Levi, Andrew (COMM)

From: MacAlister, Jamie (COMM)
Sent: Tuesday, July 11, 2017 10:14 AM
To: MN_COMM_Pipeline Comments
Subject: FW: More comments
Attachments: Bob Merrit Appendix D.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Jamie MacAlister
Environmental Review Manager
Minnesota Department of Commerce
85 7th Place East, Suite 280, Saint Paul, MN 55101
P: 651-539-1775

From: Nicolette Slagle [mailto:nicolette.slagle@gmail.com]
Sent: Monday, July 10, 2017 11:43 PM
To: MacAlister, Jamie (COMM) <jamie.macalister@state.mn.us>
Subject: More comments

Hi Jamie,

Please see the rest of my comments.

Nicolette Slagle

Only after the Last Tree has been cut down,
Only after the Last River has been poisoned,
Only after the Last Fish has been caught,
Only then will you find that
Money Cannot Be Eaten.

Appendix A
Robert Merritt Sandpiper
Testimony

From: Bob Merritt [mailto:bob.merritt7160@gmail.com]
Sent: Monday, March 17, 2014 6:59 PM
To: Hartman, Larry (COMM)
Cc: Willis Mattison
Subject: Sandpiper Pipleline

Mr. Hartman:

Were you able to obtain a complete copy of my Park Rapids testimony and all of the supporting documents? I was a bit confused during the presentation. I am used to a different format and assumed the persons behind the table were PUC Commissioners. That is why I provided my copies to them. It would be helpful in the future to explain when no PUC Commissioners are in attendance. Little did know that I was speaking to the pipeline officials. No wonder they appeared uninterested in my testimony and did not look at the figures to which I referred.

If you did not receive a complete copy of my information including yellow highlighted sections of the reports I referenced, please advise me. I would also like to know if you do have a complete copy.

I have updated my map to identify most of the irrigated parcels and highlighted locations of Park Rapids and Lamb Weston wells. I also increased its resolution; it is attached. All of Park Rapids and Lamb Weston wells are down gradient of any spill within the watershed. Spills will mobilize rapidly because of the vast number of high capacity irrigation wells between Park Rapids and the proposed pipeline.

During your opening remarks you identified a number of items that are used to determine suitability of an alignment. If I recall correctly, two of them were natural resources and proximity to towns. The proposed Sandpiper Pipeline has the potential of significant impacts to both. A spill like Embridge's in Bemidji will have greater consequences. It could greatly impact or even destroy a premium trout stream (Straight River) and it could reach the public water supplies of Park Rapids. Additionally, the high capacity irrigation could greatly exacerbate the situation, mobilizing the spill flow speed and area of influence. The attached map also identifies a major number of other wells near or down gradient of the proposed alignment. These are mostly in the surficial aquifer and are individual or small corporate supplies. A spill in these soils could have dire consequences to those individuals.

Alternative routes should be identified that do not contain such highly sensitive geologic conditions. Soils should be primarily till based which contain a substantial amount of clay; clay soils will slow and absorb a spill before disastrous affects will occur. The Pineland Sands Aquifer system clearly does not meet these criteria.

Please include this email and attached map to the Sandpiper docket information. If I have to take other actions to ensure that can transpire, please advise me.

Bob Merritt, P. G.
My address is 1241 Minnesota Avenue My
phone number is 218 850 7160

Sandpiper Pipeline Hearing
Park Rapids, MN
March 12, 2014

Testimony by Bob Merritt
B.S. and B.A. Geology
M.S. Hydrology
Minnesota Licensed Professional Geologist
MN DNR Area Hydrologist 32+ years`
Work Area Included Pineland Sands/Straight River Basin Outwash Aquifer in Becker and Hubbard Counties

First, I want to identify a problem I encountered while trying to review this project. I requested a GIS (Geographic Information Systems) layer of the pipeline alignment from the PUC. The PUC informed me that this information was Embridge work product which is exempt from the Freedom of Information Act. I assume the exemption was intended to protect public facilities from attack. Yet all existing pipelines are identified in paper and digital form on USGS topographic maps and Minnesota county maps. Additionally, with the GPS units available today, it is quite easy to map public utilities such as pipelines and processing plants. To withhold crucial information for my review hampered my analysis. I am still unsure of the exact proposed alignment and had to approximate it in one of my maps.

To me, it is ludicrous for a foreign company to invoke protection via exemption of the Freedom of Information Act under these circumstances; they are withholding crucial information for review with no real reason other than to hamper public review.

There have been 3 Major Studies of the glacial outwash plain comprising the Straight River basin and surrounding area:

- Helgsen, J.O., 1977. Ground water Appraisal of the Pineland Sands Area, Central Minnesota, USGS Water Resources Investigations Report.

- Stark, J.R., Armstrong, D.S, and Zwilling, D.R.. 1994, Stream – Aquifer Interactions in the Straight River Area, Becker and Hubbard Counties, Minnesota, USGS Water Resources Investigations Report 94-4009.

- Kruse, G and Frischman, J, 2002, Surface Water And Ground Water Interaction And Thermal Changes In The Straight River In North Central Minnesota, Minnesota Department of Natural Resources.

I was the main DNR person who identified the initial concerns leading to the Stark study, and I participated in both Stark's and the MN DNR investigations.

Helgsen and Stark described the geology of the area. Basically it is the intersection of at least 3 glacial lobes that ended in the area (Stark Figure 3). Glacial outwash is the result of glacial materials running off during glacial melting and retreat, forming sand and gravel fans interspaced with lake clay materials formed when lakes existed within

the area. The outcome is a series of 3 primary aquifers (Stark Figure 2). Stark's figure is generalized and does not entirely represent the aquifer configurations. The top aquifer is surficial and open to the atmosphere. The two lower aquifers are separated by clayey layers, but the layers thin and aquifers interfinger causing interchange between them. There is substantial evidence that the aquifers are hydraulically connected and water moves both upward and downward.

Because of their high degree of permeability, allowing rapid infiltration and movement, glacial outwash aquifers are some of the geologic environments most susceptible to contamination.

Helgesen estimated the aquifer groundwater hydraulic conductivities, a measure of ground water movement, between 320 and 630 ft/day. This is a rapid degree of ground water movement. Stark postulated that this area's groundwater movement is even greater than other similar aquifers within the state.

The area is covered with high capacity irrigation wells, which cause cones of depression, altering flow paths and moving substantial water towards the systems. (GIS 2010 Aerial Map).

Helgsen and Stark published potentiometric maps of the surficial aquifer (Helgsen Figure 7 and Stark Figure 15). I supplemented Helgsen's map and interpreted Stark's map to identify flow paths (red arrows). Water rapidly flows from the aquifer to the Straight River. The river gains at least ½ its flow from the aquifer. The hills to the north of the sand plain, the Itasca Lobe End Moraine, and the ground moraine provide about 25% of the aquifer's recharge. This is likely an even greater percentage closer to the Itasca End Moraine in the Park Rapids area. A pipeline leak in the Itasca End Moraine will end up flowing to Park Rapids. (Stark Figure 3)

Leaks within the aquifer will either end up in the Straight River or move towards the Park Rapids and the Potato Plant locations. High capacity pumping of these facilities along with irrigation wells near and down gradient of a spill or leakage has significant potential to incorporate petroleum products into the aquifer. Irrigation of the contaminated water will result in agriculture field contamination.

A leak along any portion of the pipeline from the Itasca Moraine north of the outwash sand plan through the entire plain has the potential to rapidly and permanently contaminate the aquifer. The surficial aquifer has the highest potential, but as noted earlier, all of the aquifers are interconnected. As a result, contamination of all the aquifers is a possibility. Once petroleum attaches to the sand and gravel grains, it is virtually impossible to remove the product. Each time rain, snowmelt or irrigation infiltrates through the aquifer, petroleum will be mobilized, causing ongoing contamination.

The surficial aquifer is used for irrigation and water supply. Surrounding wells already have high nitrates from the irrigation because of the high infiltration rates. Though

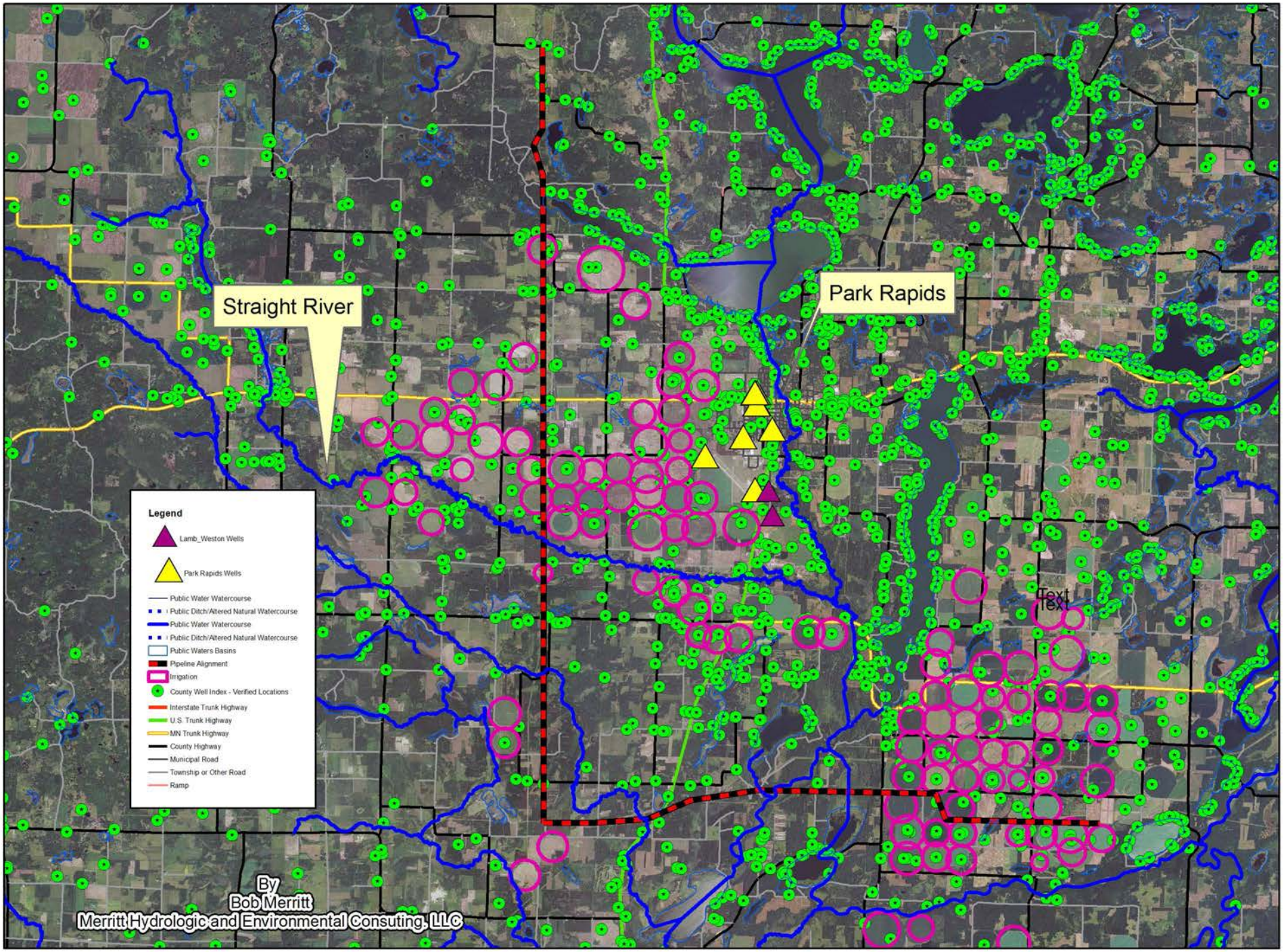
nitrate application through irrigation systems has been greatly improved by application only during the time plants require the nutrient, a Department of Agriculture study showed that approximately 60% of the nitrate is lost because of rapid infiltration. Once the nitrate passes through the root zone, it ends up in the surficial aquifer.

Because of nitrate contamination, Park Rapids will have to replace water supply wells. Osage had to in the past. Perham has had similar problems; it has the same geologic conditions. Petroleum will be even more damaging, causing loss of water supplies to individuals and communities down gradient of the leak. Straight River, the most important trout stream in Northwestern Minnesota, could also be severely affected due to petroleum contamination.

I urge you to reconsider this alignment and restrict pipelines within this highly sensitive geologic area. At the very least, I urge delay of your decision to allow further analysis with accurate data freely supplied by Embridge.

Sandpiper Pipeline Park Rapids Area
2010 Aerial Photo

2680



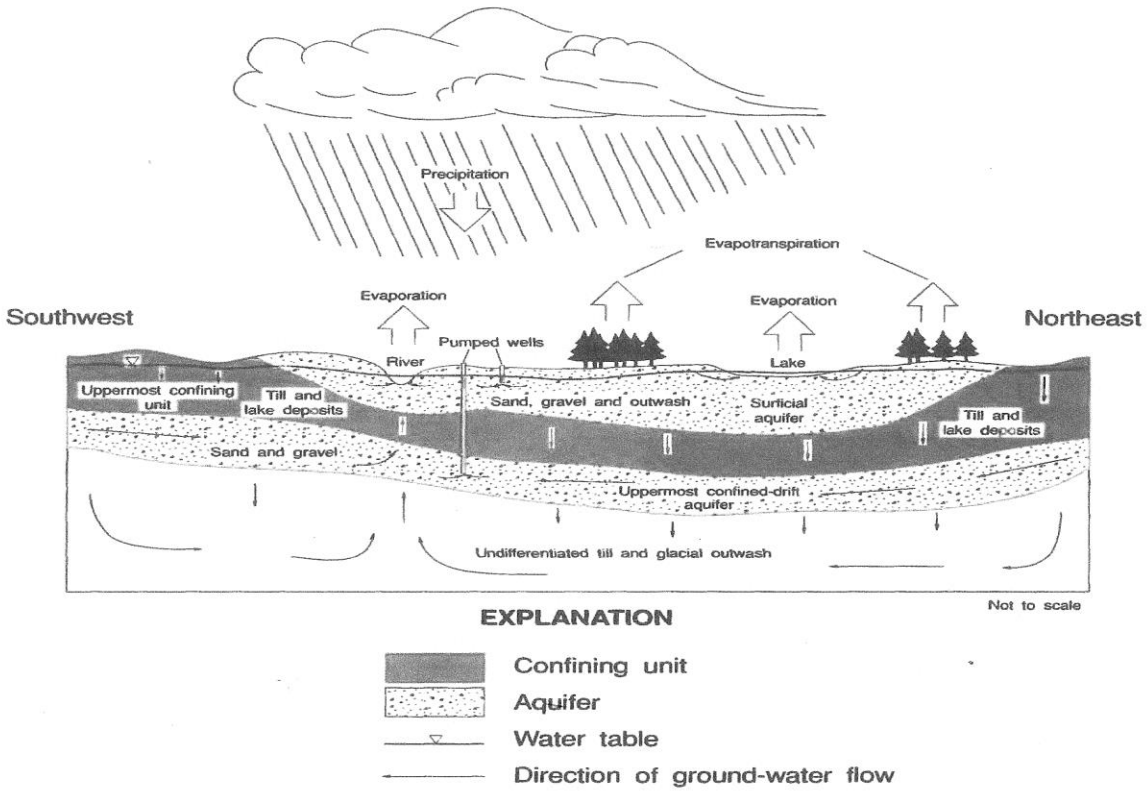


Figure 2.--Generalized hydrologic system of the Straight River investigation area.

From Stark 1994

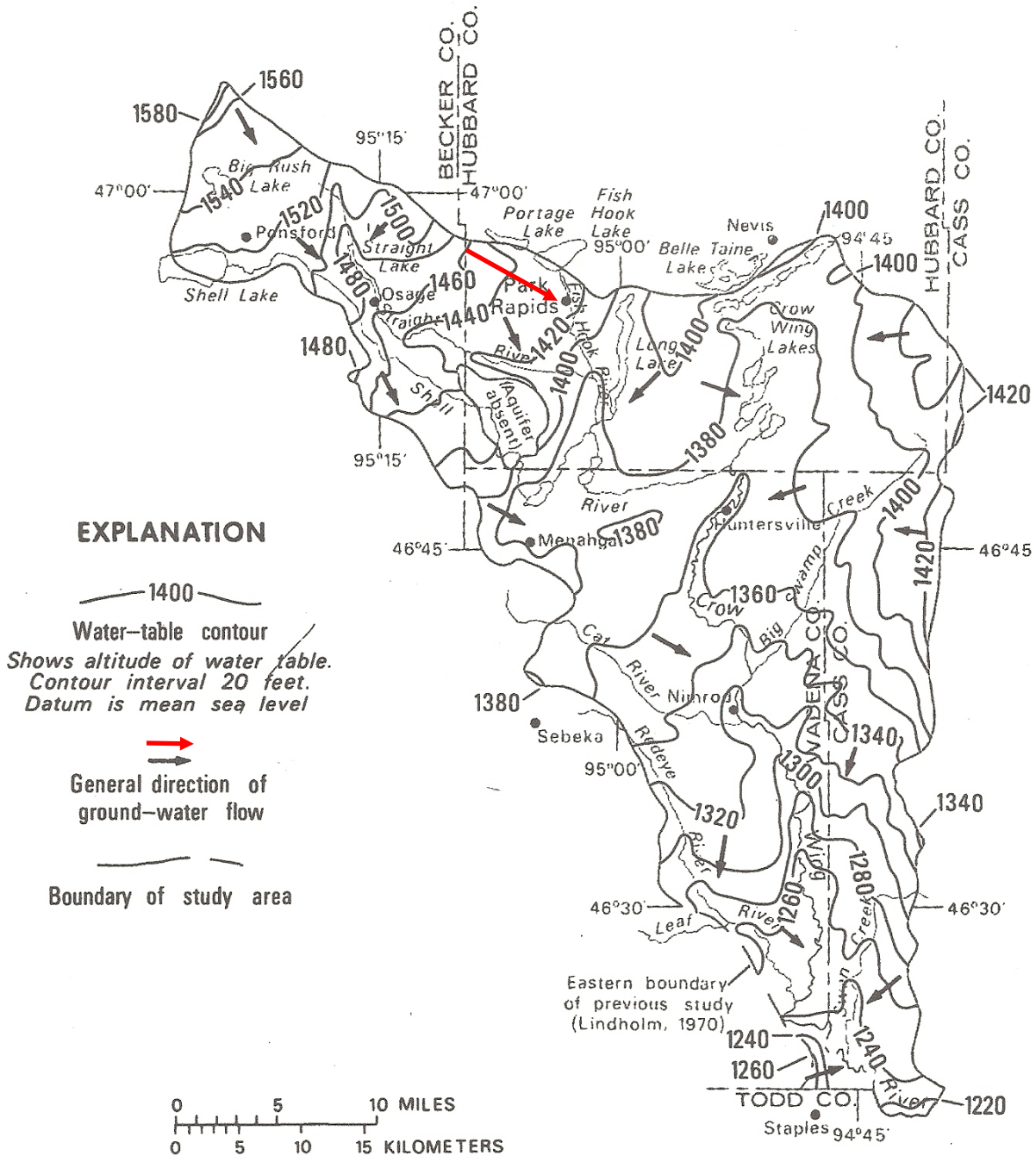
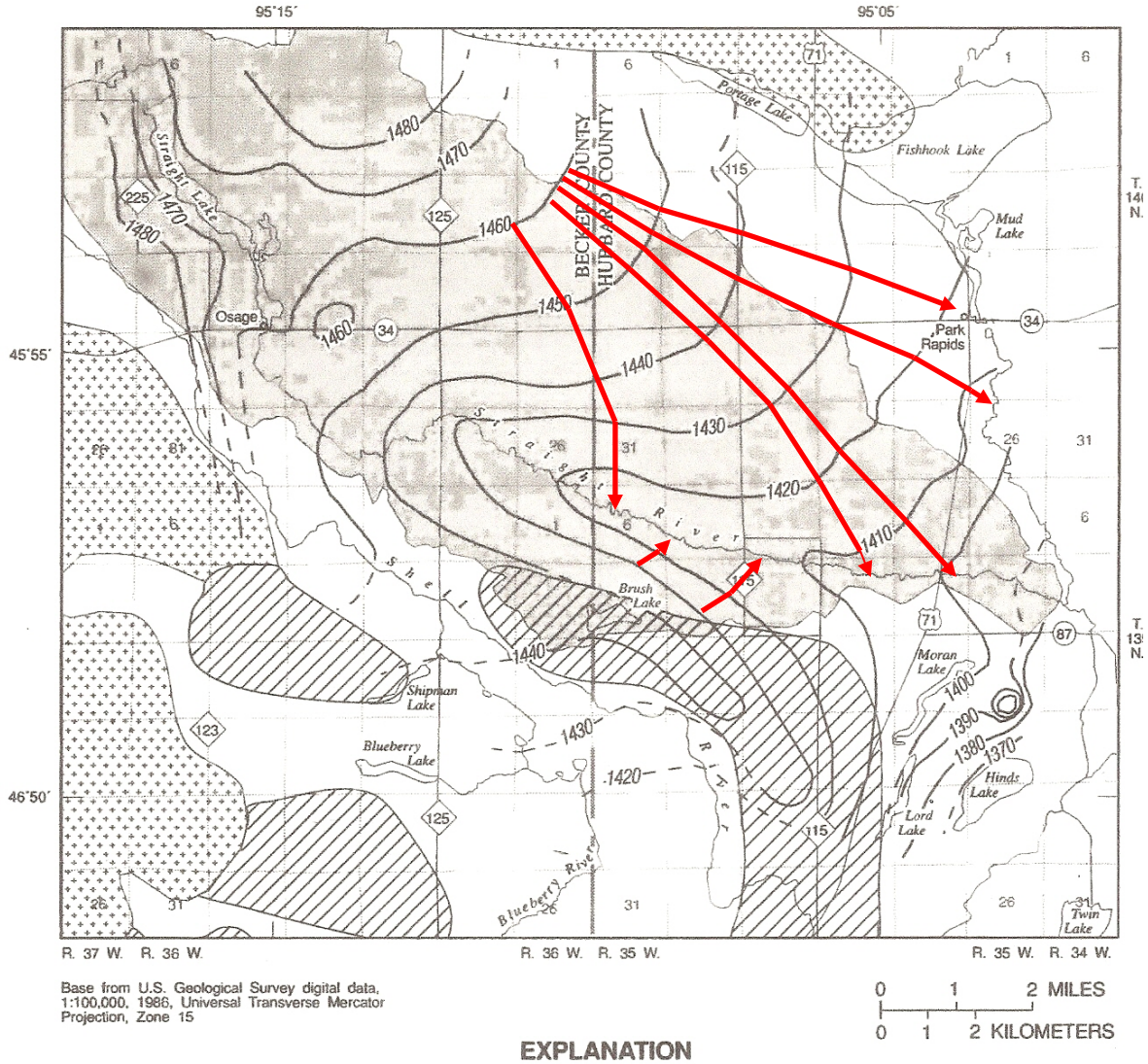


Figure 7.--Water-table configuration and general direction of ground-water movement.

From Helgsen 1977



EXPLANATION

Straight River Basin

Groundwater Flow Direction

Surficial geology:

Outwash plain

Glacial till (end moraine)

Glacial till (ground moraine)

—1440— Potentiometric contour--Shows altitude at which water level would have stood in tightly cased wells open to the surficial aquifer. Dashed where approximately located. Contour interval 10 feet. Datum is sea level.

Figure 15.--Altitude of potentiometric surface (water table) of surficial aquifer during August 1988.

From Stark 1994

Sandpiper Pipeline Hearing
Park Rapids, MN
March 12, 2014

Testimony by Bob Merritt
B.S. and B.A. Geology
M.S. Hydrology
Minnesota Licensed Professional Geologist
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I urge you to reconsider this alignment and restrict pipelines within this highly sensitive geologic area. At the very least, I urge delay of your decision to allow further analysis with accurate data freely supplied by Embridge.

Appendix B
DNR Sandpiper Letters

Minnesota Department of Natural Resources
500 Lafayette Road • St. Paul, MN • 55155-40_

August 21, 2014

Burl Haar, Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul MN 55101-2147

Re: Sandpiper Pipeline Project – System Alternatives
PUC Docket Numbers: PL-6668/CN-13-473 (Certificate of Need)
PL-6668/PPL-13-474 (Route Permit)

The Minnesota Department of Natural Resources (DNR) previously provided input regarding the Pipeline Routing Permit Application and scoping for the Comparative Environmental Assessment (CEA) for the Sandpiper Pipeline Project. During the comment periods ending April 4, 2014 and May 30, 2014, the DNR requested further analysis of a number of routes and route segments in the relative vicinity of the Preferred Route proposed by the North Dakota Pipeline Company. The DNR also attended the August 7, 2014 PUC Agenda Meeting regarding routing alternatives. We appreciate the Public Utilities Commission (PUC) determination that routes identified in DNR letters will be further analyzed in the CEA. The following comments are submitted regarding the topic of "system alternatives," generally defined as routes that do not share one or both of the Preferred Route Clearbrook, Minnesota and Superior, Wisconsin terminals.

Though the DNR review did not focus on system alternatives, our previous letter stated that the DNR "supports the efforts of state and federal resource agencies to encourage analysis of topics including various routes in the event of a leak, leak risk analysis, and reducing impacts to wetlands, lakes and streams." The Preferred Route for the Sandpiper Project is proposed in a region of the state that contains a concentration of important lakes for fisheries, trout streams, sensitive aquifers, pubic conservation lands, and mineral and forestry resources. The DNR is also concerned about "greenfield" routing along areas without previous disturbance.

Considering the current demand for transportation of oil from North Dakota and the Enbridge Line 3 project proposed to follow the Sandpiper Pipeline route, the Sandpiper route could become a new corridor for multiple pipelines. Therefore, the DNR encourages the PUC to strongly consider analysis of one or more system alternatives having fewer environmental and natural resource impacts than the Preferred Route in addition to route alternatives approved for inclusion in the CEA. Environmental review of one or more system alternatives should be equivalent to the analysis conducted for route alternatives. If a system alternative is included in the scope of an environmental review document, the DNR encourages interagency coordination so that the DNR can provide data regarding a new corridor prior to environmental review document publication.

Thank you for the opportunity to provide these additional comments regarding system alternatives.

Sincerely,

Jamie Schrenzel
Principal Planner
Environmental Review Unit
(651) 259-5115

cc: Larry Hartman, Minnesota Department of Commerce
Patrice Jensen, Minnesota Pollution Control Agency
Sara Ploetz, Enbridge

Minnesota Department of Natural Resources
500 Lafayette Road • St. Paul, MN • 55155-40_

January 23, 2015

The Honorable Eric Lipman
Administrative Law Judge
600 North Robert Street
P.O. Box 64620
St. Paul, MN 55164-0620

Re: Certificate of Need for the Sandpiper Pipeline Project
Public Utilities Commission (PUC) Docket Number: PL-6668/CN-13-473
Office of Administrative Hearings (OAH) Docket Number: 8-2500-31260

Dear Judge Lipman:

The Minnesota Department of Natural Resources (DNR) has reviewed the Sandpiper Pipeline Comparison of Environmental Effects of Reasonable Alternatives submitted by the Department of Commerce Energy Environmental Review and Analysis (EERA) unit in December 2014. The DNR has also reviewed the Rebuttal Testimony of Adam J. Heinen submitted by the Minnesota Department of Commerce Division of Energy Resources (DER) January 6, 2015 and the conclusions of the Surrebuttal Testimony submitted by Adam J. Heinen January 21, 2015. The following comments are submitted regarding these documents and DNR review of the possible natural resource impacts of System Alternatives for the Sandpiper Pipeline Project. A comment summary is given followed by additional supporting information.

Comment Summary

- The EERA prepared the Comparison of Environmental Effects of Reasonable Alternatives, covering a multi-state geographic area, addressing complicated questions with a limited amount of preparation time. The EERA also carefully followed the direction of the Public Utilities Commission (PUC) Order requesting the document. The DNR recognizes that the current comparison of System Alternatives is a somewhat unique situation and that the PUC requested analysis of environmental impacts through this Certificate of Need process to further inform the record. Further analysis of System Alternatives helped address DNR comments regarding System Alternatives. The DNR also met with EERA and submitted data sources to provide assistance with preparation. We appreciate the opportunity to provide data and input.

- In general, due to the limited scope requested for this document, the broad geographic area, and challenges related to the type of data and analysis used, DNR was not able to use this document alone to identify the least environmentally impacting System Alternatives. Examples will be provided below of the type of information that would further inform the Certificate of Need decision for context when considering the most reasonable and prudent System Alternative.

- Using the report in combination with DNR resources and professional judgment, with a limited amount of review time, the DNR is able to provide input regarding the least environmentally impacting System Alternatives.

- Within Minnesota, more southern routes (south of I-94 corridor) have less concentration of natural resources (regardless of length) within the 2-mile corridor. Therefore, there is a greater opportunity for avoidance of resources with the more southern System Alternatives. While the DNR lacks the expertise to undertake a market or economic analysis of the southern routes. From a natural resource perspective, the more southern routes appear to be feasible and prudent System Alternatives that merit consideration.

- MN Rules 7853.0130, Subpart B requires consideration of reasonable and prudent alternatives to proposed facilities as part of certificate of need decisions. Testimony of Adam J. Heinen submitted by the Minnesota Department of Commerce Division of Energy Resources (DER) January 6, 2015 and January 21, 2015 state that only System Alternative – 03 (SA-03) and System Alternative – Applicant (SA-Applicant) are reasonable based on the focus of the DER review. Note that Modified System Alternative – 03 is also discussed, but is understood to be addressed in the routing docket and will not be further discussed in this comment letter.

- The DNR conducted a focused review of SA-03 and SA-Applicant. When only comparing the two routes found reasonable by DER, SA-03 and SA-Applicant, SA-03 appears to impact less natural resources than SA-Applicant. SA-Applicant features that would incur impacts greater than those identified for SA-03 are: forest and wetland acreage, river and stream segment crossings, and crossings of public lands. Cultivated lands and occurrence of already-impaired waters are greater along SA-03, indicating the developed state of lands along this route. Our analysis is described further in the Supporting Information section of this letter.

- Minnesota Statutes 116D.04, Subdivision 6 prohibits state actions that are likely to cause pollution, impairment or destruction of natural resources as long as there is a feasible and prudent alternative. The statute also clarifies that economic considerations along shall not justify such an action. As SA-Applicant and SA-03 are both considered reasonable, environmental impacts of routing from a natural resource perspective would be a key criterion in the decision regarding the most reasonable and prudent System Alternative.

- Testimony submitted by Adam J. Heinen with the DER January 21, 2015 suggests analysis of SA-03 and SA-Applicant in the routing docket. The routing docket would include a level of environmental data helpful in comparing these two routes, along with Route Alternatives already scoped into the routing process such as Modified SA-03. For example, a Comparative Environmental Analysis (CEA) would likely include an estimated alignment within a larger route. If further analysis is completed, the DNR requests the opportunity to provide input and review a draft of the environmental analysis document.

- The DNR suggests that the Sandpiper Pipeline Project Certificate of Need and/or Routing dockets include consideration of financial assurance. The state requires financial assurance for large projects to mitigate impacts to the state and environment in the event of an accident, unplanned closure, or at the end of life of the project. Projects such as large mines and landfills must provide financial assurance to protect against the potential for expenditure of public funds. Large crude oil pipelines may arguably have some of the same environmental and financial risks and may benefit from some form of financial assurance for pipeline construction, operation and maintenance, spill response and decommissioning. The DNR can provide additional background regarding examples from regulation of mines in Minnesota.

Supporting Information

The following section provides these categories of supporting information:

- Additional Natural Resource Topics for Consideration
- Comparison of Environmental Effects of Reasonable Alternatives Section Specific Comments
- Full Length Comparison of SA-03 and SA-Applicant
- Minnesota-Specific Comparison of SA-03 and SA-Applicant

Additional Natural Resource Topics for Consideration

The DNR's review indicates that there are additional natural resource topics that have not yet been addressed but should be to provide a more thorough comparative analysis of System Alternatives. The discussion below provides input and context for the Certificate of Need in addition to the Comparison of Environmental Effects of Reasonable Alternatives record regarding natural resource impacts and System Alternatives:

Impacts of Previously Disturbed vs. Undisturbed Areas

The amount of impacts to undisturbed lands was not reviewed in the Comparison of Environmental Effects of Reasonable Alternatives. Natural resource impacts in existing corridors and cultivated lands will be significantly less than impacts to intact forests, grasslands and wetlands. Existing corridors and cultivated lands are already disturbed by the mixing and compaction of soils, application of pesticide treatments, removal of natural vegetation, and introduction of invasive species. New pipeline corridors through intact landscapes will introduce negative impacts to the existing hydrology, plant communities, and wildlife.

Forests are especially susceptible to fragmentation. A pipeline corridor would create a long, linear break in the forest canopy. Fragmentation results in changes to environmental conditions (light, wind, moisture) that alter the plants and animals using the area. The new plant communities of grass and shrubs will alter the species composition and population of birds, small mammals and large mammals.

Area sensitive avian species that require large un-fragmented blocks of forest for nesting will avoid the deforested corridors. The end result is a loss of nesting habitat that, depending on species, includes the direct forest loss and adjacent habitat that extends a considerable distance from the deforested corridor. Construction corridors also create paths for the introduction of invasive species that reach far into formerly protected forest and wetland interiors.

The Comparison of Environmental Effects of Reasonable Alternatives does not acknowledge that construction through undisturbed areas will result in habitat loss, conversion, degradation, and fragmentation. Rather, the document focuses more on construction impacts to agriculture than on impacts to undisturbed or less-disturbed habitat. The document suggests that, while agricultural activities can resume after pipeline construction, impacts (e.g., soil compaction, soil mixing, impact to prime and unique farmland) can be long lasting and permanent in those areas. This is an important consideration, particularly for social and economic reasons. However, the report should also recognize that agricultural use - by its very nature- has already introduced soil impacts. Further, the report should acknowledge that these impacts are even more environmentally significant when introduced in previously undisturbed natural areas. Best management practices (BMPs) such as topsoil stripping and soil ripping to loosen compaction are measures commonly used in disturbed areas. However, these BMPs are not considered standard, and often are not practical, in undisturbed areas. If these practices are not applied with equal diligence in natural areas, the natural areas become more susceptible to degradation such as compaction, erosion, and colonization by invasive plants.

System Alternative Length and Scope of Analysis

Readers may misunderstand the relationship between the System Alternatives' total length of the pipeline and total impacts. For example, readers may mistakenly conclude that more length of pipeline necessarily means more potential impact. If oil is transported to Joliet, Illinois, there is a greater System Alternative distance than transporting oil to Superior, Wisconsin. Routing to Joliet could be understood as therefore resulting in more natural resource impact. However, it would be reasonable to assume that there is potential for other environmental impacts (leak risk) or cumulative impacts resulting from transportation of oil from Superior, Wisconsin on to other locations from the increased delivery of oil.

Recently the DNR has participated in a comment period to the Great Lakes Commission regarding the potential delivery of oil resources through the Great Lakes and St. Lawrence River Region. Consideration of how oil is transported (currently and in the future) out of Superior, Wisconsin is important context for review of the Comparison of Environmental Effects of Reasonable Alternatives document. The DNR recognizes that quantifying this analysis would likely be challenging.

Changes in Topography

Topographic relief comparisons have not been completed. Topographic relief comparisons between the various system alternatives are important to understating potential impacts between systems alternatives for the following reasons:

1. In hilly terrain, groundwater generally travels laterally more than on flat terrain, has higher potential for surface discharge sites/springs, and creates more soil texture stratification. Changes in topography are also commonly associated with river/stream valleys. Under these conditions, oil spills can spread faster than on flatter terrain and have a high risk of affecting streams, rivers, wetland, terrestrial habitats and associated landscape functions.
2. Areas with more relief/topography will involve additional disturbances. Construction of one or more pipelines through these areas will require rights-of-way (ROWs) and workspaces that are much wider than those used in other areas. Erosion concerns, maintenance needs, and risk of invasive species introduction would also be greater.

Water Resources

SA-Applicant parallels and crosses many streams, rivers, flowages, lakes and wetlands within the northern lakes and forested ecoregions. These are generally some of the highest quality recreational and habitat water resources in the state. The DNR has a number of concerns regarding pipeline impacts and would prefer alternative routes or system alternatives that avoid these valuable waters.

The unimpaired waters along the more northern routes are highly vulnerable to degradation by impacts of construction and potential spills. This becomes a greater concern if additional emergency shut-off valves are not located near these sensitive resources. It is also noted in the document that the most sensitive locations for potential spills include those areas that are proximate to surface waters such as lakes, wetlands or streams or where groundwater is near the surface. The remoteness of the pipeline route in some areas in northern Minnesota exacerbates this problem, should a spill or leak occur.

Though more streams are crossed in southern areas, the analysis does not consider the quality of the streams crossed as compared to the other alternatives. SA-Applicant crosses a large number of lakes, streams and wetlands within the northern lakes and forested ecoregions. These are generally some of the highest quality recreational water resources in the state. This can be observed within MPCA's ecoregion concept for evaluating nutrient and trophic condition criteria for surface waters as well as other aquatic habitats that have been evaluated by the MPCA and DNR statewide for transparency, floristic quality, aquatic plant richness and fish (index of biological integrity) IBI scores (see Figures 1-5).

SA-Applicant parallels and crosses significantly important habitat of the several important smaller streams, rivers, flowages, lakes and wetlands. Because of these concerns, The DNR would prefer alternative routes or system alternatives to avoid these areas.

Minerals

SA-Applicant presents a concern regarding mineral resources in the Tamarack area, near the Aitkin-Carlton County border due to significant potential for metallic mineral resources. However, several Route Alternatives being carried forward by PUC for comparative analysis in the routing process could alleviate risk associated with metallic mineral resource/pipeline conflict. Over the rest of the SA-Applicant preferred route and other System Alternatives, presence of metallic mineral resources is highly uncertain and mineral resource information is insufficiently detailed to suggest that one of the System alternatives has more or less merit from a metallic mineral resource perspective.

For aggregate, crushed stone and peat resources, compensation would be required for any encumbrance that precludes extraction activities due to the presence of the pipeline. For comparative purposes, the value of metallic minerals is potentially order(s) of magnitude greater than nonmetallic resources.

In accordance with MN Rules 6125.07, the state and county may grant surface leases, permits and licensed to any portion of the surface under state metallic mineral lease, after consultation with the lessee. However, the surface leases, permits, or licenses shall not unduly interfere with exploration or mining operations conducted on the mining unit.

In addition, in selecting a route for the pipeline, the PUC is guided by the criteria specified in Minnesota Rules, part 7852.1900, Subp. 3. The principal relevant criteria in this situation include: existing and planned future land use, economies within the route, *including industrial and mining operations*, natural resources, and relevant policies and rules of other state agencies. The state mineral lease in the Tamarack area was in effect prior to this Project application and must be considered in any route determination.

The Department also has safety concerns with the possibility of having both future crude oil pipeline and mining operations on the same state-owned lands.

Co-location and "Corridor Fatigue"

Generally, there is an opportunity for reduction of many natural resource impacts, such as habitat clearing, fragmentation, and introduction of invasive species when utility corridors are co-located. The DNR often recommends co-location rather than routing through a less disturbed "greenfield" area. However, it is also important to consider the possible drawbacks related to co-location in an environmental analysis. New pipelines within existing pipeline corridors can exacerbate or introduce the following symptoms of "corridor fatigue": cumulative environmental impacts of multiple pipelines, increased numbers of cross-over's and route deviations, as well as creation of "pinch points" when there are conflicting land uses. Some existing pipelines were constructed prior to more modern regulations (which provide greater consideration of impacts associated with construction, operation, and maintenance) which increases cumulative environmental impacts associated with multiple pipelines. An example of cumulative impacts with Sandpiper would be the intended co-location of Sandpiper and the Line 3 Re-build/Maintenance project also currently proposed by Enbridge.

Pipeline Leak Risk

The Comparison of Environmental Effects of Reasonable Alternatives focuses primarily on construction related impacts and less on potential environmental damage as a result of leaks or ruptures. This is in contrast to the Exponent study of the Keystone XL Project Risk Assessment, which concluded that the potential damage as a result of an oil leak was the single most important consideration when conducting a risk assessment for oil pipelines.

Corridor Width

A 2-mile wide corridor was used for analysis of System Alternatives. Use of wider or narrower corridor widths affects the assessment as the ability to avoid sensitive areas within a specific zone is dependent upon the density of resources within that zone as well as acreage or number of sensitive areas. The existence of resources at low densities may not necessarily indicate that the route has more potential for impact if more avoidance opportunities are present. Conversely, there may be resources at high densities that are harder to avoid within a 2-mile corridor. The LaSalle Creek area north of Itasca is a good example: a 2 mile wide corridor still restricts alignment choices to areas with high resource densities.

State-Listed Rare Species and Sites of Biodiversity Significance

It is notable that Minnesota state-listed threatened and endangered species and Minnesota Sites of Biodiversity Significance were not addressed in the comparative section of the Comparison of Environmental Effects of Reasonable Alternatives. At this scale of analysis, one could consider Minnesota Sites of Biodiversity Significance as areas tending to concentrate rare species. See the DNR comparison of these sites specifically for SA-03 and SA-Applicant below.

Contaminated Sites

It should be noted that using contaminated sites as a comparison factor is debatable. It could be argued that contaminated sites are either more or less suitable for development, depending on the specifics of a site and measures used to lessen or avoid impacts.

Comparison of Environmental Effects of Reasonable Alternatives Section Specific Comments

Section 4.1.2 Geology /Soils/Groundwater

Soils: This section (page 49) indicates that impacts to soils are of particular concern to agricultural areas. It is important to point out that standard measures commonly used to prevent mixing of topsoil with subsoil and other impacts such as compaction and rolling topography can be effective in addressing the concerns raised for agricultural areas. This section should indicate that soil related impacts are an important concern in undisturbed or less disturbed areas, where fewer best management practices are typically available.

Hydraulic Conductivity: This section of the report is correct in stating that hydraulic conductivity information is important to assess because it is a measure of how quickly oil can move through the soil. Unfortunately the methods used in the assessment are best suited as a screening tool only as they use surficial hydraulic conductivity values rather than at depth values. Since pipelines are constructed at a fairly consistent depth, inclusion of hydraulic conductivity ratings at or below those depths will need to be used to determine potential risk to contaminant migration.

Section 4.1.6 Public Resource and Recreation Lands (Map A-14 and 15)

Upon review of these maps it is clear that they do not include all public lands. Specifically, state lands administered by DNR Division of Forestry outside of state forests and county administered state lands are not included. These lands are important to the impact assessment as they provide various services to the public, animal, plants, and industry. These areas also occupy a significant part of the landholdings in the northern part of the state and omitting them from the assessment would likely result in inaccurate assessment of impacts on public lands.

Also, from reviewing the comparison document and table 4-9 there is no distinction between State Forests and State Lands Administered by DNR Forestry, other DNR Divisions or County tax forfeit. The text makes note to only named State Forests. Therefore the analysis does not appear to compare the total amount of public forest lands. The DNR is aware that there is a higher occurrence of state public owned lands in the applicants preferred route than in all other alternatives.

Without knowing the final centerline of the proposed pipeline route, fully accessing forestry concerns is difficult. However, in general with more acres and crossings, one can reasonably conclude that there would be more potential impacts to forestry from the applicant's preferred route than from the other southern alternatives. Routes in the forested region of the state will permanently convert forested uplands and wetlands to open habitats. Impacts of new or wider fragmented areas include: decreased habitat value for wildlife and fisheries, reduction of core habitat in adjacent forests due to edge effects, conversion of habitat (i.e., changes from forested wetlands to open or shrub wetlands), and increased risk of invasive species. The pipeline will result in the permanent loss of income from timber harvests or other income producing activities on the parcels. Compensation is required for impacts to both School Trust and Acquired lands.

There are concerns regarding the potential for severing access to state parcels for land management activities. This concern would apply to both legal access across licensed/leased (or purchased) lands and the ability to run fully loaded semi-trucks carrying logs across the pipeline. This is a concern even if the pipeline runs across private property. DNR works with private owners to gain the shortest and most efficient access to state land across private land. The main concerns are Forestry lands in several sections in the Applicant's preferred route. There is also a concern for fire suppression activities anywhere the pipeline might be constructed.

Section 4.1.4 Water Resources (Maps A-10, 11 and 12)

We agree with the types of impacts that could occur as described in the report however the methods used do not allow for a comparison of those potential environmental effects among the system alternatives. Two considerations missing from the assessment are:

1. Water sensitivity – Water quality and functions of water resources vary across the state and so will potential impacts.
2. Downstream river miles and connectivity to resources and other sensitive receptors vary across the state and so will potential impacts. An analysis of flow paths for significant releases would add to this type of assessment.

Full Length Comparison of SA-03 and SA-Applicant

While the high level of analysis presented in the Comparison of Environmental Effects of Reasonable Alternatives did not provide the DNR enough information for a full comparison of system alternative impacts, we believe it provides valuable screening information in combination with professional judgment for the DNR to provide input regarding SA-03 and SA-Applicant. After a review of the data and consideration of factors and context described above, it is the opinion of the DNR that route Sa-03 has fewer natural resource impacts when compared to SA-Applicant.

SA-Applicant features that would incur impacts greater than those identified for SA-03 are: forest and wetland acreage, river and stream segment crossings, and crossings of public lands. Cultivated lands and occurrence of already-impaired waters are greater along SA-03, indicating the developed state of lands along this route. The following table represents a preliminary comparison of natural resource impacts between SA-Applicant and SA-03, using information from the Comparison of Environmental Effects of Reasonable Alternatives. These are full route comparisons, encompassing the states of North Dakota, Minnesota, and Wisconsin.

Full length System Alternative Analysis (ND, MN, WI):
Comparison of SA-Applicant and SA-03

Feature	**SA-Applicant**	**SA-03**	**Notes [The comment reflects the preferable option from a natural resource perspective]**
Total miles	615 miles	700 miles	SA-App is shorter
Acres (from landcover)	769,145	862,053	SA-App covers fewer acres
Landcover (acres)			
Forest	144,315 (18.8%)	86,195 (10%)	SA-03 covers fewer forested acres, and less by percent. This represents a reduction in forest fragmentation.
Herbaceous/grassland	86,505 (11.2%)	90,945 (10.5%)	SA-App covers fewer grassland acres, and less by percent. This is a reduction in grassland impacts.
Cultivated	363,381 (47.20%)	512,407 (59.4%)	SA-03 covers more cultivated acres and more by percent. This represents re-working of already disturbed lands.
Wetlands	107,367 (13.9%)	90,832 (10.5%)	SA-03 covers fewer wetland acres and less by percent. This is a reduction of wetland impacts.
Water Resources			
River + stream crossings	2,049 segments	895 segments	SA-03 crosses fewer water segments
Crossings with water impairments	50	98	SA-03 has a greater number of crossings over impaired waters.

			Fewer crossings of non-impaired waters is desirable.
Miss R crossings	2: 30' + 250'	1:1,000'	No advantage: both represent dangers specific to flow volume and local river and bankside conditions.
Lakes	3,397	3,777	SA-App has fewer lake crossings. A more accurate comparison would take into account the existing water quality conditions and impairments of these lakes.
Wetlands (acres)			
Forested/shrub	57,769 (7.3%)	60,210 (6.8%)	These are similar. A more accurate comparison would take into account the biological quality ranking of these communities, taking into account such things as hydrologic continuity, species diversity, disease, regeneration, and presence of invasives.
Emergent	47,010 (6%)	39,415 (4.5%)	See above
Public Resource Lands			
Acres	47,691	11,885	SA-03 crosses fewer acres of public lands.
Count	66	148	While SA-App encounters fewer public lands, this is due to the larger size of public lands along the northern route. A better comparison is made by the acres crossed.

Note that the EERA analysis of SA-Applicant and SA-03 did not compare the acreage of developed lands (existing corridors to be followed, acres under cultivation) to new land disturbance (forests, grasslands and wetlands). The analysis also did not include water quality indicators for the water bodies to be crossed by both system alternatives (rivers, streams and lakes).

Minnesota-Specific Comparison of SA-03 and SA-Applicant

The environmental analysis document also presented Appendix B – Tables and Maps for Minnesota. The DNR interprets this data to show that while SA-applicant covers less total acreage, it has the potential to adversely impact natural resources to a greater extent.

SA-Applicant encounters greater acreage and/or numbers for Sites of Biodiversity Significance (SBS), School Trust Lands, public water bodies, NWI wetlands, wild rice lakes, and trout streams. SA-03

contains a higher number of karst features and calcareous fens, more crossings of public waters (streams and rivers) and public water wetlands, and significantly more acres of native prairie than SA-Applicant.

These features reflect the difference in route lengths, as well as the changing nature of the landscape between ecoregions of the state. SA-Applicant follows the northern-most route, the majority of which passes through the Laurentian Mixed Forest ecoregion, the Northern Minnesota Drift and Lake Plains section with expanses of intact forests and wetlands. SA-03 follows a route farther to the south through the Prairie Parkland and Eastern Broadleaf Forest ecoregions, where agriculture and urban centers have become established.

Following are a few points of discussion regarding these comparisons:

- SA-Applicant crosses greater acreage of Sites of Biodiversity Significance (SBS). SBS indicate areas of intact functional landscapes that provide natural resource values such as hydrologic continuity, habitat connectivity, native plant communities, and rare plant and animal species. Not all counties crossed by SA-Applicant have been evaluated for SBS. However, those that have been evaluated contain the largest areas of SBS to be found in the state.
- SA-Applicant crosses a higher amount of state lands, particularly state forests and state wildlife management areas. The route passes through a significant amount of the forest stand inventory of the state of Minnesota.
- SA-03 crosses fewer state lands, smaller SBS due to fragmentation of natural landscapes, and a higher number of the waters crossed (rivers, streams, wetlands and lakes) are already impaired due to agricultural and urban development.
- Fragmentation of natural landscapes due to farming and urban development is significantly higher in SA-03. It would be easier to avoid important natural resources within a two mile corridor in this route.

Following is a table comparison of the two system alternatives under review within Minnesota using data from the Comparison of Environmental Effects of Reasonable Alternatives:

Minnesota System Alternative Analysis: Comparison of SA-App and SA-03

Feature	SA-Applicant	SA-03
Total acres	382,670	476,346
Karst features	0	7
Calcareous fen	1	2
Sites of Biological Diversity*		
Below	7,291	13,891
Moderate	52,117	26,320
High	6,883	5,828
Outstanding	2,459	1,914
Total	68,750	47,954
Native Prairie		
Complex	440 (57%)	279 (13.1%)
Upland	118 (15.3%)	882 (41.3%)
Wetland	213 (27.6%)	973 (45.6%)
Total	772	2,135
School Trust Land (acres)	7,880	2,004
State Trails	8	11
NWI (acres)	76,597	67,541
Public water wetland	2,372	2,792
Water Basins		
Public water basin	10,220	10,047
Water Courses		
Count	112	240
Miles	197	407
Trout Streams		
Count	46	32
Miles	54	42
Wild Rice Lakes		
Count	29	11
Acres	3,621	1,182

*The DNR assumes values provided by EERA for Sites of Biological Diversity are acres of Sites of Biodiversity Significance (SBS).

Thank you for the opportunity to provide comments regarding the Certificate of Need for the Sandpiper Pipeline Project. Please contact me with any questions.

Sincerely,

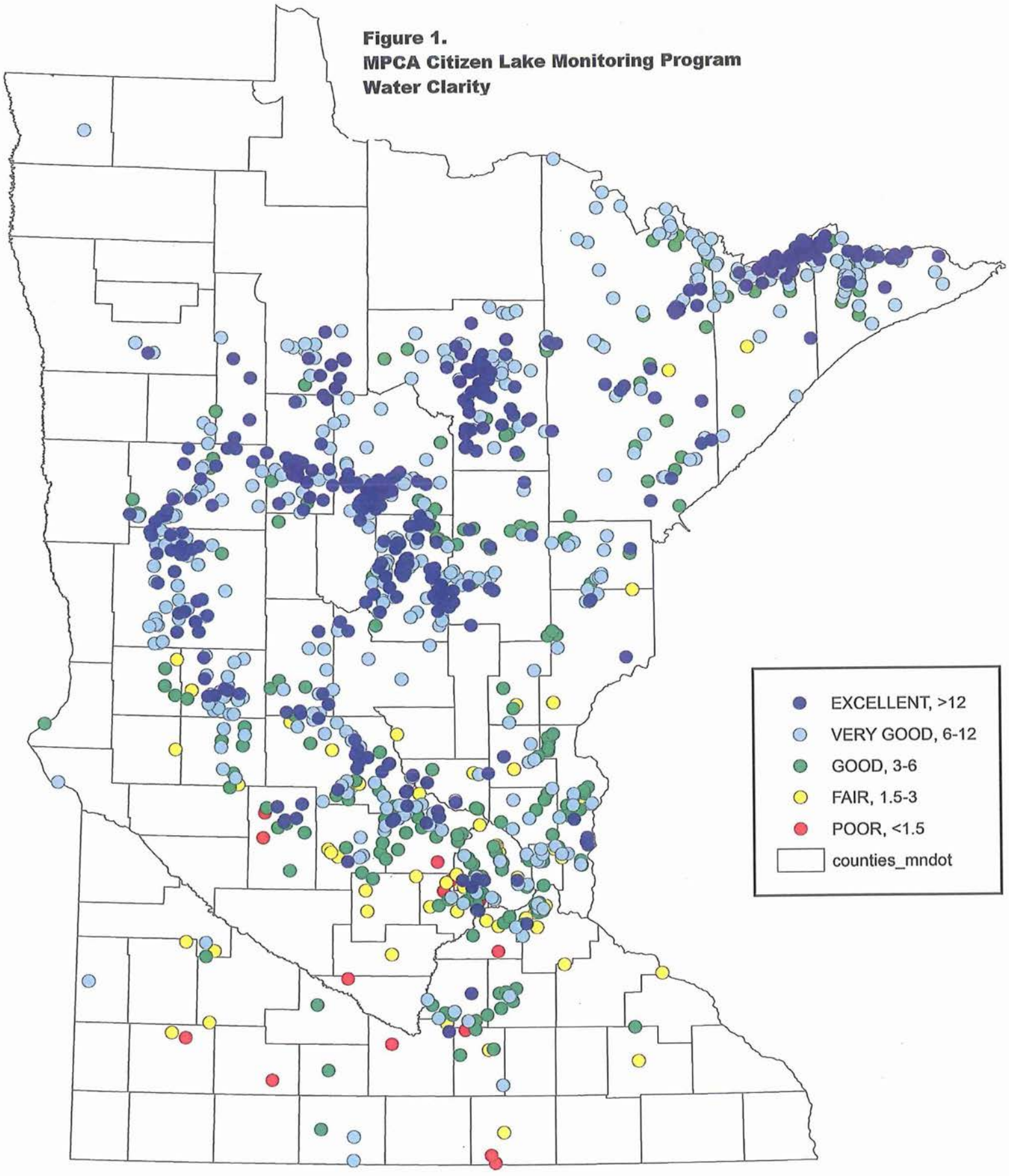
Jamie Schrenzel

Jamie Schrenzel
Principal Planner
Environmental Review Unit
(651) 259-5115

Enclosures: 5

cc: Larry Hartman, Minnesota Department of Commerce
Scott Ek, Minnesota Public Utilities Commission
Sara Ploetz, Enbridge

Figure 1.
MPCA Citizen Lake Monitoring Program
Water Clarity



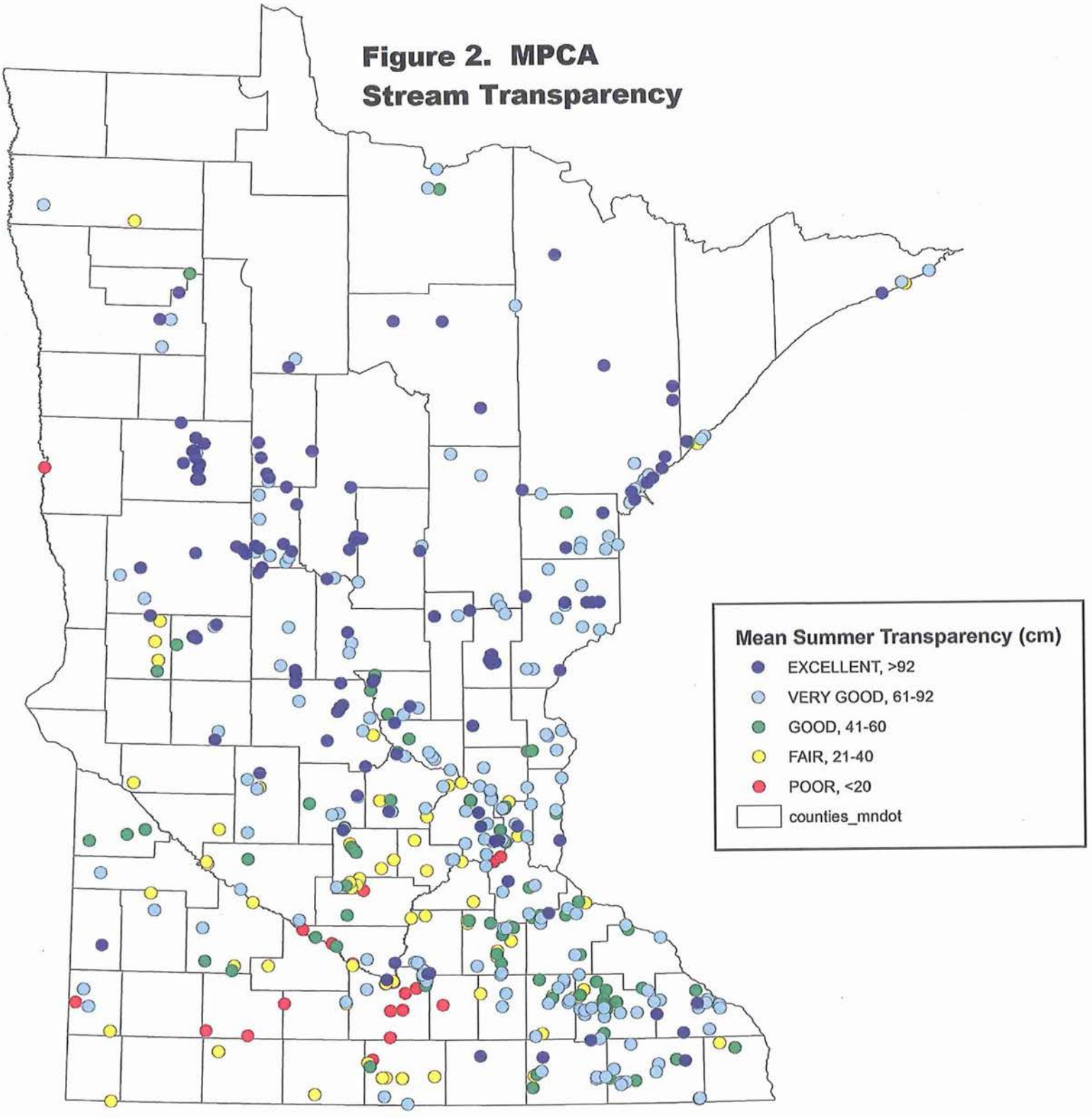
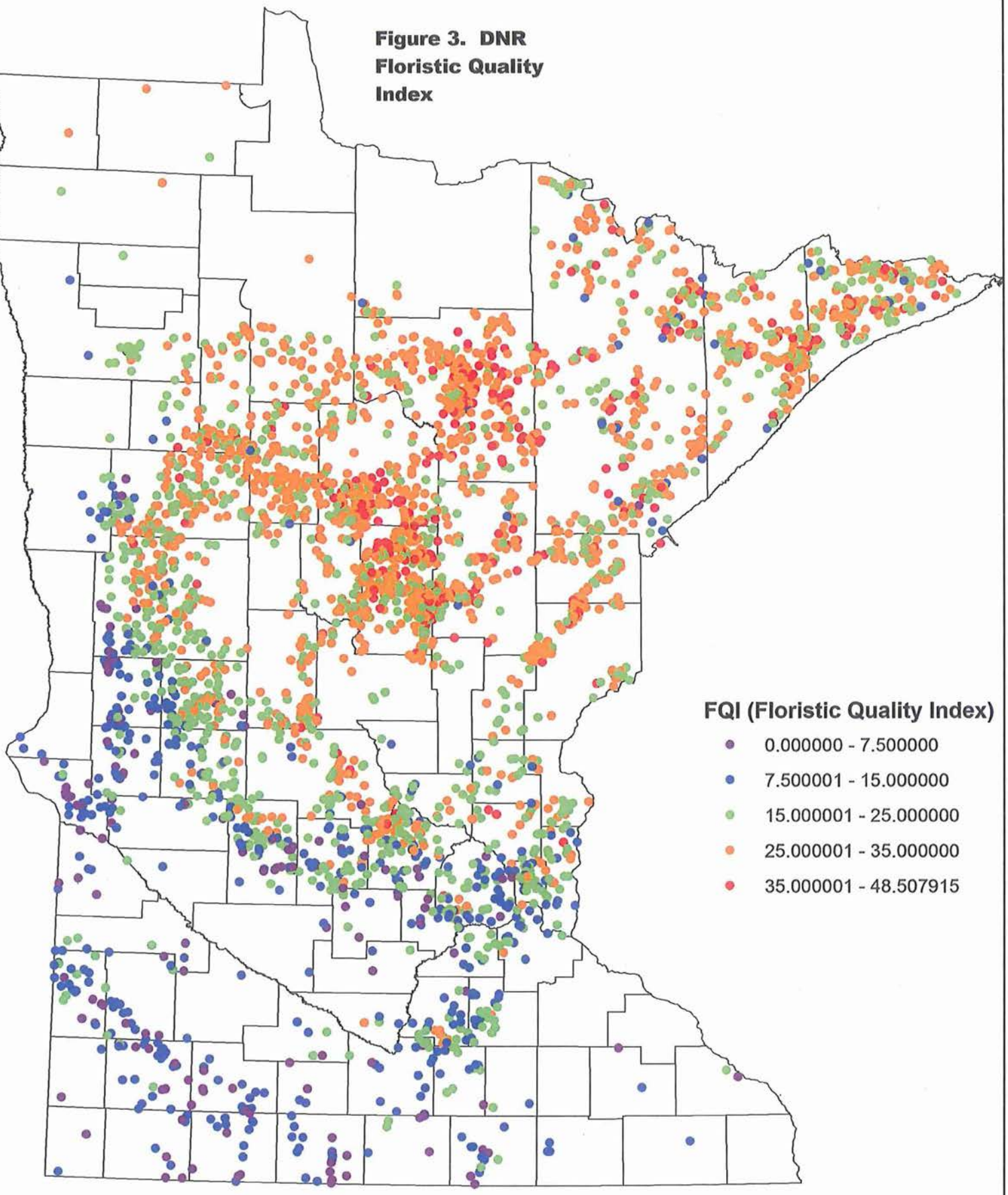


Figure 2. MPCA
Stream Transparency
Mean Summer Transparency (cm)
EXCELLENT, >92
VERY GOOD, 61-92
GOOD, 41-60
FAIR, 21-40
POOR, <20
counties_mndot

Figure 3. DNR Floristic Quality Index



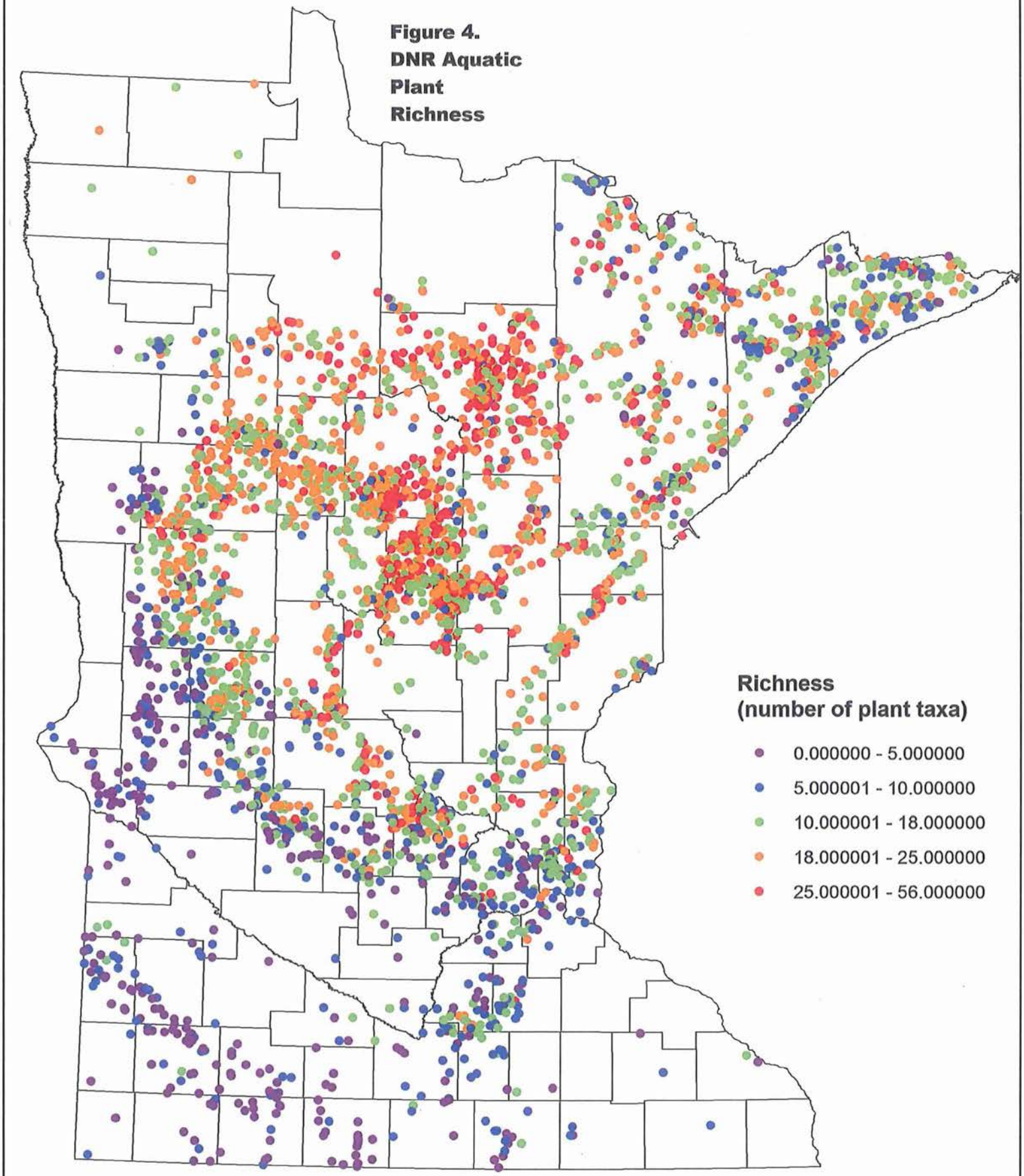
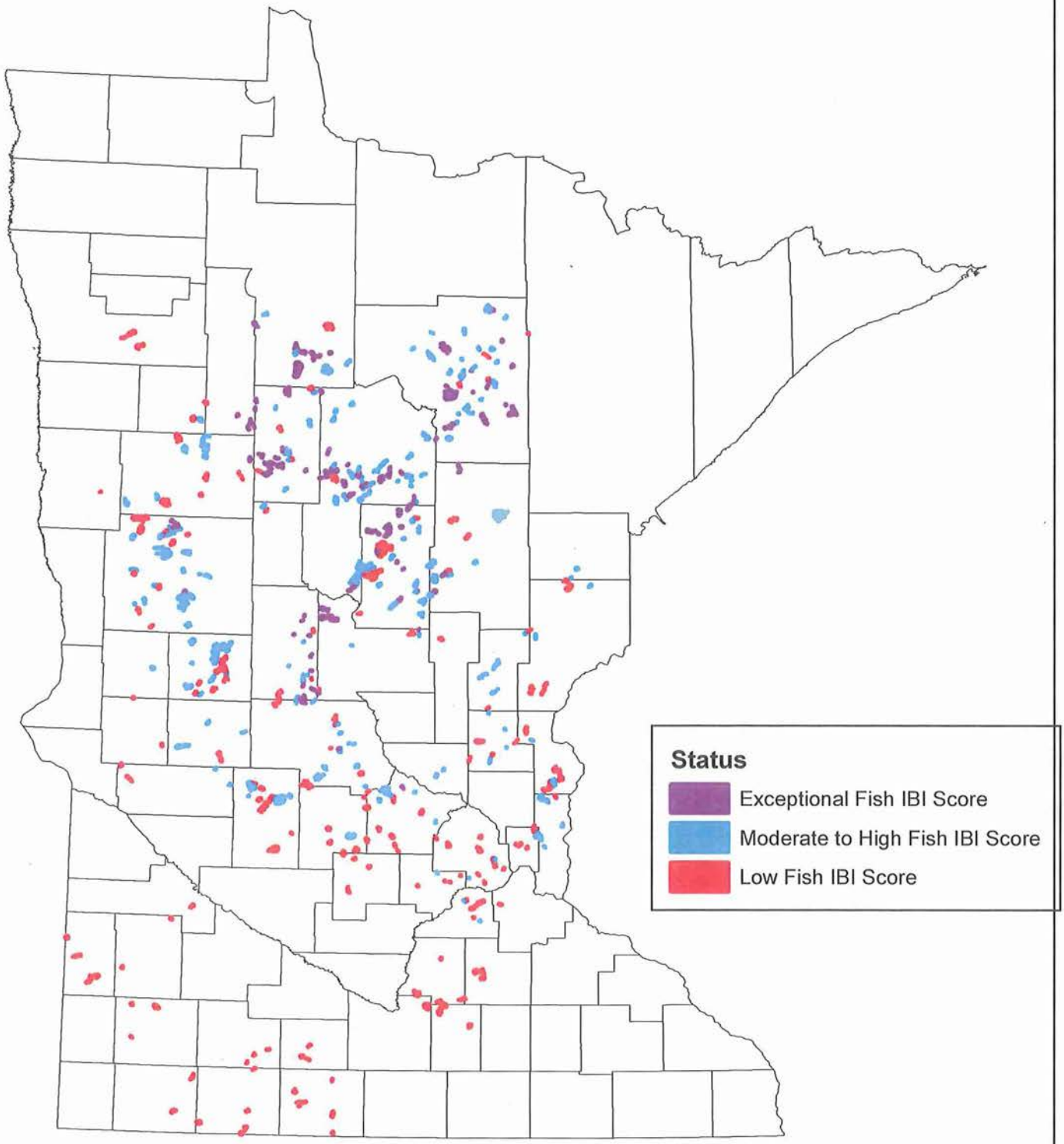


Figure 4.
DNR Aquatic
Plant
Richness
Richness
(number of plant taxa)
0.000000 - 5.000000
5.000001 - 10.000000
10.000001 - 18.000000
18.000001 - 25.000000
25.000001 - 56.000000

Figure 5.

Fish IBI Scores through 2014



Minnesota DNR Fisheries, Jan. 2015, Contact Jacquelyn Bacigalupi, MN DNR Fisheries IBI Coordinator for more information

Appendix C
PCA Sandpiper Letters

January 23, 2015

The Honorable Eric Lipman
Minnesota Office of Administrative Hearings
600 North Robert Street
P.O. Box 64620
St. Paul, MN 55164-0620

RE: In the Matter of the Application of North Dakota Pipeline Company LLC for a Certificate of Need for the Sandpiper Pipeline Project in Minnesota
MPUC Docket No. PL6668/CN-13-473
OAH Docket No. 8-2500-31260

Dear Judge Lipman:

The Minnesota Pollution Control Agency (MPCA) submits the following comments for consideration by the Administrative Law Judge (Judge) in making recommendations to the Public Utilities Commission (Commission) in this matter. The MPCA's comments provide information addressing several of the criteria set forth in Minn. Rule 7853.0130 for making a determination on a certificate of need for the Sandpiper Pipeline Project (SA-Applicant) proposed by North Dakota Pipeline Company ("NDPC" or "Applicant"). The MPCA respectfully requests that if a determination of need is reached in this proceeding, the certificate of need be conditionally granted contingent upon suitable modification of SA-Applicant to protect and avoid high quality natural and environmental resources, and the inclusion in the Route Proceeding, Docket No. CN-13-474, of SA-03 and any other System Alternative that meets the identified need, pursuant to the Commission's authority under Minn. Rule 7853.0800. The MPCA will gladly provide additional information or comments that the Judge may find helpful in the course of this proceeding.

A. The MPCA's comments address four of the criteria required under Minn. Rule 7853.0130 for a determination on a certificate of need.

Minn. Rule 7853.0100 requires evaluation of all applicable and pertinent factors listed under each of the criteria set forth in Rule 7853.0130 and a specific written finding with respect to each of the criteria. Minn. Rule 7853.0130 states that a certificate of need shall be granted if all the listed determinations can be made. However, if one or more of those determinations cannot be met, a certificate of need may be denied, or conditionally granted subject to modification, under Minn. Rule 7853.0800.

The MPCA is providing comments that address the determinations required under Rule 7853.0130.B (2); 7835.0130.B (3); 7853.0130.C (2); and 7853.0130.C (3), which state:

- 7853.0130.B. a more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence on the record by parties or persons other than the applicant, considering: . . .
  (2) the cost of the proposed facility and the cost of energy to be supplied by the proposed facility compared to the costs of reasonable alternatives and the cost of energy that would be supplied by reasonable alternatives;
  (3) the effect of the proposed facility upon the natural and socioeconomic environments compared to the effects of reasonable alternatives; and . . . .

- 7853.0130.C. the consequences to society of granting the certificate of need are more favorable than the consequences of denying the certificate, considering: . . .
  (2) the effects of the proposed facility, or a suitable modification of it, upon the natural and socioeconomic environments compared to the effect of not building the facility;
  (3) the effects of the proposed facility or a suitable modification of it, in inducing future development.

The MPCA comments will address each of the criteria mentioned above and associated listed factors.

B. SA-03 is a reasonable and prudent alternative to the Applicant's facility (SA-Applicant), since the respective costs of SA-Applicant and SA-03 and of oil to be supplied by SA-Applicant and by SA-03 are not significantly different. Minn. Rule 7853.0130.B(2).

Financial impacts and comparative costs are among the factors to be evaluated in determining whether the criteria in Minn. Rule 7853.0130.B are met. Since MPCA submitted its comments dated August 21, 2014 to the Public Utilities Commission,[1] additional relevant testimony have been submitted in this docket. This included the direct testimony of economist Adam Heinen of the Department of Commerce (Doc. ID 201411-104761-03 ("Heinen Direct"). Mr. Heinen stated his expert opinion that System Alternative SA-03, as proposed by the MPCA, would meet the need of the project if as also proposed by MPCA, the Clearbrook terminal location was moved westward to the Crookston area or another location closer to the North Dakota border. (Heinen Direct, p. 75,) Mr. Heinen also indicated that moving the terminal location could increase the cost of constructing the pipeline, and discussed Applicant's estimate of the cost increase. (Heinen Direct, 75-76). Mr. Heinen then stated in his opinion that any apparent higher costs of SA-03 based on Applicant's analysis were insignificant and unlikely to impact retail prices and that the Applicant had not shown that SA-03 was an unreasonable alternative to meet the need of the proposed project. (Heinen Direct, pp. 77-78)

[1] See PUC Docket Filing 20148-102458-02 and 20148-102458-04

Mr. Heinen reinforced his direct testimony when he filed rebuttal testimony addressing SA-03. Mr. Heinen affirmed that SA-03 appeared to be a reasonable alternative to meet the need for this project. (Heinen Rebuttal, p. 7) (Doc. No. 20151-105968-01). This testimony supports the finding that under Minn. Rule 7853.0130.B(2), based on comparative cost, SA-03 is at least a reasonable and prudent alternative. However, comparative effects on natural environments, i.e., potential environmental and natural resource impacts as discussed in the following sections, appear to make SA-03 "a more reasonable and prudent alternative" under Minn. Rule 7853.0130.B(3).

In addition to direct costs of construction and operation, the costs considered under Rule 7853.0130.B(2) should include an evaluation of whether a system alternative such as SA-03 is a more reasonable alternative to SA-Applicant because of a reduced risk of a costly spill to a sensitive environmental area. An Alternative that avoids or impacts fewer sensitive ecosystems and water bodies than SA-Applicant will have a smaller likelihood of incurring significant response costs. As documented by the U.S. Environmental Agency (USEPA), it costs considerably more to restore or rehabilitate water quality than to protect it.[2] The areas of the state traversed by the SA-Applicant have waters and watersheds that are currently subject to protection in the state's "Watershed Restoration and Protection Strategy" program, [3] financed through the Clean Water Fund and aided by significant volunteer participation of Minnesota citizens. By keeping these waters as clean as possible before they become impaired, extensive costs of restoring waters to state standards can be avoided. Location of oil pipelines in these areas place their pristine waters at risk, and also place potentially millions of dollars in state and federal funds allocated for protection of these areas at risk.

When evaluating spill response costs, the following factors would make one corridor a better choice than another in minimizing the potential for costly spills or accidental discharges: fewer crossings of flowing water; fewer adjacent water bodies; quality of those waters; presence of especially sensitive areas or habitats or species or uses; better access to downstream oiled areas; tighter soils; and closer and more equipped and prepared responders. The MPCA applies these factors in comparing SA-Applicant with SA-03 and other alternatives in the next section of our comments.

C. SA-Applicant presents significantly greater risks of potential environmental impacts and encroaches on higher quality natural resources than SA- 03 and several other system alternatives. Minn. Rule 7853.0130.B(3). The effects of SA-Applicant on the natural environment support a determination in favor of other alternatives. Minn. Rule 7853.0130.C(2) and C(3).

[2] See http://water.epa.gov/polwaste/nps/watershed/upload/economic_benefits_factsheet3.pdf (incorporated by reference) .

[3] See (http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/watershed-approach/index.html)

Environmental risks are posed by all aspects of pipeline construction and operation, including post-spill recovery and restoration activities. The primary and most significant risks are associated with the long-term effects upon environmental and natural features that will be permanently altered, eliminated, or otherwise impacted by the presence of a pipeline, as well as the potential impacts of the release of crude oil as the result of a spill event during the potential 40 years or more that the pipeline will be operational. Those risks include environmental damages such as loss of wildlife, contamination of drinking water, destruction of fisheries, loss of habitat, and alteration of ecological systems. (For a discussion of the behavior and cleanup of oil spilled to surface water, soil, and groundwater, see Appendix A to the MPCA's comments.)

During these proceedings, the MPCA has commented extensively on the environmental concerns regarding the route proposed by Applicant in comparison to alternative routes and system alternatives. MPCA's prior comments can be found in Document Nos. 20146-100780-01, 20148-102458-02 and 20148-102458-04, each incorporated by reference. These prior comments have addressed such specific items as access to potential release sites in surface waters, potential to impact ground water, wild rice, the state's highest-quality surface water systems, wildlife habitat, low income populations, watersheds currently being assessed for restoration and protection strategies, fisheries, economies, and numerous other parameters.

In these comments, the MPCA concluded that with respect to protection of the highest-quality natural resources in the state, the SA-Applicant route presents significantly greater risks of potential impacts to environment and natural resources than several of the system alternatives, including SA-03. Although all proposed routes and system alternatives have the potential to impact some natural resources, the Applicant's proposed route encroaches on higher quality resources, superior wildlife habitat, more vulnerable ground water, and more resources unique to the state of Minnesota than do many of the proposed system alternatives. Several examples of the greater potential for harmful environmental impacts of SA-Applicant compared to other alternatives are highlighted in the following pages.

The relevance of other system alternatives depends upon whether the need for the project is determined based upon a narrower and more localized view or upon a larger regional view. While SA-03 has been identified as a reasonable and prudent project alternative as a general matter, it serves as such an alternative from both a localized and regional view. However, if need is determined based on a larger regional view of need, several other system alternatives may also be reasonable and prudent alternatives to meet that regional need. Consequently, the MPCA also addresses the comparative impacts of other System Alternatives and SA-Applicant to inform a determination of need from a regional perspective.

The broader objective of the proposed project is transporting oil to markets in the Midwest and along the eastern and gulf coasts, not to transport oil through the state of Minnesota

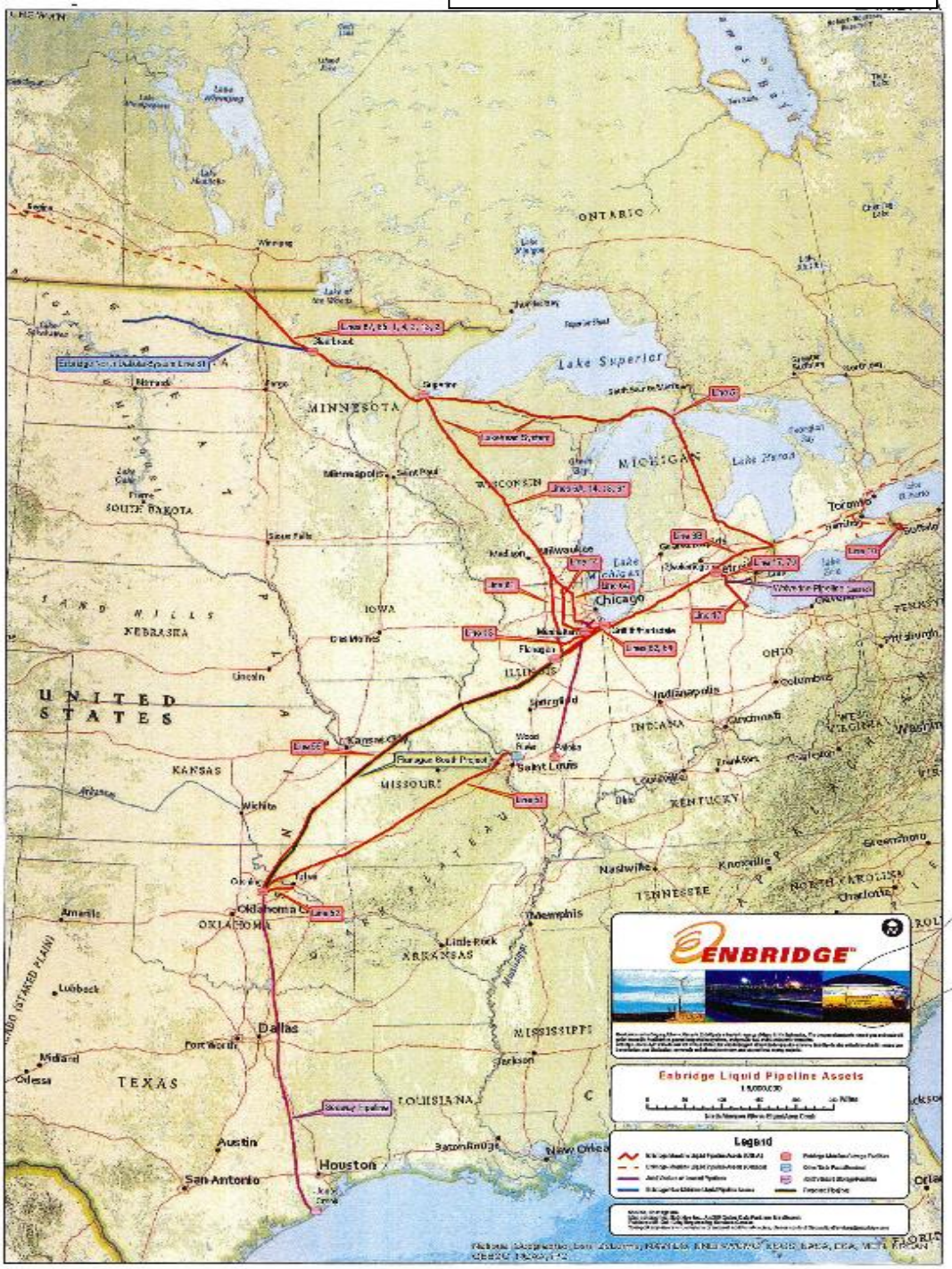
with termination in Superior Wisconsin. [4] Oil that is to be transported to Superior, Wisconsin through the proposed pipeline will continue through Wisconsin to Chicago (or Wisconsin and Michigan if routed to Sarnia, Ontario). Oil that would be transported via one of the southern system alternatives, such as SA-04, and on to the Chicago area would have to be transported through Iowa before reaching Illinois. In either case, Chicago appears to be a common destination for most if not all of the oil that is proposed to be moved through Minnesota.

Information regarding the existence of contractual agreements obtained when Applicant held an "open season" has been offered as the underlying basis for a determination of need.[5] The Applicant has suggested that the facility as proposed (SA-Applicant) is necessary in order to assure those contractual agreements are filled and that alternatives such as SA-03 would negatively affect the cost of fulfilling those agreements. This proceeding will determine whether the Applicant's open season agreements establish the need for siting a pipeline through Northern Minnesota instead of along a southern alternate route. If the underlying actual and predominate need of the project is to get Bakken oil to Midwest regional markets in Wisconsin, Michigan, or Illinois, that need can be achieved by several of the system alternatives. The foregoing is generally and specifically supported by the direct and rebuttal testimony of Applicant's witness Neil Earnest (Document ID Nos. 20148-102134-03, Earnest Direct Testimony, and 20151-105934-01, Earnest Rebuttal Testimony). See Figure 1, which is an overview of Applicant's regional infrastructure and corresponding destinations.

[4] Applicant testimony acknowledges that the project's intended destination is not Superior, Wisconsin but refineries in the Midwest. Applicant witness Earnest, in rebuttal, indicates that oil from this project is not only competing with alternative modes of transportation to refineries in Chicago, Patoka, and Cushing. The oil is also competing with all of the other crude oil choices available to the refineries in the Midwest. Enbridge rebuttal at pp 5-6. "Accordingly, all else equal, higher Sandpiper transportation costs to the Midwestern markets acts to decrease the volume of Bakken crude oil that can be expected to be processed in the Midwest, and to lower the utilization of the pipeline." (Earnest Rebuttal, 6) 20151-105934-01

[5] Heinen Direct, pp. 6-7. The nature and content of these open season transportation service agreements are confidential. The MPCA has not examined the nature or substance of these agreements or their duration. Mr. Heinen also indicates in his testimony that he does not know the ultimate destination of that oil.

Figure 1


ONTARIO
Lake Superior
MINNESOTA
MICHIGAN
Lake Michigan
Chicago
Toronto
SOUTH DAKOTA
IOWA
NEBRASKA
SAND HILLS
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSOURI
KANSAS
Kansas City
Saint Louis
Omaha
Minneapolis
Saint Paul
Milwaukee
Madison
Indianapolis
Columbus
Cincinnati
Nashville
Memphis
Knoxville
Charlotte
Wichita
Tulsa
Oklahoma City
OKLAHOMA
ARKANSAS
Little Rock
Amarillo
Lubbock
Dallas
Fort Worth
Midland
Odessa
TEXAS
LOUISIANA
MISSISSIPPI
Jackson
Austin
San Antonio
Houston
Baton Rouge
New Orleans
UNITED STATES
ENBRIDGE
Enbridge Liquid Pipeline Assets
Legend

Comparative Evaluation of Environmental Effects

The comparative long term environmental and eco-system impacts and the potential impact of spills must be carefully evaluated for each system alternative in determining the need for a pipeline project. Permanent harm to sensitive eco-systems, habitats, and species may occur following construction of a new pipeline. In addition, long-term impacts from a spill can be much more damaging in areas containing features such as environmentally sensitive areas and those with limited access. As discussed below, these long-term environmental and eco-system impacts should be accorded great weight in the determination of need for a pipeline project. Further, in associated routing proceedings, these impacts must be subjected to even more rigorous and detailed environmental review when evaluating alternative routes. It is not sufficient under Rule 7853.0130 to determine that the location for the proposed project is suitable or reasonable. Rather, the location should be one that best minimizes the risk to human populations and environmental and natural resources.

1. Adverse Impacts to High Quality Surface waters are Greater under SA-Applicant.

SA-Applicant traverses a greater number of high quality water bodies than does SA-03 and presents higher risk of environmental impacts from a spill or release of crude oil along its route corridor. Based on watershed health scores as determined by the Minnesota Department of Natural Resources in its Watershed Health Assessment Framework, MPCA documented that the adverse impacts to overall water quality from construction and operation, as well as spill cleanup and response, of Applicant's Alternative were more harmful than alternatives including SA-03, SA-04, and SA-05. See MPCA Comment letter dated August 21, 2014 , Document ID Nos. 20148-102458-02 and 20148-102458-0420148-04, page 5).

The MPCA provides these additional comments to assist in proper interpretation of the information on surface waters in the Department of Commerce environmental analysis "Comparison of Environmental Effects of Reasonable Alternatives" (DOC study) submitted on December 19, 2014, (ID 201412-105567-01) and in evaluating the criteria and factors based on that information. For example, on its face, the DOC study may be misinterpreted as indicating that SA-03 is a worse alternative than SA-Applicant in affecting impaired waters. The DOC study concluded that there were 50 impaired waters crossed by the Sandpiper route, and 98 impaired waters crossed by SA-03 (DOC Study, 72, 90). Under the Clean Water Act ("CWA"), an impaired water is any water body (e.g., lakes, rivers, streams, wetlands) that is too polluted or otherwise degraded to meet the applicable water quality standards set by states, territories, or authorized tribes. Water quality and water quality standards will vary throughout the state depending on the region of the state in which the waters reside. "Impaired" waters are not the same across the state. For a water body to be deemed impaired in southern or western Minnesota (western corn belt plains or Red River valley ecoregions), it typically will have a greater degree of contamination or degradation than would be required for a water body in the central

hardwood forest ecoregion of Minnesota traversed by the applicant's preferred route (Sandpiper) to be deemed impaired. Thus, waters that are listed as impaired along the SA-Applicant route are likely to be higher quality (having a lower contamination level) than a water listed as impaired in the southern part of the state, and might not be listed as impaired at all along the SA-03 route. Waters in northern Minnesota are generally of better water quality or more pristine.

2. Significant Environmental Damage Would Occur From a Release at or near a Water Crossing Extending up to at least a Distance of 10 Miles from the Point of Release. SA-Applicant Has Many Areas of Limited Access, Increasing the Risk of Extended Impact to Surface Waters.

The most significant potential impact to a surface water from a crude oil pipeline crossing is the environmental destruction that would occur in the event of a release at or near the water crossing. According to a third party risk assessment document developed as part of the Keystone XL EIS[6], Exponent states: "A distance of at least 10 miles downstream from the proposed centerline of the pipeline should be used for the identification of sensitive areas and for identifying CPSs(contributory pipeline segments) during the final design phase of the Project." The 10 mile estimate is fair, given the potential for flowing water to carry a release of oil, especially in remote areas such as those found throughout the proposed Sandpiper route. Considering that the 2010 Enbridge spill into Talmadge Creek and the Kalamazoo River caused significant damage approximately 35 miles from the spill site, a ten mile estimate of damages is conservative and reasonable. See Stolen testimony, Document ID 201411-104748-02, page 24.

Damage to aquatic systems from an oil release can occur either as a result of physical effects such as smothering of organisms, or toxic contamination due to the chemical compositions of the oil. An oil spill in an aquatic ecosystem could cause, among numerous other impacts, death of waterfowl, other bird species, amphibians, reptiles, aquatic mammals, microorganisms, plankton, fish, pets and livestock living adjacent to waters, stunted growth of surviving species, loss of vegetation, destruction of soils, long-term reduction of dissolved oxygen, human health damage, damage to air quality, property value loss, and destruction of drinking water resources. This does not include damages that would occur during the cleanup process, especially in areas with limited, restricted or no access.

3. Potential Damages During Pipeline Construction and Testing Are Greater for SA-Applicant than other Alternatives.

Damages to surface waters as a result of construction activities can and do occur. Flowing water can also carry these effects a long distance from their origin, as noted above. MPCA has observed and documented significant sediment discharges to surface water on pipeline

[6] See http://keystonepipeline-xl.state.gov/documents/organization/221278.pdf, page XV, "Recommendations",

projects as a result of failing to install sufficient sediment and erosion controls on hillsides adjacent to surface waters. The failure to account for spring time subsidence of soils as a result of winter construction is common; frozen soils that are dug up and replaced into trenches thaw and subside in warmer spring temperatures, causing the soils to sink over the pipeline and form a ditch. These ditches act as conduits for melt water or rain water, and as they do not have sediment controls installed, tend to erode significantly as water runs through them. It is common for these subsidence ditches to terminate in water bodies, causing sedimentation and habitat damage (MPCA Comment Letter dated April 4, 2014, -Document ID 20144-98170-01, page 8).

Damage to surface water resources during hydrostatic testing discharges has occurred recently in the state. During these tests, segments of pipeline are filled with a significant volume of pressurized water, often millions of gallons, to test the integrity of the pipe. The water is then released in a manner that should minimize environmental impact. During the Alberta Clipper/Southern lights diluent project, Enbridge exceeded agreed-upon maximum discharge rates on 15 of its hydrostatic testing discharge operations. At two of these sites (adjacent to the Mississippi River and adjacent to the Clearwater River), the exceedances were enough to cause significant erosion and sediment discharge to surface waters. These cases were referred to the U.S. Environmental Protection Agency and eventually settled by the U.S. Department of Justice in 2013 with Enbridge paying a $425,000 penalty. During these hydrostatic testing operations, as much as 4,000 gallons of water per minute can be discharged from valves. This water is general required to be discharged to an upland area or a dewatering device, but when discharged rates are exceeded, or sometimes even when they are not, the pressurized water can erode soils and carry those eroded soils to surface waters, causing turbidity or smothering of aquatic habitat.

The placement of the new terminal construction west of the proposed Clearbrook location as suggested by MPCA in SA-03 will assure that future pipelines are located west and south of these pristine areas, thus avoiding the resources that the state is spending millions of dollars to protect. Meanwhile, the continued expansion of the Clearbrook facility that will coincide with construction in the SA-Applicant location will mean continued impact and potential impact to the highest value (pristine) waters in our state as a result of future pipeline construction.

4. Threats to Groundwater and Potential Drinking Water Supplies from SA-Applicant are Difficult to Assess, but Appear to Pose More Significant Risks than the System Alternatives, including SA-03.

Highly detailed topographical data for the state of Minnesota (called “LIDAR” data)) illustrates that the Sandpiper route (SA-Applicant) traverses territory with greater topographical contrast than does the SA-03 route. Much of the topography along the SA-Applicant route in Minnesota is the result of the deposit of glacial till from thousands of years ago. The composition of this till is often dependent on how the till was deposited. A

term used to describe these soils is “moraine,” or a mass of rocks and sediment carried down and deposited by a glacier, typically as ridges at its edges or extremity.

What is most important to understand about the soils along the SA-Applicant route is that the complexity of moraines in the area creates a significant degree of localized changes in groundwater movement that are very difficult to predict, as opposed to some of the flatter lands to the west and south, such as those traversed by SA-03, SA-04, or SA-05. Typically, ground water through this till along the SA-Applicant route will move laterally and toward a water body, so it is important that significantly more data is gathered from this route before the possible movement of oil in the event of a release can be predicted and response plans developed. It would be very difficult, if not impossible, to accurately assess the potential for ground water contamination based solely on the examination of GIS layers. However, it can be predicted that the damage to groundwater, potentially used as a source of drinking water, as well as the connected soils could take decades to repair, if the damage could be repaired at all. Additional impacts could include damage to agricultural areas (inability to grow crops) and damage to surface waters, wildlife and habitat from oil carried through underground conduits to those areas.

The LIDAR data strongly suggests an increased potential for impacts to drinking water from SA-Applicant than from SA-03 and some other system alternatives. However, more in-depth study will need to be done in the routing phase in order to make an informed comparison and either confirm or negate what the LIDAR data suggests as a factual conclusion.

5. SA-Applicant Threatens a Greater Percentage of Wild Rice and Native Forests than any of the Proposed Alternatives, including SA-03.

Wild rice, in addition to being an important economic consideration in Minnesota, is also an extremely important cultural resource, as well as an essential food source for humans and wildlife. It requires very specific conditions and good water quality, both of which are provided by north central Minnesota lakes. The Sandpiper pipeline would encroach on some of the richest wild rice territory in the state of Minnesota. Further, MPCA staff has identified 10 wild rice locations along the Sandpiper route for which there is no access from pipeline to the location of the wild rice. By comparison, SA-03 has two such areas. As shown in Figure 2, SA-Applicant (in green) would threaten significantly more of the state wild rice crop than any system alternative.

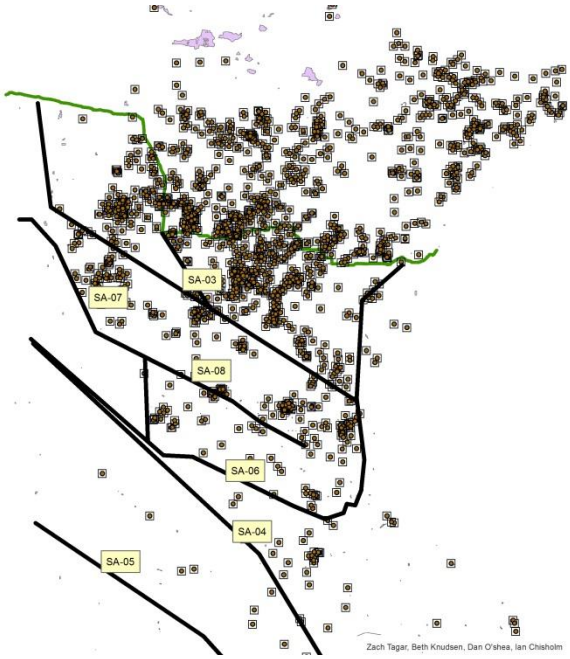


FIGURE 2 -- Wild Rice stands in Minnesota. The Sandpiper route (in green) would threaten more of the state's wild rice stands than any of the proposed system alternatives.

6. SA-Applicant Has a Greater Potential for Impact on Ecoregions than other Alternatives, including SA-03.

As accurately indicated in the DOC study, the majority of SA-03 crosses land that has been converted to agriculture or developed; this is true even when one considers only the portion of the system alternative within the state of Minnesota. Analysis of a GIS map of land cover in Minnesota (Figure 3 below) is helpful to indicate the land cover that would be crossed by SA-Applicant and the Alternatives. When the location of SA-Applicant, and other Alternatives are superimposed on Figure 3, it demonstrates that SA-03 skirts large areas of hay, grassland, pasture, and cultivated crop with infrequent passes through forested areas and wetland. By contrast, the SA-Applicant route crosses a significant amount of forested lands and wetlands, encroaching on significant agricultural land only west of Clearbrook and in the Park Rapids area. SA-Applicant can be seen to skirt far more forest and wetland areas than either system alternative SA-03, SA-04, or more southern alternatives.

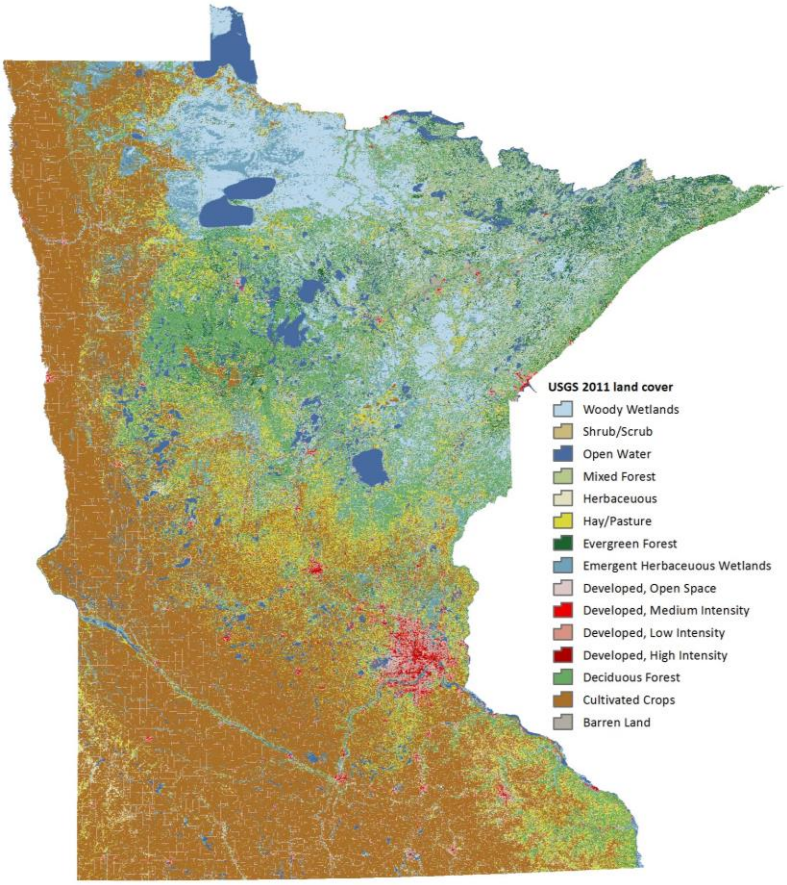


FIGURE 3-- The legend on the left indicates what land cover types are represented by what colors.

Forested areas, particularly larger, unfragmented expanses of forest, are necessary for a number of species of wildlife to survive. Many species of song birds, for example, need deep woods for nesting to avoid "edge species," or species that are more tolerant of human disturbance, because certain edge species such as cowbirds can parasitize their nests and cause mortality to their young. Other species, such as certain reptiles and amphibians, are very habitat specific and cannot easily disperse if that habitat is damaged, such as when a pipeline is placed through that habitat, altering vegetation, soils, and hydrology. Sensitive species of animals and plants require very specific, balanced conditions which can be permanently altered when a pipeline corridor is opened. Long term disturbance and fragmentation of these areas as a result of pipeline construction and siting will have negative impacts on these ecosystems and the wildlife dependent on these conditions.

In addition, an oil spill or release in these areas could result in toxic conditions in soils and vegetation which could kill wildlife. Vegetation would die off either as a result of direct exposure to oil, as a result of altering corridor topography or soil composition during construction activities or clean up after a spill. It is important to note that Enbridge has promised to separate topsoil only if asked to do so by landowners. It is equally important to separate and replace topsoil in forested, remote environments to maintain the integrity of those systems and mitigate some of the potential long-term impacts of pipeline construction.

Impacts to agriculture and pastureland can also occur, and have. However, farms typically do not provide habitat for large numbers of sensitive species or plants or animals that cannot exist elsewhere, and oil movement is likely to be reduced to some extent in flatter terrains with less water movement. Although financial impacts to the landowner and company responsible for the oil release may be greater than in some natural areas, actual environmental damage is apt to be less, and more easily mitigated.

7. SA-Applicant Has More Locations with Poor Access in the Event of a Release than SA-03 or other Alternatives.

As indicated in the June 24, 2014 letter by the MPCA (Document ID 20146-100780-01), access to potential leak sites in the State of Minnesota is of significantly greater concern along the SA-Applicant route than on any of the proposed system alternatives. MPCA staff identified 28 sites along the Sandpiper route for which access would be difficult or impossible within 250 feet of a 2000 foot downstream flow if oil were to be released in certain water bodies. By comparison, seven such areas were located on the SA-03 route, and none on SA-04.

A primary rule of thumb when planning for response to an oil leak is that a release in soil is better than a release in water, and a release in stagnant water is better than a release in flowing water. (For a more detailed discussion of the factors involved in oil spills and responses, see Appendix A to the MPCA comments.) In the Enbridge 2010 Kalamazoo River oil spill, oil caused environmental damage a reported 35 miles downstream from the original release site. The MPCA analysis was limited in scope and only took into account access within 2000 feet of a possible spill. The agency has not evaluated or assessed how much farther oil could travel in some of the identified locations along SA-Applicant's route before containment of a spill could be implemented if the leak were discovered in a timely manner. According to the aforementioned Exponent risk assessment for the Keystone XL pipeline, a small leak from a hole of 1/32 inch in diameter in a pipeline could remain undetected for several months, even with the most up-to-date leak detection technology in place. The same leak could release up to 28 barrels of oil per day, at 42 gallons per barrel. Thus, even a very small, virtually undetectable leak in a remote area, such as those located along much of the proposed Sandpiper route, could cause significant environmental damage such as that described under heading C.3 of this letter without being detected in remote areas, and limited access may also reduce the chance that a citizen may observe and report a leak too small for detection by technology.

The creation of access in remote locations where none exists can create its own problems, including damage to habitat, creation of a source of long-term erosion, fragmentation, aesthetic issues, alteration of hydrology, and other issues. The best way to avoid these concerns is to avoid or reduce the number of crossings of flowing water bodies, or those where access is limited.

From a perspective of minimizing risk of major environmental incidents due to inability to access potential leak sites in Minnesota, the proposed Sandpiper route fares more poorly than any of the proposed system alternatives.

8. SA-03 and Other System Alternatives Follow Existing Corridors to a Greater Extent than does SA-Applicant.

System Alternatives SA-03, SA-04, and SA-05 all follow specific, already existing pipeline corridors. Assuming that all have already passed at least some degree of environmental scrutiny and have been adjusted in critical areas to avoid key resources, a route in these corridors can also likely avoid critical areas and resources. It is important to consider that for these routes, there is no need to "estimate" possible impacts by using an inclusive buffer of a random width to determine quantities of resources that "might" be impacted if one imagines the width of the pipeline corridor to be several miles wide. Instead, one can make a fairly accurate determination of what the impacts or potential impacts of these routes would be based on a width of a few hundred feet. These proposed routes are not "crayon drawings" on a map, but represent actual in-the-ground infrastructure. Precise numbers of water body crossings, mineral extraction sites, forests, wetlands, population densities, cultural resources sites, access areas, and potential downstream carry of released oil all can be determined with relatively little effort by state agencies with access to the required location data. What cannot be determined without more detailed study because of limitations in ArcMap(GIS) capabilities is the quality of those resources. MPCA and Minnesota Department of Natural Resources (DNR) staff can provide general overviews of how the resources in those areas compare to the resources in the northern or forested parts of the state, but on the ground site-by-site analysis is required.

Some of the proposed system alternatives follow highway corridors to some extent, and thus specific placement of the lines is more difficult to guarantee and resource data would be difficult to assess at this stage without more specific information. However, a required consideration for pipeline routing as stated in MN. R. 7852.1900, subp. 3. F., is the use of existing rights-of-way and right-of-way sharing or paralleling. With that in mind, since SA-03, SA-04, and SA-05 all follow specific existing corridors, while SA-Applicant does not in its entirety, then all three system alternatives could be brought forward for further review if they are determined to meet the need for the project, provided that this criteria is considered worthy of sufficient weight in the process.

Conclusion.

SA-03 is a reasonable and prudent alternative to meet the need that may be demonstrated in this proceeding with fewer potential impacts to the highest quality surface waters and other natural resources in the state of Minnesota than SA-Applicant. Further, if the project need is to transport oil from the Bakken fields of North Dakota to markets in the Midwest, system alternatives SA-04 and SA-05 must also be considered as candidates to meet that

need, as they present fewer potential impacts to the natural environment of Minnesota and surrounding states than SA-Applicant.

If a determination of need is reached in this proceeding, the MPCA respectfully requests that the certificate of need be conditionally granted contingent upon suitable modification of SA-Applicant as necessary to protect and avoid high quality natural and environmental resource and the inclusion in the Route Proceeding, Docket No. CN-13-474, of SA-03 along with any other System Alternative that meets the identified need, pursuant to the Commission's authority under Minn. Rule 7853.0800.

Thank you for consideration of these comments.

Sincerely,

William Sierks

William Sierks
Manager, Energy and Environment Section
Minnesota Pollution Control Agency

APPENDIX A

BEHAVIOR AND CLEANUP OF OIL SPILLED TO SURFACE WATER, SOIL, AND GROUNDWATER

Presented below is general description of behavior and cleanup of oil spilled to surface water, soil, and groundwater.

Behavior of Oil in Surface Water

Many factors contribute to the spread and spill response efforts of an oil spill to surface waters, including weather, wave action and the chemical and physical properties of the oil. Oil that reaches surface water spreads on the surface of the water. If the water is flowing, the oil will be carried along. Additionally, wind will spread oil on water. By these forces thick layers of oil will spread and become thinner, more extensive layers. Oil spills may range from thickness measured in feet to a micron-thick rainbow of oil.

Some of the oil on water will evaporate. For example, Bakken oil is more volatile than many other crude oils. The evaporation of the "light end" portion of the oil increases the risk of ignition and exposure of responders to the toxic volatile components in the oil. Some of the oil on the water's surface will sink, especially as it mixes with sediment and as it loses the light ends through evaporation. Alberta oil sands crude is more prone to sinking than are many other crude oils. Sunken oil may move with water and/or may sink into bottom sediment. It may later release from bottom sediment if disturbed or with changes in temperature or current. Oil that sinks is especially challenging and tactics for finding and recovering sunken deposits of oil are not well developed. Removal of oiled sediment creates significant damage on its own. Some of the oil on water will dissolve into the water. Benzene, a toxic component of all crude oil, is among the most soluble components of crude and refined oils. Oil in moving waters will form emulsifications, called oil mousse, which is difficult to recover. Crude oils and refined oils will also have varying levels of hydrogen sulfide and other gases and constituents that are potentially toxic to humans and water life. In addition, oil spilled in surface water will coat and kill emergent vegetation, wildlife, shoreline, structures, and vessels.

Most aspects of response to an oil spill to surface water are made more difficult and less effective in winter ice and snow conditions. This is especially so if oil gets under ice, or if

the ice is not safe for holding up responders and equipment. Sometimes oil on frozen ground or oil on top of competent ice makes for easier oil recovery.

Often a point is reached where the environmental damage caused by attempting to recover spread out and dispersed oil outweighs the damage of the oil. Consequently, oil spill response strategy is to contain spilled oil before it gets away.

Spill Response to Protect Surface Water

Every oil spill recovery tactic requires speedy deployment of specialized equipment by specially trained responders. The tactics of recovery of oil from surface water include:

- Reaching the location of the spill, and reaching downstream oiled or potentially oiled locations. Access along a railroad track or pipeline right-of-way to the spill site sometimes is easy. But getting access to oil that has gotten away from the spill site down river or into fringing wetlands is often very difficult.
- Stopping the flow of oil from the land into the water. Each tactic requires access, and much equipment and specialized training.
- Capturing and containing oil downstream of the spill site. This is usually attempted with floating "containment booms" (floating 50 foot long plastic tubes chained together) to hold the oil. Placing containment booms require access and boats, booms and ropes, anchors, buoys, and specialized training. This equipment is seldom nearby. Containment booms are limited in the amount of oil they will hold back. Containment booms lose effectiveness in water with currents or shallow water. Containment also typically becomes less effective the further downstream oil travels and the more dispersed oil has become. Downstream capture and containment depends on the currents, weather, shoreline type, and access. The best-prepared companies have examined and prioritized potential down-stream containment sites in their response planning before the spill.
- Skimming, sorbing, or pumping oil from the water's surface. A skimmer is a vacuum or sorbing device that pulls the floating oil layer off of the water. Sorbents are natural or man-made materials that absorb oil but not water. The oiled sorbent must then be recovered from the water for disposal. Vacuum trucks can pump oil from oil pools or thick layers of oil on water. Skimming, sorbing, and pumping oil requires access to the oil location and equipment and tanks to store recovered oil for eventual disposal.
- Down-stream, ahead-of-oil protection of shorelines and sensitive features. Containment boom can be deployed at some sensitive locations before the oil arrives to deflect oil further down-stream. Protection measures require careful selection of sites to be protected, since equipment and time does not allow

protection of all areas. In the best of cases, sensitive areas have been examined and prioritized in response planning before the spill.

- Mopping up oil that has been stranded on shorelines, wetlands, marinas, structures, etc. This can be done with sorbents, power washers, oil-lifting chemicals, excavation, etc. This is very labor-intensive work requiring equipment, access, and specialized training. Some mopping-up methods can damage or destroy environmental features, for example excavating beaches, steam cleaning rocky shores, or moving people and boats through wetlands.
- Sampling water, sediment, shoreline, vegetation, etc. to assess where oil or oil components remain in the environment and whether additional recovery is possible and warranted.
- Recovering residual oil from sediments, shorelines, wetlands, and other places as possible.
- Monitoring the ongoing effects of residual oil and of recovery operations.

Even a very aggressive and effective spill response will not recover all spilled oil from a surface water.

Behavior of Oil on the Ground, And In Groundwater

As oil spilled onto the ground sinks into the ground, some oil will be retained by soil. So a small spill may be absorbed into soil and may never reach groundwater directly. But whether or not oil reaches groundwater, the oil retained on or in the soil will serve as a continuing source of groundwater contamination as infiltrating precipitation passes through it. Some soils such as clay have small or non-connected pore spaces such that oil will not readily pass through it, while soils like sands and gravels have large interconnected pore spaces through which oil will pass readily and quickly. The speed of travel is also dependent on the viscosity of the substance. Some oils are very "liquid," passing through soil quickly; other oils are thick, and those thick oils move through soil pores slowly.

"Groundwater" happens at the depth below the surface when the pore spaces between soil particles are filled with water instead of air. The depth of groundwater is highly variable in Minnesota from a few feet to one hundred or more feet. Groundwater moves, typically slowly, towards connections with surface water, wells, or other discharge points. Some fractured rock formations will allow oil plumes to move very quickly and very far.

When oil meets groundwater, the oil will mostly float near the surface of the groundwater, smearing the soils in that interface. The floating oil is termed "free product." It will spread out in a floating layer in the direction of groundwater flow. Some of this floating oil will

dissolve into groundwater forming a "plume." Some will evaporate and rise towards the surface. Some will remain sorbed onto soil.

Spill Response to Protect Groundwater

Once groundwater has become contaminated, the response strategies include understanding the direction, speed, and other characteristics of the groundwater. These response strategies use a variety of tools, including pre-existing information, soil borings, groundwater monitoring wells and geophysical methods. Classic physical strategies to protect groundwater from spills include:

- Pumping spilled oil from the ground's surface before it sinks into the soil;
- Digging oil-saturated soils so that the oil won't continue sinking into groundwater;
- Using high capacity blowers into the soil to suck the oil off the soil or groundwater as a vapor;
- Installing skimmers and pumps into the free product oil floating on the groundwater surface to pump out free product, and;
- Pumping groundwater to draw floating and dissolved oil to the surface for treatment.

Unfortunately, even a very aggressive and effective spill response will not recover all spilled oil from the ground. In those cases, if oil reaches groundwater, strategies for mitigating contaminated groundwater include:

- Ongoing groundwater pumping and treatment;
- Well replacement or treatment of a contaminated well;
- Adding restrictions on drilling new wells in the area;
- Adding oxygen and other materials to enhance natural degradation of oil;
- Ongoing monitoring to track contaminated groundwater behavior, and;
- Monitoring natural attenuation and biodegradation.

So, a spill of oil onto tight soils, with prompt recovery of oil from the ground's surface, and prompt excavation of contaminated soils is more effectively cleaned up and less damaging than is a spill of oil onto permeable soils, or areas with shallow groundwater. Especially concerning are spills of large volumes of oil on permeable soils near wellheads.

Biodegradation of Oil

It is well understood that oil that cannot be retrieved after a spill will eventually biodegrade over a period of years or decades. The rate at which biodegradation occurs in surface water, ground water, or soil is variable and contingent on many factors including oil concentration, soil types, temperatures, adequate oxygen and moisture. Oil-specific

chemical and physical properties influence biodegradation. Some refined oils have additives or other non-biodegradable components.

Dissolved oil at the front and side of the plume will typically be attacked by indigenous microbes. A steady-state will eventually be reached as the microbial biodegradation at the forward edge of the plume keeps up with the oncoming oil in the oncoming groundwater. As oil content of the plume is exhausted, this biodegradation consumes the most or all of the spilled oil and the plume shrinks. This process is called natural attenuation. Understanding natural attenuation is important in a spill response, but natural attenuation is never accepted as the sole response to any spill. Plumes of oil contamination in groundwater are typically measured in hundreds of feet or fractions of a mile from the spill. A plume's life may be only some years, or may be very long.

Synopsis of A Few Oil Pipeline Spills in Minnesota

The largest pipeline spill in Minnesota in recent decades was a 1.7 million gallon crude oil spill from Lakehead (now called Enbridge pipeline number 3 in Grand Rapids in March of 1991. Pumping and extensive excavations of wetland was done to recover most of the oil. About 300,000 gallons escaped to the Prairie River. Luckily, most of that oil flowed onto the river's ice surface, and was recovered by an aggressive and effective company response. If the spill had gone beneath the ice, or had it been in a different season, it would have been far more challenging to recover and would have caused much surface water and downstream damage.

In 2002, the Lakehead (now called Enbridge) pipeline number 3 leaked approximately 250,000 gallons of crude oil into wet land near Cohasset in 2002. An oil burn was done because of concern with impending rain pushing oil to the nearby Mississippi River. Remaining oil was pumped and excavated from the wet land and extensive land restoration done over several years.

In 2009 near Staples, Minnesota Pipe Line Company was reinforcing or replacing sections of pipe. A device placed on the line to temporarily reroute the line failed during the night, and approximately 210,000 gallons of crude oil was lost. It pooled at the surface and no surface water was nearby. An aggressive excavation was immediately begun. Many thousands of cubic yards of soil were removed and disposed off-site. A passive sump system was left in place for a few years at the deepest point of impact. The contamination did not migrate off site due to the significant excavation effort.

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