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To: [+WPG725 - Clean Environment Commission](#)
Subject: Silica sand Proposal comments March 24/23
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Mr. Secretary:

Please remove my old comments from the registry and replace with this more current version.
Thanks

Thank you for the opportunity to provide comments to the CEC concerning the Silica Sand Proposal (SIO) to mine sand out of the Winnipeg Sandstone in the vicinity of Vivian Manitoba. The proponent has broken up the proposal into a geotechnical portion, and a hydrological component. In the geotechnical Stantec on behalf of SIO was able to define the parameters of the cavity dimensions that SIO would need to operate under to excavate the silica without causing surface subsistence. Unfortunately, from my perspective I have found the details concerning the actual removal of sand confusing and lacking sufficient detail concerning how SIO plans to meet the new exaction guidelines. This can be better explained as follows:

• The size of the cavities have been reduced in the new 2023 model but there is no information regarding what the potential amount of sand that is available versus the proposed amount actually recoverable for each individual scenario of limestone thickness (Slide23 - Feb 27/23 Geotech summary). Clarification is also needed on how the bulk density was derived or measured. Information is also needed whether a bulking factor was used or is proposed to be used in present and future calculations of the sand amounts.

• The proponent has indicated that the slurry mixture has a ratio of 50% sand to 50% water that was derived from test excavations. The proponent has also stated that ratio can vary over time and has been as high as 90% sand to 10% water. More information is needed explaining the context of the variations and how they were measured, especially as time progresses in the excavation and the ratio of water to sand increases in the cavity.

• Spacing has not been given between wells or the configuration of wells that could be potentially used for each scenario of limestone thickness. The pumping rates per cluster. vary from 40 gallons per minute to 600 plus gallons per minute in the numerical model scenarios. It is unclear when or in what scenario (Slide 23) this range of pumping rates would be needed or used without further clarification.

• It is unclear how the production of wells in two clusters will proceed or the how the volumes of reinjected water will be adjusted to return to appropriate well and cluster origin.

• Sonar imaging is proposed to be used to determine the extent of the cavity development after periods of excavation. It is unclear how this would be an effective tool in defining the cavity depth and spatial distance to the 65 degree sidewall slope when the bottom one third to half of excavated volume is composed of fine particulate matter which the sonar cannot penetrate.

Porous Tech in their review identified that in the calibration of the model at steady state, there was a consistent overestimation of what was modelled compared to what was observed. What is important from my perspective is that this bias started at elevations that stretch approximately from the eastern fringe of the extraction area to the western edge of the regional area close to the floodway. or pretty well consistent throughout the model area not

just a localized area. Porous tech also implies that any model predictions used to date are therefore questionable. There was also the issue of calibration of storativity and the shale layer in the transient calibration. It seems as requested Porous Tech has provided areas of concern within the predictive model and now the onus is on SIO to complete the necessary input adjustments to better define the model. It would also seem prudent that the model undergoes similar review once the necessary adjustments are made.

The potential collapse of the Winnipeg shale has been identified by both technical reviews provided by Arcadis and Porous Tech as an area of concern. The actual collapse of the Winnipeg shale has also been shown to occur sequentially in the sonar scan graphics from August 28/21 to Dec 17/21 of SIO station Bru 92-8. The Winnipeg shale acts as a hydrogeologic barrier between the potable carbonate limestone aquifer above and the potable Winnipeg sandstone aquifer below. Both aquifer properties have been well documented in reports to date. In the simplest of terms, the carbonate limestone is a dense fractured orientated limestone with larger fracture zones often found at the top overburden limestone contact and the lower Winnipeg shale contact zone. Minor fracturing may also occur throughout but are not consistent. The Winnipeg sandstone aquifer in contrast is a consistent sedimentary silica sand matrix, with an assumed porosity ranging from 25 to 30 percent. Both aquifer have been used for domestic water sources. However, in the past wells have been drilled through both formation and thereby interconnecting both formations. Regulations are now in place requiring that wells interconnecting both aquifers be properly sealed preventing any exchange between aquifers. SIO sand extraction proposal would counter act this proactive measure of preventing interconnection by likely causing the collapse of the shale and allowing the interconnection to occur but at a much larger scale. It is like comparing the local impact of a 0.127 meter diameter well interconnection and that of a 22 to 40 meter diameter interconnection which is much more magnified when multiple clusters are located in a quarter section of land as has been proposed in the extraction plan.

The proponent has qualified that there is insufficient structural strength in the shale to support the overlying overburden during excavation. The design of the excavation cavities has been based solely on the thickness of the limestone and its capabilities to support the overlying overburden from collapse into the mined cavity below. Intuitively this span would be much greater than the shear and bending properties of any corresponding shale span as dictated by the limestone design although no data was provided in the report regarding the structural integrity of the Winnipeg shale to support itself. However, it was noted that if the shale collapses it is irreversible. The proponent has not proposed any mitigation plans regarding the shale deterioration/collapse. The proponent has stated that the water quality of both aquifers are similar so it is assumed with the collapse of the shale there would be minimum impacts to water quality in either aquifer. However, that logic does not recognize the value of having two distinct potable water sources with a natural barrier already in place protecting and separating two distinct aquifers each with unique defined properties for present and future water source demands. Nor does it recognize the extent of the mixing that occurs over such a large cavity space should mining occur. In my opinion that is the key in viewing this as a show stopper or as a consequence of the mining process. If you accept the view of using water quality as a criteria then not only are you setting a precedent but allowing for similar exploitation over the whole extent of the two south eastern bedrock flow systems originating from the Sandilands area. Using these criteria any process causing the collapse of the shale and allowing mixing of the two aquifers would be acceptable as long as the water quality was similar at occurrence, 2 months later or 1 year later or in whatever time frame???or at a location 8 miles to the west or 15 miles to the south???. or a location in a densely populated area??? Basically, the permutations are endless and is a criteria that is at best difficult to define or enforce. What is significant from my perspective is that it potentially allows for reduced control of the uses of the resource which foremost has been domestic use. On the other hand, if the goal is to protect a precious resource of potable water then preserving the integrity of both aquifers should be foremost and follow the precedent of not allowing the interconnection of the limestone and sandstone in potable areas. As mining would likely result in the collapse of the shale and interconnection of the two aquifers then that would be a showstopper. However, another option to consider would be to allow mining operation west of the Red river where the water is non-potable in both the Winnipeg Sandstone and Limestone bedrock. Thus, if the Winnipeg shale collapsed non - issue because both formations are non-potable and the likelihood of impacting domestic wells within the localized zone would be close

to zero. I believe the proponent has mineral rights close to the north south rail line just west of #75 highway between Aubigny and St Agathe. My vote is to not allow mining in any area where the shale will collapse in a potable water supply area allowing for interconnection of the two aquifers.

The proponent has stated "that the impacts of sand extraction are temporary in nature and full recovery of water levels is anticipated after excavation." However, this statement doesn't consider the changes that will occur within the extraction area in the cavity space consisting of water and fine particulate matter as well as an interconnection to the carbonate from the sandstone. It is unclear what mitigations or safety measures are in place for future use of the water resource that may occur concurrently with the mining process over the 1 to 24 yr period. As an example, what are the safety areas and areas of no future development in the excavation area and pillar area that would be needed to be defined in order to prevent subsistence from future well development and withdrawal.