expected environmental and producer surplus effects of foreclosing DAPL in June, 2014. The decrease in pipeline flows of 306 mbbl/d causes a reduction in local environmental harm of $144,000 per day and a reduction in CO_2 emissions

[29]The sum $\tau + \lambda_0$ is $9.20/bbl and is the shadow value of pipeline capacity at $K_d = 0$. This shadow value increases as total pipeline capacity decreases but will be bounded above by the cost of crude-by-rail.

[30]We evaluate equation 18 by Gauss-Legendre quadrature, solving equation 17 at each quadrature node. We set $\tau = \$6.17/\text{bbl}$, the value of the right-hand-side of equation (17) when $\lambda = 0$, with $K_d(0) = 520$ mbbl/d. We use the Harberger triangle approach in our producer surplus calculations because we cannot directly evaluate the level of producer surplus at $K_d = 520$ mbbl/d and $K_d = 0$. In particular, our upstream production model is designed to capture the dynamics with which Bakken production responds to price shocks, but it is not founded on a model of dynamically optimizing behavior that would allow us to directly evaluate producers' profit functions.

of 2.5 thousand metric tonnes (2.5 mtonnes) per day. The 248 mbbl/d increase in crude-by-rail flows, however, increases local pollution damage by $588,000 per day and increases CO_2 emissions by 1.8 mtonne/d. Thus, even though the magnitude of the decrease in pipeline oil flow exceeds the increase in rail flow, overall local environmental damage increases because the per-barrel harm from railroad transport exceeds that from pipeline transport.

We estimate a decrease in producer surplus of $716,000 per day, greater than the change in monetized local environmental harm but of a comparable magnitude. The decrease in oil production of 58 mbbl/d is associated with a 25.2 mtonne/d decrease in CO_2 emissions from oil consumption. This emissions reduction is much greater than the changes in emissions associated with changes in pipeline and rail flows, even though the change in oil production is much smaller in magnitude than the swing in transportation from pipeline to rail.

The bottom section of table 5 computes the the cost of foreclosing DAPL in terms of dollars per tonne of avoided CO_2 emissions. The increase in local pollution damages imposes a cost of $17/tonne, while the decrease in producer surplus amounts to $28/tonne. The total cost, with equal weight on environmental damages and producers' surplus losses, is $45/tonne. This cost is similar to the U.S. government's contemporaneous value for the SCC of $42/tonne (Interagency Working Group on the Social Cost of Carbon, 2013) but lower than the value of $190 per tonne proposed in U.S. Environmental Protection Agency (2022b).[31] Section 6 below further characterizes these costs by evaluating alternative policies and discussing factors outside our model that may be important.

6 Discussion and extensions

6.1 Policy alternative: upstream production tax

In this section, we compare outcomes from blocking pipeline construction to outcomes from policies that directly tax oil production upstream in the Bakken. An example of such a policy is a "royalty adder," like that under consideration for federally-owned oil and gas resources (Prest, 2022; Prest and Stock, 2023). The vast majority of Bakken oil lies on private rather than public mineral estates, so in the Bakken the tax would instead have to take the form of a state-imposed severance tax.[32]

[31]The average SCC in Interagency Working Group on the Social Cost of Carbon (2013) for 2014, using a 3% discount rate to evaluate future climate damages, is $37/tonne in 2007 dollars. Accounting for inflation per Bureau of Labor Statistics (2023) yields $42/tonne. The $190 per tonne figure is for the year 2020 in 2020 dollars and was computed using a 2% discount rate to evaluate future climate damages.

[32]The State of North Dakota already imposes a 5% production tax and a 5% extraction tax, so this counterfactual calculation would not represent something totally unprecedented. See `https://www.tax.nd.gov/business/oil-and-gas-severance-tax`.

We model a Bakken production tax as a wedge between the price received by upstream producers and the price paid by pipeline and rail shippers for oil in the Bakken. To normalize our comparisons between policies, we set the value of the tax so that the induced reduction in CO_2 emissions is the same as that achieved by blocking the pipeline (26.0 mtonnes/d). We set the effective date of the tax as June, 2017 (DAPL's in-service date).

We model the tax in two ways. First, we treat the tax as being announced after DAPL shippers made their firm commitments, so that we hold DAPL's capacity fixed at 520 mbbl/d. In this case, a production tax of \$3.68/bbl (equivalent to \$8.52/tonne CO_2) reduces emissions by the same amount as blocking DAPL's construction. Second, we model the tax as being announced before the firm contracts were executed, and we compute the new equilibrium pipeline capacity that accounts for the tax. In this case, the emissions-equivalent production tax is \$3.24/bbl (\$7.51/tonne CO_2), and the new pipeline capacity is 443 mbbl/d.[33]

Table 6 compares outcomes from the DAPL foreclosure policy and the two tax policies. Because the policies are normalized on CO_2 emissions, they all induce roughly the same reduction in Bakken oil production. But the production taxes do not induce the large shift in flows from pipeline to rail that characterizes the ban on DAPL's construction. Holding DAPL's capacity fixed, the production tax reduces both pipeline and rail volumes, while if DAPL's capacity responds to the tax, the entire volume reduction comes from pipeline flows.

The fourth and fifth rows of table 6 show that the production tax induces a large transfer from producers to the government of five to six million dollars per day, depending on how the tax's timing is modeled.[34] This transfer is nearly an order of magnitude greater than the \$716,000 per day decrease in producers' surplus when DAPL is banned. It arises from the fact that the tax affects inframarginal barrels of oil, not just the transported oil that is on the margin. An alternative policy of a production quota with tradeable credits would avoid the large transfer and leave all other impacts unchanged from those shown in table 6.

The tax reduces combined producer surplus and government revenue by \$109,000 per day if DAPL's capacity is held fixed, and by \$96,000 per day if DAPL's capacity responds to the tax. These surplus reductions—which are the deadweight loss of the tax ignoring environmental effects—are considerably smaller than the \$716,000 per day reduction in producers' surplus when DAPL is banned. Intuitively, banning DAPL induces a large, distortionary shift in oil transport mode that increases the industry's costs, whereas upstream production taxes do not.

Turning to environmental impacts, we find that while banning DAPL increases local

[33]The counterfactual capacity of 443 mbbl/d assumes no economies of scale in pipeline construction. To the extent that economies of scale are important, the upstream production tax would cause a larger decrease in DAPL's capacity than what what we simulate here.

[34]These transfers may induce a positive fiscal externality that we do not account for in our analysis.

Table 6: Expected impacts from foreclosing DAPL and from taxing Bakken oil production

	Blocking DAPL	Production tax, DAPL capacity fixed	Production tax, DAPL capacity adjusts
Impacts per day			
Δ Pipe flows (mbbl/d)	-306	-29	-59
Δ Rail flows (mbbl/d)	248	-30	0
Δ Total flows (mbbl/d)	-58	-59	-59
Δ Producer surplus ($1000/d)	-$716	-$6035	-$5316
Δ Tax revenue ($1000/d)	-	$5926	$5221
Δ PS + Δ tax revenue ($1000/d)	-$716	-$109	-$96
Δ Local pollution damage ($1000/d)	$444	-$82	-$26
Δ CO_2 emissions (mtonnes/d)	-26.0	-26.0	-26.0
Costs per tonne of CO_2 abated			
Lost producer surplus	$27.56	$232.26	$204.59
Tax revenue	-	$228.07	$200.90
Lost PS - tax revenue	$27.56	$4.19	$3.68
Increase in local pollution damages	$17.08	-$3.17	-$1.01
Lost PS - tax revenue + local pollution	$44.63	$1.01	$2.68

All expectations are taken as of June, 2014 and are averages over 10000 Monte Carlo draws of possible downstream price paths. For each simulated price path, we compute average discounted outcomes during DAPL shippers' ten-year commitment period (June, 2017 - May, 2027). The production tax in column (2) is $3.68/bbl ($8.52/tonne CO_2), and that in column (3) is $3.24/bbl ($7.51/tonne CO_2). The simulation used to generate column (3) assumes that DAPL's equilibrium capacity investment anticipates the tax and is therefore 443 mbbl/d rather than 520 mbbl/d. All monetary values are in real June, 2014 dollars. "mtonnes/d" denotes thousands of metric tons per day.

environmental damages, taxing upstream production modestly reduces these damages. The increase in local damages from banning DAPL stems from the large increase in crude-by-rail traffic. Taxing upstream production instead weakly decreases both pipeline and rail flows.

The bottom half of table 6 summarizes these results in terms of costs per tonne of abated CO_2 emissions. Here again the tax's transfer from oil producers to the government is large: at least $201 per tonne. Its deadweight loss is small, however: just $3.68 per tonne in the case in which DAPL's capacity responds to the tax. Putting equal weight on all impacts, the total cost per tonne of CO_2 from the production tax is $1.01 holding DAPL's capacity fixed, and $2.68 if DAPL's capacity responds to the tax. This overall impact is considerably smaller than the total cost of blocking DAPL: $45 per tonne. This difference reflects both the tax's relatively small deadweight loss and its induced decrease (rather than increase) in local environmental pollution damage.

6.2 Potential impacts on oil production from other basins

Thus far, our welfare analysis has assumed that every barrel of avoided Bakken oil production translates to a barrel of avoided oil consumption. However, this assumption will be violated if decreased Bakken production leads to increases in oil production elsewhere via the re-equilibration of the global market. The mechanism for such "leakage" of production would be an increase in world oil prices that induced production increases outside of the Bakken. The strength of this mechanism depends on supply and demand elasticities: leakage will be greatest when global oil demand is inelastic and non-Bakken supply is elastic (Prest et al., 2023; Weisbach, Kortum, Wang and Yao, 2023).[35]

Rather than develop and quantify a model of the global oil market—a task we view as outside the scope of this paper—we rely on recent research to assess how leakage might affect the results from our counterfactual analyses. Prest (2022) estimates a leakage rate of 52–72% for policies that reduce production on U.S. federal lands, using data from International Energy Agency (2019); these estimates were used to evaluate federal oil royalty adders in Prest and Stock (2023). Prest et al. (2023) calculates a leakage rate of 55% using a meta-analysis of global oil demand and supply elasticity estimates from the literature. Based on this work, we re-evaluate our counterfactual analyses using leakage rates of 52% and 72%.

When we account for production leakage, the policies' effects on CO_2 emissions associated with combustion of the produced oil are all attenuated by a factor of $(1 - \ell)$, where ℓ is the leakage rate. This attenuation then inflates the policies' costs per tonne of CO_2 abated, as shown in table 7. At a leakage estimate of 72%, the combined private and local environmental cost from foreclosing DAPL increases from \$45 to \$159 per tonne of CO_2 abated. The combined cost of taxing upstream production increases from \$1.01 to \$3.62 per tonne (or from \$2.68 to \$9.56 per tonne if DAPL's capacity responds to the tax).

6.3 Limitations

While our model of upstream supply is dynamic in the sense that it allows oil production each period to be a function of lagged prices, it does not incorporate a Hotelling-style model of resource exhaustion. One potential concern with our approach is then that policies that reduce oil production today are really just postponing production rather than truly "keeping it in the ground."

[35] Note that our infinite Bakken downstream oil demand elasticity assumption in the analysis thus far is consistent with either highly elastic global oil demand or highly elastic non-Bakken supply.

Table 7: Expected costs per tonne of CO_2 abated from foreclosing DAPL and from taxing Bakken oil production, accounting for production leakage to other basins

	Blocking DAPL	Production tax, DAPL capacity fixed	Production tax, DAPL capacity adjusts
No leakage			
Lost PS - tax revenue	\$27.56	\$4.19	\$3.68
Increase in local pollution damages	\$17.08	-\$3.17	-\$1.01
Lost PS - tax revenue + local pollution	\$44.63	\$1.01	\$2.68
52% leakage			
Lost PS - tax revenue	\$57.41	\$8.72	\$7.67
Increase in local pollution damages	\$35.57	-\$6.61	-\$2.10
Lost PS - tax revenue + local pollution	\$92.99	\$2.11	\$5.58
72% leakage			
Lost PS - tax revenue	\$98.42	\$14.95	\$13.16
Increase in local pollution damages	\$60.98	-\$11.33	-\$3.60
Lost PS - tax revenue + local pollution	\$159.41	\$3.62	\$9.56

All expectations are taken as of June, 2014 and are averages over 10000 Monte Carlo draws of possible downstream price paths. For each simulated price path, we compute average discounted outcomes during DAPL shippers' ten-year commitment period (June, 2017 - May, 2027). The production tax in column (2) is \$3.68/bbl (\$8.52/tonne CO_2), and that in column (3) is \$3.24/bbl (\$7.51/tonne CO_2). The simulation used to generate column (3) assumes that DAPL's equilibrium capacity investment anticipates the tax and is therefore 443 mbbl/d rather than 520 mbbl/d. All monetary values are in real June, 2014 dollars.

Similar to Prest (2022) and Prest et al. (2023), we do not view dynamics related to resource exhaustion as a first-order threat to our analyses. The Bakken production data do not exhibit any evidence of a long-run decline: since the Covid-19 interruption in spring 2020, production has been roughly constant between 1,000 and 1,100 mbbl/d through at least July, 2023 (U.S. Energy Information Administration, 2021b). Thus, to the extent that reserve exhaustion has been important, productivity improvements like learning-by-doing (Kellogg, 2011; Covert, 2015; Agerton, 2020) have been sufficient to compensate. North Dakota Pipeline Authority (2023b), moreover, forecasts that under the 2023 EIA price forecast, Bakken production will actually increase in the coming decade and not fall below 1,000 mbbl/d until sometime after its last forecast year of 2047. We therefore conclude that policies that reduce Bakken oil production today will keep the otherwise-produced oil in the ground for a very long time, quite plausibly beyond the time at which substitute fuels and technologies (or strong carbon policies) substantially reduce oil demand.

Second, there are limits to the scope of environmental effects we quantify in this paper.

We do not quantify harms from local pollution associated with upstream extraction. There is a literature that studies pollution from shale oil production using large-scale data, focusing mainly on the Marcellus shale in Pennsylvania (Currie, Greenstone and Meckel, 2017; Bonetti, Leuz and Michelon, 2021; Zhang, Li, Khanna, Krupnick, Hill and Sullivan, 2023), but we are unaware of a comprehensive valuation study analogous to Clay et al.'s (2019) study of transportation-related emissions. The extant literature suggests that impacts are local to drilling and production sites, and given the Bakken area's low population density we see these damages as being small in magnitude relative to those we quantify.[36] Additionally, we do not incorporate local environmental damages from downstream oil refining or the consumption of refined products, nor do we evaluate emissions associated with oil's substitutes in consumption. These considerations may be important, though they would not affect our relative cost per tonne estimates across policies because they would proportionally re-scale the cost per tonne of each.

7 Conclusions

This paper demonstrates that initiatives to "keep carbon in the ground" by blocking fossil fuel transportation infrastructure can present difficult trade-offs. For oil pipelines, these trade-offs arise because the availability of crude-by-rail as a substitute can still allow oil to reach demand centers, and because this substitute induces larger environmental externalities than the blocked infrastructure itself. Despite the differences between pipelines' and railroads' technology and cost structure, we find that these two transport modes are strongly substitutable, such that if the construction of DAPL had been enjoined, 81% of the blocked pipeline flows would have moved by rail instead in expectation. This quantitative conclusion is of course specific to DAPL, but our modeling framework can be applied to other situations, across which the cost and availability of substitute transport may vary.

We find that the combined private plus local environmental cost of blocking DAPL, per tonne of CO_2 abated, is \$45. This value is on par with the contemporaneous (2014) U.S. social cost of carbon (SCC) of \$42/tonne (Interagency Working Group on the Social Cost of Carbon, 2013) but significantly lower than the value of \$190 per tonne recently proposed in U.S. Environmental Protection Agency (2022b). Thus, blocking DAPL may still pass a Kaldor-Hicks cost-benefit test under recent valuations of the SCC, though this conclusion can be overturned if "leakage" of oil production to other basins is sufficiently large.

[36] Even if local damages from extraction were of the same per-bbl magnitude as local damages from transportation, the large changes in transportation mode share (relative to the change in production) associated with blocking DAPL implies that our results on local pollution damages would be qualitatively unchanged.

Moving beyond a standard cost-benefit lens, blocking DAPL presents an environmental justice dilemma, since the policy reduces global climate damages while imposing local pollution damages onto communities near railroad corridors. This trade-off between local and global pollution is typically absent from other carbon abatement policies that directly target fossil fuel production or consumption itself. In these cases, substitution is often to other energy technologies that have lower, not higher, local pollution externalities.

Finally, we find that alternative policies that directly target upstream production can avoid the local environmental externalities imposed by blocking DAPL while also imposing less of a burden on productive efficiency. However, upstream policies face their own challenges. Upstream carbon taxes, which could be implemented as “royalty adders” or severance taxes, generate large transfers from industry to the government that can potentially exceed monetized climate benefits and lead to political resistance. And upstream policies in general require authority over upstream producers and resource owners, presenting a challenge in the U.S. because the vast majority of onshore oil and gas resources are privately-owned. Pipeline infrastructure projects, in contrast, present multiple veto points because approvals are needed in every state that the proposed line would pass through. In situations in which upstream policies are not on the table because local authorities are unable or unwilling to enact them, blocking pipeline infrastructure may therefore still present itself as an attractive option to advocates and policy-makers who strongly value carbon reductions.

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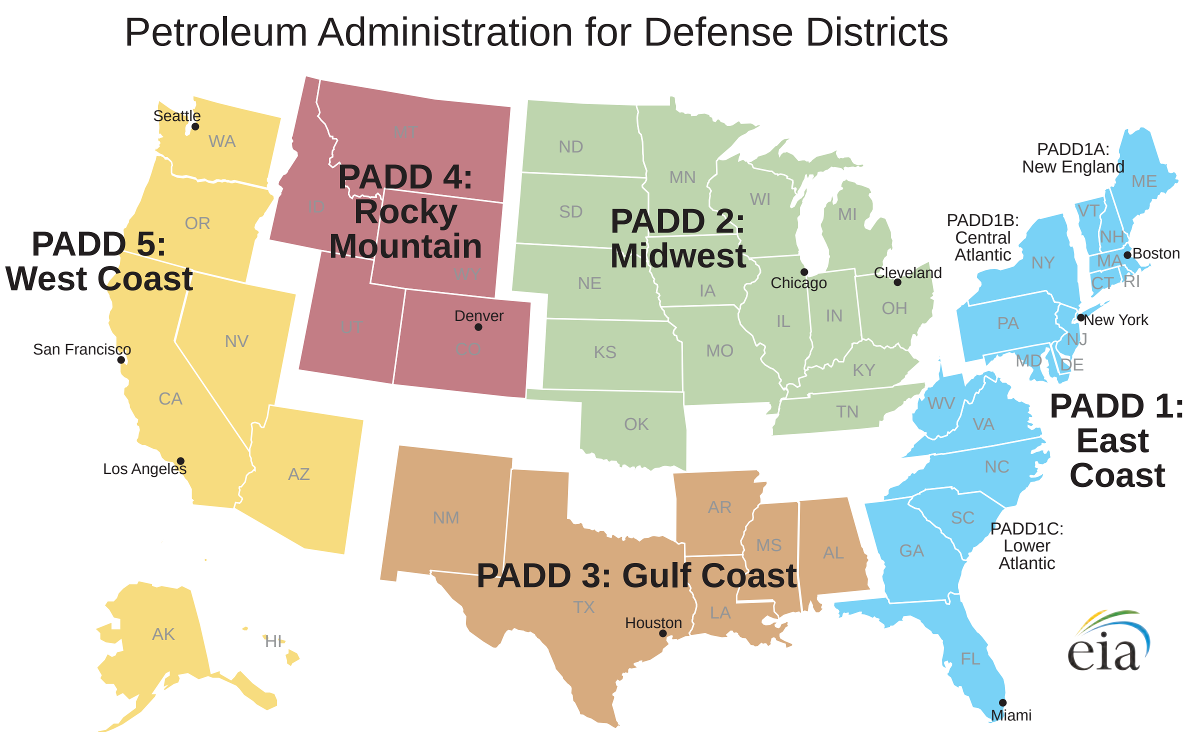
Online appendix for "Environmental Consequences of Hydrocarbon Infrastructure Policy"

A Additional figures and tables

Figure A.1: Map of EIA Petroleum Administration for Defense Districts (PADDs)



Source: U.S. Energy Information Administration (2023)

Figure A.2: Upstream supply function productivity intercepts

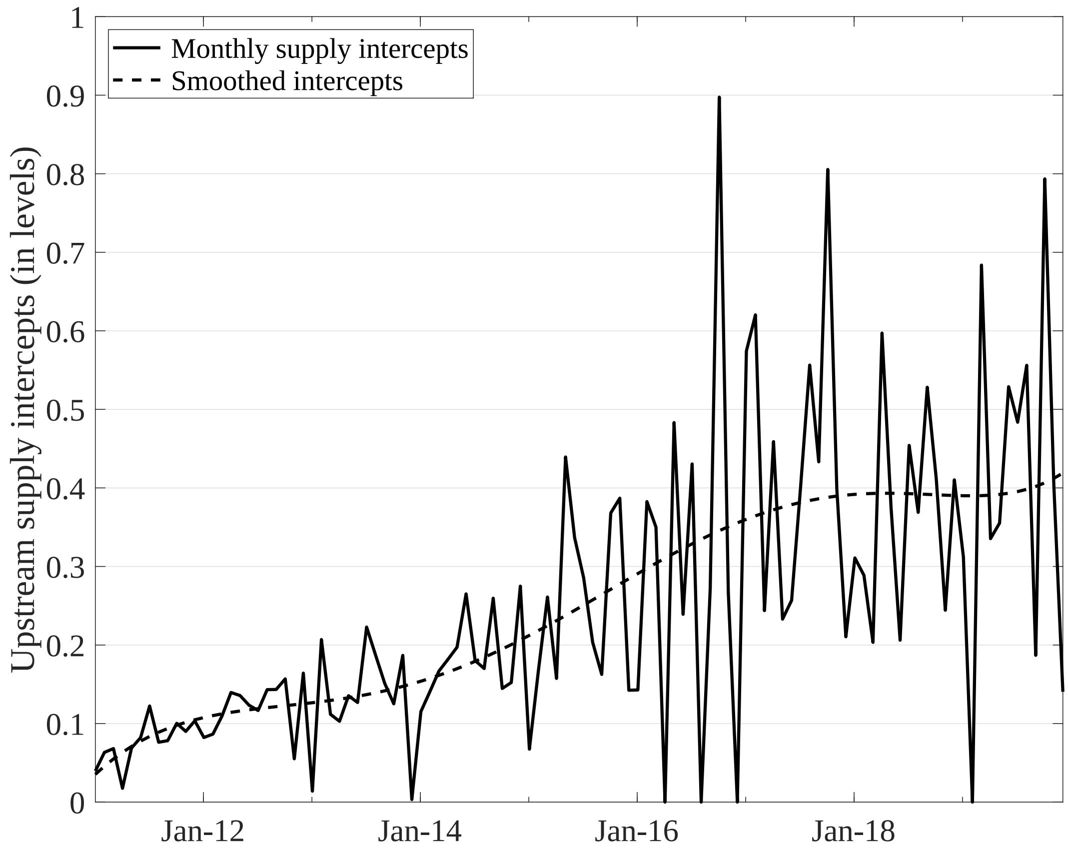
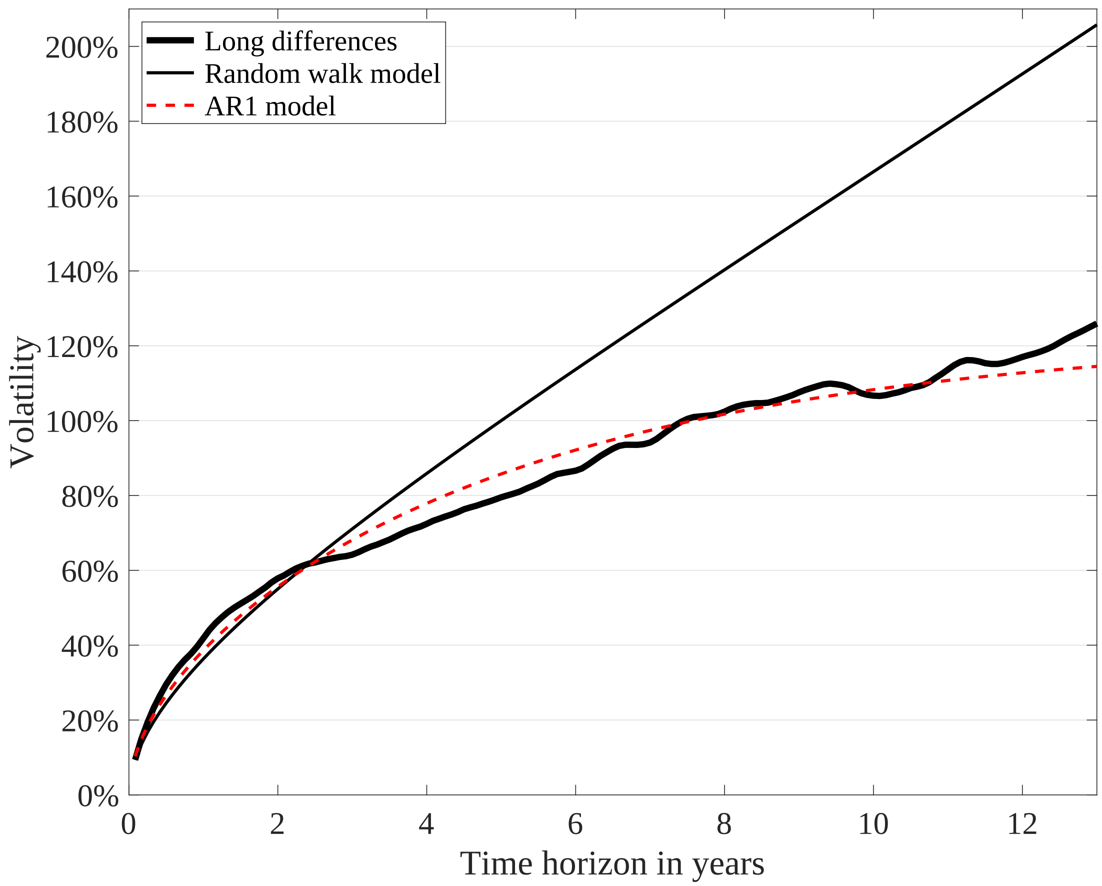


Figure shows the imputed intercepts $\exp(\theta_t)$ of upstream supply equation 7. Units are mbbl/d, with price entering equation 7 in units of \$/bbl. The smoothed intercepts are the result of a sixth-degree polynomial fit to the imputed intercepts. There are 4 months in which the imputed intercepts have a value of zero. These zeros arise because in those months, the quantity of decayed "old" production exceeds the month's total production reported in the data.

Figure A.3: Brent price volatility estimates at horizons up to 13 years



Note: The long differenced volatility at each horizon t is calculated as the standard deviation of t-month differences in historic logged (real June, 2014) Brent crude prices. The random walk model extrapolates the historic one-month Brent volatility to longer time horizons by multiplying the one-month volatility by $\sqrt{t}$. The AR(1) model is the best fit of equation 14 to the series of t-month historic volatilities. Volatilities in percent are calculated for each horizon by exponentiating the standard deviation, subtracting one, and multiplying by 100.

Figure A.4: NDPA production forecasts as of June, 2014

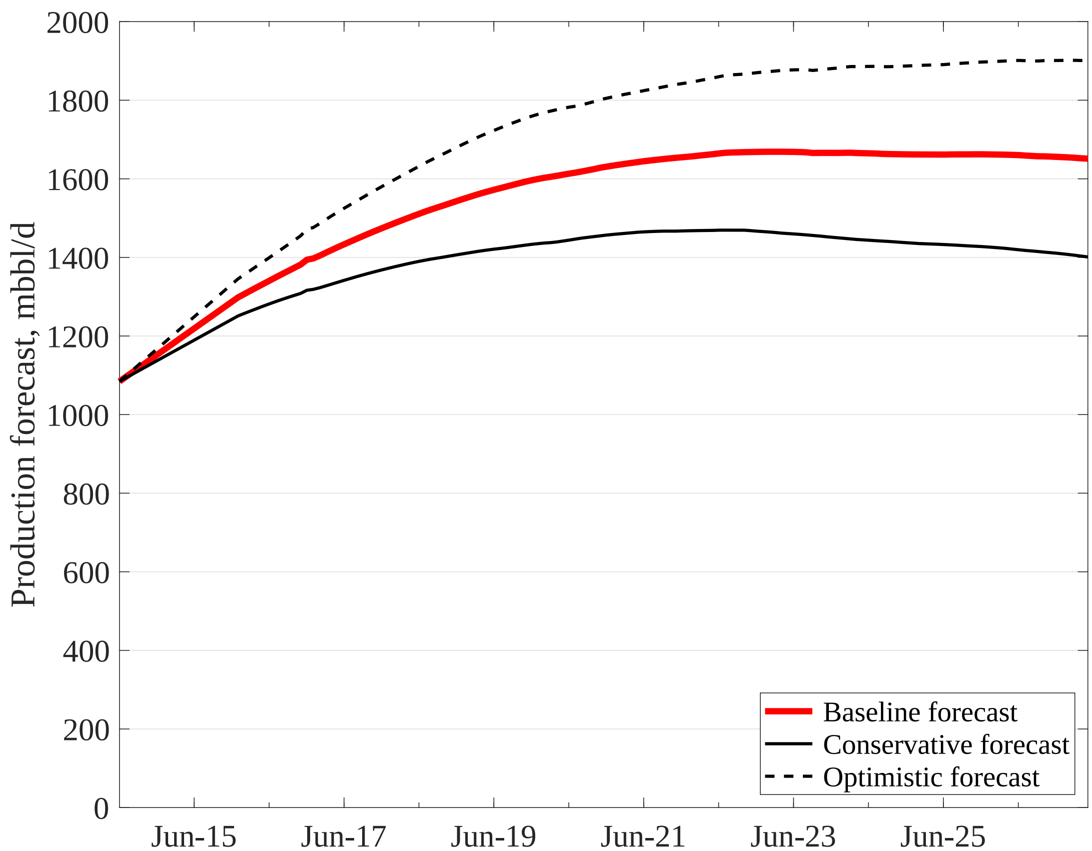
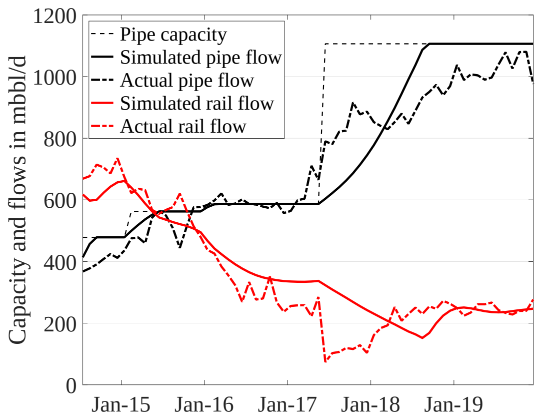


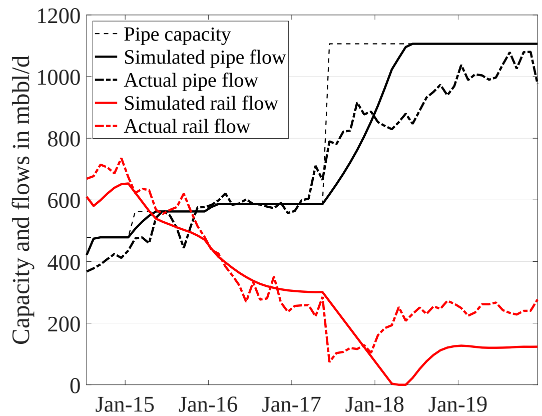
Figure shows the NDPA's production forecasts as of June, 2014 (North Dakota Pipeline Authority, 2014). The NDPA publishes a figure showing the production forecast time series but not the underlying data. We digitized the NDPA figure and then evaluated production for each month $t \in [1, 156]$ by applying a local linear smoother to the digitized points (Calonico, Cattaneo and Farrell, 2019). Our digitized forecast starts in January, 2016; we linearly interpolate this forecast back to July, 2014 using realized production from June, 2014. The conservative forecast is the NDPA's "case 2" forecast. We construct the optimistic forecast by adding, in each month, the difference between the baseline and conservative forecast to the baseline forecast.

Figure A.5: Simulated and actual pipeline and rail flows, using the full model and alternatives

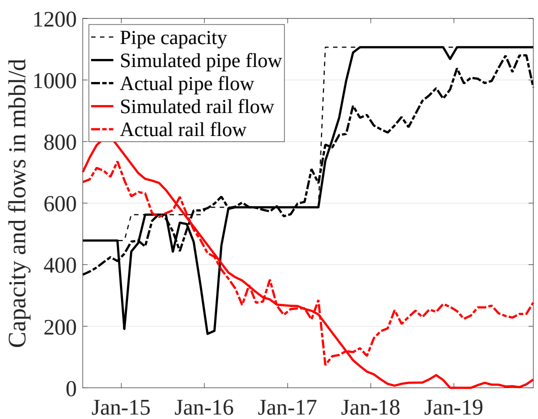
(a) Full model



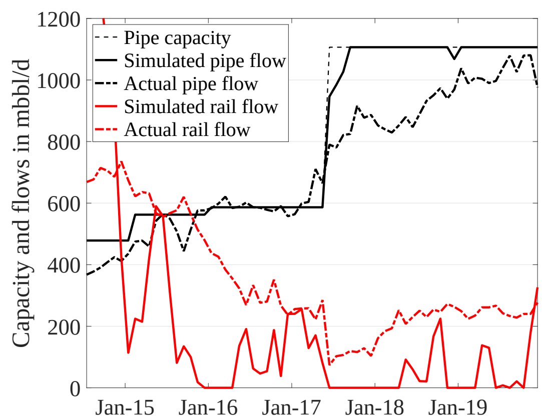
(b) All rail to Gulf Coast (USGC)



(c) All rail to USGC, static upstream



(d) All rail to USGC, static upstream, no rail frictions



"Full model" in panel (a) shows forward simulations using the full model discussed in section 3, starting from initial conditions as of June, 2014. This panel is identical to figure 3 in the main text. Panels (b), (c), and (d) present simulations from simplifications of the full model. "All rail to USGC" forces all crude-by-rail to flow to the USGC; this model divides the friction parameter γ by 3 so that it is comparable to the multiple-destination full model. "All rail to USGC, static upstream" additionally simplifies the upstream model so that production Q_t each period is a constant elasticity function of the upstream price P_{ut}, with the elasticity equal to the sum of the coefficients estimated in equation 8; i.e., 1.32. Finally, "All rail to USGC, static upstream, no rail frictions" additionally sets $\gamma = 0$; simulated rail flows in this model in 2014 exceed 1400 mbbl/d. Actual flows and pipeline capacity are identical across panels. All simulations use realized downstream prices through 2019.

Figure A.6: Simulated and actual crude-by-rail flows to each destination

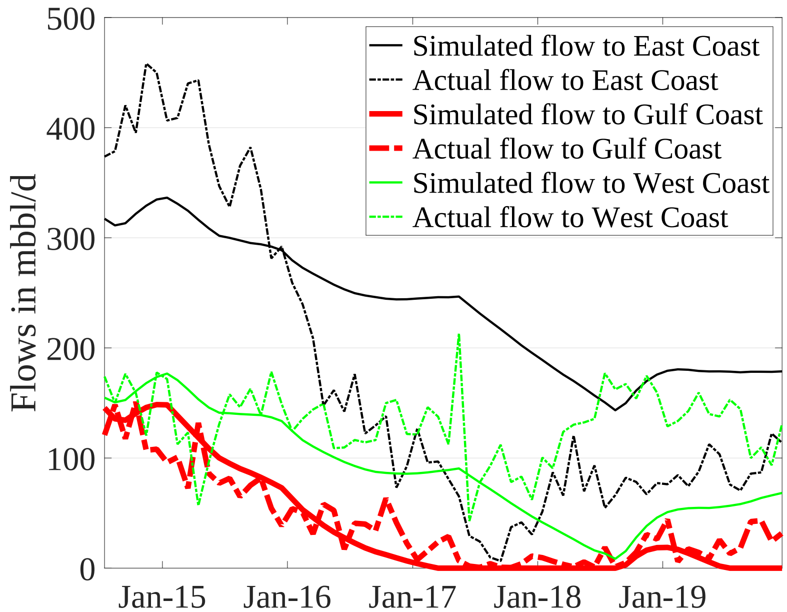
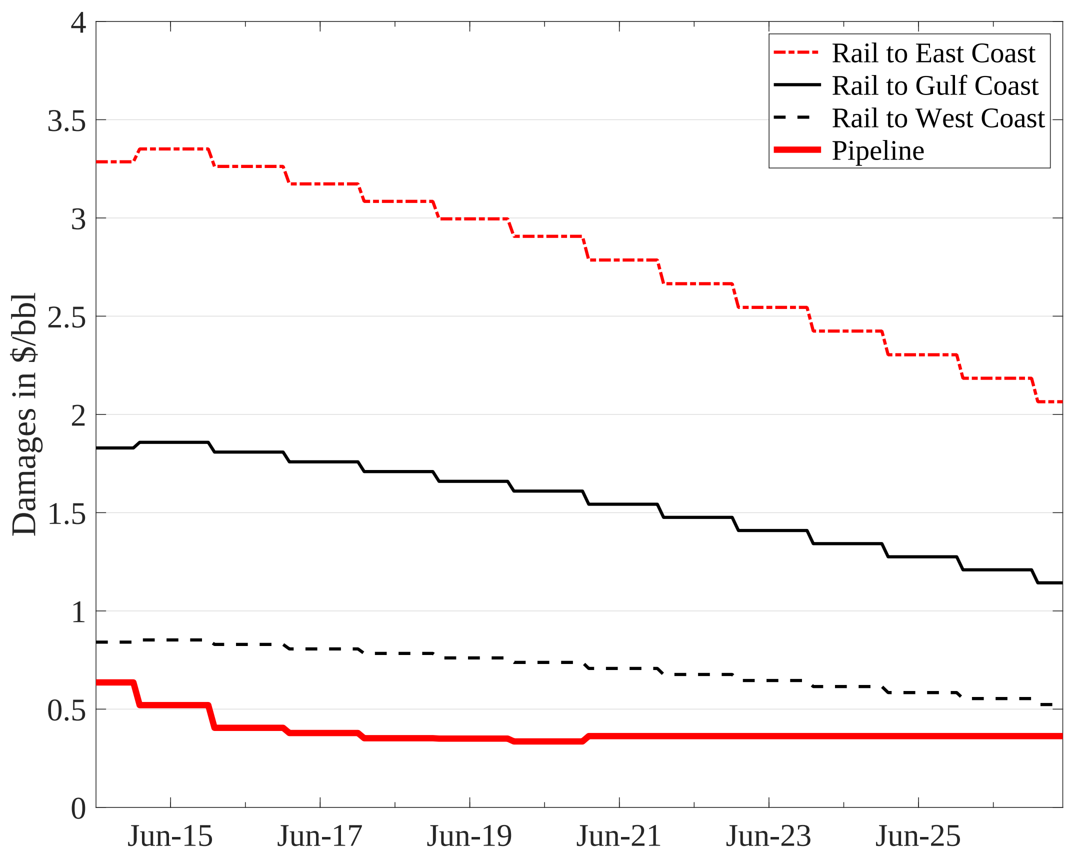


Figure shows forward simulations using the full model discussed in section 3, starting from initial conditions as of June, 2014, and using realized downstream prices through 2019.

Figure A.7: Estimated local air pollution damages from pipeline and rail transportation of Bakken crude



Estimates computed from Clay, Jha, Muller and Walsh (2019), U.S. Environmental Protection Agency (2023), and U.S. Department of Transportation (2018). See section 5.2.1 and appendix B.5 for details.

Figure A.8: Simulated pipeline and crude-by-rail flows, with and without an upstream production tax, DAPL capacity held fixed

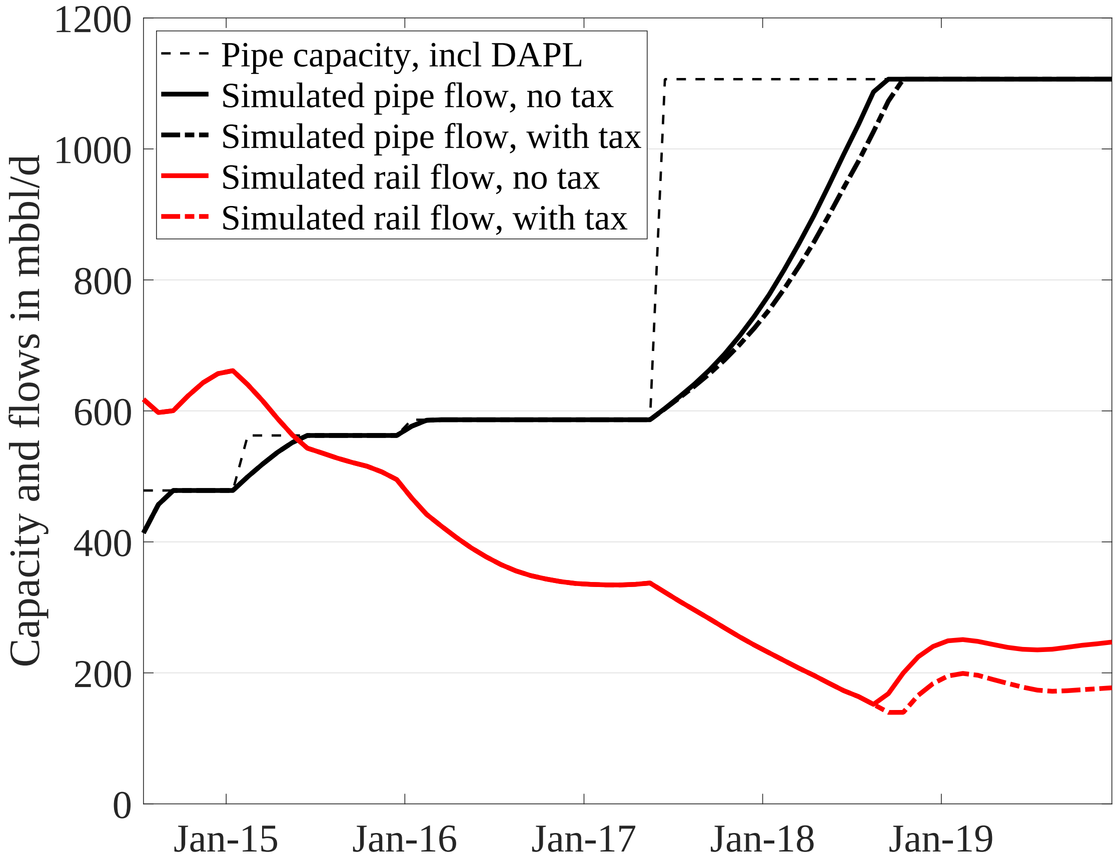


Figure shows forward simulations using the full model discussed in section 3, starting from initial conditions as of June, 2014 and using realized downstream prices through 2019, both with and without the imposition of a \$3.68/bbl upstream production tax (\$8.52/tonne carbon tax) starting in June, 2017. Simulated flows without the tax are are identical to those shown in figure 3. See section 6.1 for discussion.

Figure A.9: Simulated pipeline and crude-by-rail flows, with and without an upstream production tax, DAPL capacity responds to the tax

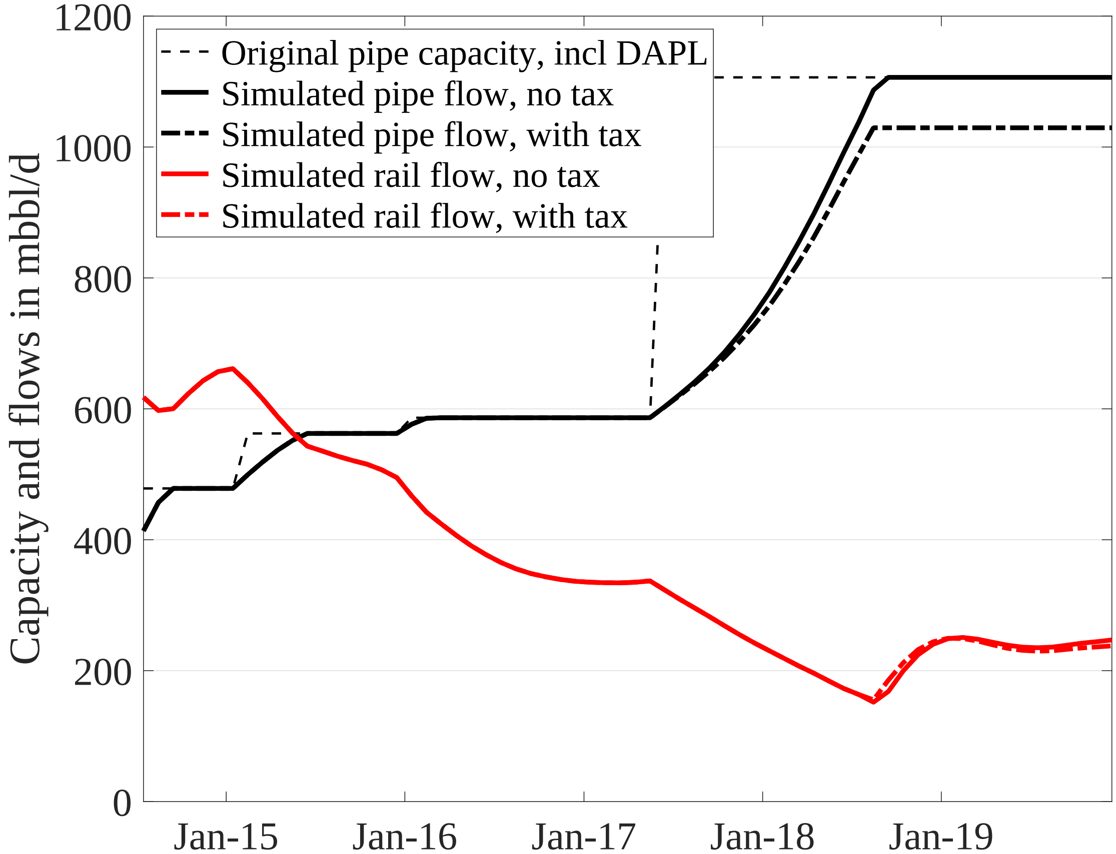


Figure shows forward simulations using the full model discussed in section 3, starting from initial conditions as of June, 2014 and using realized downstream prices through 2019, both with and without the imposition of a $3.24/bbl upstream production tax ($7.51/tonne carbon tax) starting in June, 2017. DAPL's equilibrium capacity investment anticipates this tax. Simulated flows without the tax are are identical to those shown in figure 3. See section 6.1 for discussion.

Table A.1: Expected return to DAPL shippers, using the full model and alternatives

	Expected return
Full model	\$6.17/bbl
Random walk belief for P_G	\$7.59/bbl
All rail to Gulf Coast (USGC)	\$7.73/bbl
All rail to USGC, static upstream	\$8.93/bbl
All rail to USGC, static upstream, no rail frictions	\$6.09/bbl

Expected returns are calculated as the right-hand-side of equation 13, starting from initial conditions as of June, 2014. "Full model" uses the full model discussed in section 3. "Random walk belief for P_G" assumes shippers have a random walk belief regarding the future Gulf Coast oil price P_g rather than the AR(1) belief estimated in section 3.5. "All rail to USGC" returns to the AR(1) price belief but forces all crude-by-rail to flow to the USGC; this model divides the friction parameter γ by 3 so that it is comparable to the multiple-destination full model. "All rail to USGC, static upstream" additionally simplifies the upstream model so that production Q_t each period is a constant elasticity function of the upstream price P_{ut}, with the elasticity equal to the sum of the coefficients estimated in equation 8; i.e., 1.32. Finally, "All rail to USGC, static upstream, no rail frictions" additionally sets $\gamma = 0$. The actual DAPL committed tariffs were \$5.50–\$6.25/bbl (Gordon, 2017). All returns are in real June, 2014 dollars.

Table A.2: Expected return to DAPL shippers; alternative specifications

	Expected returns, \$/bbl			
	$K_d = 320$	$K_d = 450$	$K_d = 520$	$K_d = 570$
Full model	\$7.15	\$6.50	\$6.17	\$5.96
Full model, plus supply uncertainty	\$7.14	\$6.48	\$6.16	\$5.95

Expected returns are calculated as the right-hand-side of equation (13), starting from initial conditions as of June, 2014. "Full model" uses the full model discussed in section 3. "Full model, plus supply uncertainty" endows prospective shippers with uncertainty over future Bakken oil supply, per the discussion in appendix B.4. Each column provides expected returns with an assumed DAPL capacity commitment of 320, 450, 520, or 570 mbbl/d. The actual DAPL committed tariffs were \$5.50–\$6.25/bbl (Gordon, 2017). All returns are in real June, 2014 dollars.

Table A.3: Simulated oil flow changes from foreclosing DAPL, in expectation, with alternative specifications

	Δ pipe flow mbbl/d	**Δ rail flow mbbl/d**	**Δ production volume mbbl/d**	**Δ rail as % of Δ pipe**
Baseline model	-306	248	-58	-81%
$K_d = 320$mbbl/d	-208	169	-39	-81%
$K_d = 450$mbbl/d	-274	222	-52	-81%
$K_d = 570$mbbl/d	-328	265	-63	-81%
Random walk belief	-289	236	-53	-82%
Supply uncertainty	-305	247	-58	-81%

All expectations are taken as of June, 2014 and are averages over 10000 Monte Carlo draws of possible downstream price paths. For each simulated price path, we compute average discounted volumes (pipeline, rail, local, total) during DAPL shippers' ten-year commitment period (June, 2017 - May, 2027). The first row ("Baseline model") corresponds to table 3 in the main text. Rows 2 through 4 use alternative values for DAPL's committed capacity (the baseline model uses $K_d = 520$ mbbl/d). Row 5 assumes shippers have a random walk belief regarding the future Gulf Coast oil price P_g rather than the AR(1) belief estimated in section 3.5. Row 6 endows prospective shippers with uncertainty over future Bakken oil supply, per the discussion in appendix B.4.

B Detail on data sources and estimation

B.1 Oil price and crude-by-rail flow data

The LLS, Brent, and ANS prices that we use are given by Bloomberg keys USCRLLSS, EUCRBRDT, and USCRANSW, respectively. ANS crude is 32 API and 0.96% sulfur (S&P Global, 2017), making it heavier and more sour than Bakken crude (43 API and 0.07% sulfur). To account for this grade difference, we compute the average price difference between Light Louisiana Sweet and Heavy Louisiana Sweet using their full price history from 1988–2019, and we then add this value ($0.62/bbl) to the ANS price series.

The S&P Global (2021) "Bakken local" price series begins in April, 2014, so we impute earlier Bakken local prices using prices at the Clearbrook, MN hub, also obtained from S&P Global (2021). We compute an average Clearbrook premium of $2.21/bbl over the Bakken local price from April, 2014 through 2019, when both price series were available. To impute Bakken local prices before April, 2014, we subtract this value from the Clearbrook price series (which goes back to May, 2010).

To deflate all price data, we use the Bureau of Labor Statistics' Consumer Price Index for all goods less energy, all urban consumers, and not seasonally adjusted (Bureau of Labor Statistics, 2023). The CPI series ID is CUUR0000SA0LE.

The destination-specific crude-by-rail flow data that we obtained from U.S. Energy Information Administration (2021) define regions using Petroleum Administration for Defense Districts (PADDs). The Midwest is PADD 2, and we use data on rail flows from PADD 2 to three destination PADDs: we define East Coast destinations as PADD 1, Gulf Coast destinations as PADD 3, and West Coast destinations as PADD 5. A map of PADDs is presented in appendix figure A.1. Note that the EIA reports that small volumes of crude-by-rail stay within the Midwest; we allocate these volumes proportionally to PADDs 1, 3, and 5 rather than include the Midwest as a fourth crude-by-rail destination. Shipping to the Midwest is dominated by shipping to the coasts due to both the depressed West Texas Intermediate crude oil price at Cushing, OK during most of 2010–2015 and the presence of pre-existing pipeline connections to Midwest destinations.

Due to sampling error in the STB waybill sample (which the EIA uses to estimate destination-specific rail flows), the total rail volumes reported by the EIA do not perfectly match what we obtain from the NDPA. We therefore estimate destination-by-month rail volumes by: (1) using the EIA data to compute the fraction of rail shipments going to each destination each month; and (2) multiplying these fractions by total Bakken rail exports per the NDPA.

B.2 Crude-by-rail costs

Per the discussion in section 4 of the main text, our model does a satisfactory job of matching aggregate crude-by-rail flows in our validation exercise but less well at matching destination-specific flows. Increasing the cost of rail shipments to the East Coast (r_E) by \$1.50/bbl and decreasing the cost of rail shipments to the West Coast (r_W) by \$1.50/bbl yields a better match to East Coast versus West Coast flows while holding total simulated rail transport roughly constant. In this alternative specification, we compute that the expected return to DAPL shippers is \$6.18/bbl, essentially unchanged from the value of \$6.17/bbl reported in section 4. When we use this alternative specification to evaluate the counterfactual in which DAPL's construction is foreclosed, we find that 81% of the decrease in expected pipeline flow would move by rail instead; this value is again essentially unchanged from its corresponding value in the main text (section 5.1). Finally, the total (private surplus + local pollution damages) cost per tonne of CO_2 abated that we obtain with this model is \$43. This value is slightly smaller than the value of \$45 reported in table 5 in the main text; the difference arises because crude-by-rail shipments to the West Coast are associated with less local pollution damage than shipments to the East Coast (recall table 4).

B.3 Construction of data series on production from new wells

In each month t, we compute the share of production from new wells, s_{nt}, as the DPR's estimate of new Bakken production per rig, times the DPR's estimate of the number of active Bakken rigs, divided by the DPR's estimate of total Bakken production. The DPR estimates of total Bakken production differ from the "Tight oil production estimates by play" data series (which we use for Q_t) because the former are short-term production estimates, while the latter use state administrative data and are published with a lag of several months. Finally, we compute $Q_{nt} = s_{nt} * Q_t$.

B.4 Shippers' beliefs about future oil prices and upstream supply

Beliefs about future Gulf Coast prices

We estimate the parameters ϕ_0, ϕ_1, and σ_G^2 from equation 14 to fit measures of the long-run expected Gulf Coast price $\mathbb{E}[P_G]$ and the evolution of its variance over time, conditional on P_{G0}. For $\mathbb{E}[P_G]$, we use the June, 2014 three-year Brent crude future price of \$93.47/bbl. This value is based on a nominal futures price of \$99.19/bbl from Quandl (2017), adjusted for 2.0% inflation per Federal Reserve Bank of Atlanta (2014). Setting the long-run expected price equal to \$93.47/bbl pins down the parameter ϕ_0 in equation 14 as a function of ϕ_1 and σ_G^2 via the formula $\phi_0 = (1-\phi_1)\log \mathbb{E}[P_G] - \sigma_G^2/2$. Given $\mathbb{E}[P_G] = \$93.47$/bbl and our AR(1) estimates of ϕ_1 and σ_G^2, this calculation yields $\phi_0 = 0.0293$. For the first 36 months of our simulations, we use a slightly smaller value of $\phi_0 = 0.0264$ so that the expected price three years from June, 2014 (when the LLS spot price was \$108.21/bbl) is \$93.47/bbl.

Given the known initial price at $t = 0$, the variance of P_{Gt} in the model given by equation (14) is equal to $\sigma_G^2(1-\phi_1^{2t})/(1-\phi_1^2)$. The variance of the future oil price therefore increases with the time horizon for $\phi_1 > 0$. To estimate ϕ_1 and σ_G^2, we fit this variance formula to the historic variance of log oil prices over time horizons ranging from 1 month to 13 years. We calculate historic variance at each horizon t by taking the variance of t-month differences in historic logged Brent prices.

Appendix figure A.3 shows the price volatilities that we compute via this long differences approach, using Brent price data from May, 1996 (the first observation for which a 13-year lag is available in the data) through 2019.[1] We find that uncertainty over the future price of Brent increases substantially over the 1-month to 13-year horizon, from a volatility of 9.4% at one month, to 64.8% at 37 months, and to 126% at 13 years.

We fit our AR(1) model given by equation 14 to these volatilities using a minimum distance estimator, obtaining estimates of ϕ_1 and σ_G equal to 0.9925 and 0.098, respectively. This estimator minimizes the sum, over $t \in [1, 156]$, of the squared differences between the AR(1) model's log variance at horizon t and the log long-differenced variance at horizon t. Figure A.3 shows how this estimated AR(1) process smoothly fits the estimated long-differenced volatilities. The figure also shows an alternative model that assumes a random walk ($\phi_1 = 1$) and sets σ_G equal to the historic one-month volatility of 9.4%. This random walk assumption produces a much greater price variance over long time horizons.

Expected upstream production

The NDPA monthly production forecast (North Dakota Pipeline Authority, 2014) provides monthly expected Bakken production volumes throughout the ten-year pipeline contract (and beyond), under the prevailing EIA oil price forecast (personal communication from Justin J. Kringstad at NDPA (June, 2018)). The NDPA publishes a figure showing the production forecast time series but not the underlying data. We digitized the NDPA figure and then evaluated production for each month $t \in [1, 156]$ by applying a local linear smoother to the digitized points (Calonico et al., 2019). Our digitized forecast starts in January, 2016; we linearly interpolate this forecast back to July, 2014 using realized production from June,

[1] The volatility estimates are similar if we use only data through May, 2014, the last month prior to DAPL's open season.

2014.

In an alternative specification, we allow for uncertainty in upstream supply by letting the supply intercept be stochastic, using a conservative ("case 2") production forecast from the NDPA that is, on average, 188 mbbl/d lower than the expected production path. We also construct an "optimistic" forecast that is symmetric to this conservative forecast. That is, in each month our optimistic forecast exceeds the baseline forecast by the same amount that the conservative forecast falls short. Then, in alternative specifications of our model, we model prospective pipeline shippers as having beliefs that the supply intercept each period is stochastic, with a probability of 1/3 assigned to each production path. These probabilities are arbitrary; the NDPA does not assign probabilities to its production cases.

DAPL capacity commitment

There are two reasons why it is difficult to be certain of the capacity to which Bakken pipeline shippers had committed in June, 2014. First, the official June, 2014 announcement of DAPL shippers' commitments stated a volume of 320 mbbl/d (Energy Transfer Partners LP, 2014a). However, by September, 2014 DAPL announced executed precedent agreements with shippers supporting a capacity of 450 mbbl/d (Energy Transfer Partners LP, 2014b), and then a supplemental open season in early 2017 supported an increase in capacity to the constructed value of 520 mbbl/d (Energy Transfer Partners LP, 2017). Second, back in 2013 a competing project, the Sandpiper Pipeline, had secured shipper commitments for a 225 mbbl/d line from the Bakken to Lake Superior (Enbridge Energy Partners LP, 2015). This project was beset by environmental permitting delays in Minnesota and was postponed indefinitely in September, 2016 after Enbridge (Sandpiper's main owner) and Marathon (Sandpiper's "anchor shipper") invested in DAPL and canceled their Sandpiper shipping agreement (Shaffer, 2014; Marathon Petroleum Corporation, 2016). It is not clear to what extent Sandpiper's demise was foreseen in June, 2014, when shippers initially committed to DAPL. The base case specification of our model assumes a committed capacity of 520 mbbl/d, equal to the DAPL capacity actually constructed and approximately equal to the total DAPL plus Sandpiper capacity that had been announced by June, 2014 (320 mbbl/d for DAPL and 225 mbbl/d for Sandpiper). As sensitivities, we also examine results based on assumed capacities of 320, 450, and 570 mbbl/d (DAPL was built with the ability to expand to 570 mbbl/d, and it initiated an open season on the incremental 50 mbbl/d in March, 2018 (Energy Transfer Partners LP 2018)).

B.5 Pollution emission factors and costs per barrel

To adjust Clay et al.'s (2019) pipeline transportation emissions factors for changes in the electric generation fleet, we use data from eGrid (U.S. Environmental Protection Agency, 2023). These data provide average emissions factors (for CO_2, NO_x, and SO_x) by eGrid subregion for each year in 2018–2021, and for even-numbered years before 2018. For each year, we compute weighted average emissions factors over the four eGrid regions that DAPL passes through. eGrid subregions roughly correspond to North American Electric Reliability Corporation reliability assessment areas. We assign weights of 1/2 to MROW (upper Midwest), 1/6 to SRMW (IL and MO), 1/6 to SRTV (Tennessee Valley), and 1/6 to SRMV (Arkansas and Louisiana). We interpolate emissions factors for odd-numbered years before 2018, and then we compute per-barrel emissions from pipeline transport for each year in 2014–2021 by multiplying the values from Clay et al. (2019) by the ratio of the target year's eGrid emissions factors to eGrid's 2011 emissions factors. When modeling 2022 onward, we hold the emissions factors fixed at their 2021 values. As shown in appendix figure A.7, emissions factors for these eGrid regions have been roughly constant since 2017. Were emissions factors to fall after 2021, our analysis would be an under-estimate of the increase in local pollution damage from foreclosing DAPL's construction.

For rail emissions, we re-scale the damage estimates from Clay et al. (2019) using locomotive emissions factors from U.S. Department of Transportation (2018), which projects the locomotive fleet-weighted emissions of NO_x, VOCs, and PM per gallon of fuel out to 2040. For each year and route of our analysis, we multiply the per-bbl-mile rail damages from Clay et al. (2019) by the U.S. Department of Transportation's (2018) emissions factors for the target year and divide by the 2014 emissions factors. We assume that CO_2 emissions per bbl-mile are constant over time.

Finally, we note that Clay et al. (2019) provides damage valuations for 2014 using the Environmental Protection Agency's 2014 VSL of $8.5 million. We therefore treat their estimates as being in real 2014 dollars and do not adjust them for inflation.

C Existence and uniqueness of each period's equilibrium oil flows and upstream price

This appendix proves that the equilibrium defined by the four conditions enumerated in section 3.4 exists and is unique.

C.1 Existence

The equilibrium involves only a single endogenous price, P_{ut}. Given P_{ut}, upstream production Q_t and rail flows to each destination Q_{rit} are determined by the functions in conditions 1 and 3. Pipeline flows Q_{pt} are determined by the correspondence in condition 2. Define the net supply correspondence $NS(P_{ut})$ as the left-hand-side of condition 4 (upstream supply) minus the right-hand-side of condition 4 (local and transportation demand).

For $P_{ut} \neq P_{Gt}$, $NS(P_{ut})$ is a continuous and increasing function, since: (1) Q_t is a continuous and increasing function of P_{ut}, and strictly increasing for $P_{ut} > 0$;[2] (2) the Q_{rit} are continuous and weakly decreasing functions of P_{ut}, and strictly decreasing whenever $Q_{rit} > 0$; and (3) local consumption Q_L and pipeline flows Q_{pt} are constant and single-valued. It is always possible to find a P_{ut} sufficiently large that $NS(P_{ut}) > 0$, since upstream supply $Q(P_{ut})$ is unbounded above. Likewise, it is always possible to find a P_{ut} sufficiently small that $NS(P_{ut}) < 0$, since the rail flows $Q_{ri}(P_{ut})$ are unbounded above. Finally, at $P_{ut} = P_{Gt}$, the correspondence $NS(P_{ut})$ is upper hemicontinuous, with $NS(P_{ut})$ forming a connected set.

A candidate value for P_{ut} is an equilibrium if $0 \in NS(P_{ut})$. We now prove constructively that such a P_{ut} exists. We consider three exhaustive cases based on the elements of $NS(P_{ut})$ at $P_{ut} = P_{Gt}$.

First, if all elements of $NS(P_{Gt})$ are strictly less than zero, then by the upper hemicontinuity of $NS(P_{ut})$ at P_{Gt}, the continuity of $NS(P_{ut})$ for $P_{ut} > P_{Gt}$, and the existence of $\overline{P_{ut}} > P_{Gt}$ such that $NS(\overline{P_{ut}}) > 0$, the intermediate value theorem implies that there must exist a $P_{ut} > P_{Gt}$ such that $NS(P_{ut}) = 0$.

Second, if all elements of $NS(P_{Gt})$ are strictly greater than zero, then by the upper hemicontinuity of $NS(P_{ut})$ at P_{Gt}, the continuity of $NS(P_{ut})$ for $P_{ut} < P_{Gt}$, and the existence of $\underline{P_{ut}} < P_{Gt}$ such that $NS(\underline{P_{ut}}) < 0$, the intermediate value theorem implies that there must exist a $P_{ut} < P_{Gt}$ such that $NS(P_{ut}) = 0$.

Finally, if neither of the first two conditions hold, then the connectedness of $NS(P_{Gt})$ implies that $0 \in NS(P_{Gt})$, which implies that $P_{ut} = P_{Gt}$ is an equilibrium. Then, because the three conditions we have considered are exhaustive, an equilibrium must exist.

C.2 Uniqueness

Suppose there are two values of P_{ut}, denoted P_{1t} and P_{2t}, that are equilibria (without loss of generality, we assume $P_{1t} < P_{2t}$). We show that this conjecture leads to a contradiction. First, suppose that $P_{1t} > P_{Gt}$ and $P_{2t} > P_{Gt}$. In this case, the strict monotonicity of $NS(P_{ut})$

[2] P_{ut} may be negative, in which case we define new upstream supply $Q_n(P_{ut}) = 0$ so that $Q_t = \beta Q_{t-1}$.

for $P_{ut} > P_{Gt}$ implies that we cannot have both $NS(P_{1t}) = 0$ and $NS(P_{2t}) = 0$. A similar contradiction holds, with one knife-edge exception, in the case that $P_{1t} < P_{Gt}$ and $P_{2t} < P_{Gt}$.[3]

Suppose $P_{1t} < P_{Gt}$ and $P_{2t} > P_{Gt}$. With $NS(P_{1t}) = 0$, strict monotonicity of $NS(P_{ut})$ for $P_{ut} < P_{Gt}$ and the upper hemicontinuity of $NS(P_{Gt})$ imply that all elements of $NS(P_{Gt})$ are strictly greater than zero. Then, the upper hemicontinuity of $NS(P_{Gt})$ and the strict monotonicity of $NS(P_{ut})$ for $P_{ut} > P_{Gt}$ imply that $NS(P_{2t}) > 0$, so that P_{2t} is not an equilibrium.

Finally, suppose $P_{1t} < P_{Gt}$ and $P_{2t} = P_{Gt}$ (the case of $P_{1t} = P_{Gt}$ and $P_{2t} > P_{Gt}$ is similar). With $NS(P_{1t}) = 0$, strict monotonicity of $NS(P_{ut})$ for $P_{ut} < P_{Gt}$ and the upper hemicontinuity of $NS(P_{Gt})$ imply that all elements of $NS(P_{Gt})$ are strictly greater than zero. Thus, P_{2t} is not an equilibrium. By contradiction, it must therefore be the case that the equilibrium is unique.

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[3]The exception concerns the possibility that $P_{1t} < 0$ and $P_{2t} \leq 0$, in which case $Q_t = \beta Q_{t-1}$ (since new well production is zero). If the downstream prices P_{it} are sufficiently low, then it is possible to have a situation in which $Q_{rit} = 0 \; \forall i$. Then if $Q_t = Q_L + K_t$, there can be multiple strictly negative downstream prices that satisfy the equilibrium conditions (though oil production and flows are unique, with the pipeline at capacity and no rail flow). This situation requires that $\beta Q_{t-1} = Q_L + K_t$, which is a measure zero event. If $\beta Q_{t-1} > Q_L + K_t$, then rail flows must be strictly positive, restoring the strict monotonicity of $NS(P_{ut})$ and the uniqueness of equilibrium. If $\beta Q_{t-1} < Q_L + K_t$ while rail flows are zero, then equilibrium condition 2 requires the unique $P_{ut} = P_{Gt} > 0$.

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ATTACHMENT N

Elaine Kub Paper



Rail Traffic Congestion:

Economic losses to agricultural sectors if oil transported by the Dakota Access Pipeline shifts to rail

Analysis and Projections made by:
Elaine Kub, CFA
Agricultural Economist
Roscoe, South Dakota
Website: elainekub.com
Email: analysis@elainekub.com

JULY 2023

Contents

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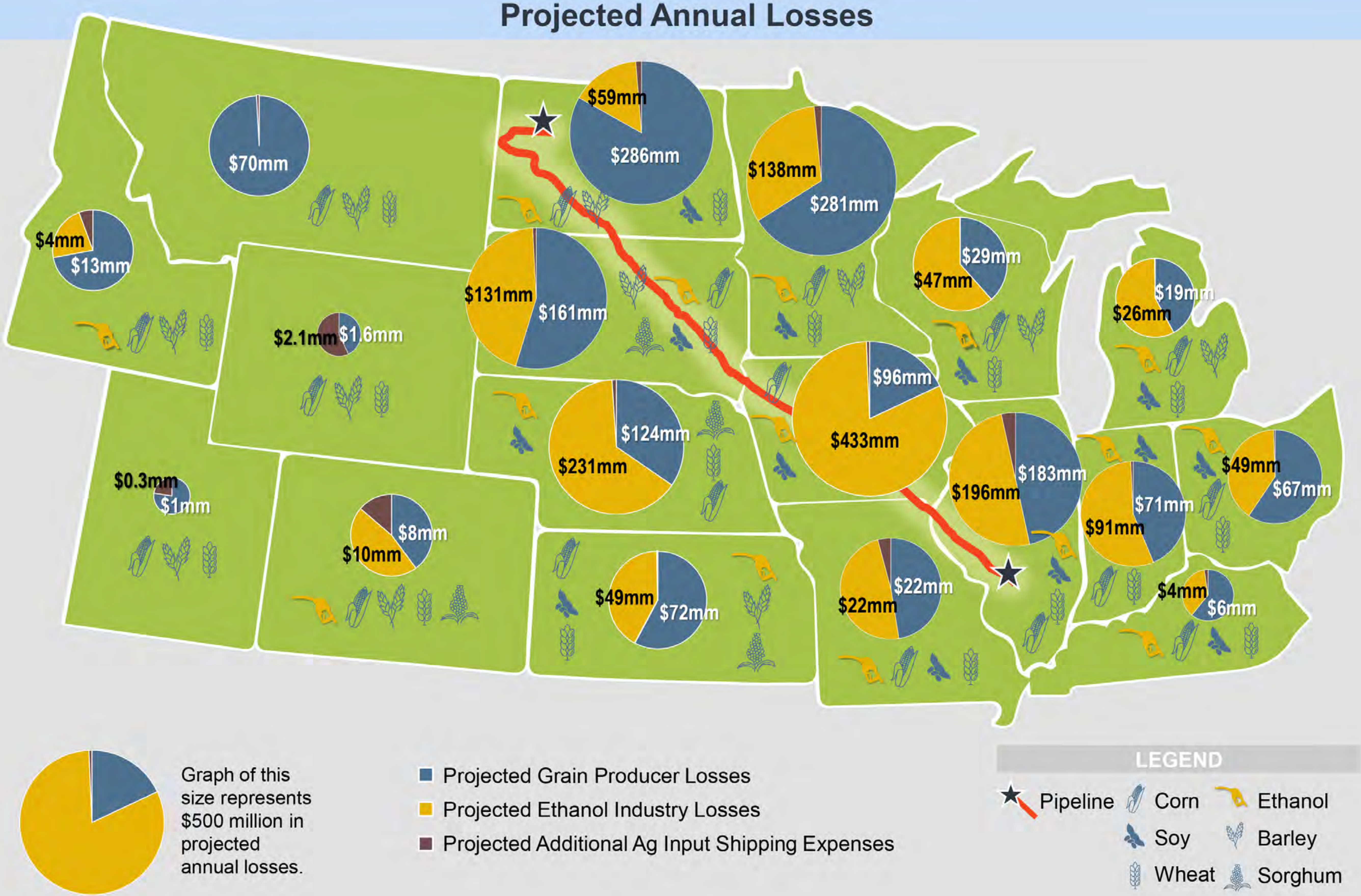
Economic losses to agricultural sectors if oil transported by Dakota Access Pipeline shifts to rail

Projected Annual Losses



Projected Annual Losses				
	Grain Producers	Ethanol Industry	Ag Inputs	Total Estimated Losses
IOWA	$95,868,366	$432,923,656	$3,509,220	$532,301,243
MINNESOTA	$280,863,825	$137,801,210	$6,640,634	$425,305,669
ILLINOIS	$182,545,219	$195,795,741	$13,466,518	$391,807,478
NEBRASKA	$123,923,976	$230,752,278	$3,718,052	$358,394,306
NORTH DAKOTA	$285,596,546	$53,525,067	$4,377,724	$343,499,337
SOUTH DAKOTA	$160,744,874	$130,738,444	$2,372,058	$293,855,376
INDIANA	$71,192,937	$90,655,332	$1,183,104	$163,031,372
KANSAS	$72,237,753	$48,687,970	$611,338	$121,537,062
OHIO	$67,046,109	$48,648,153	$313,040	$116,007,302
WISCONSIN	$29,188,415	$46,698,728	$93,470	$75,980,613
MONTANA	$70,358,571	–	$611,390	$70,969,961
MISSOURI	$22,012,868	$22,438,387	$1,938,248	$46,389,503
MICHIGAN	$19,035,964	$26,029,021	$103,896	$45,168,881
COLORADO	$8,222,500	$9,569,976	$2,830,646	$20,623,122
IDAHO	$13,052,097	$4,035,502	$1,018,082	$18,105,681
KENTUCKY	$5,912,962	$3,564,693	$226,122	$9,703,776
WYOMING	$1,612,070	–	$2,140,268	$3,752,338
UTAH	$1,011,540	–	$295,464	$1,307,004

Grain Producer Losses

Lower farm receipts for grain. Shippers pass back freight costs to farmers via lower grain bid prices. The competitive basis landscape shifts for all grain, not only rail-shipped grain along the precise route of DAPL's displaced oil.

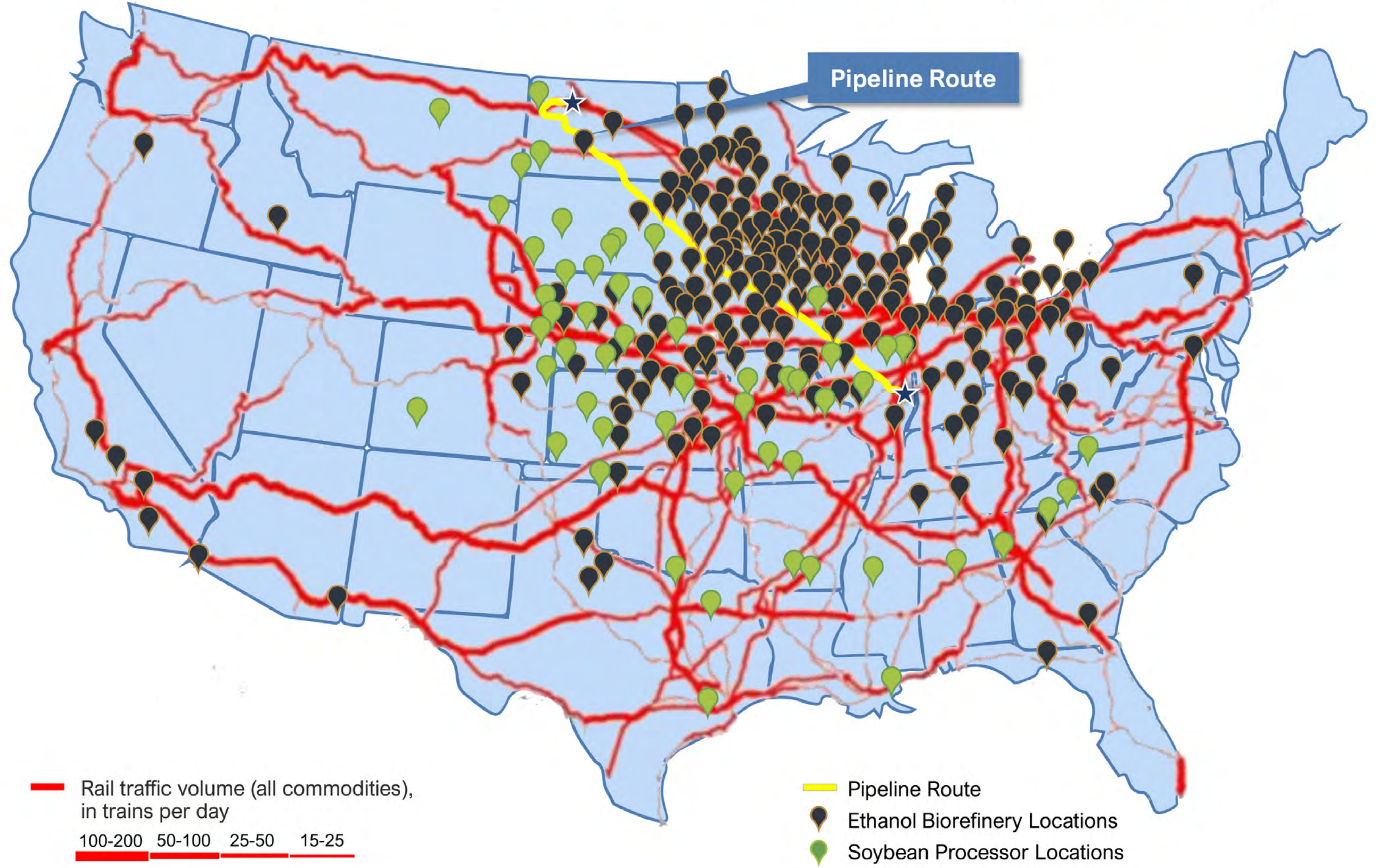
Ethanol Industry Losses

Processors must pay increased freight costs and lose production when rail service cannot be delivered in a timely manner. Railroad resources (tanker cars, locomotives) get enlisted to oil movement.

Ag Input Losses

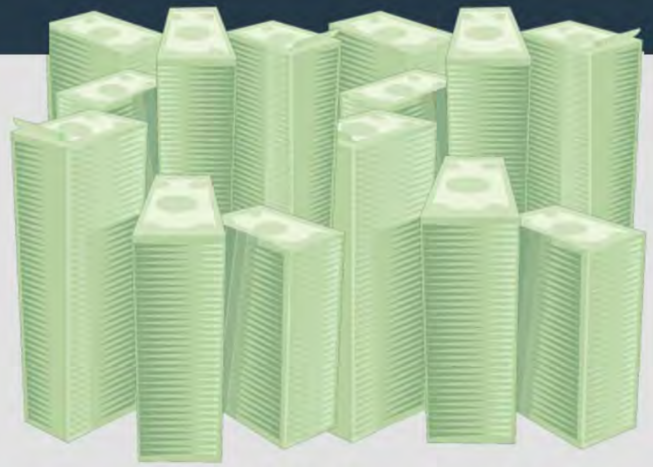
Higher freight costs for ag retailers and their customers. The fertilizers and agricultural chemicals (herbicides, fungicides) that are necessary to produce crops also rely on rail service to reach their destinations and will rise in price as freight costs increase.

Rail Freight Competition:
Nationwide interrelationship between oil movement and grain processing



Ethanol data @ https://ethanolrfa.org/resources/ethanol-biorefinery-locations
Soybean data @ https://www.soymeal.org/processors/
Trains per Day: Oak Ridge National Laboratory analysis of Freight Analysis Framework version 3.4, 2012

Economic losses resulting from freight congestion due to a shift in oil flows from DAPL to the Midwest rail system:



$3+ BILLION

In Total Annual Losses to the Ag Industry

$1.51 BILLION

In Annual Losses
to Grain Producers

$1.48 BILLION

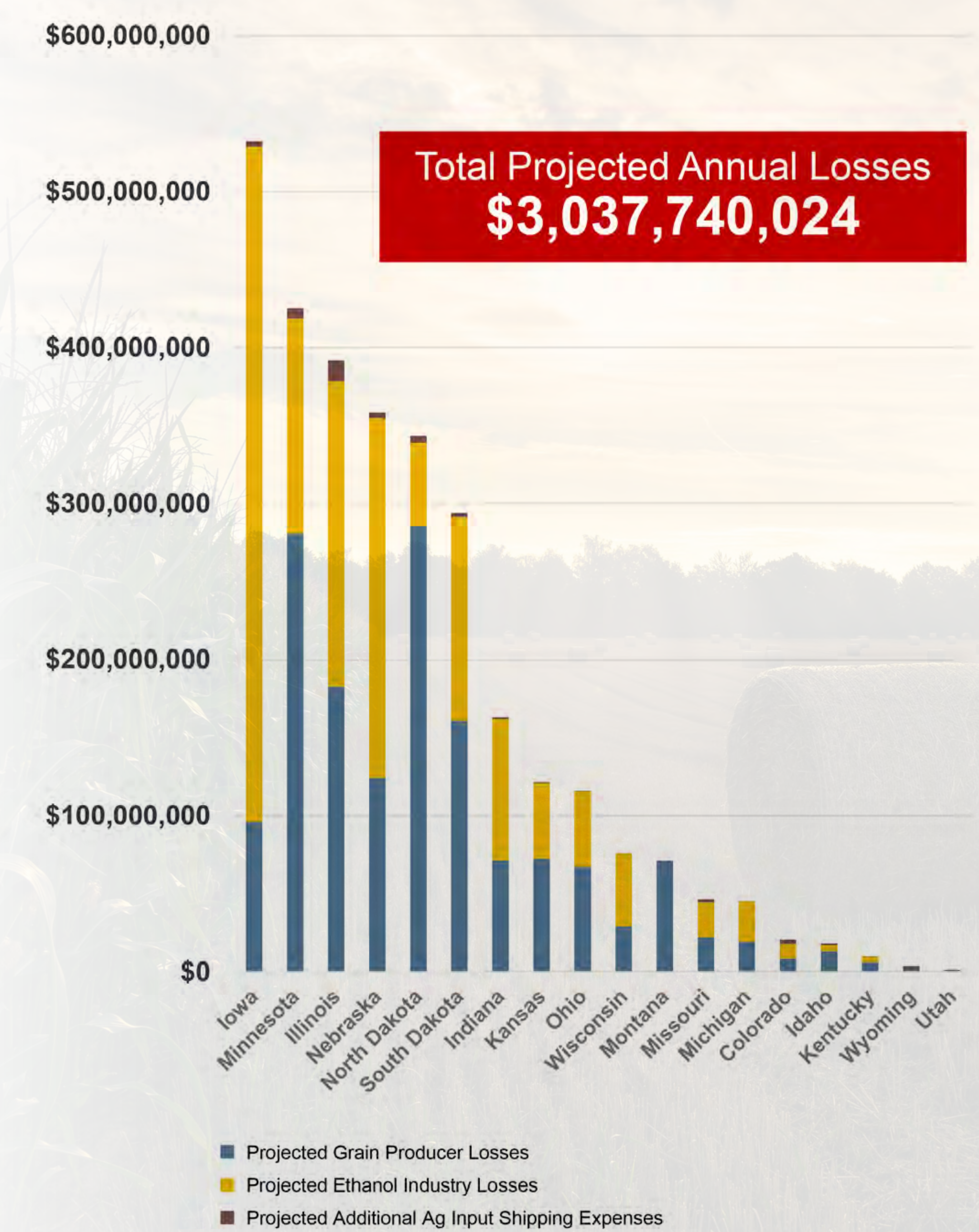
In Annual Losses
to the Ethanol Industry

$0.45 BILLION

In Annual Losses due to
increased Ag Input
Shipping Expenses

5

Projected Annual Losses



Executive Summary

If the oil currently flowing on the Dakota Access Pipeline (DAPL) were to instead shift to the Midwest rail system as a means of transport, the Midwest agricultural sector could suffer more than $3 billion in annual losses.

DAPL is a 1,172-mile oil pipeline which is currently capable of transporting 750,000 barrels of oil per day from the Bakken oil fields in North Dakota to a terminal in Patoka, Illinois. DAPL's current capacity can accommodate approximately 65%[1] of North Dakota's oil output and more than 6%[2] of national oil production, providing freight capacity equivalent to more than 1,100 rail cars per day that would otherwise congest the Midwest rail system. This analysis quantifies the effect, in economic terms, on the agriculture industry if the oil flowing on DAPL were to shift to the Midwest rail system. Its conclusions rely on an economic natural experiment from history — comparing the periods when oil was moving from North Dakota to the Midwest in large volumes by rail (prior to construction of DAPL) versus the periods when the oil has been transported by pipeline (after construction of DAPL).

The agriculture industry is uniquely dependent on efficient rail systems to transport commodities over long distances. Less than a decade ago, it experienced a demonstration of just how vulnerable it is. In 2013 and 2014, before DAPL began operations, the 40-65% of the Bakken region's oil output that has since flowed on DAPL instead flowed on Midwestern rail routes. The resultant rail congestion caused severe bottlenecks in the Midwest rail system. The economic hardship experienced by the agriculture industry as a result of that congestion is well documented. The USDA estimated[3] grain and oilseed producers throughout the Upper Midwest may have received *$570 million* less for the crops they marketed in 2014 than they could have earned in a normal freight environment. This rail congestion also increased freight costs nationwide, affected farmers throughout the Corn Belt, and led to ethanol plants shutting down production for lack of rail cars to ship their products.

This analysis considers data from multiple sources and timeframes to highlight illustrative scenarios that can help to predict what may happen to agricultural markets if similar freight congestion were to occur and affect present-day volumes of commodity transportation. Past research shows how grain basis bids were damaged in the 2013-2014 scenario compared to (a) a 2009 "normal" condition, and (b) a post-DAPL condition when the markets returned to "normal" function without oil train congestion. Estimates are made based on those insights and applied to projected 2023 annual shipping volumes which are considerably higher than they were during the 2013-2014 time frame.

If flows on DAPL were to shift to the Midwest rail system, and freight congestion were to occur that was similar (or worse) than what occurred in 2013-2014, **the agriculture industry should expect to lose over $3 billion per year.** The economic losses would come from at least three sources:

1. Freight costs passed back to farmers in the form of weaker grain bids. May lead to **$1.51 billion** in annual losses.
2. Increased freight costs for processed ag commodities and a loss of 9% of annual ethanol production. May lead to **$1.48 billion** in annual losses to the ethanol industry.
3. Higher freight costs to ship ag inputs (e.g. fertilizer) by rail. May cost ag retailers and farmers **$45 million** more annually to receive necessary products.

1 April 2023 NDPA production report (https://ndpipelines.files.wordpress.com/2023/04/ndpa-april-17-2023-press-slides.pdf) forecasted 1.16mm bbls for February 2023. 750k/1.16mm = 64.65%.
2 Jan 2023 EIA short term outlook (https://www.eia.gov/outlooks/steo/) forecasted 12.4mm barrels per day. 750k/12.4mm = 6.05%.
3 Rail Service Challenges in the Upper Midwest: Implications for Agricultural Sectors – Preliminary Analysis of the 2013-2014 Situation. United States Department of Agriculture Office of the Chief Economist and the Agricultural Marketing Service. January 2015.

PAST RESEARCH

In 2013 and 2014, Bakken crude oil was largely transported by rail, creating intense congestion in Midwest rail systems. In 2014 and 2015, a collection of economic studies was performed to quantify the effects on grain markets and farm income due to the oil-induced rail freight congestion of 2013 and 2014. These include the Soy Transportation Coalition's survey response update, "2014 Harvest: Attaching a Garden Hose to a Fire Hydrant," (December 8, 2014), the United States Department of Agriculture (USDA) Office of the Chief Economist's analysis, "Rail Service Challenges in the Upper Midwest: Implications for the Agriculture Sectors," (January 2015), and a study written by this author and published by the American Farm Bureau Federation, "Insufficient Freight: An Assessment of U.S. Transportation Infrastructure and Its Effects on the Grain Industry," (June 2015) (*Insufficient Freight*).

Insufficient Freight concluded:

> "When rail is the only reasonable transportation solution for farmers in certain regions, like the Upper Midwest, rail service providers have the agriculture industry at their mercy, and insufficient service threatens the industry's ability to operate. It's therefore imperative for the agriculture industry to encourage infrastructure projects that take congested freight volume off the rail lines and add that capacity to the overall system … Expansion of U.S. pipeline capacity … represents the best alternative to add overall freight system capacity and relieve the congestion that has threatened grain movement during recent marketing years. Crude oil and fuels can be moved cheaply through pipelines without disrupting the already-crowded freight hubs, without congesting traffic in communities, and without even altering the landscape or agricultural use of the land where the pipeline passes."

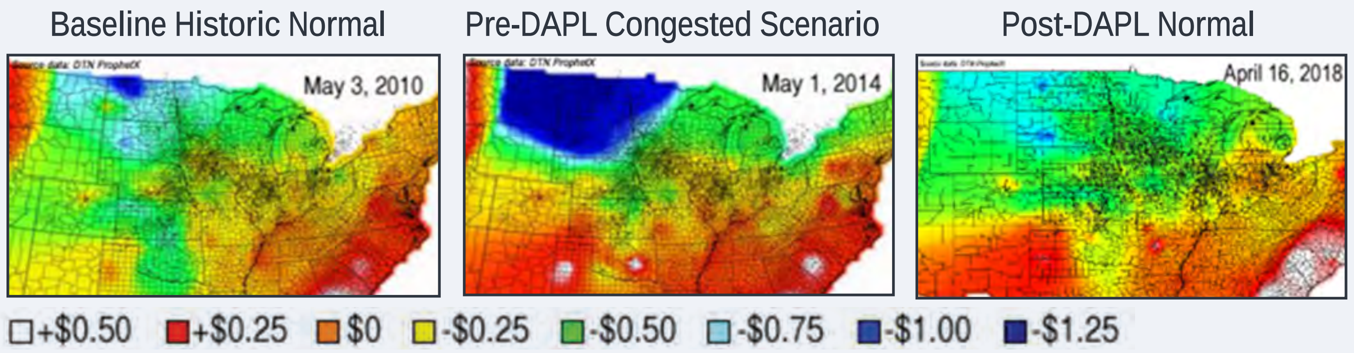
This conclusion has been proven accurate.

Table 1: Measures of pre- and post-DAPL rail service and grain market effects
Source: Elaine Kub analysis

	Pre-DAPL Congested scenario *November 2014*	Post-DAPL Normal scenario *March 2020*
Grain shuttle train cost[4] AMS Shuttle Cost Index, inclusive of fuel surcharge, baseline year 2000 values = 100	411 *(peak on 10/1/2014)*	224
Grain train speeds	19.8 mph	23.7 mph
Grain train origin dwell times	35.0 hours	15.7 hours
Ethanol train origin dwell times	35.8 hours	17.1 hours
Northern Plains corn basis[5] versus benchmark futures price	minus $0.95	minus $0.65
Central Corn Belt corn basis versus benchmark futures price	minus $0.40	minus $0.05

After DAPL came online in 2017, it relieved much of the oil-induced congestion in Midwest rail markets. A follow-up analysis made by this author in 2020 concluded that "grain basis values reverted to their historic means once the [rail-congesting Bakken crude oil] was instead moved by pipeline and the congestion on the rail lines was relieved. Faster train speeds and shorter origin dwell times showed the efficient functioning of the grain-by-rail supply chain." That analysis also showed, via linear regression models of local grain basis bids[6] and the USDA Shuttle Train Cost Index[7], that higher rail freight prices not only depress grain prices in the Upper Midwest states that are most heavily reliant on rail service, but in other Midwestern states, as well.

4 Grain Transportation Report Datasets https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.
5 DTN Market Tracker database of local grain basis bids https://www.dtnpf.com/agriculture/web/ag/markets/local-grain-bids
"Basis" is a commodity's local price offset from the benchmark futures contract (a local grain elevator's price of $3.00 per bushel might compare to the Chicago corn futures price at $3.50 and be called "minus $0.50" local basis). Stronger (less negative) basis values are more favorable for farmers. To compare grain market scenarios across timeframes, we use basis values instead of flat price values. Corn prices may have been $5 per bushel in 2008 and $3 per bushel in 2020 for a multitude of reasons unrelated to the corn market's own supply and demand (geopolitical factors, investment flows, outside market influence). Meanwhile, the local basis values directly express the supply and demand of the physical commodity moving through a supply chain and can be compared across geography and across time.
6 DTN Market Tracker database of local grain bids https://www.dtnpf.com/agriculture/web/ag/markets/local-grain-bids.
7 Grain Transportation Report Datasets https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.



- **Grain basis values tend to be weaker in the west where longer transportation distances add to freight costs** (e.g. -$0.60 would be a fairly normal springtime basis value for corn at Fargo, ND). Basis values tend to be stronger in the eastern Corn Belt because of the strong competition between multiple end markets (e.g. $0.00 would be fairly normal for corn near Chicago, IL, where the physical price should in theory match the Chicago futures price).
- **Hotspots exist at end users' locations, where basis bids reflect the cumulative transportation costs** (e.g. cattle feed yards in the Texas panhandle and export facilities at the Gulf of Mexico typically pay prices above the benchmark futures value, or 'positive basis').

- **Unprecedented volumes of crude oil tankers clogged the rail lines** and prevented timely service to other industries, including to grain shippers.
- **This led to higher freight costs and subsequently, profoundly depressed basis values** in the regions where rail congestion was most disruptive and where the grain was uniquely dependent on rail transportation to reach a market.
- **Pain points (late arrivals and drastically elevated basis values) were also noted** in terminal grain customers' prices (e.g. feedlots, poultry feeders in the Southeast, etc).[8]

- **Grain basis values reverted to their historic means once the crude oil was instead moved by pipeline** and the congestion on the rail lines was relieved.
- **Faster train speeds and shorter origin dwell times showed the efficient functioning** of the grain-by-rail supply chain.

Figure 1: Corn basis values during various freight scenarios
Source: Elaine Kub 2020 analysis

8 Bushnell, James B., Jonathan E. Hughes, and Aaron Smith. Food versus Fuel? Impacts of the North Dakota Oil Boom on Agricultural Prices. Journal of the Association of Environmental and Resource Economists. January 2022. Web: https://doi.org/10.1086/716522

Agricultural Dependency on Rail

Efficient transportation is crucial to agriculture. It is necessary to be able to provide safe, affordable, and abundant food, feed, fiber, and fuel to consumers who may be located very far away from the fields in which these commodities are grown or the plants in which they are processed.

Freight flows by highway, railway, and waterway, 2018 (all commodities)

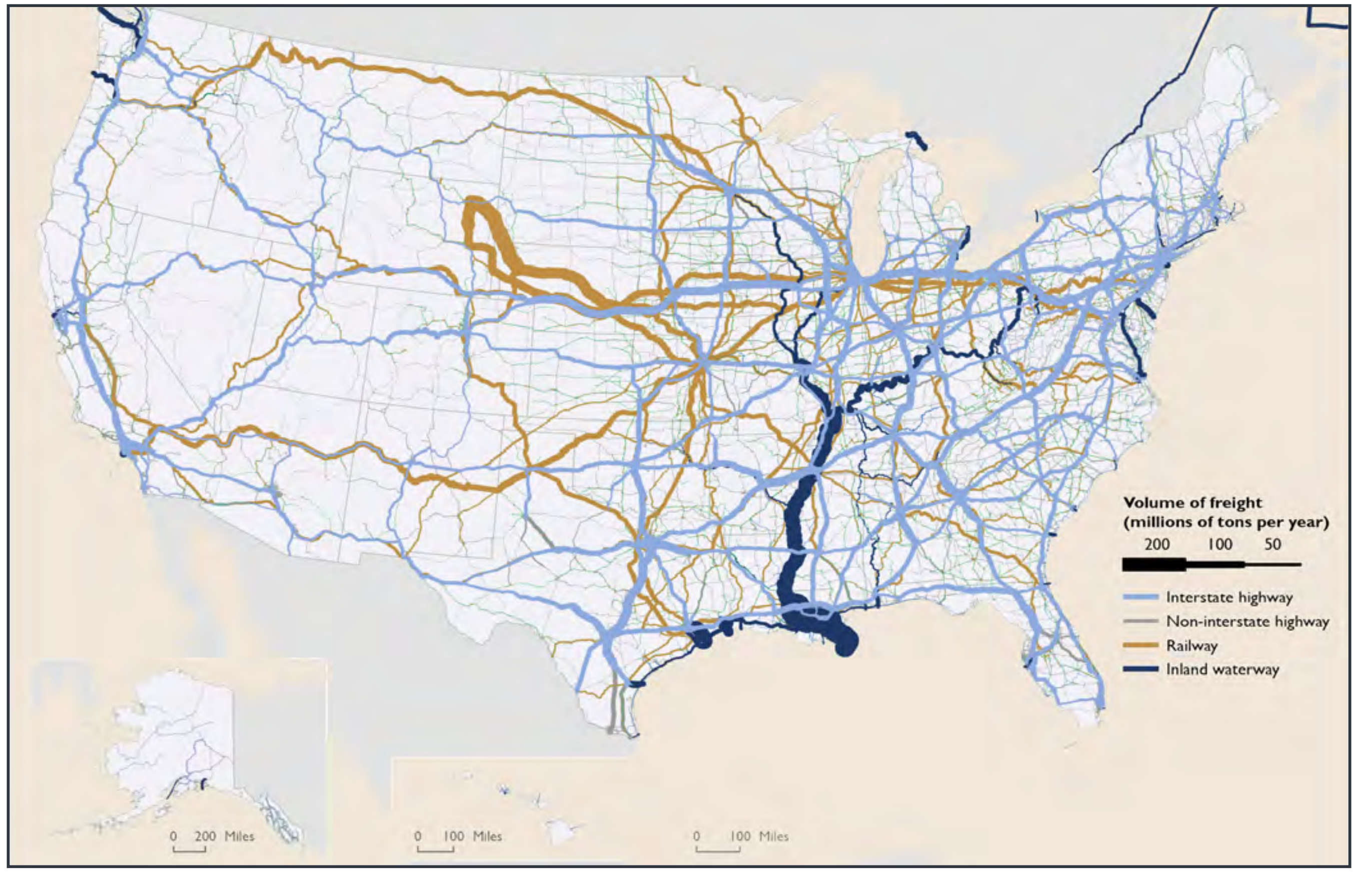


Figure 2: Freight flows by highway, railway, and waterway, 2018 Highway flows depicted in the map are based on the Freight Analysis Framework data from 2015. Waterway and port tonnages are based on data for 2017, and rail is based on 2016 data.
Source: Highway: U.S. Department of Transportation (USDOT), Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.5, 2019. Rail: USDOT, Federal Railroad Administration, 2019. Inland Waterways: U.S. Army Corps of Engineers, Institute of Water Resources, Annual Vessel Operating Activity and Lock Performance Monitoring System data, 2018.

Certain regions and states are more reliant on rail service than others, mostly as a function of their geographic distance from either domestic population centers or from coastal export facilities. A bushel of grain grown in Iowa, for instance, has multiple market routes: it may move by truck to a local livestock feeder or a local ethanol plant for domestic use; it may get routed to a rail shipper for ultimate use in domestic consumption or for export; or it may get routed to a barge shipper that will ultimately load the grain on an ocean-going vessel for export. In contrast, a bushel of grain grown in North Dakota has virtually only one feasible market route — to be loaded onto a train bound for the Pacific Northwest to be exported to Asia.

Table 2: Share of grain shipped by rail

Source data: USDA Agricultural Marketing Service's "State Grain Rail Statistical Summary"[9]

	Share of Grain Shipped by Rail
COLORADO	*Net Importer*
IDAHO	32.4%
ILLINOIS	31.4%
INDIANA	27.8%
IOWA	15.9%
KANSAS	35.4%
KENTUCKY	9.1%
MICHIGAN	20.4%
MINNESOTA	37.5%
MISSOURI	14.7%
MONTANA	84.6%
NEBRASKA	35.2%
NORTH DAKOTA	79.2%
OHIO	38.8%
SOUTH DAKOTA	43.7%
UTAH	*Net Importer*
WISCONSIN	21.6%
WYOMING	*Net Importer*

While any bushel of grain used domestically will almost certainly rely on truck shipping at some point (to be transported out of its field of origin, if nothing else), exported grain tends to rely heavily on rail transportation because the coastal export facilities are located long distances from the rural origins of the grain, and not all rural grain origins have access to the relatively cheap barge freight system.

Note that grain shipped in 2022 and 2023 that typically could access the barge freight system may be more heavily reliant on rail transport as a result of the effect the Mississippi River's current low water levels have on barge transportation rates and shipping times. In its October 20, 2022 Grain Transportation Report, the USDA explained that:

> "Throughout [2022], the barge industry has struggled with higher fuel costs and a shortage of workers that has delayed shipments by 1-2 days. Throughout the third quarter, the Lower Mississippi River (LMR) was plagued by low water levels, which exacerbated delays. Most recently, low levels not seen since 1988 have led to reduced flows, reduced tow sizes, and grounded barges. As a result, portions of the river have closed, at times for periods of 12-36 hours. These multiple river challenges have driven third-quarter barge rates higher than they would rise during a typical harvest."[10]

9 2014 State Grain Statistics https://www.ams.usda.gov/services/transportation-analysis/research/rail/statistics

10 U.S. Department of Agriculture, Agricultural Marketing Service. Grain Transportation Report. October 20, 2022. Web: http://dx.doi.org/10.9752/TS056.10-20-2022.

Potential Shift in DAPL Oil Flows to Midwest Rail Systems

A shift in DAPL oil flows to Midwest rail systems would have a significant impact on freight costs and availability throughout the Midwest and nationally. Because nationwide freight cost increases affect all agricultural shippers – from local elevators in North Dakota to ethanol plants in Ohio – any analysis of economic impacts to the agriculture industry in the event of a shift in DAPL oil flows must consider not only the effects in regions where DAPL is currently running (and where oil trains full of displaced Bakken oil would subsequently run), but also the rest of the nation's primary grain-producing regions.

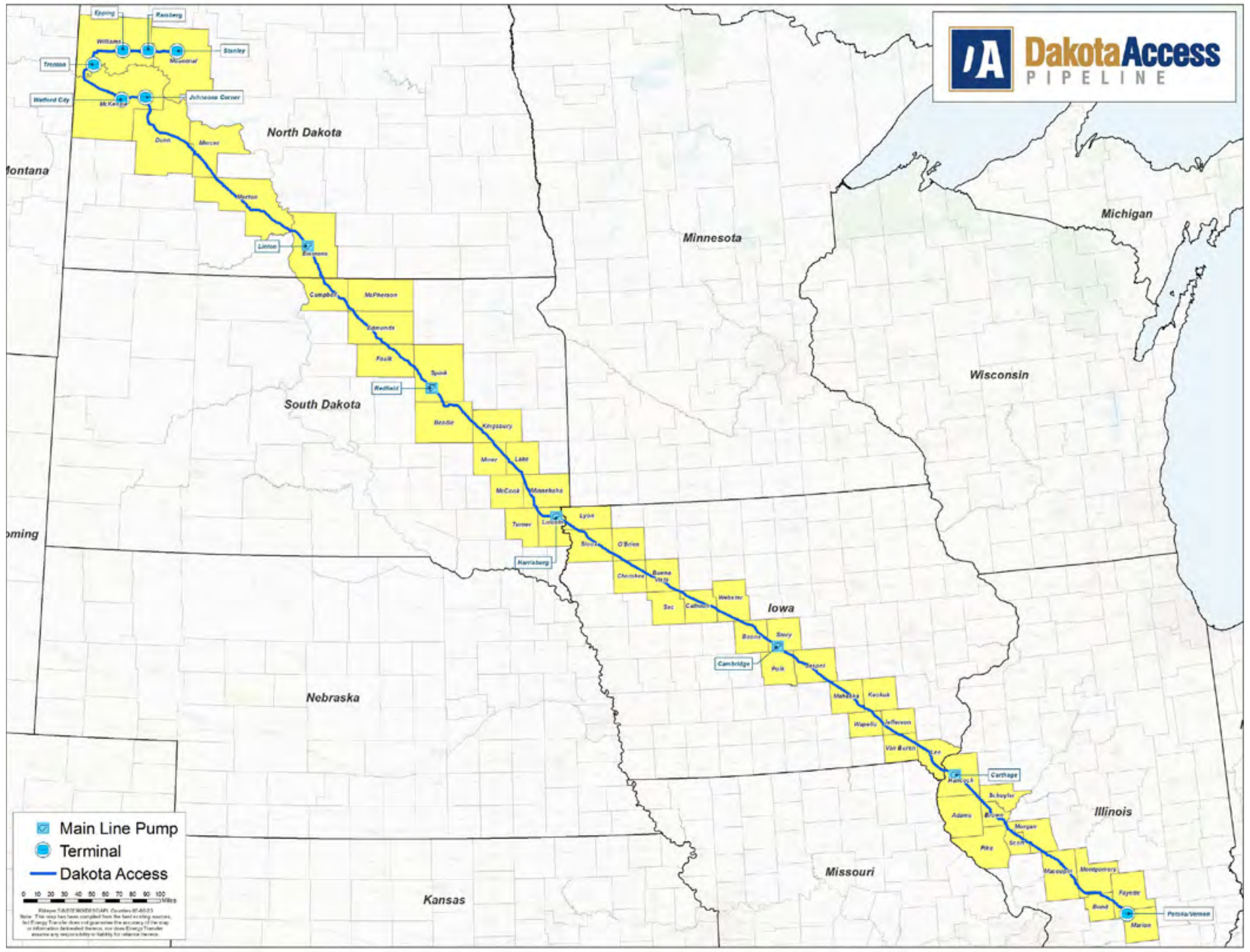


Figure 3: Dakota Access Pipeline route

Source: Energy Transfer

Projected impacts of a shift in DAPL oil flows on the economics of the agriculture industry can be considered in light of the known observations from previous scenarios:

Pre-DAPL 2013-2014 oil-induced congestion

- Freight bids for shipping grain in a shuttle train skyrocketed as high as $5,875 per car on the secondary market.[11]
- The higher freight costs affected farmers as basis got weaker (i.e. more negative), resulting in prices as much as $0.46 less for each bushel of grain than would otherwise be the case.[12]
- On a rail system congested with oil trains, average train speeds fell. Dwell times (the period after a train has been loaded but before it's hauled by the railroad's locomotives) reached 14 days across much of Upper Midwest, and at one point averaged 29 days across North Dakota. **'Plugged' up elevators could no longer accept grain to store in their facilities.** In response to these "acute service issues," the Surface Transportation Board began requiring Class I rail carriers to provide weekly data showing rail service performance.[13]
- Meanwhile, equally poor service for the tanker cars used by ethanol producers caused shutdowns and lost ethanol production. **Nationwide losses "amounted to 80,000 barrels per day between December 2013 and March 2014,"** according to Renewable Fuels Association President Bob Dinneen at the time.[14] These losses were equivalent to 9% of national production.
- The average freight cost to ship agricultural inputs (e.g. fertilizer or herbicide) increased to as much as $876 per ton.[15]

Nationwide ethanol production losses "amounted to 80,000 barrels per day between December 2013 and March 2014."

Renewable Fuels Association President Bob Dinneen

11 Grain Transportation Report Datasets Table 5 https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.
12 Rail Service Challenges in the Upper Midwest: Implications for Agricultural Sectors – Preliminary Analysis of the 2013-2014 Situation. Web: https://doi.org/10.1086/716522.
13 Rail Performance Metrics https://agtransport.usda.gov/stories/s/Rail-Dashboard/appm-bhti.
14 Rail Delays Hitting Home for Ethanol, Grain Shippers https://www.farmprogress.com/farm-business/rail-delays-hitting-home-for-ethanol-grain-shippers.
15 Carload Waybill Sample https://www.stb.gov/reports-data/waybill/.

During DAPL operation, 2017 to present

- The secondary market for shipping grain by rail falls back to historically normal $0 per car (average bid).[16]
- Grain basis bids return to normal levels based on local supply-and-demand, varying by location as seen in Figure 1, but in the eastern Dakotas settling at roughly 50 cents under the futures price.[17]
- Origin dwell times for loaded grain shuttles fall back to a matter of hours, not days. In the March 2020 post-DAPL normal scenario, grain train origin dwell times average 15.7 hours, showing timely seasonal service by the railroads.[18]
- Nationwide ethanol production surges to 16 billion gallons per year, or 20% higher than was seen during the congested period.[19]
- The average freight cost to ship agricultural inputs, like fertilizer or herbicide, falls by approximately 3% to $850 per ton. For nitrogen fertilizer solution, specifically, the freight cost falls from $500 per ton to $453 per ton, a drop of 9%.[20]

Potential DAPL flow shift scenario

- Predicted rail service challenges due to freight congestion that would take place in 2023 would be more severe than the scenario observed in 2013-2014, because the rail system is already more burdened with a higher volume of commodities. Nationwide grain production is projected to be 10% higher in 2023[21] than in 2013 (e.g. 15.265 billion bushels of corn compared to 13.831 billion bushels in 2013). Similarly, 2023 ethanol production may be 14% higher (15.2 billion gallons per year) compared to 2013's volume (13.3 billion gallons), with a growing portion of that production likely to be exported and therefore needing to be shipped by rail.[22]
- Freight costs passed back to farmers at the same scale seen in 2014 ($0.42 per bushel of corn or sorghum shipped by rail, $0.27 per bushel of soybeans, $0.46 per bushel of wheat or barley) may lead to **$1.5 billion in annual losses out of farmers' pockets.**[23]
- Increased freight costs and a loss of 9% of 2023 ethanol production may lead to **$1.4 billion in annual losses to the ethanol industry.**[24]
- Higher freight costs to ship ag inputs by rail may cost ag retailers and farmers **$45 million more to receive their necessary fertilizers and chemicals by rail.**[25] In a fertilizer market with persistent high prices[26] due to geopolitical developments and high energy prices (remaining above 5-year averages in May 2023), agricultural producers would be alarmed to experience freight scarcity and uncertainty on top of market scarcity and uncertainty.

16 Grain Transportation Report Datasets Table 5 https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.
17 DTN Market Tracker database of local grain bids https://www.dtnpf.com/agriculture/web/ag/markets/local-grain-bids.
18 Agricultural Rail Service Metrics Dashboard https://agtransport.usda.gov/stories/s/Agricultural-Rail-Service-Metrics-Dashboard/jxpf-zf6y/
19 Table 12 Ethanol plants.
20 Carload Waybill Sample https://www.stb.gov/reports-data/waybill/.
21 USDA Office of the Chief Economist https://www.usda.gov/oce/commodity/wasde/wasde0523.pdf.
22 Figure 6 Use of STB Waybill Data.
23 Table 19 Conclusions.
24 Table 19 Conclusions.
25 Table 9 Ag inputs (fertilizer, herbicides, etc.).
26 DTN Retail Fertilizer Trends https://www.dtnpf.com/agriculture/web/ag/crops/article/2023/04/26/anhydrous-drops-1-000-per-ton-first.

In a letter to the Surface Transportation Board dated May 12, 2023, U.S. Secretary of Agriculture Tom Vilsack highlighted the deterioration of rail service to agricultural shippers and the rail system's present vulnerability to any unexpected spikes in demand, writing "Rail service … remains inadequate and unreliable for many agricultural shippers … The [present] operating model does not leave sufficient buffer in labor and assets for railroads to be able to handle unexpected spikes in demand … It is of utmost important that the STB moves quickly to strengthen our rail system overall and specifically to improve service to agricultural shippers before railroad capacity again becomes an urgent, national issue."[27]

In 2020 testimony in support of the U.S. Corps of Engineers in litigation relating to DAPL's permits and authorizations, Oliver Wyman partner William J. Rennicke provided modeling and documentation to show that "quickly increasing the volume of crude oil by rail shipped out of the Bakken region by DAPL's [then-]current capacity would rapidly aggravate congestion, cause delays, and crowd out capacity for other commodities on rail routes of vital importance to the Upper Midwest's economy." Specific projections were made to show how rail service would deteriorate in scenarios where extra oil trains travel the rail routes out of the Bakken region.

PROJECTED LEVEL-OF-SERVICE FOR THE MINNESOTA PORTION OF THE RAIL ROUTE FROM BAKKEN TO CHICAGO VIA FARGO, ND

Level-of-Service of E (at capacity) or F (above capacity) increases from 15.9% of route-miles in Minnesota using current volume, to 20.5% of route-miles with half the then-DAPL volume, to 74.2% of route-miles with the full then-DAPL volume, based on the AAR methodology and public data on train volumes and capacity.

Figure 4: Oliver Wyman analysis

See Case 1:16-cv-01534-JEB Document 512-2 (Rennicke Apr. 29, 2020 Declaration) for complete analysis of rail capacity and level-of-service scenarios

27 Letter on Rail Service Issues, Secretary of Agriculture Tom Vilsack https://www.ams.usda.gov/sites/default/files/media/8892306_SignedSecLetterRailService_20230512.pdf.

PROJECTED LEVEL-OF-SERVICE FOR THE MINNESOTA PORTION OF THE RAIL ROUTE FROM BAKKEN TO CHICAGO VIA FAIRMONT, ND

Level-of-Service of E (at capacity) or F (above capacity) increases from 5.0% of route-miles in Minnesota using current volume, to 34.5% of route-miles with half the then-DAPL volume, to 77.2% of route-miles with the full then-DAPL volume, based on the AAR methodology and public data on train volumes and capacity.

Figure 5: Oliver Wyman analysis

See Case 1:16-cv-01534-JEB Document 512-2 (Rennicke Apr. 29, 2020 Declaration) for complete analysis of rail capacity and level-of-service scenarios

Rennicke concludes, "As more trains are added to a rail line, the average delay for all trains increases. A large, sudden increase in trains on a route, as would be the case in the event of [a shift in oil flows], would add delay for all trains using the route."

"As more trains are added to a rail line, the average delay for all trains increases. A large, sudden increase in trains on a route, as would be the case in the event of [a shift in oil flows], would add delay for all trains using the route."

Oliver Wyman partner William J. Rennicke

Use of STB Waybill Data

Supporting data for the conclusions drawn in this analysis were largely sourced from the Public Use Waybill file[28] of the Surface Transportation Board's Carload Waybill Sample, which is a stratified sample[29] of carload waybills for all U.S. rail traffic submitted by major rail carriers.

This data documents trends in rail traffic over time and across various geographical regions, split into BEA Economic Areas by the Bureau of Economic Analysis (see Appendix A: BEA Economic Areas by State). For instance, although overall U.S. production of ethanol has dipped in recent years since 2018, the volume of ethanol shipped by rail continues to grow ever-larger year by year.

Annual U.S. Rail Carloads of Ethanol

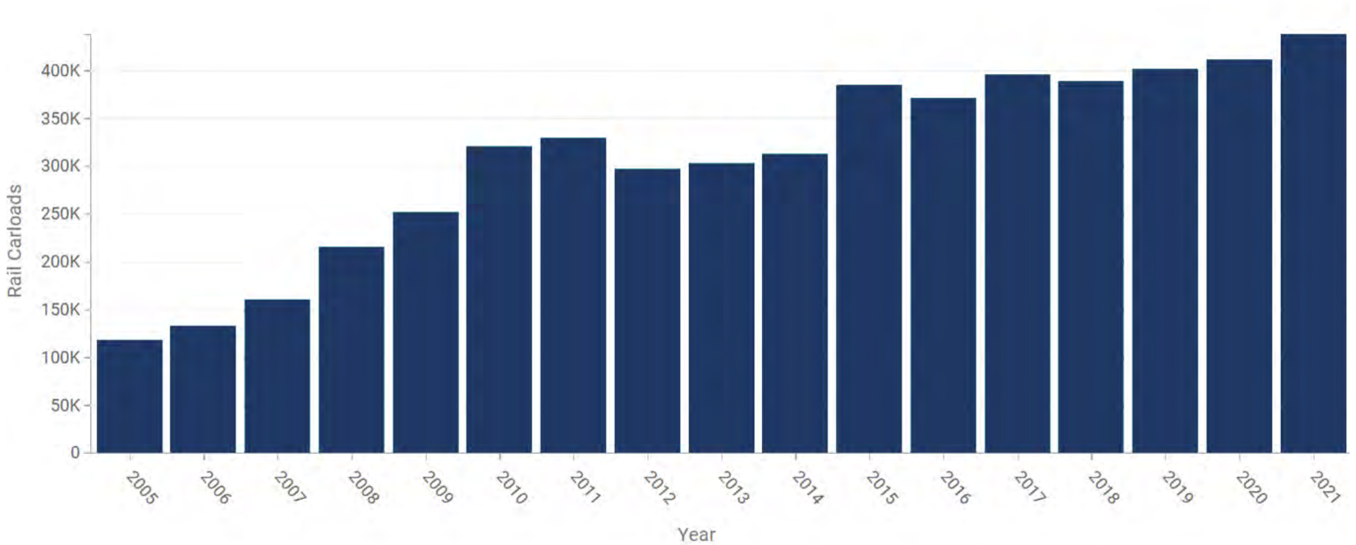


Figure 6: Sample chart from STB waybill data
Source: agtransport.usda.gov

For the purposes of the remainder of this analysis, the STB waybill data was filtered to show agricultural products shipped to or from BEA areas of interest to the agriculture industry, illustrating actual tons of freight moving in or out of specific destinations or origins.

28 https://agtransport.usda.gov/Rail/Public-Use-Carload-Waybill-Sample/xve5-xb56.
29 https://agtransport.usda.gov/api/views/xve5-xb56/files/347e7e6f-a8af-43af-8c24-d766c1480871?download=true&filename=2018-STB-Waybill-Reference-Guide.pdf.

Use of Freight Price Information

USDA's Agricultural Marketing Service maintains datasets of various freight cost indicators — Grain Transportation Report Datasets[30] — including bids and offers for railcars to be delivered in the secondary market (i.e. negotiated between parties outside the railroads' posted tariff rates). These bids and offers represent the current market supply and demand for rail freight that can ship grain by either 'shuttle' train (a dedicated set of 110+ railcars, all loaded with one commodity moving from one origin to one destination) or non-shuttle train. The secondary market is the best indicator of the availability or scarcity of rail freight in times of congestion or poor service.

In early 2023, rail freight for grain shuttles on the secondary market have reverted back to a historically normal $0 per car.[31] That figure is an average encompassing a complex collection of bids and offers that vary by railroad, type of train, and timeframe of delivery, and which are frequently negative values (e.g. -$300 per car bid in early May 2023 for a grain shuttle in the Union Pacific pool for June 2023 delivery). Present averages around $0 per car indicate a balanced supply and demand of available rail freight, and unimpeded rail service levels. This balance would be in danger if DAPL oil flow shifts to the rail system and freight congestion once again occurs. During the freight congestion of 2014, bids for grain shuttles on the secondary market spiked and were commonly noted at +$4,000 per car (~$40 per ton). The highest-ever bid tracked in this dataset was +$5,875 per car bid on October 9, 2014 for a grain shuttle to be delivered that same month on the BNSF rail line.

The following chart shows the spike in railcar bids during the 2013-2014 freight congestion as a broad average across multiple types of bids.

Historical Secondary Auction Market Grain Railcar Bids

This shows the full history (monthly averages) of bids for grain cars in the secondary auction market, broken out by train type.

Figure 7: Monthly average bids for grain cars in the secondary auction market
Source: Transportation & Marketing Programs/AMS/USDA

30 Grain Transportation Report Datasets https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.
31 Grain Transportation Report Datasets Table 5 https://www.ams.usda.gov/services/transportation-analysis/gtr-datasets.

Economic Implications for Agricultural Producers

In the event of a shift in DAPL oil flows that would once again induce congestion, making reliable rail service scarce to the agriculture industry, this analysis shows agricultural producers (farmers) will suffer economic losses by both paying more for freight charges and earning less for their produced goods. They would experience higher freight costs for inputs like fertilizer and herbicides which are shipped by rail. Simultaneously, they would receive lower prices for their grain as shippers pass back higher freight costs via weaker basis bids.[32]

Grain Basis Bids

The Upper Midwest states of North Dakota, South Dakota, Minnesota, and Montana would bear the most severe direct losses to grain producer income, because a higher proportion of their annual grain production must be shipped long distances by rail. When rail freight costs increase, the grain prices received by farmers in this region tend to collapse in a virtually 1-to-1 relationship.

In a freight-congested environment, each bushel of corn would lose between $0.17 and $0.42 of market value, each bushel of soybeans would lose between $0.11 and $0.27 of market value, and each bushel of wheat would lose between $0.18 and $0.46 of market value (per an analysis made by the USDA Office of the Chief Economist in January of 2015 — "Rail Service Challenges in the Upper Midwest: Implications for Agricultural Sectors - Preliminary Analysis of the 2013-2014 Situation"[33]). After extrapolating those losses across all the rail-shipped grain from those four states, **the USDA estimated grain and oilseed producers throughout the Upper Midwest may have received $570 million less for the crops they marketed in 2014 than they could have earned in a normal freight environment.**

However, even in states where grain producers are less dependent on rail freight, there would still be significant impacts resulting from congestion and nationwide freight cost increases. The entire competitive landscape for grain bids would likely become depressed, with a price sensitivity of approximately 0.5-to-1 (per independent modeling conducted in 2020 by Elaine Kub to confirm the consistency of market behavior over time and across regions, using data from a private database of historical individual basis bids collected daily from over 2,500 locations by DTN ProphetX[34], versus USDA Agricultural Marketing Service's "Shuttle Cost Index.")[35]

The effects of congestion will likely be exacerbated by the expected increase in grain production and shipment. Grain shipment volumes vary from year-to-year and season-to-season, but North American grains are annual crops, and each year's production must ultimately move within a calendar year. Official USDA projections for 2023 grain production volumes published in May 2023 show a recovery from 2022's drought-diminished production.[36] Meanwhile, the spring shipping season continues to handle grain produced in 2022, so those annual production numbers have been used as a proxy for annual shipping volumes.

32 Wilson, W.W. and Dahl, B. (2011), Grain pricing and transportation: dynamics and changes in markets. Agribusiness, 27: 420-434. https://doi.org/10.1002/agr.20277.
33 USDA Analysis of 2013-14 Rail Service Challenges for Senators ThuneKlobuchar.pdf.
34 DTN Market Tracker database of local grain bids https://www.dtnpf.com/agriculture/web/ag/markets/local-grain-bids.
35 Transportation Research and Analysis. USDA Agricultural Marketing Service. https://www.ams.usda.gov/services/transportation-analysis.
36 USDA Office of the Chief Economist https://www.usda.gov/oce/commodity/wasde/wasde0523.pdf.

Table 3: State by state grain production, in bushels
Source data: USDA/NASS

	Share of Grain Shipped by Rail	Number of farming Operations	2022 Corn production	2022 Soybean production	2022 Wheat production	2022 Barley production	2022 Sorghum production
COLORADO	*Net Importer*	38,800	118,580,000	-	35,750,000	4,440,000	7,600,000
IDAHO	32.4%	24,600	23,760,000	-	93,515,000	59,940,000	-
ILLINOIS	31.4%	70,700	2,268,400,000	677,250,000	44,240,000	-	-
INDIANA	27.8%	56,000	974,700,000	335,225,000	19,440,000	-	-
IOWA	15.9%	85,300	2,480,000,000	586,755,000	-	-	-
KANSAS	35.4%	58,500	510,600,000	132,275,000	244,200,000	165,000	105,300,000
KENTUCKY	9.1%	74,800	210,600,000	98,940,000	30,000,000	-	-
MICHIGAN	20.4%	44,300	336,000,000	105,280,000	34,445,000	400,000	-
MINNESOTA	37.5%	68,000	1,460,550,000	369,500,000	73,810,000	3,960,000	-
MISSOURI	14.7%	95,200	502,320,000	275,730,000	24,600,000	-	-
MONTANA	84.6%	26,800	7,728,000	-	139,300,000	34,440,000	-
NEBRASKA	35.2%	45,700	1,455,300,000	278,320,000	26,240,000	-	6,875,000
NORTH DAKOTA	79.2%	26,100	349,770,000	198,450,000	299,900,000	48,180,000	-
OHIO	38.8%	77,800	594,660,000	281,940,000	36,735,000	-	-
SOUTH DAKOTA	43.7%	29,600	661,320,000	192,660,000	71,560,000	324,000	11,900,000
UTAH	*Net Importer*	17,800	2,640,000	-	3,168,000	1,230,000	-
WISCONSIN	21.6%	64,100	545,400,000	116,100,000	18,720,000	165,000	-
WYOMING	*Net Importer*	12,000	8,568,000	-	1,615,000	5,394,000	-

A conservative estimate of the economic losses that would be faced by each state's farmers in 2023 if DAPL's oil flows shift and the nation's rail network became congested with oil trains again, in the manner observed in 2013-2014, was made first by calculating only the number of grain bushels each state would likely ship by rail.

These quantities, certain to be affected by higher rail freight costs in the event of widespread congestion, were then multiplied by the projected per-bushel losses for each class of grain.

In the Upper Midwest states — Minnesota, North Dakota, South Dakota, and Montana — with more limited market options for shipping grain, the projected per-bushel losses were assumed to be the same range documented in the 2015 USDA analysis "Rail Service Challenges in the Upper Midwest: Implications for Agricultural Sectors," specifically $0.17 (low) to $0.42 (high) per bushel of corn or sorghum, $0.11 (low) to $0.27 (high) per bushel of soybeans, or $0.18 (low) to $0.46 (high) per bushel of wheat or barley.

For other states with more complex market options for grain, the projected per-bushel losses were taken from a linear regression model performed in 2020, confirming how grain basis bids weaken overall in an environment of higher rail freight. Practically speaking, although a farmer in Iowa, for instance, may be able to avoid selling grain into a weak rail market, and instead pivot to selling grain to a nearby ethanol plant or livestock feeder, the prices everywhere for that grain will weaken in tandem if the rail market's bids weaken. If the local rail shipper drops its bidding to -50 cents under the futures market for corn from -30 cents under, then the local feedlot won't reasonably continue to bid -30 cents under the futures market; instead, it will allow its bids to sink too.

Therefore, the projected per-bushel losses for the remaining states – Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, Ohio, Utah, Wisconsin, Wyoming – were assumed to be $0.09 (low) to $0.21 (high) per bushel of corn or sorghum, $0.06 (low) to $0.14 (high) per bushel of soybeans, and $0.09 (low) to $0.23 (high) per bushel of wheat or barley. These per-bushel loss calculations were conservatively applied only to the share of grain production that each state ships by rail.

For instance, the 'high' range calculation for how much annual income Kansas farmers may lose in a congested freight environment at present-day production volumes would be made as follows:

+ (510,600,000 bushels of corn) x (35.4% shipped by rail) x ($0.21)
+ (132,275,000 bushels of soybeans) x (35.4% shipped by rail) x ($0.14)
+ (244,200,000 bushels of wheat) x (35.4% shipped by rail) x ($0.23)
+ (165,000 bushels of barley) x (35.4% shipped by rail) x ($0.23)
+ (105,300,000 bushels of sorghum) x (35.4% shipped by rail) x ($0.21)

Equals $72,237,753 in combined losses for Kansas farmers

Table 4: Calculated annual losses for various classes of grain due to lower basis bids in a congested-freight environment

LOW RANGE ANNUAL LOSS ESTIMATES

	Rail Corn Losses Low	Rail Soybeans Losses Low	Rail Wheat Losses Low	Rail Barley Losses Low	Rail Sorghum Losses Low	COMBINED
COLORADO	-	-	$3,217,500	-	-	**$3,217,500**
IDAHO	$692,842	-	$2,726,897	$1,747,850	-	**$5,167,589**
ILLINOIS	$64,104,984	$12,759,390	$1,250,222	-	-	**$78,114,596**
INDIANA	$24,386,994	$5,591,553	$486,389	-	-	**$30,464,936**
IOWA	$35,488,800	$5,597,643	-	-	-	**$41,086,443**
KANSAS	$16,267,716	$2,809,521	$7,780,212	$5,257	$3,354,858	**$30,217,564**
KENTUCKY	$1,724,814	$540,212	$245,700	-	-	**$2,510,726**
MICHIGAN	$6,168,960	$1,288,627	$632,410	$7,344	-	**$8,097,341**
MINNESOTA	$93,110,063	$15,241,875	$4,982,175	$267,300	-	**$113,601,413**
MISSOURI	$6,645,694	$2,431,939	$325,458	-	-	**$9,403,090**
MONTANA	$1,111,441	-	$21,212,604	$5,244,523	-	**$27,568,568**
NEBRASKA	$46,103,904	$5,878,118	$831,283	-	$217,800	**$53,031,106**
NORTH DAKOTA	$47,093,033	$17,288,964	$42,753,744	$6,868,541	-	**$114,004,282**
OHIO	$20,765,527	$6,563,563	$1,282,786	-	-	**$28,611,877**
SOUTH DAKOTA	$49,129,463	$9,261,166	$5,628,910	$25,486	$884,051	**$64,929,075**
UTAH	-	-	$285,120	$110,700	-	**$395,820**
WISCONSIN	$10,602,576	$1,504,656	$363,917	$3,208	-	**$12,474,356**
WYOMING	-	-	$145,350	$485,460	-	**$630,810**

Table 5: Calculated annual losses for various classes of grain due to lower basis bids in a congested-freight environment

HIGH RANGE ANNUAL LOSS ESTIMATES

	Rail Corn Losses High	Rail Soybeans Losses High	Rail Wheat Losses High	Rail Barley Losses High	Rail Sorghum Losses High	COMBINED
COLORADO	-	-	$8,222,500	$4,466,729	-	**$8,222,500**
IDAHO	$1,616,630	$1,616,630	$6,968,738	$4,466,729	-	**$13,052,097**
ILLINOIS	$149,578,296	$149,578,296	$3,195,013	-	-	**$182,545,219**
INDIANA	$56,902,986	$56,902,986	$1,242,994	-	-	**$71,192,937**
IOWA	$82,807,200	$82,807,200	-	-	-	**$95,868,366**
KANSAS	$37,958,004	$37,958,004	$19,882,764	$13,434	$7,828,002	**$72,237,753**
KENTUCKY	$4,024,566	$4,024,566	$627,900	-	-	**$5,912,962**
MICHIGAN	$14,394,240	$14,394,240	$1,616,159	$18,768	-	**$19,035,964**
MINNESOTA	$230,036,625	$230,036,625	$12,732,225	$683,100	-	**$280,863,825**
MISSOURI	$15,506,618	$15,506,618	$831,726	-	-	**$22,012,868**
MONTANA	$2,745,913	$2,745,913	$54,209,988	$13,402,670	-	**$70,358,571**
NEBRASKA	$107,575,776	$107,575,776	$2,124,390	-	$508,200	**$123,923,976**
NORTH DAKOTA	$116,347,493	$116,347,493	$109,259,568	$17,552,938	-	**$285,596,546**
OHIO	$48,452,897	$48,452,897	$3,278,231	-	-	**$67,046,109**
SOUTH DAKOTA	$121,378,673	$121,378,673	$14,384,991	$65,130	$2,184,126	**$160,744,874**
UTAH	-	-	$728,640	$282,900	-	**$1,011,540**
WISCONSIN	$24,739,344	$24,739,344	$930,010	$8,197	-	**$29,188,415**
WYOMING	-	-	$371,450	$1,240,620	-	**$1,612,070**

Table 6: Calculated annual losses due to congested freight environment for corn, soybeans, wheat, barley, and sorghum combined

COMBINED ANNUAL LOSS ESTIMATES

	Combined Losses **Low**	Combined Losses High	Number Of Farming Operations	Average Loss Per Farming Operation
COLORADO	$3,217,500	**$8,222,500**	38,800	$147
IDAHO	$5,167,589	**$13,052,097**	24,600	$370
ILLINOIS	$78,114,596	**$182,545,219**	70,700	$1,843
INDIANA	$30,464,936	**$71,192,937**	56,000	$908
IOWA	$41,086,443	**$95,868,366**	85,300	$803
KANSAS	$30,217,564	**$72,237,753**	58,500	$876
KENTUCKY	$2,510,726	**$5,912,962**	74,800	$56
MICHIGAN	$8,097,341	**$19,035,964**	44,300	$306
MINNESOTA	$113,601,413	**$280,863,825**	68,000	$2,900
MISSOURI	$9,403,090	**$22,012,868**	95,200	$165
MONTANA	$27,568,568	**$70,358,571**	26,800	$1,827
NEBRASKA	$53,031,106	**$123,923,976**	45,700	$1,936
NORTH DAKOTA	$114,004,282	**$285,596,546**	26,100	$7,655
OHIO	$28,611,877	**$67,046,109**	77,800	$615
SOUTH DAKOTA	$64,929,075	**$160,744,874**	29,600	$3,812
UTAH	$395,820	**$1,011,540**	17,800	$40
WISCONSIN	$12,474,356	**$29,188,415**	64,100	$325
WYOMING	$630,810	**$1,612,070**	12,000	$93

The per-bushel loss estimates calculated by the USDA in 2015 remain a solid proxy for losses that might occur in 2023. While inflation has driven up the prices for just about everything – from fuel and freight, to retail goods, to grain commodities themselves, the mechanism of how grain shippers' basis bids pass freight costs back to farmers has remained unchanged over time. Basis bids are not considered to be a function of the underlying grain price, so although corn, for instance, may be worth $6.50 per bushel in January 2023, compared to a price tag of only $4.00 per bushel in January 2014, the basis offset should remain static if all other things were equal, varying only with availability of rail freight capacity and competition for scarce rail cars.

Further, when estimating the total potential losses likely to be experienced by agricultural producers in 2023, it is more appropriate to use the 'high' range of estimates rather than the 'low' range in calculating potential per-bushel losses. For one thing, relatively higher fuel costs will drive up the fuel surcharges included in rail freight and exacerbate the weakness in grain basis bids. More importantly, the volume of grain and other agricultural commodities that are produced in the United States and that need to be shipped by a more-burdened rail system have increased, driving up the stakes for receiving reliable transportation. Service losses and volatility in freight prices can be confidently predicted to be worse in 2023 than in 2013-2014 if the rail network becomes congested with DAPL-displaced oil again in the current freight environment.

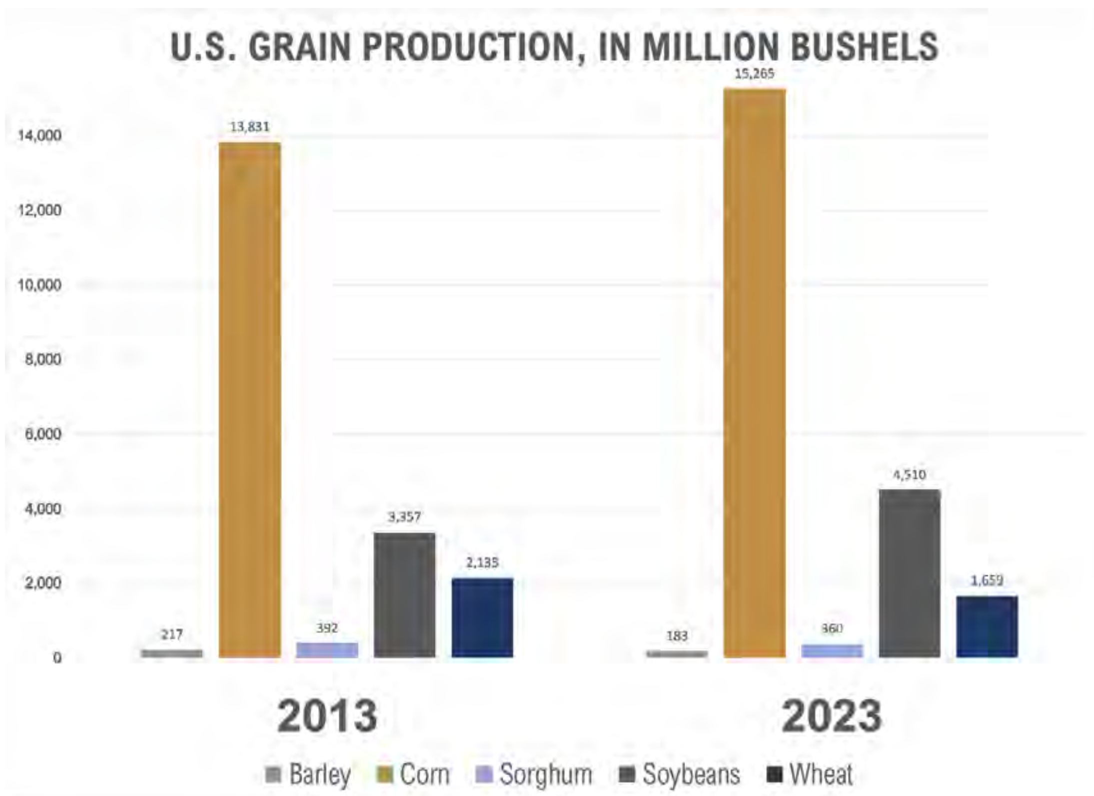


Figure 8: Combined production volumes for barley, corn, sorghum, soybeans, and wheat are projected to be 10% larger in 2023 (21.977 billion bushels) than the combined 2013 production (19.932 billion bushels)
Source: Elaine Kub analysis of NASS data[37,38]

37 USDA National Agricultural Statistics Service https://www.nass.usda.gov/Data_and_Statistics/index.php.
38 USDA Office of the Chief Economist https://www.usda.gov/oce/commodity/wasde/wasde0523.pdf.

Agricultural Inputs (fertilizer, herbicides, etc.)

The agriculture industry relies on a robust supply chain not only to transport its products from distant origins to global destinations, but also to bring necessary goods to the often-rural regions where agricultural production takes place. Table 12 shows the volume of ag inputs shipped by rail in the U.S. in 2021. Note that this list includes farm-specific inputs but not many of the other products necessary for agricultural production – like gravel, steel, concrete, or tires – which also ship to rural locations by rail, but which aren't unique to agriculture.

Table 7: Quantity of farm inputs shipped by rail in 2021, in tons
Source data: Elaine Kub analysis of NASS data. Surface Transportation Board's Carload Waybill Sample, agtransport.usda.gov

1,762,692	Nitrogen fertilizer solution or superphosphate solution
778,090	Ashes (i.e. potash fertilizer)
525,901	Miscellaneous fertilizer compounds
362,278	Anhydrous ammonia
260,541	Potassium alkalies
217,915	Gypsum products
102,130	Agricultural chemicals (fungicides, herbicides, insecticides)
50,432	Agricultural limestone, broken or crushed
11,024	Wheel tractors, parts or attachments
4,412	Other fertilizers
289	Other farm machinery or equipment

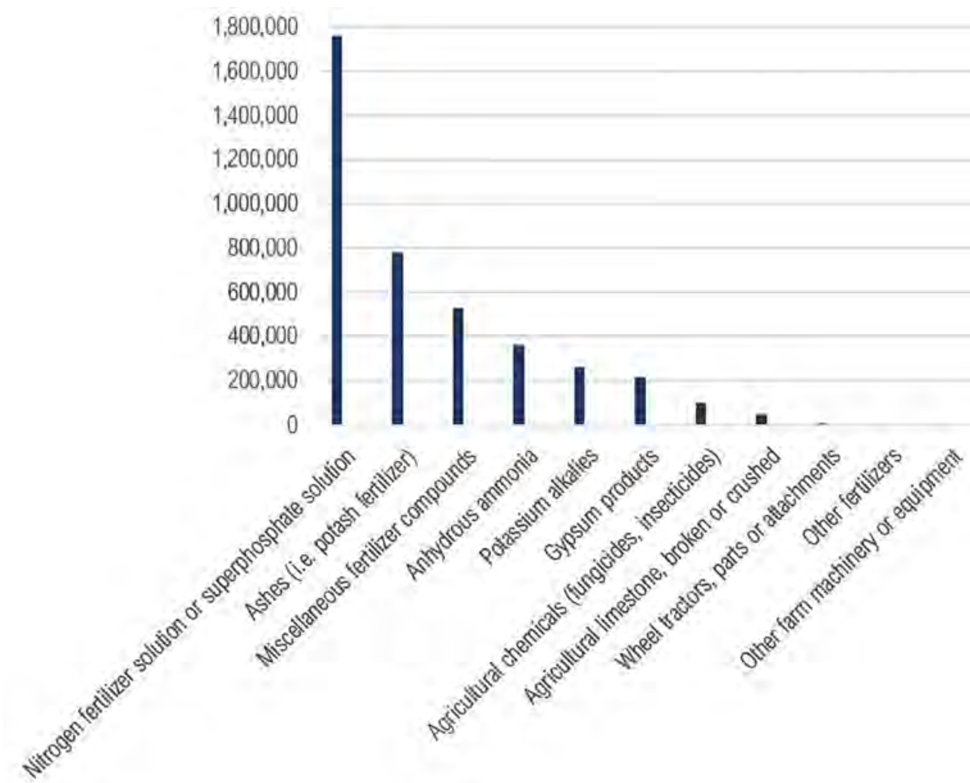


Figure 9: Quantity of farm inputs shipped by rail in 2021, in tons
Source data: Elaine Kub analysis of NASS data. Surface Transportation Board's Carload Waybill Sample, agtransport.usda.gov

On average, freight costs for agricultural inputs dropped $26 per ton in the post-DAPL freight scenario compared to the pre-DAPL freight congestion.[39] However, freight rates vary greatly for this sector of goods – it's quite different to ship bulk dry fertilizer pellets in a hopper car versus farm machinery on a flatbed railcar.

Table 8: Freight costs per ton for agricultural input categories

Source data: Elaine Kub analysis of Surface Transportation Board's Carload Waybill Sample, agtransport.usda.gov

	Pre-DAPL	Post-DAPL
Agricultural Chemicals: Fungicides, Insecticides, Herbicides or Plant Hormones	$3,537	$3,750
Agricultural Limestone, Broken or Crushed	$771	$304
Anhydrous Ammonia	$5,272	$5,034
Ashes	$465	$586
Other Farm Machinery or Equipment	$4,701	$5,871
Other Fertilizers	$5,088	$5,191
Gypsum Products	$102	$80
Harvesting or Hay Parts	$11,978	$8,474
Miscellaneous Fertilizer Compounds	$3,331	$2,786
Potassium Alkalies	$2,602	$2,317
Superphosphate Solution or Nitrogen Fertilizer Solution	$500	$453
Wheel Tractors, Parts or Attachments	$9,670	$9,470
	$876	**$851**

Therefore, in order to estimate the economic impact to the agriculture industry from increased freight costs in a flow shift condition, this analysis collected recent (2021) volumes of ag inputs shipped by rail to certain terminal destinations, filtered using the BEA areas. Note that the BEA areas do not align with state borders in all cases. A conservative assumption was made that in a potential 2023 freight congestion scenario, the freight costs for this class of freight would increase, on average, $26 per ton, as it did in the congested 2013-14 condition. In reality, freight congestion may be even more severe in 2023 if a flow shift causes congestion on a more-burdened rail system. In May 2023, the volume of fertilizer being shipped by rail has surged to an all-time high of 6,550 carloads per week.[40] In the event of sudden congestion, ag input freight could easily rise even more than $26 per ton. Notably, the freight rate for nitrogen fertilizer, the most important ag input shipped by rail and the one shipped at the highest volume, fell almost $50 per ton after the 2013-14 congestion was relieved.

39 Public Use Carload Waybill Sample https://www.stb.gov/reports-data/waybill/.
40 Seasonal Originated Fertilizer Carloads https://agtransport.usda.gov/Rail/Seasonal-Originated-Fertilizer-Carloads/bpst-47qp.

Table 9: State-by-state estimates of increased farm input shipping expenses

Source data: Elaine Kub analysis of Surface Transportation Board's Carload Waybill Sample, agtransport.usda.gov

	Tons of Farm Inputs **Shipped by Rail**, Terminating in States' **BEAs - 2021**	Additional Freight Costs per Ton	Estimated Additional Farm Input Shipping Expenses
COLORADO	108,871	$26	**$2,830,646**
IDAHO	39,157	$26	**$1,018,082**
ILLINOIS	517,943	$26	**$13,466,518**
INDIANA	45,504	$26	**$1,183,104**
IOWA	134,970	$26	**$3,509,220**
KANSAS	23,513	$26	**$611,338**
KENTUCKY	8,697	$26	**$226,122**
MICHIGAN	3,996	$26	**$103,896**
MINNESOTA	255,409	$26	**$6,640,634**
MISSOURI	74,548	$26	**$1,938,248**
MONTANA	23,515	$26	**$611,390**
NEBRASKA	143,002	$26	**$3,718,052**
NORTH DAKOTA	168,374	$26	**$4,377,724**
OHIO	12,040	$26	**$313,040**
SOUTH DAKOTA	91,233	$26	**$2,372,058**
UTAH	11,364	$26	**$295,464**
WISCONSIN	3,595	$26	**$93,470**
WYOMING	82,318	$26	**$2,140,268**

Economic Implications for Processors of Agricultural Commodities

For grain bushels that get exported, freight congestion's costs to the U.S. agriculture industry may end as soon as a shipper has paid the excess freight and passed back that loss to farmers in the form of weaker basis bids. But for the majority of grain bushels which remain within this country, there are additional increased costs as a result of rail congestion. For instance, over 50% of the soybeans used in America[41] are crushed domestically into soybean meal and soybean oil. When the nation's rail system becomes congested and unreliable, the plants which do this processing activity then face the very same problem that farmers and grain shippers originally faced — trying to get timely rail service and paying increased freight charges for whichever trains are available. **Oil flows shifted from DAPL would compete directly with these processors for rail freight service.**

For the processors of liquid ag commodities and perishable livestock feed, there is an additional concern. If an ethanol plant doesn't receive rail service on time, it can only produce ethanol until its available storage capacity is met. Bottlenecked without a freight outlet, the ethanol plant will have to shut down production.

If an ethanol plant doesn't receive rail service on time, it can only produce ethanol until its available storage capacity is met. Bottlenecked without a freight outlet, the ethanol plant will have to shut down production.

Indeed, this is what happened in the pre-DAPL congested freight scenario of 2013-14. Nationwide **ethanol production decreases "amounted to 80,000 barrels per day between December 2013 and March 2014" during the pre-DAPL freight congestion**, according to Renewable Fuels Association President Bob Dineen[42] at the time. 80,000 barrels per day equated to 9% of lost production at that time when nationwide ethanol production ranged between 868 and 944 thousand barrels per day, averaging 904,000 barrels per day between December 2013 and March 2014.[43]

This analysis draws on that historical observation to estimate annual production and economic losses using the higher state-by-state ethanol production volumes seen today. Economic losses suffered by ag processors would come from two directions: the processors would pay more (higher freight costs for the portion of their production that gets shipped by rail) and at the same time they would earn less (lost production when poor rail service means they cannot move or store value-added ag commodities, so they must shut down production).

41 USDA Office of the Chief Economist https://www.usda.gov/oce/commodity/wasde/wasde0523.pdf.
42 Rail Delays Hitting Home for Ethanol, Grain Shippers https://www.farmprogress.com/farm-business/rail-delays-hitting-home-for-ethanol-grain-shippers.
43 Elaine Kub analysis of Weekly Ethanol Production https://www.eia.gov/dnav/pet/pet_pnp_wprode_s1_w.htm.

Table 10: Tons of processed ag commodities produced and shipped by rail

	U.S. Annual Production in Tons	U.S. Annual Quantity Shipped By Rail[44] in Tons	Percent of Production Reliant on Rail Service
SOYBEAN MEAL[45]	52,539,000	4,325,336	8%
ETHANOL[46]	50,743,000	12,009,798	24%
DDGS (ETHANOL CO-PRODUCT LIVESTOCK FEED)	46,200,000	3,017,616	7%
WHEAT FLOUR[47]	21,514,200	1,445,843	7%
SOYBEAN OIL	13,097,500	1,284,141	10%

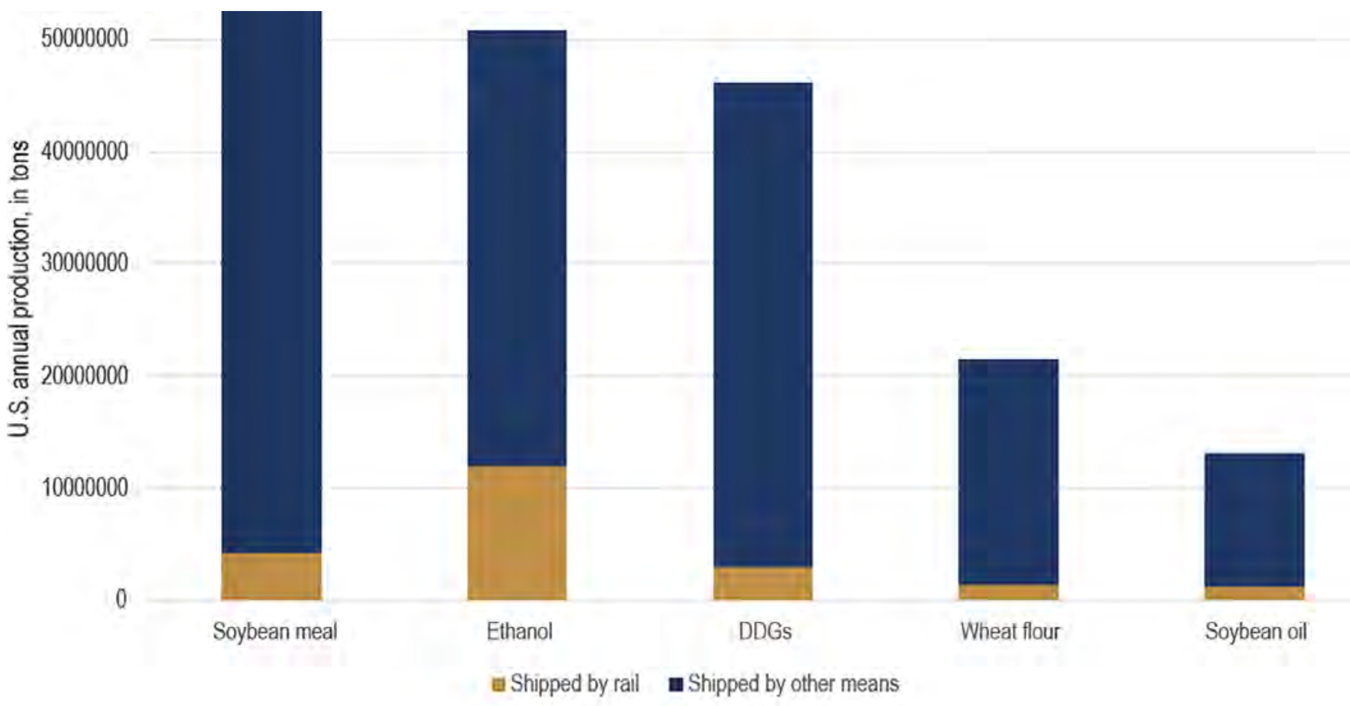


Figure 10: Percent of processed ag commodity production reliant on rail service

44 Elaine Kub analysis of https://agtransport.usda.gov/Rail/Public-Use-Carload-Waybill-Sample/xve5-xb56.
45 Oil Crops Yearbook https://www.ers.usda.gov/data-products/oil-crops-yearbook/.
46 Most U.S. Fuel Ethanol Production Capacity https://www.eia.gov/todayinenergy/detail.php?id=53539.
47 https://www.bakingbusiness.com/articles/58318-flour-production-reaches-a-new-record-in-2022.

Table 11: Processed ag commodities shipped by rail, 2021, actual weight in tons[48]

Source data: Elaine Kub analysis of Surface Transportation Board's Carload Waybill Sample, agtransport.usda.gov

	Colorado	Illinois	Indiana	Iowa	Kansas	Minnesota	Missouri	Nebraska	North Dakota	Ohio	South Dakota	Wisconsin
Ethanol	3,045	1,604,023	40,950	2,421,816	184,162	847,586	3,410	1,604,986	395,462	1,624	677,932	122,310
Ethanol By-Products	-	-	30,331	208,671	-	153,485	-	17,060	208,207	6,169	164,143	-
Corn Meal or Flour	-	2,135	-	-	-	-	6,340	-	-	-	-	-
Corn Oil	-	4,694	-	16,040	-	-	-	11,953	-	-	3,131	-
Corn Starch	-	9,506	2,765	-	-	-	-	-	-	-	-	-
Corn Syrup	-	123,335	-	31,536	-	-	-	180,537	-	-	-	-
Distilled, Rectified or Blended Liquors	-	5,624	-	-	-	-	2,361	-	-	-	-	-
Fatty Acids	-	-	-	14,462	-	-	-	-	-	-	-	-
Other Flour or other Grain Products	-	23,920	3,053	6,115	-	-	-	4,297	1,718	-	-	-
Nut or Vegetable Oils	-	25,263	-	-	-	-	-	-	-	-	-	-
Malt Extracts or Brewers Spent Grains	-	-	-	53,364	-	-	-	-	-	-	-	-
Prepared Feed, Animal, Fish or Poultry	-	378,904	-	704,341	-	-	205,141	493,575	-	-	-	-
Soybean Cake, Flour, Grits, Meal or other By-Products	-	338,055	4,251	196,559	-	130,068	197,701	453,197	-	-	-	-
Soybean Oil, Crude or Refined	-	15,067	1,244	29,597	-	31,704	12,532	13,802	-	-	-	-
Wet Process Corn or Lar Mill Byproducts	-	-	-	2,548	-	-	-	6,829	-	-	-	-
Other Sugar Mill Products or Byproducts	-	-	-	-	-	-	-	-	7,558	-	-	-
Sugar Molasses	-	-	-	-	-	-	-	-	2,733	-	-	-
Sugar, Granulated or Powdered, Sugar Cubes or Tablets	2,021	11,986	-	-	-	9,039	-	-	25,594	-	-	-
Wheat Flour	-	21,210	-	-	12,098	9,640	7,475	958	-	-	-	-

48 Elaine Kub analysis of https://agtransport.usda.gov/Rail/Public-Use-Carload-Waybill-Sample/xve5-xb56.

Ethanol Plants

Annual U.S. rail carloads of ethanol reached 438,199 in 2021, a 40% increase over 2014 levels.[49] The scale of disruption to the ethanol industry would therefore likely be considerably worse today if 2014-levels of congested rail service occurred in 2023.

Table 12: U.S. ethanol plants, capacity, and production 1999-2021

Source data: https://afdc.energy.gov/data/10342, eia.gov/petroleum/ethanolcapacity/index.php, eia.gov/totalenergy/data/monthly/#renewable, https://anolrfa.org

Year	Ethanol Plants	Capacity (BGY)	Production (BGY)	Production as % of Capacity
1999	50	1.779	1.465	82%
2000	54	1.840	1.622	88%
2001	56	2.007	1.765	88%
2002	61	2.738	2.140	78%
2003	68	3.190	2.810	88%
2004	72	3.699	3.404	92%
2005	81	4.398	3.904	89%
2006	95	6.317	4.884	77%
2007	110	11.623	6.521	56%
2008	139	13.424	9.309	69%
2009	170	14.541	10.938	75%
2010	193	13.614	13.298	98%
2011	194	13.728	13.929	101%
2012	193	13.852	13.218	95%
2013	187	13.681	13.293	97%
2014	195	14.369	14.313	100%
2015	195	14.903	14.807	99%
2016	198	15.505	15.413	99%
2017	200	16.288	15.936	98%
2018	200	16.868	16.061	95%
2019	201	17.378	15.776	91%
2020	197	17.546	13.926	79%
2021	192	17.380	15.016	86%

Notes: Prior to 2010, plant and capacity data were retrieved from the RFA. Starting in 2010, plant and capacity data were retrieved from EIA U.S. Fuel Ethanol Plan Production Capacity. Production data are retrieved from EIA Monthly Energy Review. Number of plants and total capacity are listed as of the end of the posted year. This causes the production/capacity ratio to look falsely low because plants built late in the year count 100% to capacity but only partially to production.
BGY: Billion gallons of ethanol per year
Last updated December 2022

49 https://agtransport.usda.gov/Rail/Annual-U-S-Rail-Carloads-of-Ethanol/sgce-bw6d.

Analysis of STB waybill data shows that the most common origin of rail-shipped ethanol is Iowa (BEA origins 100, 103, and 117 — see Appendix A), and the most common route for ethanol-by-rail coming out of Iowa is toward Chicago, using the same route, same cars, same locomotives, same crew as Bakken oil trains would use. Further north along the same rail routes that would need to serve shifted DAPL oil flows, the most common destinations for ethanol coming out of South Dakota or North Dakota include California, the Pacific Northwest, or Texas.

For a full list of ethanol plants with their present capacities and locations, see Appendix B: Full List of U.S. Ethanol Plants by State.

Table 13: State-by-state ethanol production.

Source: Elaine Kub analysis of U.S. Energy Information Administration data

State By State Ethanol Production in 2023, Assuming 100% of Capacity	
COLORADO	461,100 tons per year
IDAHO	197,614 tons per year
ILLINOIS	5,740,695 tons per year
INDIANA	4,331,046 tons per year
IOWA	15,460,024 tons per year
KANSAS	1,979,436 tons per year
KENTUCKY	174,559 tons per year
MICHIGAN	1,274,612 tons per year
MINNESOTA	4,690,046 tons per year
MISSOURI	1,090,172 tons per year
NEBRASKA	7,390,774 tons per year
NORTH DAKOTA	1,801,584 tons per year
OHIO	2,377,959 tons per year
SOUTH DAKOTA	4,755,917 tons per year
WISCONSIN	1,976,143 tons per year

In the event of a shift of flows from DAPL to Midwest rail systems and associated freight congestion, the economic losses to the ethanol industry would come from two sources: increased costs from higher freight prices and losses from necessary production shutdowns. The scale of potentially higher freight costs in 2023 can be estimated by comparing the ethanol freight costs during the 2013-14 congested freight scenario to the post-DAPL relieved freight scenario, then applying those increases to the present-day volumes of ethanol which ship by rail from each state. Freight costs for ethanol shipped by rail fell an average of $39.90 per ton in the post-DAPL scenario compared to the pre-DAPL congested scenario.

Table 14: Ethanol freight costs per ton, 2005-2021

Source data: Elaine Kub analysis of STB waybill data

	Ethanol Shipped by Rail - Sum of Billed Weight in Tons	Freight Revenue	Freight Cost per Ton
2005	577,741	$437,324,688	$756.96
2006	898,959	$625,060,526	$695.32
2007	1,576,615	$859,698,760	$545.28
2008	2,928,280	$1,321,092,216	$451.15
2009	5,022,256	$1,499,412,734	$298.55
2010	6,845,915	$1,820,012,708	$265.85
2011	7,649,999	$1,993,947,499	$260.65
2012	7,044,997	$1,808,571,995	$256.72
2013	7,579,311	$1,848,536,252	$243.89
2014	8,432,371	$1,987,557,161	$235.71
2015	10,904,142	$2,135,058,575	$195.80
2016	10,461,032	$2,091,005,875	$199.89
2017	11,345,513	$2,237,892,090	$197.25
2018	12,601,309	$2,374,246,452	$188.41
2019	11,991,627	$2,357,466,912	$196.59
2020	10,660,113	$2,178,890,939	$204.40
2021	14,233,376	$2,465,088,090	$173.19

Table 15: State-by-state estimated additional ethanol shipping expenses in a freight-congested environment at 2023 volumes

Source: Elaine Kub analysis of EIA data and STB waybill data

	Projected 2023 Ethanol Production in Tons	Historical Annual Statewide Ethanol Production in Tons	Historical Annual Rail[50] Shipments of Alcohol in Tons	Historical % Shipped by Rail	Additional Rail Freight Costs per Ton	Estimated Additional Ethanol Shipping Expenses
COLORADO	461,100	364,269	3,045	0.8%	$39.90	$153,792
IDAHO	197,614	156,115	-	-	$39.90	-
ILLINOIS	5,740,695	4,676,522	1,604,023	34.3%	$39.90	$78,564,247
INDIANA	4,331,046	3,201,368	40,950	1.3%	$39.90	$2,210,467
IOWA	15,460,024	12,745,311	2,421,816	19.0%	$39.90	$117,212,454
KANSAS	1,979,436	1,759,696	184,162	10.5%	$39.90	$8,265,645
KENTUCKY	174,559	137,901	-	-	$39.90	-
MICHIGAN	1,274,612	1,021,013	-	-	$39.90	-
MINNESOTA	4,690,046	3,774,196	847,586	22.5%	$39.90	$42,025,158
MISSOURI	1,090,172	843,536	3,410	0.4%	$39.90	$175,840
NEBRASKA	7,390,774	5,929,239	1,604,986	27.1%	$39.90	$79,824,301
NORTH DAKOTA	1,801,584	1,698,692	395,462	23.3%	$39.90	$16,734,681
OHIO	2,377,959	1,760,249	1,624	0.1%	$39.90	$87,536
SOUTH DAKOTA	4,755,917	3,826,761	677,932	17.7%	$39.90	$33,617,231
WISCONSIN	1,976,143	1,520,247	122,310	8.0%	$39.90	$6,343,649

50 Elaine Kub analysis of https://agtransport.usda.gov/Rail/Public-Use-Carload-Waybill-Sample/xve5-xb56

The second set of losses would be experienced by the ethanol industry if freight congestion causes individual plants to shut down production. As a reminder, if an ethanol plant cannot receive rail service in a timely manner, and has already met its available storage capacity, it may have to shut down production and forgo its expected profit margin on the lost volume of business. Calculating the scale of such losses industry-wide requires making two critical assumptions.

First of all, how much production would be cut if freight service for ethanol tanker cars became unreliable in a congested-freight environment? For this analysis, it was assumed the industry would have to cut 9% of its expected annual production, in line with the cuts seen in late 2013 and early 2014 during the pre-DAPL freight congestion.

Second, how much profit margin would be lost for each gallon the ethanol plants are unable to produce? The plants would lose the opportunity to sell each gallon of ethanol they couldn't ship, but they would also lose the opportunity to sell the associated co-products (e.g. distillers grains, a common livestock feed product) that would never be made because each original bushel of corn feedstock would never be processed. In early 2023, an average industry expectation for ethanol crush margins would be to produce 2.8 gallons of ethanol and 18 pounds of distillers grains from each bushel of corn processed by an ethanol plant. Wholesale ethanol at $2.22 per gallon[51] therefore contributes $6.22 of revenue for each bushel of corn processed, and distillers grains worth $290 per ton contribute $2.61 of revenue for each bushel of corn processed. The combined value of the crush products reaches $8.83 for each bushel of corn processed. The input cost for each bushel of corn during this timeframe would average $6.70.[52] Therefore, the gross profit margin for each bushel of corn processed by an average U.S. ethanol plant in early 2023 should be assumed at $2.13. This gross profit margin figure doesn't include additional overhead expenses involved in the operation of the plant, because the plant will still be running, and it is instead the marginal loss of the 9% production cuts which are being calculated. By still operating the ethanol plant, but simply purchasing fewer bushels of corn and producing fewer gallons of ethanol and fewer tons of DDGs, the ethanol plant forgoes the opportunity to see $2.13 per bushel gross profit ($8.83 of crush products never sold netted against $6.70 of corn never purchased.)

Each gallon of ethanol not produced due to freight congestion accounts for 36% of the lost profit margin from each corn bushel not processed (1 bushel ÷ 2.8 gallons per bushel). This analysis assumes that each gallon of lost ethanol production is equivalent to $0.76 of lost crush margin ($2.13 gross per bushel ÷ 2.8 gallons per bushel). These cumulative losses are then calculated for each ethanol-producing state.

51 USDA AMS Livestock, Poultry & Grain Market News, January 13 2023 National Weekly Ethanol Report https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/3616/2023-01-09/668861/ams_3616_00026.pdf.

52 USDA AMS Livestock, Poultry & Grain Market News, January 13 2023 National Weekly Ethanol Report https://mymarketnews.ams.usda.gov/filerepo/sites/default/files/3616/2023-01-09/668861/ams_3616_00026.pdf.

Table 16: Estimated ethanol industry losses due to lost production in a congested-freight environment, assuming 9% production cuts from original expected 2023 production, 303.63 gallons per short ton of ethanol, and $0.76 per gallon lost

Source: Elaine Kub analysis

	Estimated Lost Production (Tons) If Congestion Lasts 1 Year	Estimated Lost Production (Gallons) If Congestion Lasts 1 Year	Estimated Lost Profit Opportunity If Congestion Lasts 1 Year
COLORADO	40,805	12,389,716	$9,416,184
IDAHO	17,488	5,309,871	$4,035,502
ILLINOIS	508,026	154,251,967	$117,231,495
INDIANA	383,278	116,374,823	$88,444,865
IOWA	1,368,144	415,409,477	$315,711,202
KANSAS	175,171	53,187,270	$40,422,325
KENTUCKY	15,448	4,690,385	$3,564,693
MICHIGAN	112,798	34,248,712	$26,029,021
MINNESOTA	415,048	126,021,121	$95,776,052
MISSOURI	96,475	29,292,825	$22,262,547
NEBRASKA	654,051	198,589,443	$150,927,977
NORTH DAKOTA	159,432	48,408,403	$36,790,386
OHIO	210,439	63,895,548	$48,560,616
SOUTH DAKOTA	420,878	127,791,069	$97,121,212
WISCONSIN	174,880	53,098,788	$40,355,079

Overall, the combined losses to the ethanol industry, including both the increased freight expenses, plus the lost profit opportunity due to production shutdowns, could reach approximately $1.5 billion.

Table 17: Estimated annual losses to the ethanol industry in a congested-freight environment
Source: Elaine Kub analysis

	Estimated Additional Ethanol Shipping Expenses	Estimated Lost Profit Opportunity If Congestion Lasts 1 Year	Estimated Ethanol Industry Losses
COLORADO	$153,792	$9,416,184	**$9,569,976**
IDAHO	-	$4,035,502	**$4,035,502**
ILLINOIS	$78,564,247	$117,231,495	**$195,795,741**
INDIANA	$2,210,467	$88,444,865	**$90,655,332**
IOWA	$117,212,454	$315,711,202	**$432,923,656**
KANSAS	$8,265,645	$40,422,325	**$48,687,970**
KENTUCKY	-	$3,564,693	**$3,564,693**
MICHIGAN	-	$26,029,021	**$26,029,021**
MINNESOTA	$42,025,158	$95,776,052	**$137,801,210**
MISSOURI	$175,840	$22,262,547	**$22,438,387**
NEBRASKA	$79,824,301	$150,927,977	**$230,752,278**
NORTH DAKOTA	$16,734,681	$36,790,386	**$53,525,067**
OHIO	$87,536	$48,560,616	**$48,648,153**
SOUTH DAKOTA	$33,617,231	$97,121,212	**$130,738,444**
WISCONSIN	$6,343,649	$40,355,079	**$46,698,728**
TOTAL			**$1,481,864,158**

Other Grain Processing

Although state-by-state information about production volumes aren't available for the nation's soybean meal, soybean oil, and other oilseed crush products, and although the rail shipping volume of these products is outweighed by the scale of ethanol shipments, for each individual grain processor that relies on rail freight, the availability of uncongested rail service remains an important concern. Grain processors not only pay higher input costs when poor rail service and high freight costs drive up the prices of grain at these destinations, but they also experience higher freight costs when shipping their own value-added products out from the processing plant by rail.

Geographically, the production and shipment of soybean meal and soybean oil tends to be focused in the Midwest and states farther east.[53] Other types of grain processors which would be equally interested in keeping the nation's rail network free of congestion include cottonseed oil producers, located primarily in the southern United States, and any other business dependent on shipping or receiving animal feed. Many specialty crops such as sunflower seed, canola, and flaxseed — as well as sugarbeets and their processed sugar — are produced primarily in North Dakota, where rail congestion in the pre-DAPL 2013-14 scenario was particularly severe.

Wheat flour milling operations are not necessarily located near the origin of the wheat and are often closer to the final customers in larger population centers. They are therefore dependent on efficient rail service uninterrupted by congestion to receive grain. A few major wheat-producing states are among the top five rail shippers of wheat flour.

Table 18: Wheat flour shipped by rail, 2021, in tons
Source: STB waybill data

	Wheat Flour shipped by rail, 2021, in tons
ILLINOIS	21,210
KANSAS	12,098
MINNESOTA	9,640
MISSOURI	7,475
NEBRASKA	958

Projections for a significant increase in renewable diesel production in the United States in coming years[54] present a particularly thorny concern for the agricultural industry if DAPL oil flows shift to the rail system and freight congestion once again occurs. It is reasonable to expect that the already short supply of tanker cars may become more constrained if oil flows shift to the rail system. *Biodiesel Magazine* maintains a list of all the operational, under-construction, and proposed biodiesel plants in the U.S. at https://biodieselmagazine.com/plants/listplants/USA/construction/.

If all the plants listed there reach their capacity, nationwide production will reach 7.5 billion gallons per year,[55] drastically altering the freight competition for soybean oil and other edible oils to move in nontraditional routes toward these renewable diesel plants and, of course, for the finished diesel to move by rail from these plants. Not only will these movements create congestion on the railways, but they will also create additional competition for (and increase costs) for the already-scarce supply of DOT-approved tanker cars.

53 Soybean Meal Info Center https://www.soymeal.org/processors/.
54 https://farmdocdaily.illinois.edu/2023/02/overview-of-the-production-capacity-of-u-s-biodiesel-plants.html.
55 https://www.dtnpf.com/agriculture/web/ag/news/article/2023/04/19/looming-renewable-diesel-revolution.

Conclusions

In the event of a shift in DAPL oil flows to Midwest rail systems, overall losses to the agriculture industry would accumulate to more than $3 billion. This shift would cause rail freight congestion like that seen in 2013-2014, but would have a greater impact as a result of the higher volumes of commodity shipment anticipated in 2023. Certain states would be most affected by this congestion, namely the Upper Midwest states that are heavily reliant on rail for shipping grain long distances (and which share DAPL's route for oil moving from North Dakota to Illinois), but also the states in the heart of the Corn Belt where large volumes of ag processing take place.

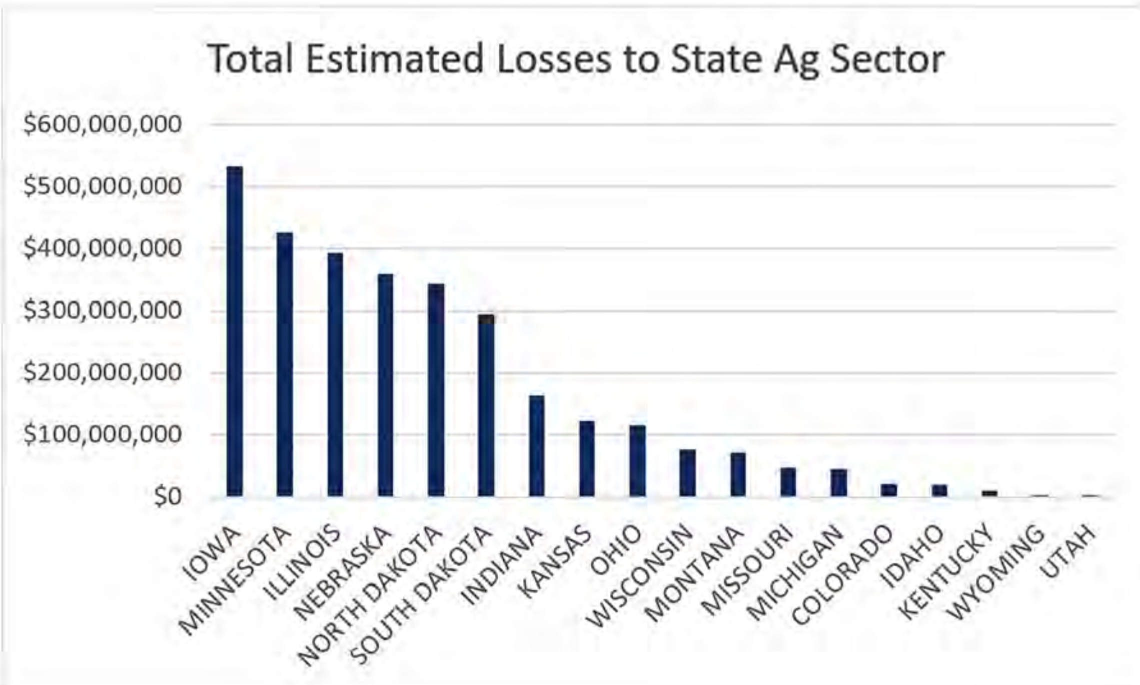


Figure 11: Total estimated statewide ag industry losses due to freight congestion, annual

Freight costs passed back to farmers at the same scale seen in 2014 ($0.42 per bushel of corn or sorghum shipped by rail, $0.27 per bushel of soybeans, $0.46 per bushel of wheat or barley), may lead to **$1.51 billion in annual losses out of farmers' pockets.**

Increased freight costs and a loss of 9% of 2023 ethanol production may lead to **$1.48 billion in annual losses to the ethanol industry.**

Higher freight costs to ship ag inputs by rail may cost ag retailers and farmers **$45 million more to receive their necessary fertilizers and chemicals by rail.**

Table 19: Summary of projected state-by-state losses to the agriculture industry in congested freight environment, annual

	Projected Grain Producers Losses	Projected Ethanol Industry Losses	Projected Ag Inputs	TOTAL ESTIMATED LOSSES TO STATE AG SECTOR
COLORADO	$8,222,500	$9,569,976	$2,830,646	**$20,623,122**
IDAHO	$13,052,097	$4,035,502	$1,018,082	**$18,105,681**
ILLINOIS	$182,545,219	$195,795,741	$13,466,518	**$391,807,478**
INDIANA	$71,192,937	$90,655,332	$1,183,104	**$163,031,372**
IOWA	$95,868,366	$432,923,656	$3,509,220	**$532,301,243**
KANSAS	$72,237,753	$48,687,970	$611,338	**$121,537,062**
KENTUCKY	$5,912,962	$3,564,693	$226,122	**$9,703,776**
MICHIGAN	$19,035,964	$26,029,021	$103,896	**$45,168,881**
MINNESOTA	$280,863,825	$137,801,210	$6,640,634	**$425,305,669**
MISSOURI	$22,012,868	$22,438,387	$1,938,248	**$46,389,503**
MONTANA	$70,358,571	-	$611,390	**$70,969,961**
NEBRASKA	$123,923,976	$230,752,278	$3,718,052	**$358,394,306**
NORTH DAKOTA	$285,596,546	$53,525,067	$4,377,724	**$343,499,337**
OHIO	$67,046,109	$48,648,153	$313,040	**$116,007,302**
SOUTH DAKOTA	$160,744,874	$130,738,444	$2,372,058	**$293,855,376**
UTAH	$1,011,540	-	$295,464	**$1,307,004**
WISCONSIN	$29,188,415	$46,698,728	$93,470	**$75,980,613**
WYOMING	$1,612,070	-	$2,140,268	**$3,752,338**
	$1,510,426,592	**$1,481,864,158**	**$45,449,274**	**$3,037,740,024**

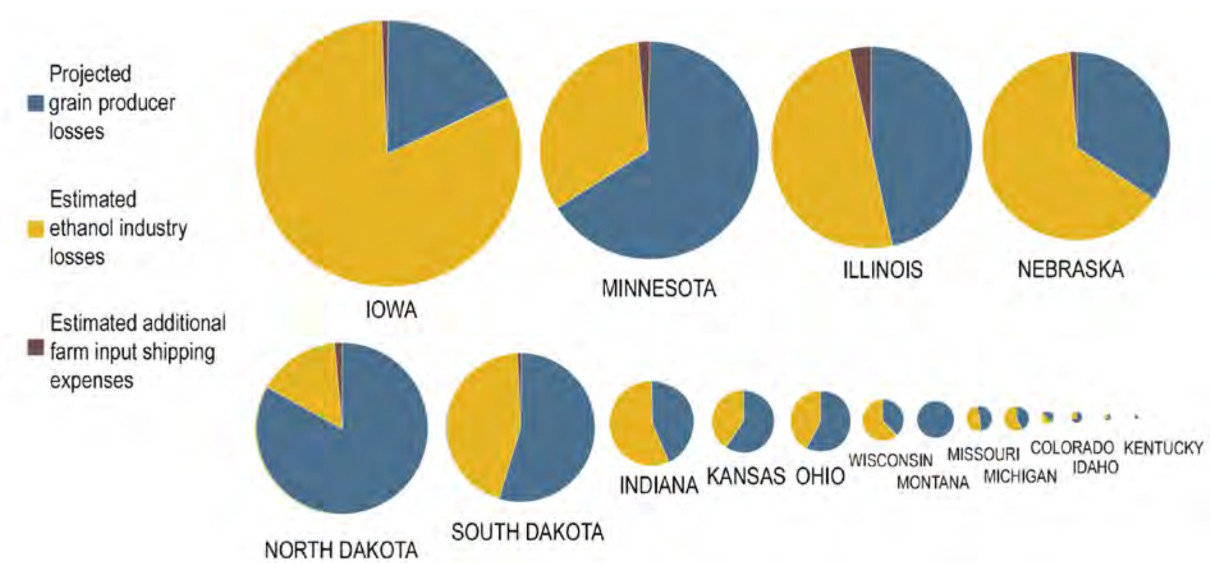


Figure 12: Sources and scale of projected annual state-by-state agriculture industry losses in a freight congested environment

For More Information

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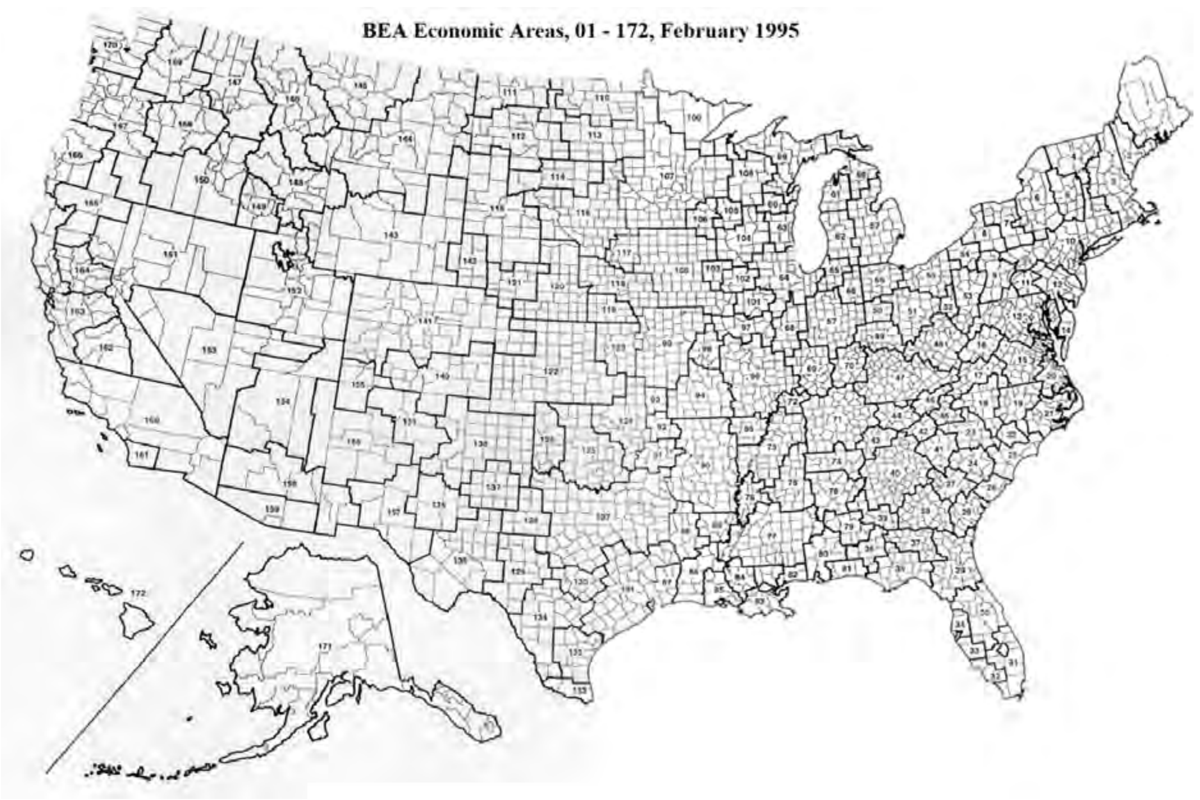
Appendix A: Business Economic Areas by State

For the purposes of state-by-state analysis of the volumes of agricultural commodities shipped by rail, the following BEA codes, as defined by the U.S. Bureau of Economic Analysis, were determined to represent each state.



Idaho	147, 149, 150
Montana	144, 145, 146, 148
Wyoming	143
Utah	152
Colorado	140, 141
North Dakota	110, 111, 112, 113
South Dakota	114, 115, 116
Nebraska	118, 119, 120, 121, 142
Kansas	122, 123
Minnesota	106, 107, 109
Iowa	100, 103, 117
Missouri	93, 94, 98, 99
Wisconsin	60, 63, 104, 105, 108
Illinois	64, 68, 96, 97, 101, 102
Michigan	57, 58, 59, 61, 62
Indiana	65, 66, 67, 69, 70
Ohio	49, 50, 51, 52, 55, 56
Kentucky	47

See https://www.bts.gov/archive/publications/federal_register/1995/bts_19950310 for a full list of BEA Economic Areas.

Appendix B:
Full List of U.S. Ethanol Plants by State

Original data tracked by the U.S. Energy Information Administration at https://www.eia.gov/petroleum/ethanolcapacity/index.php
State sums and conversions to tons made by Elaine Kub's analysis

U.S. Fuel Ethanol Plant Production Capacity as of January 1, 2022

STATE	RESPONDENT	CITY	MMGAL/YR	MB/D	STATE SUM (MMGAL/YR)	STATE SUM (TONS PER YEAR)
NEW YORK	Western New York Energy LLC	Medina	62	4	**62**	**204,201**
NORTH CAROLINA	Tyton NC Biofuels LLC	Raeford	57	4	**57**	**187,734**
PENNSYLVANIA	Pennsylvania Grain Prcsg LLC	Clearfield	128	8	**128**	**421,577**
ILLINOIS	Adkins Energy LLC	Lena	60	4	**1,743**	**5,740,695**
	ADM	Decatur	375	24	-	-
	Alto ICP LLC	Pekin	82	5	-	-
	Alto Pekin LLC Wet Mill	Pekin	100	7	-	-
	Alto Pekin LLC Dry Mill	Pekin	53	3	-	-
	Big River Resources Galva LLC	Galva	100	7	-	-
	Biourja Renewables LLC	Peoria	61	4	-	-
	Green Plains Madison LLC	Madison	88	6	-	-
	Illinois River Energy LLC	Rochelle	138	9	-	-
	Lincolnland Agri-Energy LLC	Palestine	66	4	-	-
	Marquis Energy LLC	Hennepin	340	22	-	-
	One Earth Energy LLC	Gibson City	150	10	-	-
	Patriot Renewable Fuels LLC	Annawan	130	8	-	-
INDIANA	Cardinal Ethanol LLC	Union City	133	9	**1,315**	**4,331,046**
	Central Indiana Ethanol LLC	Marion	50	3	-	-
	Grain Processing Corp	Washington	37	2	-	-
	Green Plains Mount Vernon LLC	Mount Vernon	88	6	-	-
	Iroquois Bio-Energy Co LLC	Rensselaer	60	4	-	-
	Poet Biorefining - Alexandria LLC	Alexandria	90	6	-	-
	Poet Biorefining - North Manchester LLC	North Manchester	90	6	-	-
	Poet Biorefining - Portland LLC	Portland	90	6	-	-
	Poet Biorefining - Shelbyville LLC	Shelbyville	94	6	-	-
	South Bend Ethanol LLC	South Bend	100	7	-	-
	The Andersons Marathon Holdings LLC	Logansport	130	8	-	-
	Valero Renewable Fuels LLC	Bluffton	118	8	-	-
	Valero Renewable Fuels LLC	Linden	135	9	-	-
	Valero Renewable Fuels LLC	Mt Vernon	100	7	-	-
IOWA	Absolute Energy LLC	St Ansgar	125	8	**4,694**	**15,460,024**
	ADM Dry Mill	Cedar Rapids	300	20	-	-
	ADM Wet Mill	Cedar Rapids	240	16	-	-
	ADM	Clinton	237	15	-	-
	Big River Resources LLC	West Burlington	92	6	-	-
	Big River United Energy LLC	Dyersville	100	7	-	-
	Cargill Inc	Eddyville	71	5	-	-
	Cargill Inc	Ft Dodge	130	8	-	-
	Corn Lp	Goldfield	75	5	-	-
	Elite Octane LLC	Atlantic	150	10	-	-
	Golden Grain Energy LLC	Mason City	120	8	-	-
	Grain Processing Corp	Muscatine	83	5	-	-
	Green Plains Inc	Shenandoah	80	5	-	-
	Green Plains Superior LLC	Superior	50	3	-	-
	Homeland Energy Solutions LLC	Lawler	196	13	-	-
	Lincolnway Energy LLC	Nevada	90	6	-	-
	Little Sioux Corn Processors LLP	Marcus	165	11	-	-
	Louis Dreyfus Co	Grand Junction	122	8	-	-
	Pine Lake Corn Processors	Steamboat Rock	73	5	-	-
	Plymouth Energy LLC	Merrill	55	4	-	-
	Poet Biorefining - Arthur LLC	Arthur	132	9	-	-
	Poet Biorefining - Ashton LLC	Ashton	68	4	-	-
	Poet Biorefining - Coon Rapids LLC	Coon Rapids	65	4		-
	Poet Biorefining - Corning LLC	Corning	90	6		-
	Poet Biorefining - Emmetsburg LLC	Emmetsburg	68	4		-
	Poet Biorefining - Fairbank LLC	Fairbank	132	9		-
	Poet Biorefining - Gowrie LLC	Gowrie	90	6		-
	Poet Biorefining - Hanlontown LLC	Hanlontown	80	5		-
	Poet Biorefining - Iowa Falls LLC	Iowa Falls	112	7		-
	Poet Biorefining - Jewell LLC	Jewell	90	6		-
	Poet Biorefining - Menlo LLC	Menlo	132	9		-
	Poet Biorefining - Shell Rock LLC	Shell Rock	128	8		-
	Quad Cnty Corn Processors Coop	Galva	38	2		-
	Siouxland Energy & Livestock Co-Op	Sioux Center	65	4		-
	Southwest Iowa Renewable	Council Bluffs	130	8		-
	The Andersons Marathon Holdings LLC	Denison	55	4		-
	Valero Renewable Fuels LLC	Albert City	135	9		-
	Valero Renewable Fuels LLC	Charles City	140	9		-
	Valero Renewable Fuels LLC	Fort Dodge	140	9		-
	Valero Renewable Fuels LLC	Hartley	140	9		-
	Valero Renewables Fuels LLC	Lakota	110	7		-
KANSAS	Arkalon Ethanol LLC	Liberal	110	7	**601**	**1,979,436**
	Bonanza Bioenergy LLC	Garden City	55	4		-
	East Kansas Agri-Energy LLC	Garnett	48	3		-
	Element LLC	Colwich	70	5		-
	Kansas Ethanol LLC	Lyons	80	5		-
	Mgp Ingredients Inc	Atchison	6	(s)		-
	Nesika Energy LLC	Scandia	10	1		-
	Prairie Horizon Agri Enrgy LLC	Phillipsburg	40	3		-
	Pratt Energy LLC	Pratt	55	4		-
	Purefield Ingredients LLC	Russell	55	4		-
	Reeve Agri Energy Inc	Garden City	20	1		-
	Western Plains Energy LLC	Oakley	52	3		-
KENTUCKY	Commonwealth Agri-Energy LLC	Hopkinsville	48	3	**53**	**174,559**
	Parallel Products Inc	Louisville	5	(s)		-
MICHIGAN	Carbon Green Bioenergy LLC	Lake Odessa	57	4	**387**	**1,274,612**
	Marysville Ethanol LLC	Marysville	60	4		-
	Poet Biorefining - Caro LLC	Caro	80	5		-
	The Andersons Marathon Holdings LLC	Albion	135	9		-
	Valero Renewable Fuels LLC	Riga	55	4		-
MINNESOTA	ADM	Marshall	48	3	**1,424**	**4,690,046**
	Agri-Energy LLC	Luverne	24	2		-
	Al-Corn Clean Fuel	Claremont	130	8		-
	Bushmills Ethanol Inc	Atwater	90	6		-
	Chippewa Valley Ethanol Co LLP	Benson	50	3		-
	Denco II LLC	Morris	30	2		-
	Granite Falls Energy LLC	Granite Falls	63	4		-
	Greenfield Global Corn Plus LLC	Winnebago	43	3		-
	Green Plains Fairmont LLC	Fairmont	110	7		-
	Green Plains Otter Tail LLC	Fergus Falls	60	4		-
	Guardian Energy LLC	Janesville	150	10		-
	Heartland Corn Products	Winthrop	140	9		-
	Heron Lake Bioenergy LLC	Heron Lake	68	4		-
	Highwater Ethanol LLC	Lamberton	72	5		-
	Poet Biorefining - Bingham Lake LLC	Bingham Lake	35	2		-
	Poet Biorefining - Glenville LLC	Glenville	48	3		-
	Poet Biorefining - Lake Crystal LLC	Lake Crystal	68	4		-
	Poet Biorefining - Preston LLC	Preston	55	4		-
	Valero Renewable Fuels LLC	Welcome	140	9		-
MISSOURI	Golden Triangle Energy LLC	Craig	21	1	**331**	**1,090,172**
	Icm Biofuels LLC	Saint Joseph	50	3		-
	Mid-Missouri Energy LLC	Malta Bend	60	4		-
	Poet Biorefining - Laddonia LLC	Laddonia	80	5		-
	Poet Biorefining - Macon LLC	Macon	55	4		-
	Show Me Ethanol	Carrollton	65	4		-

STATE	RESPONDENT	CITY	MMGAL/ YR	MB/D	STATE SUM (MMGAL/YR)	STATE SUM (TONS PER YEAR)
NEBRASKA	ADM Dry Mill	Columbus	313	20	**2,244**	**7,390,774**
	ADM Wet Mill	Columbus	100	7	-	-
	Alten LLC	Mead	25	2	-	-
	Aurora West LLC	Aurora	110	7	-	-
	Bridgeport Ethanol LLC	Bridgeport	54	4	-	-
	Cargill Inc	Blair	210	14	-	-
	Chief Ethanol Fuels Inc	Hastings	70	5	-	-
	Chief Ethanol Fuels Inc	Lexington	52	3	-	-
	E Energy Adams LLC	Adams	101	7	-	-
	Elkhorn Valley Ethanol	Norfolk	52	3	-	-
	Green Plains Atkinson	Atkinson	47	3	-	-
	Green Plains Central City LLC	Central City	100	7	-	-
	GreenAmerica Biofuels Ord LLC	Ord	57	4	-	-
	Green Plains Wood River LLC	Wood River	110	7	-	-
	Husker Ag LLC	Plainview	90	6	-	-
	Kaapa Ethanol LLC	Minden	87	6	-	-
	Kaapa Ethanol Ravenna LLC	Ravenna	125	8	-	-
	Mid America Agri Products LLC	Madrid	50	3	-	-
	Midwest Renewable Energy LLC	Sutherland	28	2	-	-
	Nebraska Corn Processing LLC	Cambridge	50	3	-	-
	Poet Biorefining - Fairmont LLC	Fairmont	128	8	-	-
	Siouxland Ethanol LLC	Jackson	95	6	-	-
	Trenton Agri Products LLC	Trenton	55	4	-	-
	Valero Renewable Fuels	Albion	135	9	-	-
NORTH DAKOTA	Blue Flint Ethanol LLC	Underwood	73	5	**547**	**1,801,584**
	Dakota Spirit Agenergy	Spiritwood	77	5	-	-
	Hankinson Renewable Energy LLC	Hankinson	150	10	-	-
	Red River Biorefinery LLC	Grand Forks	17	1	-	-
	Red Trail Energy LLC	Red Trail	65	4	-	-
	Tharaldson Ethanol	Casselton	165	11	-	-
OHIO	CE Acquisitions Co LLC	Coshocton	50	3	**722**	**2,377,959**
	Guardian Lima LLC	Lima	73	5	-	-
	Poet Biorefining - Fostoria LLC	Fostoria	90	6	-	-
	Poet Biorefining - Leipsic LLC	Leipsic	90	6	-	-
	Poet Biorefining - Marion LLC	Marion	154	10	-	-
	The Andersons Marathon Holdings LLC	Greenville	130	8	-	-
	Valero Renewable Fuels LLC	Bloomingburg	135	9	-	-
SOUTH DAKOTA	Dakota Ethanol LLC	Wentworth	92	6	**1,444**	**4,755,917**
	Glacial Lakes Energy LLC	Watertown	148	10	-	-
	Glacial Lakes Energy LLC	Mina	162	11	-	-
	Hub City Energy LLC	Aberdeen	61	4	-	-
	Huron Energy LLC	Huron	38	2	-	-
	Nugen Energy LLC	Marion	150	10	-	-
	Poet Biorefining - Big Stone LLC	Big Stone City	105	7	-	-
	Poet Biorefining - Chancellor LLC	Chancellor	125	8	-	-
	Poet Biorefining - Groton LLC	Groton	68	4	-	-
	Poet Biorefining - Hudson LLC	Hudson	80	5	-	-
	Poet Biorefining - Mitchell LLC	Mitchell	86	6	-	-
	Poet Research Center	Scotland	12	1	-	-
	Red River Energy LLC	Rosholt	32	2	-	-
	Redfield Energy LLC	Redfield	65	4	-	-
	Ringneck Energy & Feed LLC	Onida	80	5	-	-
	Valero Renewable Fuels	Aurora	140	9	-	-
TENNESSEE	Dynamic Recycling LLC	Bristol	1	(s)	**236**	**777,283**
	Green Plains Obion LLC	Obion	125	8	-	-
	Tate & Lyle	Loudon	110	7	-	-
WISCONSIN	Ace Ethanol LLC	Stanley	52	3	**587**	**193,304**
	Badger State Ethanol LLC	Monroe	85	6	-	-
	Big River Resources Boyceville LLC	Boyceville	55	4	-	-
	Didion Ethanol LLC	Johnson Creek	50	3	-	-
	Fox River Valley Ethanol LLC	Oshkosh	64	4	-	-
	Marquis Energy-Wisconsin LLC	Necedah	50	3	-	-
	United Ethanol LLC	Milton	61	4	-	-
	United Wisconsin Grain Producers LLC	Friesland	60	4	-	-
	Valero Renewable Fuels LLC	Jefferson	110	7	-	-

STATE	RESPONDENT	CITY	MMGAL/ YR	MB/D	STATE SUM (MMGAL/YR)	STATE SUM (TONS PER YEAR)
TEXAS	Hereford Ethanol Partners LP	Hereford	120	8	**380**	**1,251,557**
	Plainview Bioenergy LLC	Plainview	130	8	-	-
	White Energy Hereford LLC	Hereford	130	8	-	-
COLORADO	Front Range Energy LLC	Windsor	40	3	**140**	**461,100**
	Sterling Ethanol LLC	Sterling	50	3	-	-
	Yuma Ethanol LLC	Yuma	50	3	-	-
IDAHO	Alto Magic Valley LLC	Burley	60	4	**60**	**197,614**
CALIFORNIA	Aemetis Advanced Fuels Keyes Inc	Keyes	70	5	**188**	**619,191**
	Calgren Renewable Fuels LLC	Pixley	55	4	-	-
	Parallel Products	Rancho Cucamonga	3	(s)	-	-
	Pelican Renewables LLC	Stockton	60	4	-	-
OREGON	Alto Columbia LLC	Boardman	40	3	**40**	**131,743**
U.S. TOTAL			**17,380**	**1,134**	**17,380**	**57,242,271**

(S)=Less than 0.5 Mmgal/yr or mb/d

Note: Totals may not equal sum of components due to independent rounding

ATTACHMENT O

Declaration of Ronald J. Henke

Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement	

DECLARATION OF Ron Henke IN SUPPORT OF THE STATE OF NORTH DAKOTA'S COMMENTS TO THE SEPTEMBER 2023 DRAFT DAPL ENVIRONMENTAL IMPACT STATEMENT

I, Ronald J. Henke, Director of the North Dakota Department of Transportation, state and declare as follows:

1. My name is Ronald J. Henke. I am over 21 years of age and am fully competent and duly authorized to make this Declaration. The facts contained in this Declaration are based on my personal and professional knowledge and are true and correct.

2. I am Ronald J. Henke, Director for the North Dakota Department of Transportation.

3. In review of the Draft Environmental Impact Statement (DEIS), I believe t the document does not fully account for the impact the closure of the Dakota Access Pipeline (DAPL) will have on the state highway system in North Dakota.

4. The North Dakota Department of Transportation (NDDOT) designs each roadway for a specific design life. NDDOT does this by looking at the current traffic volumes, projecting the increase in traffic, and calculating the Equivalent Single Axle Load (ESAL) over the design life for that stretch of roadway. ESALs is a concept used in pavement engineering to quantify the varying destructive potential of different axle loads on a road or pavement structure. It serves as a standardized measure to estimate the cumulative damage caused by various vehicle loads, allowing engineers to assess the overall impact on the pavement's durability and design.

5. ESAL is particularly important in predicting pavement performance over time and is commonly employed in the design and analysis of roads. By converting different axle loads into an equivalent single axle load, engineers can simplify the assessment of pavement life and durability.

6. An increase in the number of trucks, particularly those with heavier axle loads, can significantly impact ESAL calculations and, consequently, the overall deterioration and cumulative damage of pavement structures. Each additional truck contributes to a higher ESAL value, which reflects a greater load-induced stress on the pavement, potentially accelerating the wear and tear of the road surface.

7. Section 2.4.1. of the Dakota Access Pipeline Lake Oahe Crossing Project Draft Environmental Impact Statement (DEIS) estimates 5,000 loaded trucks would be needed to transport the 1,100,000 barrels per day (bpd) of crude oil the pipeline would no longer carry. To estimate the impact of the additional 5,000 loaded trucks, NDDOT assumed the crude oil would be transported to one of the nine transload facilities located in western North Dakota. This was assumed because NDDOT believes the costs to haul the crude oil to one of the transload facilities rather than refineries in the Midwest and Gulf Coast would be more financially beneficial to minimize the number of miles that the crude oil would need to be

hauled by trucks. This also aligns with how the industry similarly reacted before the Dakota Access Pipeline was operational, which was to haul to the transload facilities in western North Dakota to access the rail network for long-distance shipment.

8. As stated by the ND Pipeline Authority, each of the 5,000 trucks can haul 220 barrels of crude oil per trip. Given the typical axle configuration used in western North Dakota and the approximate weight of the loads, each truck load calculates out to be approximately 2.4 ESALs. These additional ESALs from the truck loads of crude oil were not anticipated during the design of the state roadway network and would consume the amount of design ESALs faster than what was anticipated on each segment of roadway where a transload facility exists.

9. This would result in an annual state highway system value loss or increased depreciation of approximately $46 million per year from the reduced service life of the roads due to the increase in ESALs. The $46 million per year is a conservative number for the system value loss as it only considers the major state highways that lead to the transload facilities and does not quantify the impact over the entire travel route. For example, the losses to local roadways near the well heads and the full state system routes between the local roads and the transload facilities were not considered in this calculation.

10. Additionally, to ensure a conservative (i.e., low-end) analysis, only the loaded trucks were considered; the empty trucks returning to the well heads would also have an impact on the roadway life, to a lesser (but not insignificant) degree. See the attached map for the major state highways that would be impacted and the location of the nine transload facilities. Also not considered in this analysis were the increased delays and other service impacts to the traveling public as state and local roadways would be under construction with a more frequent rehabilitation schedule.

11. As it relates to safety on the highways with the increase in truck volumes, Section 2.4.1 of the DEIS states:

    "Between 2012 and 2019, the number of fatalities has dropped by 41 percent (NDDOT, 2019); however, increased truck traffic on public roads under a trucking alternative transportation method would likely decrease road safety. When comparing transportation methods of hazardous liquids, truck transportation accounts for more than five times the fatalities per year as pipeline and rail transportation (Furchtgott-Roth and Green, 2013). Coupled with harsh winter weather affecting travel conditions, the potential impact on safety is much greater with this alternative."

12. The NDDOT agrees with the general statement above as it is difficult to quantify how crashes would change due to the increase in truck traffic.

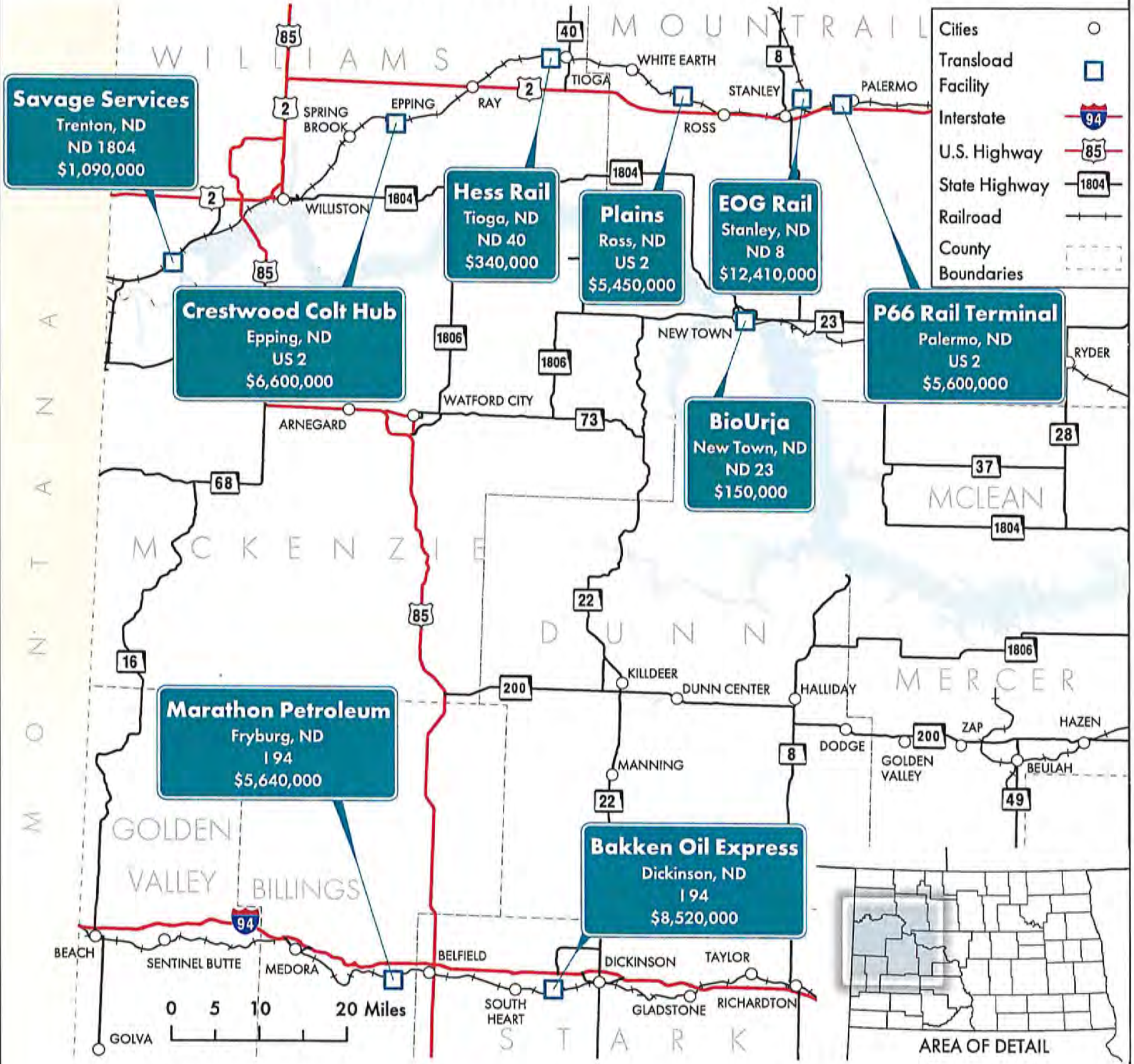
Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 8th, 2023.

Ronald J. Henke, PE, Director
North Dakota Department of Transportation

HIGHWAY SYSTEM LOSS

FROM POTENTIAL DAPL SHUTDOWN



NORTH Dakota | Transportation

Be Legendary.

EOG Rail	Facility Name
Stanley, ND	Facility Location
ND 8	Highway Impacted
$12,410,000	Annual Value Loss

PREPARED BY THE
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
PLANNING AND ASSET MANAGEMENT DIVISION

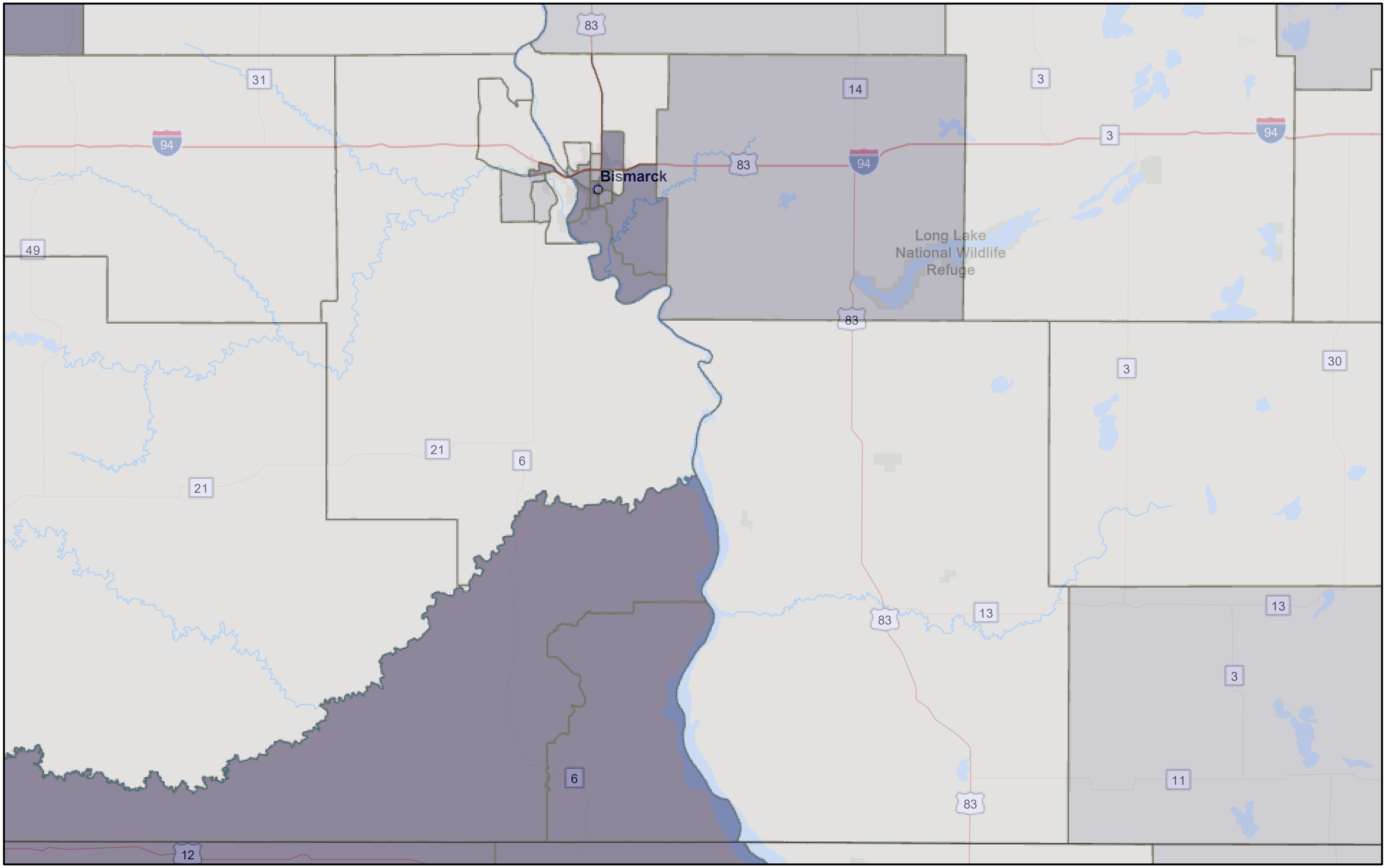
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

2023

ATTACHMENT P

EJ Screen Map

American Indian Population Below Poverty Level Bismarck Region



11/28/2023

American Indian Population Below Poverty Level

- 0 – 0
- > 0 – 7
- > 7 – 17
- > 17 – 43
- > 43 – 3,931

1:1,155,581

0 5 10 20 mi

0 10 20 40 km

EPA, State of North Dakota, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS