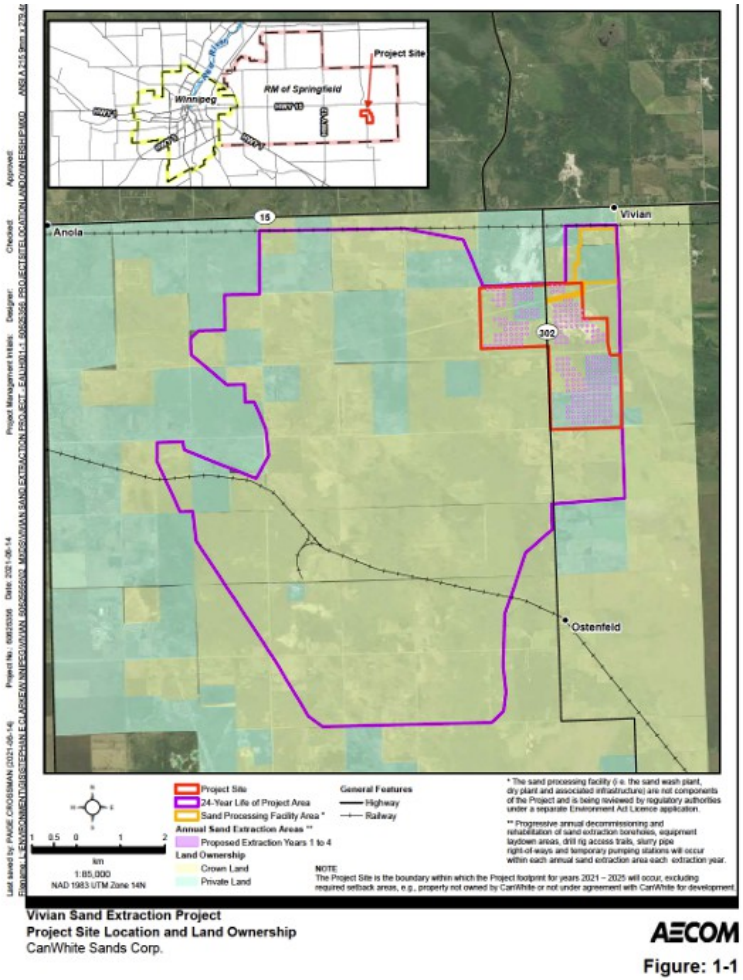
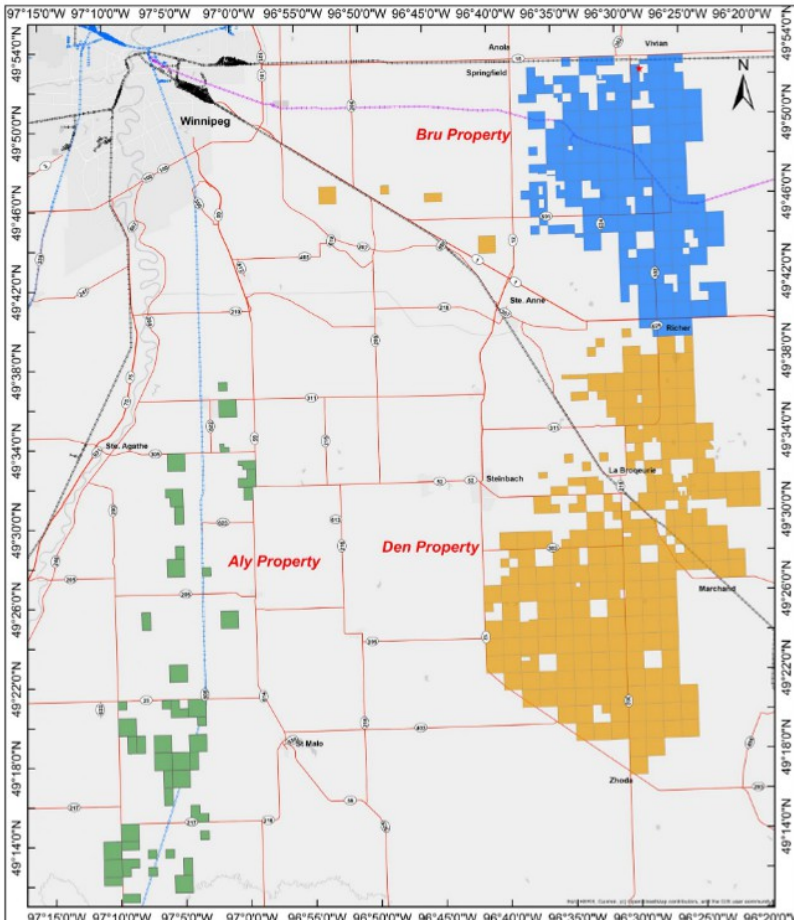
Sio Silica 24 year project area and mining claims

Extraction licence denied by Manitoba Government

Feb. 16, 2024 following CEC Hearing





Two Approvals Processes
Processing Facility and Extraction Project

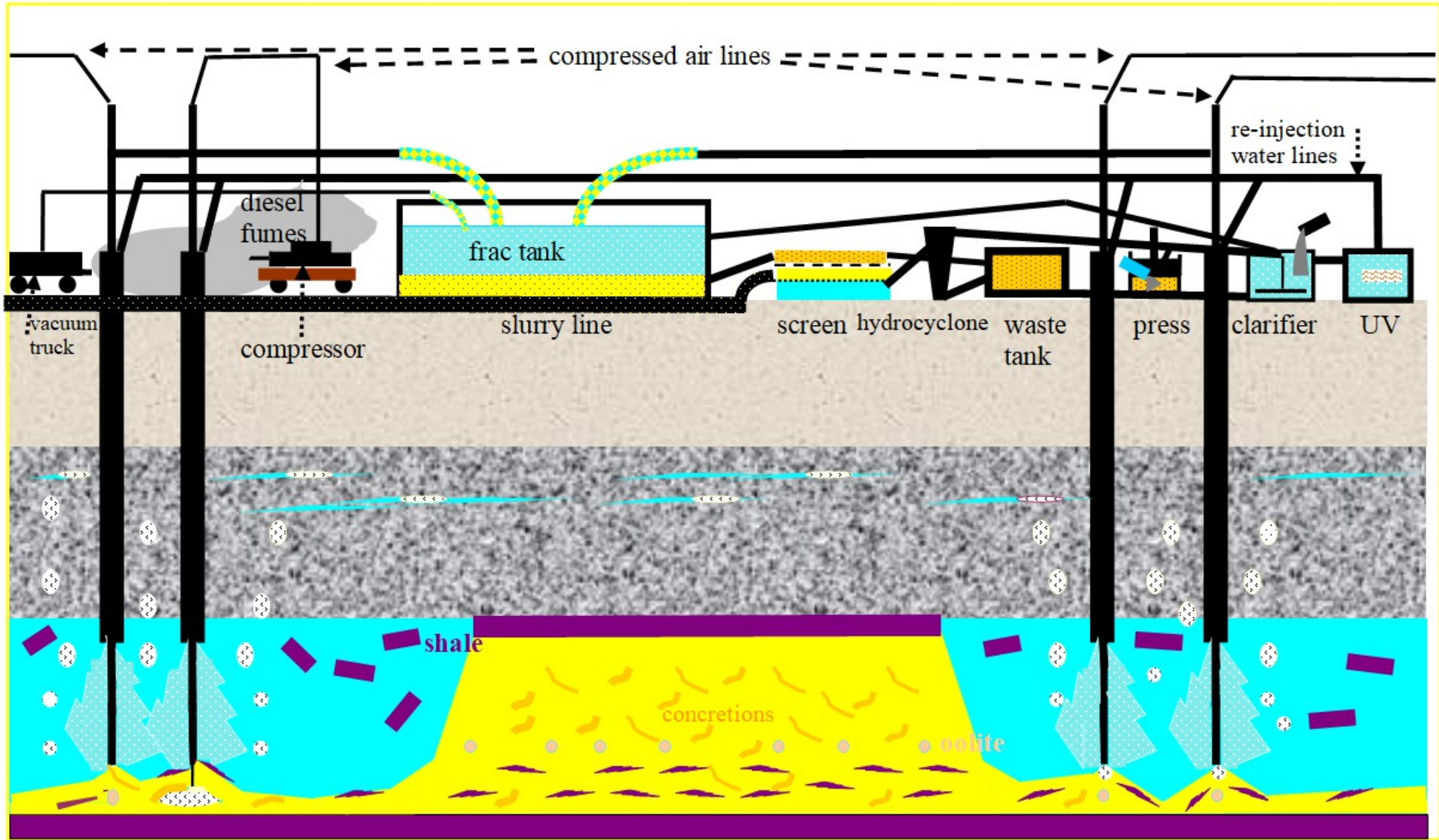
- **July 20, 2020 EAP for Vivian Sand Processing Facility** by AECOM solar panel production, electronics, oil and gas operations, fibre optics, sports field, glass and ceramics - 1.36 million tonnes per year silica sand
- Sept. 2020 TAC, public, BON, MMF, comments/letters posted
- Sept.10, 2020 Update rail loop letter M. Gifford AECOM
- Nov.4, 2020 CEC Hearing letter Director denial posted
- Nov. 2020 Proponent response to TAC
- Nov.10, 2020 Proponent response to public comments
- Feb.16,2020 Notice of Alteration French Drain
- **Dec.17, 2021 Processing Facility Project Licence Posted**
- **Aug.3, 2021 EAP for Vivian Sand Extraction Project Posted**
- Nov.15, 2021 Public and TAC comments posted
- **Nov.23,2021 CEC Hearing Notice from Minister Guillemard posted**
- Dec.20, 2021, Proponent response to TAC comments posted
- Jan.25, 2021 Proponent response to public comments Attachment A: Stantec Geotechnical Analysis for Sio Silica Extraction Project - Public Version
- Aug.19, 2022 Jeff Wharton Minister of Environment form letter denial of processing licence appeal *"I am confident the licence's terms and conditions protect human health and the*
- *environment. The environmental assessment and licensing process to build and operate the*
- *facility was completed per The Environment Act (the act). Environment, Climate and Parks*
- *conducts rigorous scientific reviews of all proposals in consultation with experts to ensure a safe*
- *and prosperous Manitoba*."
- **Feb.16, 2024, Extraction Licence Denied**

CEC Hearing

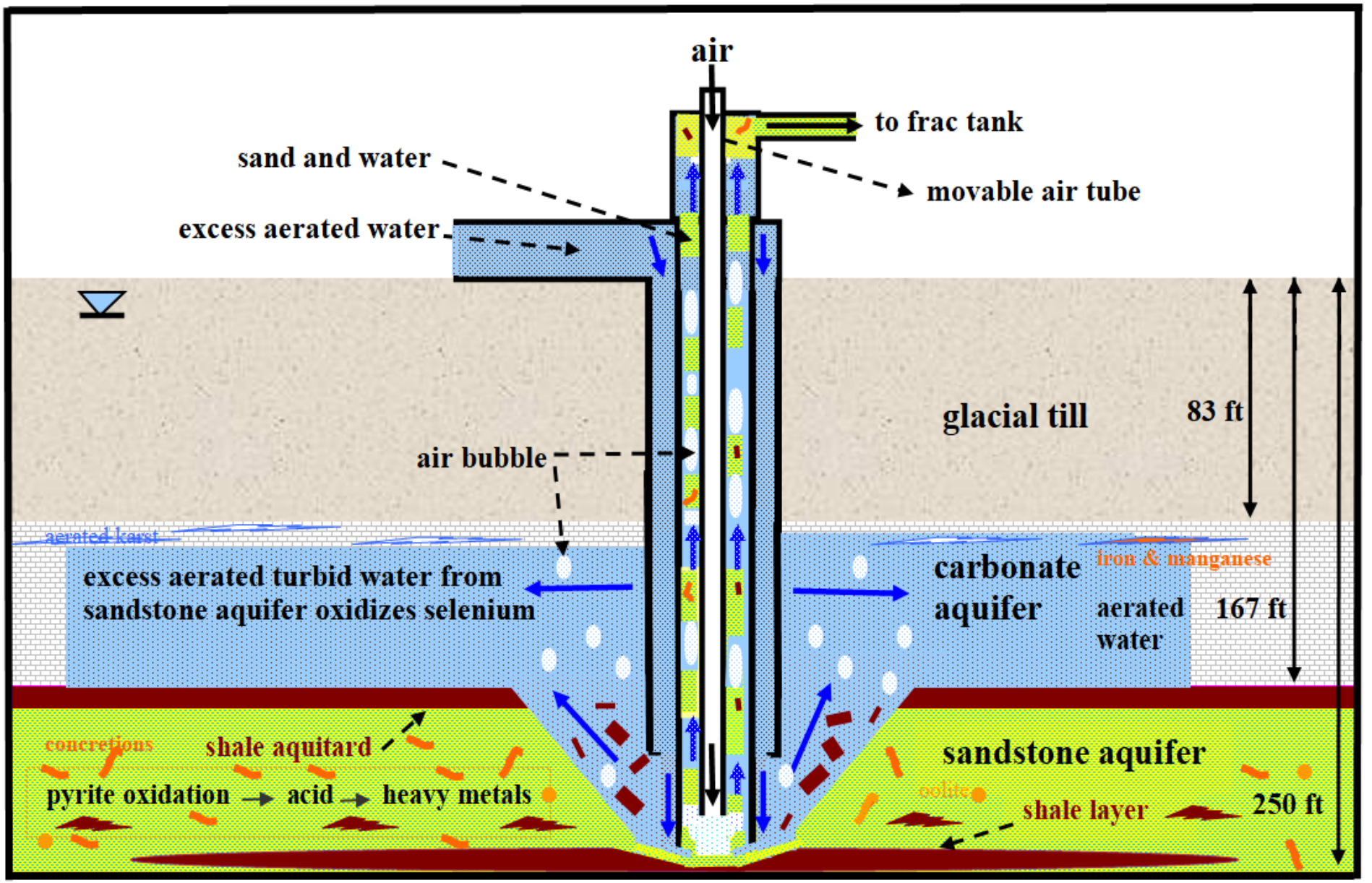
- Nov.23, 2021 Minister's notice of CEC Hearing
- No participate funding – technical experts hired by province Arcadis – geotechnical Hollaender and Woodbury- hydrogeological
- Sept.26, 2022 technical reports issued
- Oct.4, 2022 Prehearing meeting
- Oct. 14, 2022 motions to adjourn Hearing – lack of information
- Oct.19, 2022 Information requests begin
- Feb.13, 2023 14 day rule submissions
- Feb. 27.2023 Oral Hearings Begin
- Mar.15, 2023 Hearings end

Sio Silica Extraction Process

Presented to CEC Hearing by Participant DLN
verified by Dr. E. Pip independent submission



Sio Silica Extraction Well



Memorandum of Understanding with RCT GmbH and MB Government

a) RCT Solutions GmbH (RCT) has approached the Economic Development Board with a proposal to build a 10 Gigawatt fully integrated solar panel manufacturing facility, including a glass factory, (the "Facility") in the Province of Manitoba;

b) The Facility is estimated to be a $3 Billion (CDN) investment that could eventually require a workforce of up to 8,000 staff;

c) Silica sand, sourced in the Province of Manitoba would be an essential input in its entire production process; and

II. **Manitoba** will:

a) provide a One-Window/Concierge Service to RCT to assist them, by making them aware of specific programs and providing assistance in the application process;

b) assist RCT in their efforts by supporting applications under various economic stimulus programs offered by the Government of Canada, including, for example:

MB Strategic Investment Fund, training incentives, capital works incentive fund, corporate tax credits, green energy equipment tax credit, paid work experience tax credit, MB E&D tax credit as represent by J. Wharton Minister of Economic Development and Trade July 26, 2023

Excerpts of Sio Silica Pres Release in Response to Licence Denial

- We are disappointed with the decision of the NDP Government today on our licence, (Feb. 16, 2024)
- A draft licence was circulated to Sio in September of 2023 from the Approvals Branch with a phased approach requiring Sio to conduct initial multi-well testing, rigorous data collection and a final report on findings as well as a Cumulative Effects Assessment all before proceeding with commercial-scale extraction. All recommendations from the CEC were included in the draft licence and Sio accepted these recommendations from the findings of the CEC and conveyed that acceptance to the Provincial Government.
- Sio has also entered into discussions with Broken Head Ojibway Nation for the location of advanced manufacturing facilities on their lands. Peguis Special Projects and Consultation and Broken Head Ojibway Nation are going to meaningfully participate in the development of our project through education, jobs, benefits, and revenues. These benefits will disappear if the project is cancelled.
- It is a known fact that RCT and Sio are contingent upon each other.

https://www.sec.gov/Archives/edgar/data/1848756/000121390024015068/ea194000ex99-1_pyrophyteacq.htm

Evidence that silica sand cannot be used to produce silicon metal for solar panels

In my public comments documented on the Processing Facility Project Registry 6057.00 in 2020 I stated;
"*Solar panels are normally fabricated using high purity quartzite rock. In a paper in the Journal of Physics conference series in 2020, Darvis et al. write*;

"*Silicon is very rarely found in pure form, silicon can be found in the form of silica compounds (SiO2), so to produce pure silicon, high silica purity is needed. Silica that is used for raw materials for making solar panels must have a purity of 99.99%. Quartz sand cannot be used as a raw material for pure silicon for the manufacture of solar panels with ordinary washing processes. This requires a breakthrough in the process of processing quartz sand into pure silica as a raw material for making silicon with high purity that reaches the standard"*

My comments were ignored

References:
https://www.gov.mb.ca/sd/eal/registries/6057canwhite/index.html ERRATA- Updated Comments (6) Page 12-58)
http://www.suncyclopedia.com/en/polysilicon-from-sand-to-solar-cells-it-starts-here/
https://ui.adsabs.harvard.edu/abs/2020JPhCS1434a2021D/abstract"

The SisAL Project

•SisAl is an EU Pilot Project to develop an aluminum metallurgical process to remove oxygen from silica (SiO2) rather than carbon as used in the established commercial carbothermic process. The use silica sand as well as quartz is being investigated.

•Sio Silica Corp's and Pyrophyte's November 2023 Investor Presentation filed with the United States Securities and Exchange Commission states; "*Silicon Metal created from Sio's Silica Sand. Metix and Mintek, world leaders in silicon smelting and metallurgical engineering products have successfully created silicon metal from Sio's high purity silica. This is* ***the first time*** *silicon metal was created successfully from silica sand*."

•Sio Silica did not provide evidence to support their 'breakthrough claim'.- no chain of custody - no report from Metix and Mintex who are involved in the SisAL project

•-Javier Camarasa regarding the SisAl Project published in "*Silicon for the chemical and solar industry*" states; (In the established carbothermic process) "*at an anecdotal level, it can be verified that normally polysilicon manufacturers indicated that beach-type sand is the origin of metallurgical silicon as they don´t know that this type of sand cannot be introduced into electric arc furnaces, whose* ***raw material is quartz in stones, never sand***."

References https://www.sec.gov/Archives/edgar/data/1848756/000121390023085565/ea186711ex99-2_pyrophyte.htm
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4117713

The B and P problem

Measured B and P in Sio Sand is too high for solar panels

- Boron and phosphorus (B and P) must be below **2 ppm** in the feedstock **(**Camarasa paper**)**

- In 2023 Sio Silica/Pyrophyte submitted to the US SEC, a technical report by Stantec Engineering on the silica sand purity in the Vivian area.

- The average concentration of boron in four 2022 drill holes was measured to be **17.2 ppm** .

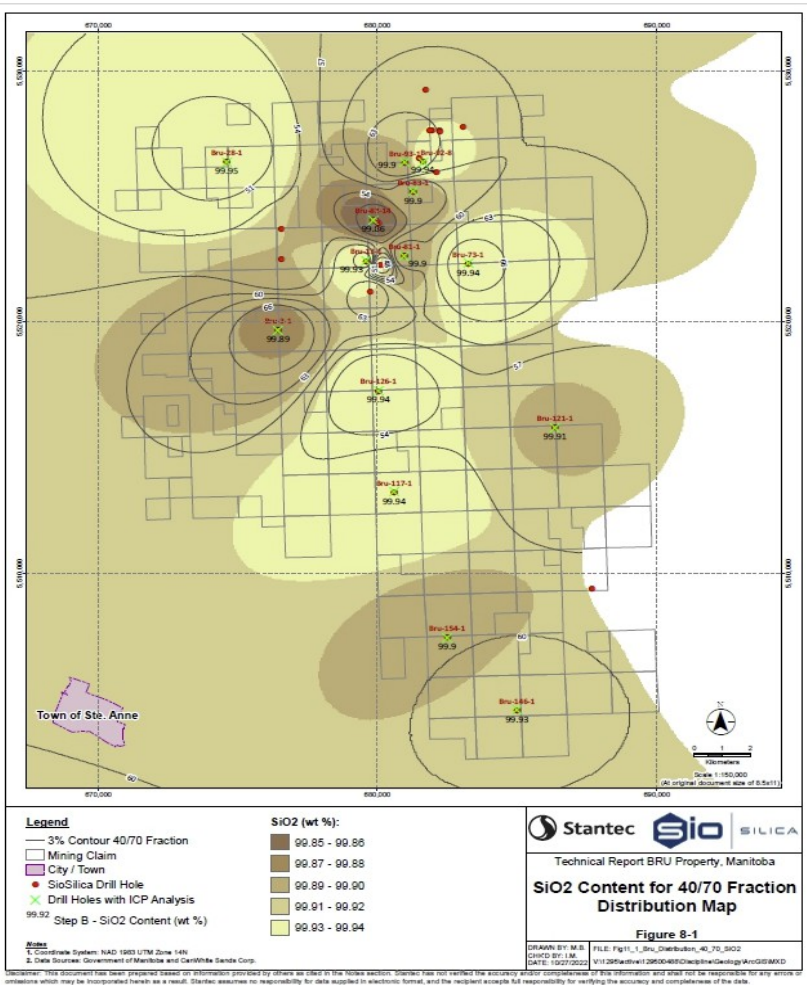
- The P2O5 content of the silica sand was measured as of 0.01 weight % (**100 ppm**) in in 29 samples 2017 to 2022 with only 6 samples reported as less that 0.01%

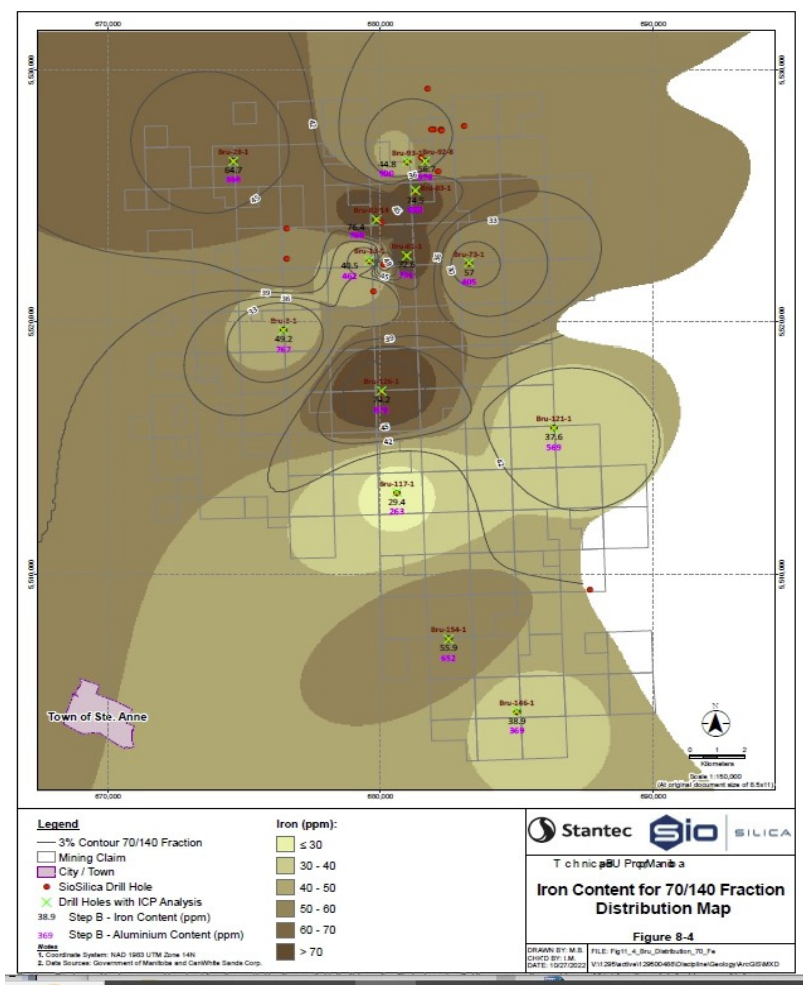
- Stantec did not conduct extensive acid-base accounting testing of the entire deposit to evaluate the potential for acid rock drainage as required by federal MEND guidelines

- **Measured B and P content of Sio Silica sand is too high for silicon metal for solar panels.**

https://www.sec.gov/Archives/edgar/data/1848756/000121390023085565/ea186711ex96-1_pyrophyte.htm

Measured Sand Purity Reported to US SEC by Stantec Oct. 2023

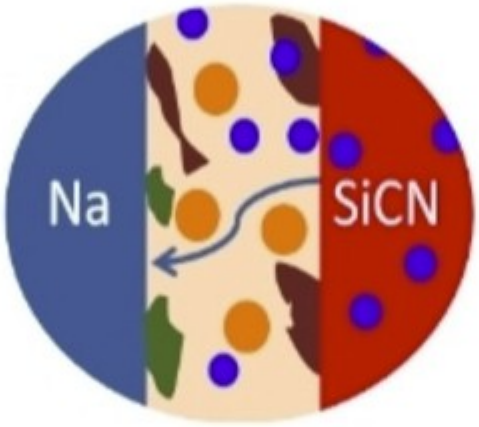


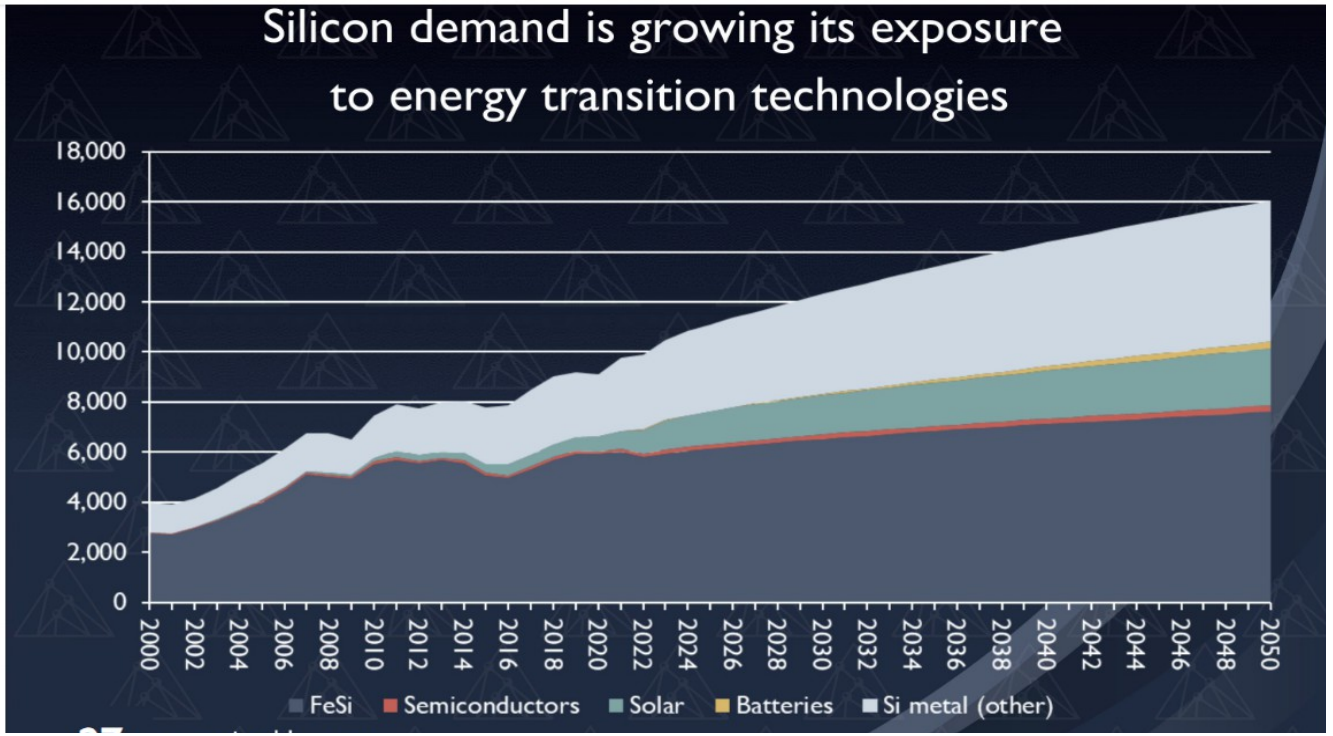


magnetic separator used by Sio Silica was successful in increasing sand purity from a mean of 99.87% SiO2 to 99.91% SiO2 for the 40/70 size fraction, and 99.86% SiO2 to 99.91% SiO2 for the 70/140 size fraction in 14 samples.

EU SIMBA Project

- The SIMBA project consortium consists of 16 partners from 5 different EU countries, two associated countries and one other country
- Investigating the use of solid state electrolytes and novel electrodes including bio-mass hard carbon and silicon carbonitride ceramic (SiCN) anodes for sodium ion batteries
- requires 9N silicon purity from trichlorosilane - currently lab scale
- Despite overtaking semiconductor demand volumes in the 2040s, batteries will still only account for **less than 5% of the silicon metal market by 2050**.

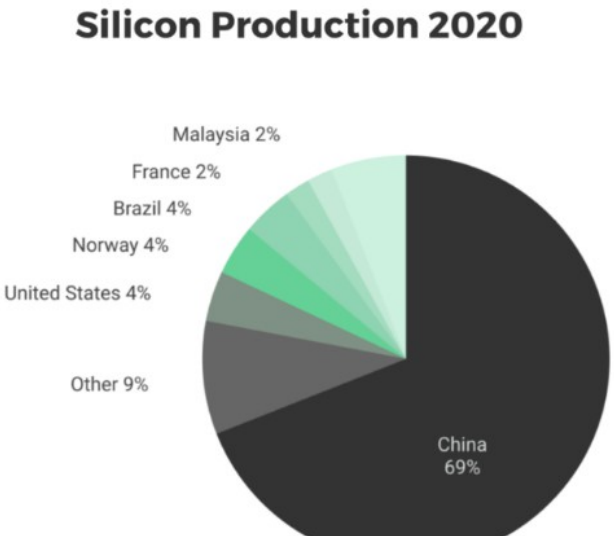




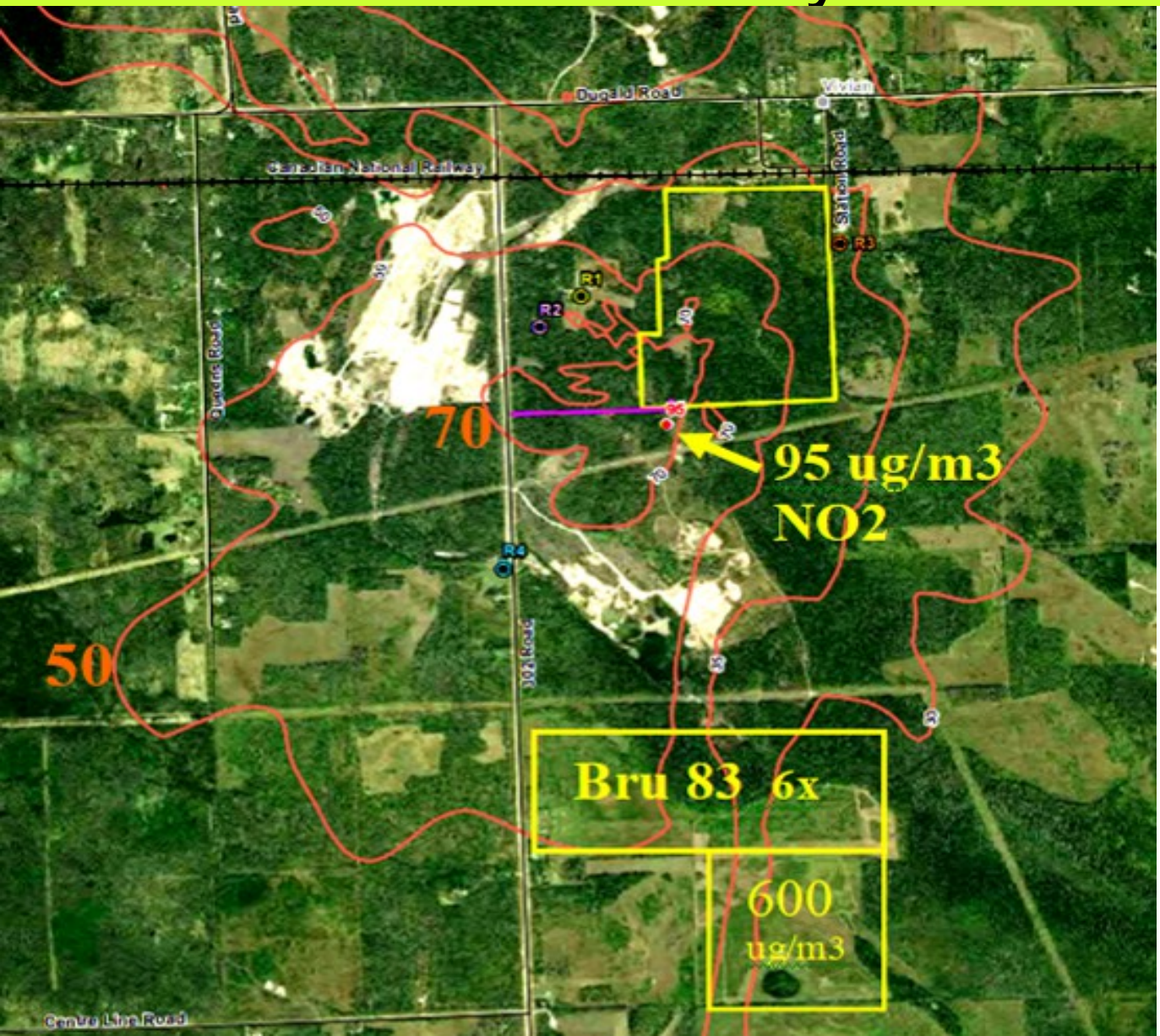
https://simba-h2020.eu https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/batt.202200066
https://projectblue.com/blue/news-analysis/492/what-role-does-silicon-play-in-the-energy-transition
https://simba-h2020.eu/wp-content/uploads/2024/06/SIMBA_MaterialsDevelopment_Zarrabeitia.pdf

Silicon metal and solar panel/electrode production

- Established carbothermic process requires high purity crushed quartz feedstock not silica sand
- Produces large amounts of airborne CO2
- Siemens process is used to remove carbon and impurities to produce trichlorosilane
- Siemens process has large toxic waste streams- Dichlorosilane, Silicon tetrachloride, Hydrogen chloride (HCl)
- Low B and P required in silicon metal from trichlorosilane for electronics, electrodes and solar panels –Evidence shows Sio silica sand too high in B and P



Background Air Quality from Processing Facility EAP



GHG from Extraction EAP Table 6-3 is 6.79 kt CO_2e

GHG for Processing Plant EAP Table 9 is 1.08 kt CO_2e

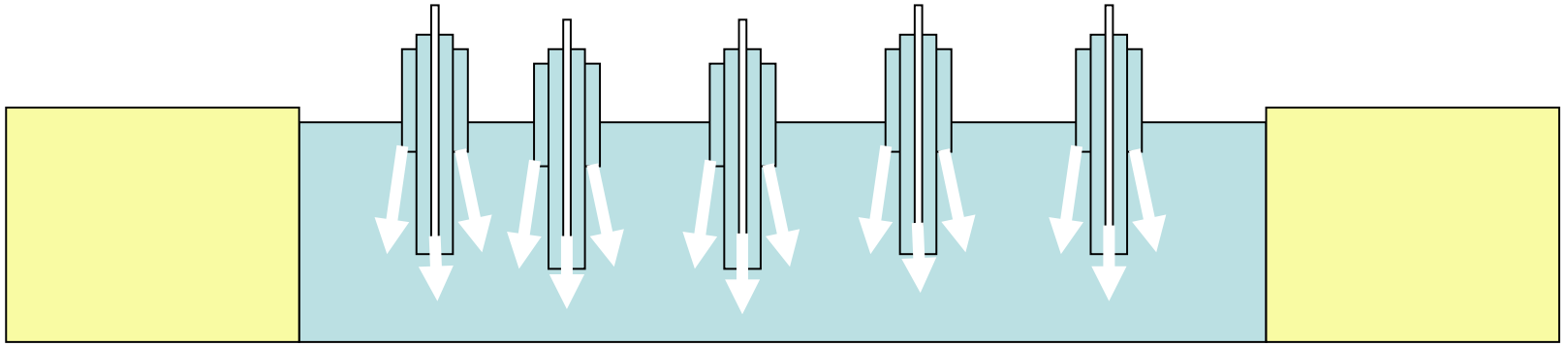
NO_2 air limit 200 ug/m^3

NO_2 contours Figure B-5 Appendix B Air Quality Report Vivian Sand Facility Report July 2, 2020 https://www.gov.mb.ca/sd/eal/registries/6057canwhite/appendix_a_and_b.pdf

Pollutants injected into aquifer in compressor air

Potential contaminant concentrations in the extraction cavity for 12.84 cubic meters of diesel fuel used for each well cluster air compressor and a cavity volume of 16970 cubic meters for 3M NO2 → 2M HNO3 and 1M SO2→1M H2SO4. Cavity volume based on 2100 tonnes of sand extracted per cluster. Diesel fuel based on 5 compressors operating for 5 days at 21.4 L diesel fuel per hour

Substance	NPRI emf (kg/m^3) diesel fuel	Capture fraction	Aquifer Concentration (mg/L)	pH	Capture fraction	Aquifer Concentration (µg/L)	pH	drinking water limit
SO2	4.61	0.1	3.60	4.25	0.01	360	5.25	pH 6.0
NO2	72.4	0.1	54.8	3.10	0.01	5480	4.10	pH 6.0
CO2	2700	0.1	204	-	0.01	20400	-	
benzene	$1.53x10^{-2}$	0.1	$1.16x10^{-2}$	-	0.01	1.16	-	5 µg/L

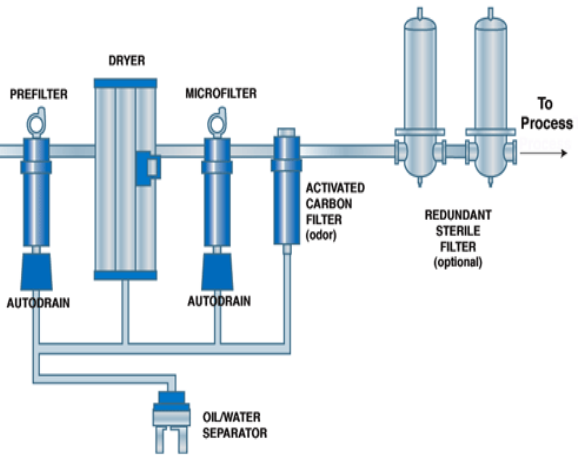


Controlling Micro-organism Growth in Compressed Air A White Paper By Mark White Compressed Air Treatment Applications Manager, https://www.parker.com/Literature/IGFG/PDF-Files/WPCMGICA-00-NA-012021_POST.pdf https://www.parker.com/Literature/Hiross%20Zander%20Division/PDF%20Files/Brochures/WPCAC-EN_00.pdf32 Myths of Oil-free Compressed Air, Mattei, https://www.matteicomp.com/32-myths-of-oil-free-compressors-mattei

Plant Services Home Blog, Compressor power - Actual vs nameplate https://www.plantservices.com/home/blog/11314044/compressor-power-actual-vs-nameplate

Rotocomp Screw Compressor Co. Ltd. Calculation Method of Fuel Consumption for Diesel Air Power Compressor, http://www.rotorcompressor.com/calculation-method-of-fuel-consumption-for-diesel-air-power-compressor.html#:~:text

Microbes Compressor Air Filtration



Source: https://www.coleparmer.com/tech-article/compressed-air-purification-selection-guide

Source: Figure 73 CEC submission by Dr. E. Pip

- No mention of compressor air filtration in EAP
- No mention in EAP or IR responses of chemical air scrubbers required to remove molecular pollutants such as NO2 and benzene
- No consideration of scrubber maintenance and waste
- In response to DLN IR 001 Sio Silica states; "*Most compressors come with a standard intake filter which is designed to remove 99% of 5 micron or larger contaminants and 95% of 3 micron or larger contaminants*."
- **Dr. Eva Pip's** CEC submission states*:" virtually all bacteria can pass through a 3 µ filter. Huge growths of iron bacteria have been reported in wells containing less than 5 mg/L of dissolved oxygen (see Cullimore and McCann, 1978)."*
- Contrary to Sio's rebuttal of DLN submission ISO 8573 for compressor air applies to food and beverage industry as well as pharmaceutical (Trace Analytics)
  https://www.aircheckIab.com/topic/food-grade-air-contamination-video

Simultaneous removal of nitrogen oxide/nitrogen dioxide/sulfur dioxide from gas streams by combined plasma scrubbing technology, J. Air Waste Management Assoc. Moo Been Chang et al. . 2004 Aug;54(8):941 https://pubmed.ncbi.nlm.nih.gov/15373362/#:~:text=Both%20sodium%20sulfide%20(Na2S)%20and,for%20NO2%20and%20SO2%20absorption.

Cullimore, D.R. and McCann, A.E. 1978. The identification, cultivation and control of iron bacteria in ground water. In: Aquatic Microbiology, Skinner and Shewan, Eds., Academic Press, N.Y. 32 pp. https://www.dbi.ca/Books/PDFs/Water-Paper.PDF

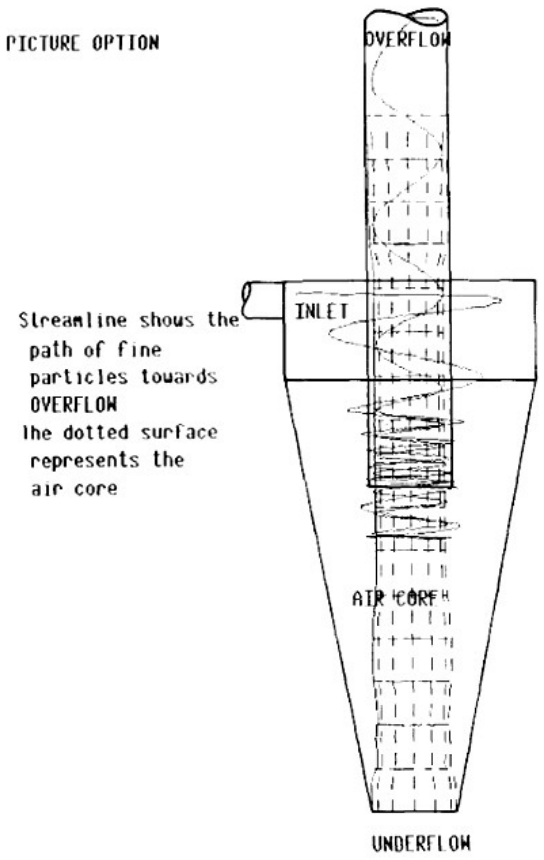
Novel Aquifer Air Sources from Sio Silica Extraction

- Dissolved air in re-injected water
- Entrained gaseous air in re-injected water
- Air leakage or injection from airlift tube

Entrained Gaseous Air in Re-injected Process Water

Sio Silica Sand Extraction Quarry SW of Vivian 2021

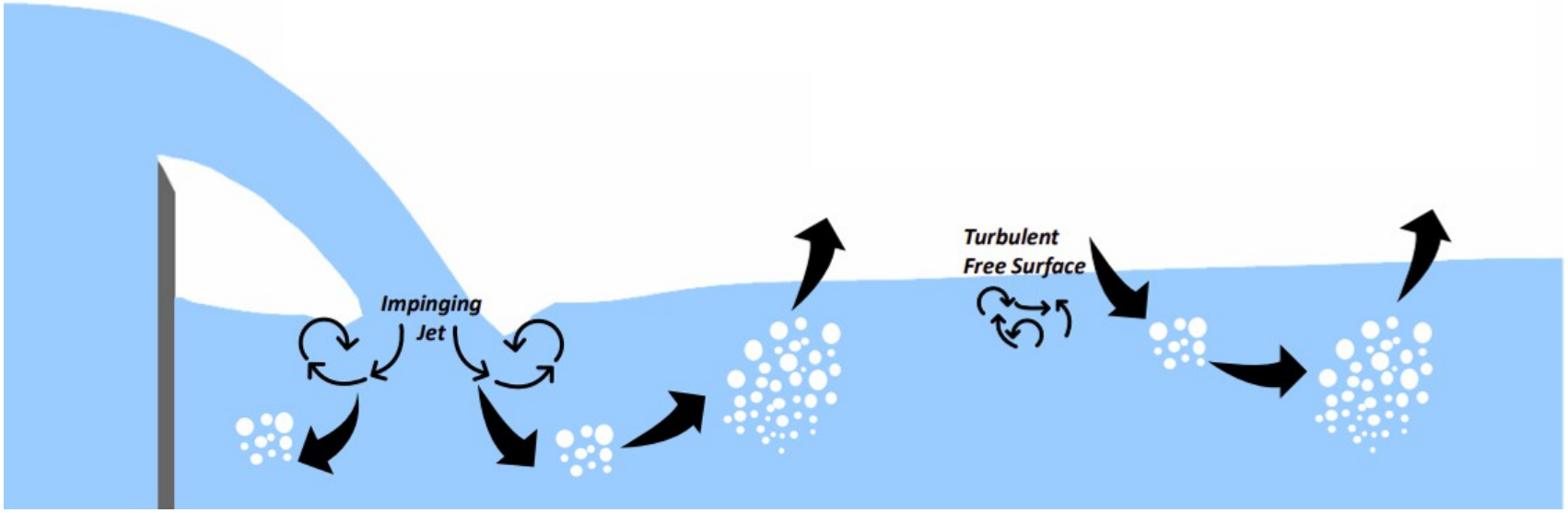
Image used with the photographer's permission

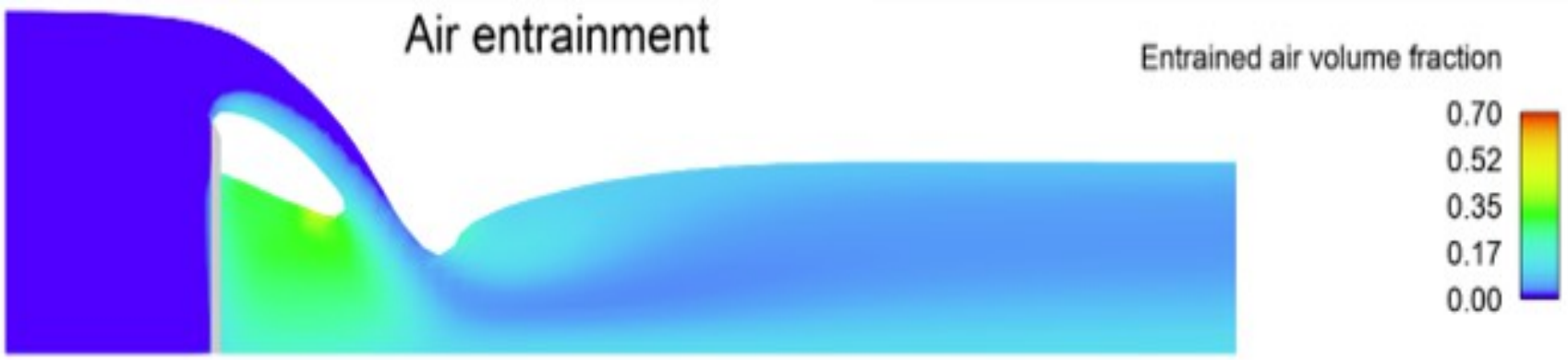


Air Entrainment by a hydrocyclone

Mathematical simulation of hydrocyclones K. A. Pericleous CHAM Limited, Bakery House, Wimbledon, London, SW19 SAU, UK (Received February 1986; revised November 1986) 242 Appl. Math. Modelling, 1987, Vol. 11, August, PII: 0307-904X(87)90139-9

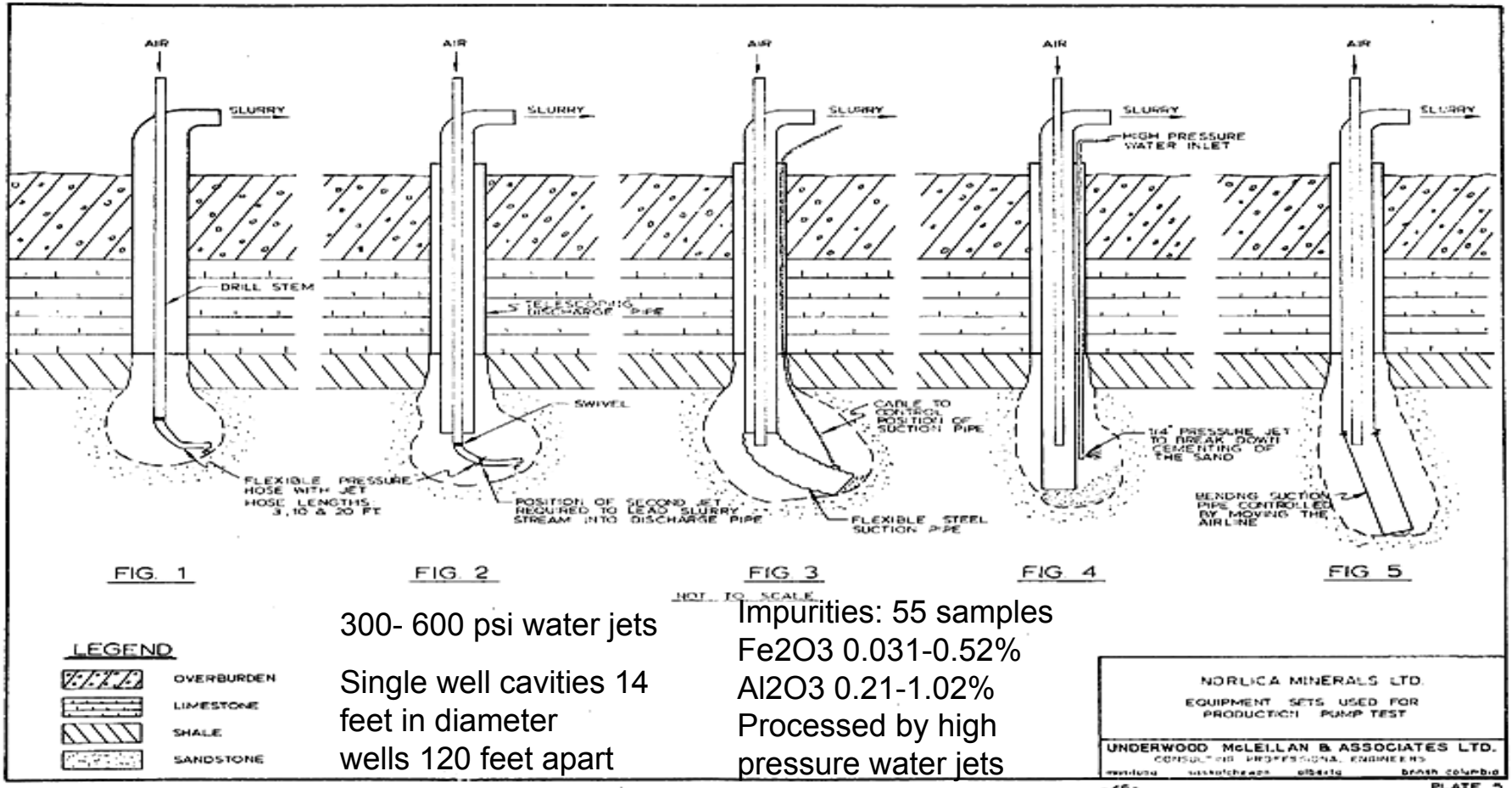
Volume fraction of Entrained Water





CFD Methods for Evaluating Air Entrainment in Drop Structures Karthik Ramaswamy, MS CFD Engineer, Flow Science, Inc. https://www.ohiowea.org/docs/7_Wed_Modeling_3330PM_Karthik.pdf

Norlica Carman Sands Air Lift 1967



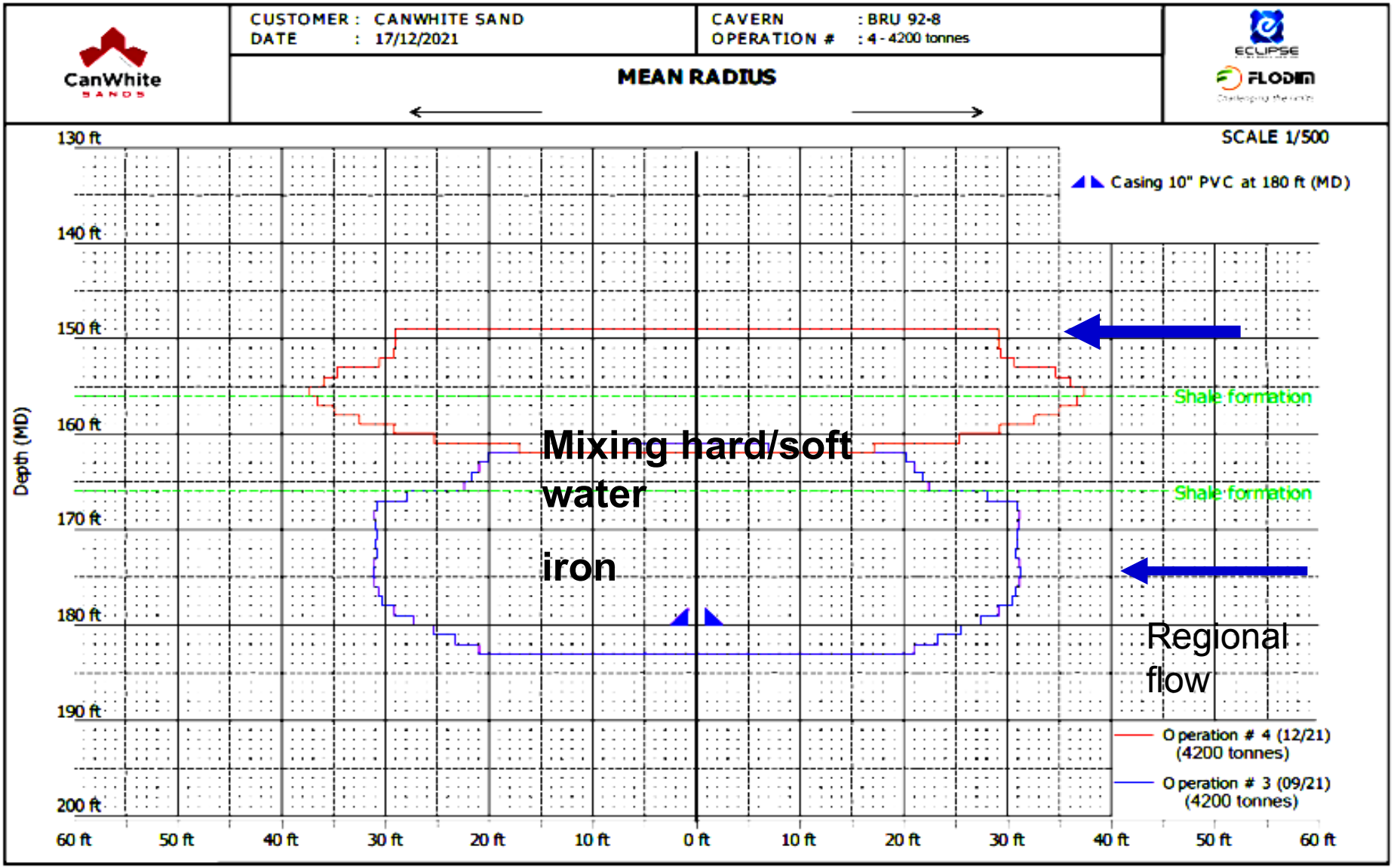
300- 600 psi water jets

Single well cavities 14 feet in diameter
wells 120 feet apart

Impurities: 55 samples
Fe2O3 0.031-0.52%
Al2O3 0.21-1.02%
Processed by high pressure water jets

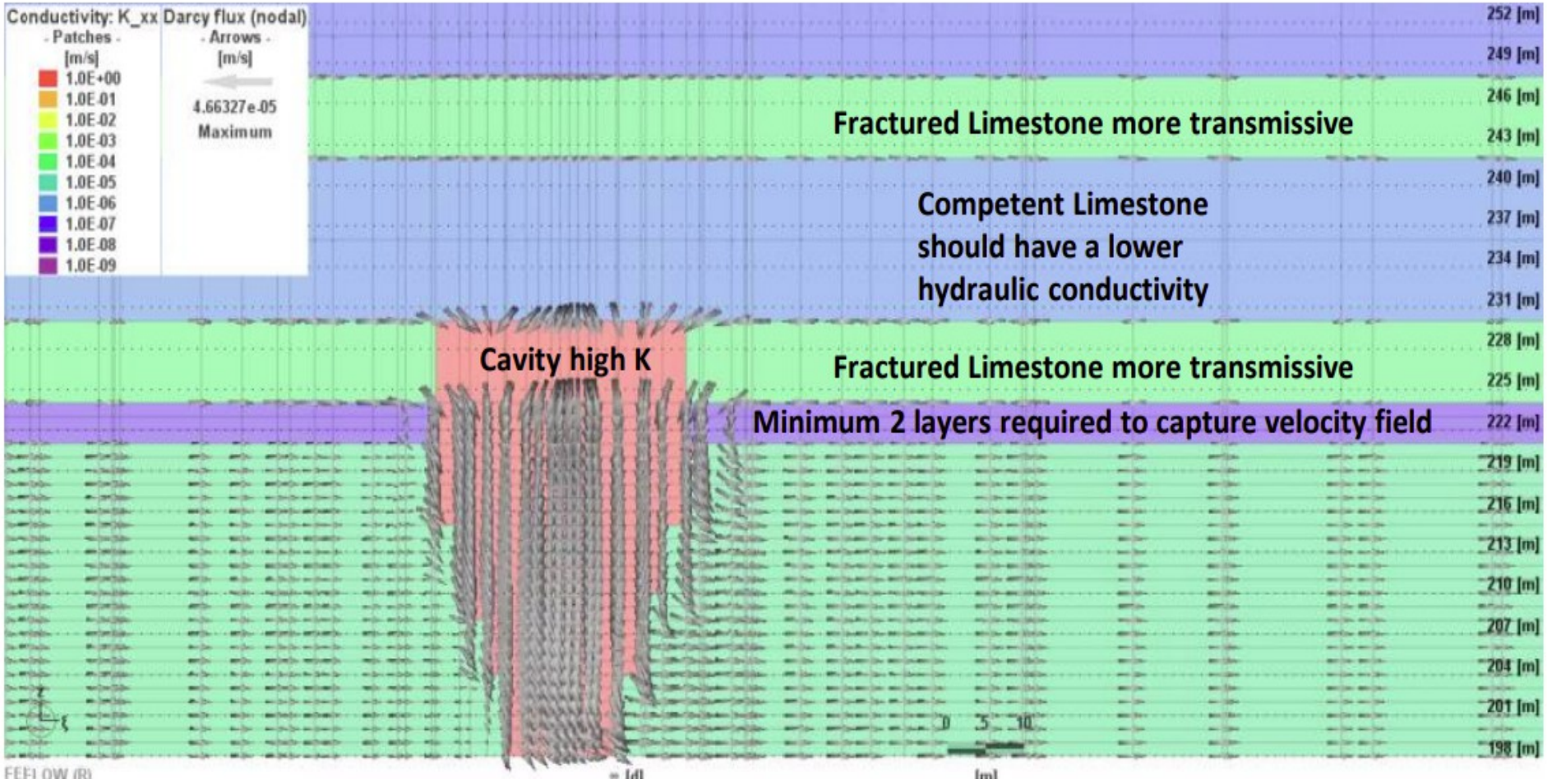
A feasibility Study Of Recovery and Utilization of the St. Anne Silica Sand Deposits, Underwood and McLellan &Associates Ltd. 1967.

Sio Silica Bru 92-8 Sonar



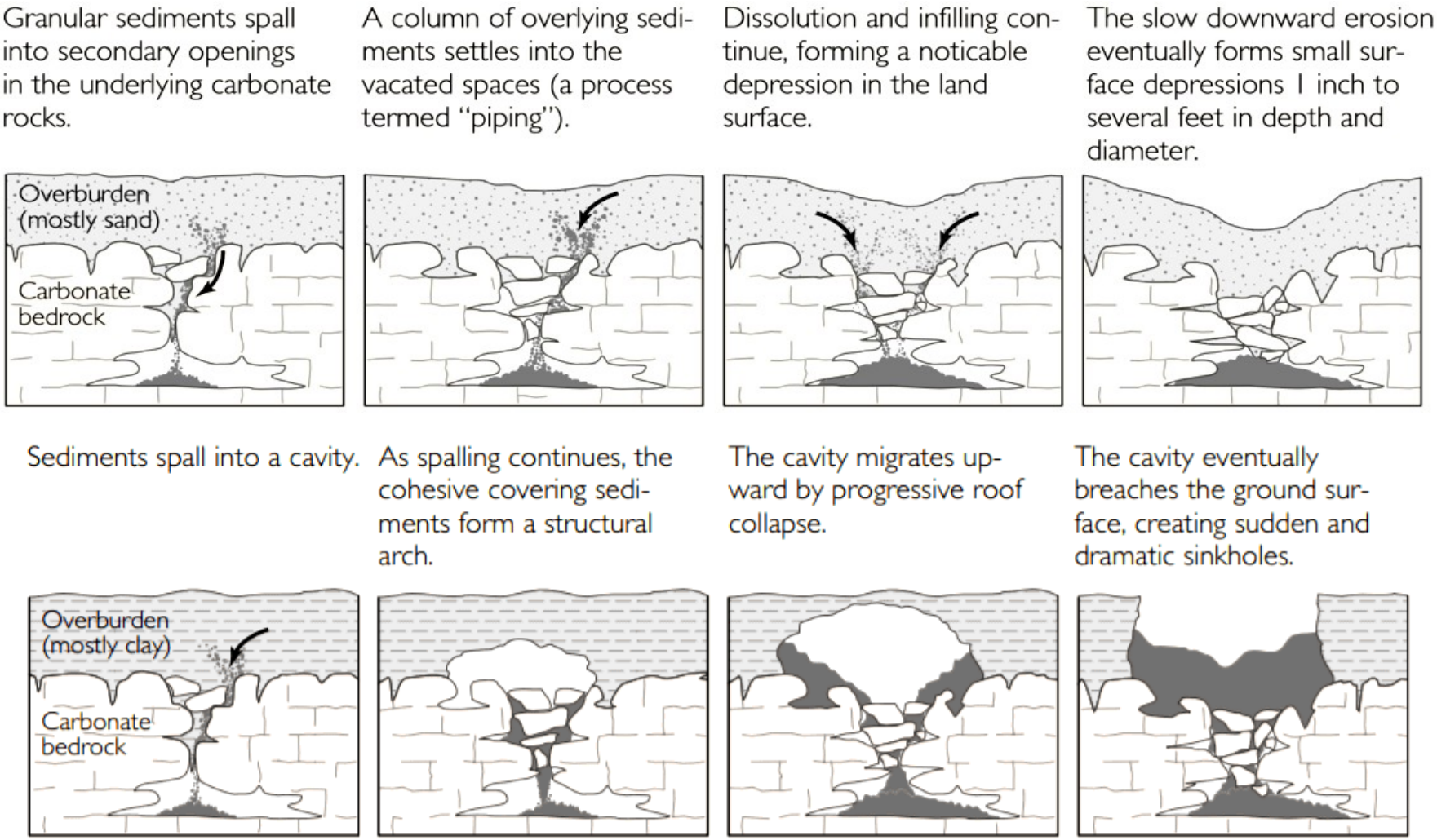
Source: Sio Silica CEC IR 014 response Appendix A

Local Scale FeFlow Model
Mixing of Aquifer Waters



CEC Hearing Vivian Sands Project MBEN/OLS Hydrogeological Evidence Presentation Louis-Charles Boutin, P. Eng. Principal Groundwater Engineer Technical Lead Numerical Modelling 8 March 2023

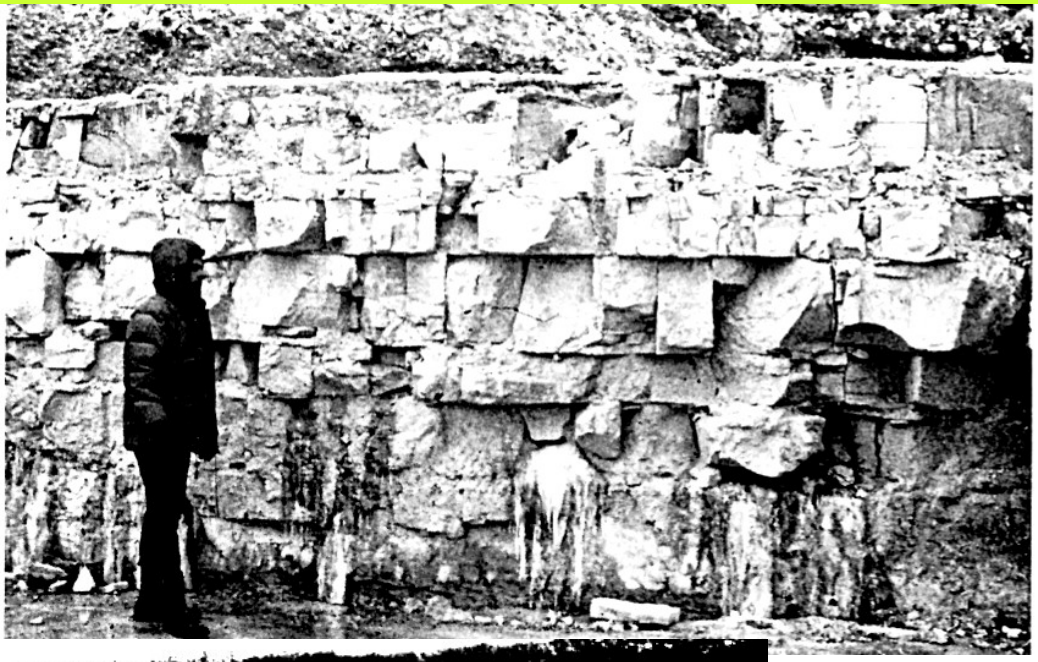
Cover subsidence can occur through increased or enlarged vertical fractures



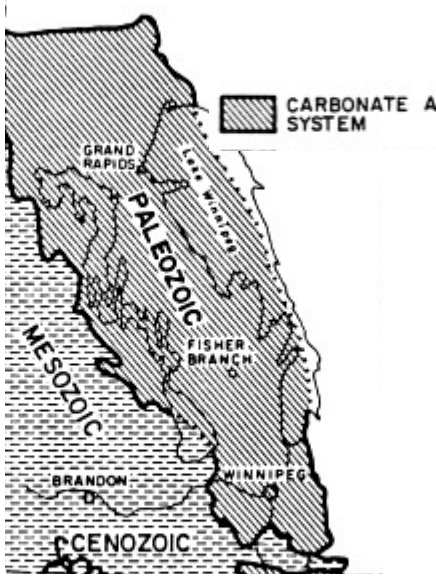
The image is from US Geological Survey (USGS). USGS Water Science School, Sinkholes, https://www.usgs.gov/special-topic/water-science-school/science/sinkholes?qt-science_center_objects=0#qt-science_center_objects

LeNeveu public comments https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_4.pdf

Fractured Limestone Fort Garry Aquifer and Stonewall Quarry



outcrop



Mowat farm 15 km north of Winnipeg

Geological Report GR93-1: The Fort Garry Aquifer in Manitoba R.N. Betcher, H.R. McCabe, and F.W. Render 1993 https://www.manitoba.ca/iem/info/libmin/GR93-1.pdf

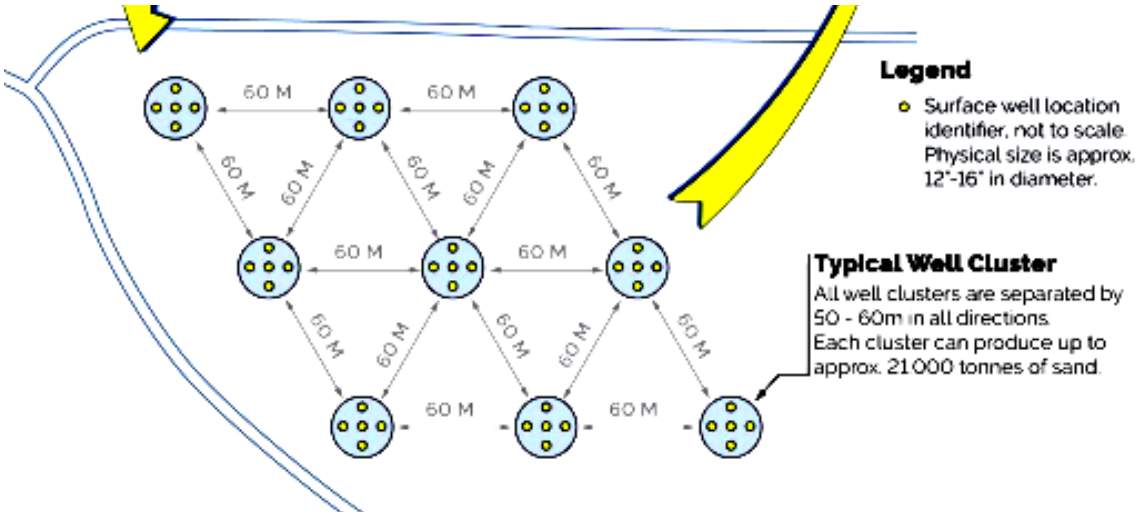
Gillis Quarry Garson 2012 G. Penner http://www.mhs.mb.ca/docs/sites/garsonquarries.shtml

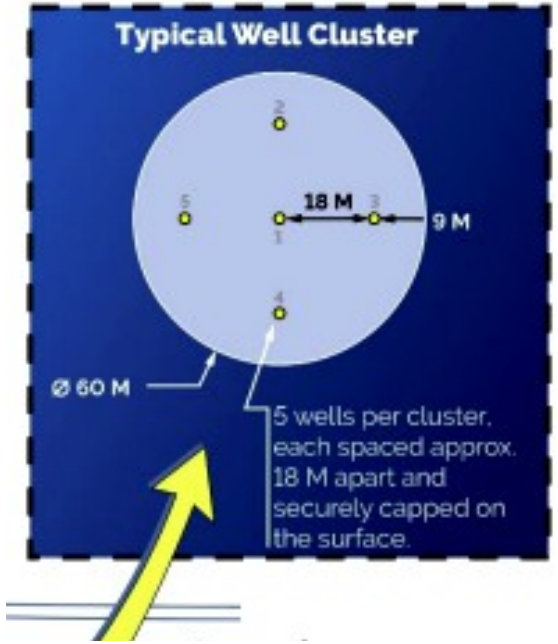
Overestimate of Sand Slope Stability

- Bru 92-8 shows overhang only in shale
- Only one early image of Bru 92-2 with overhang in sand
- Very large sand cohesion value back calculated not measured and not in agreement with most literature values for sand
- Overhang in Arcadis image only in limestone
- No consideration of cover subsidence through fractured limestone
- No consideration of stress from change in formation pressure during extraction

Extraction Plan Timeline

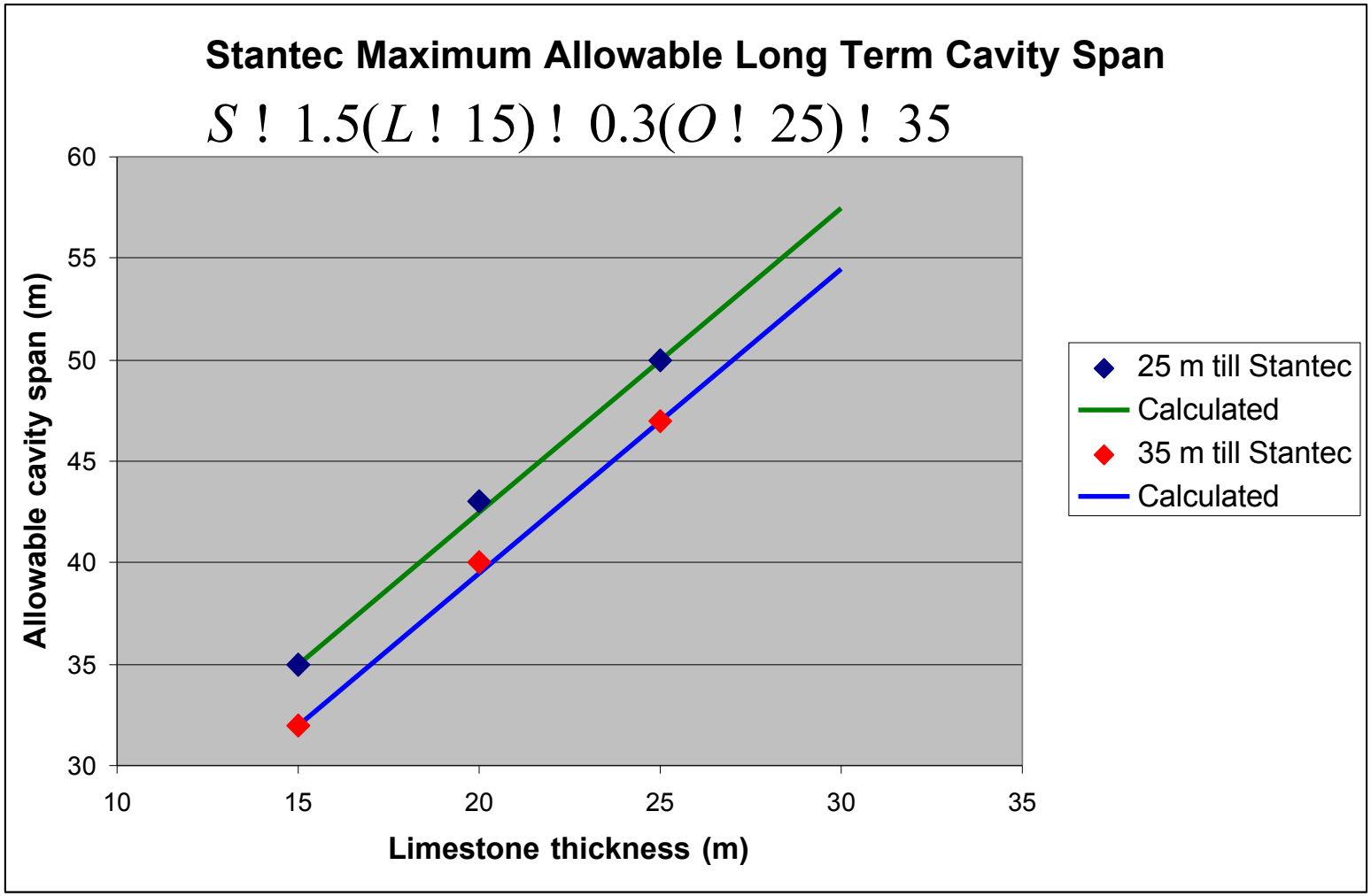
- Stantec Table 9 Data January 14, 2022 in Sio Silica Responses to Public Comments
- Supplemental Filing #1 Extraction Plan June 3, 2023 with 60 m cluster spans





- Information from 6 new wells?
- Revised Extraction Plan Jan. 24, 2023 - no 60 m cluster spans and 1-5 wells per cluster

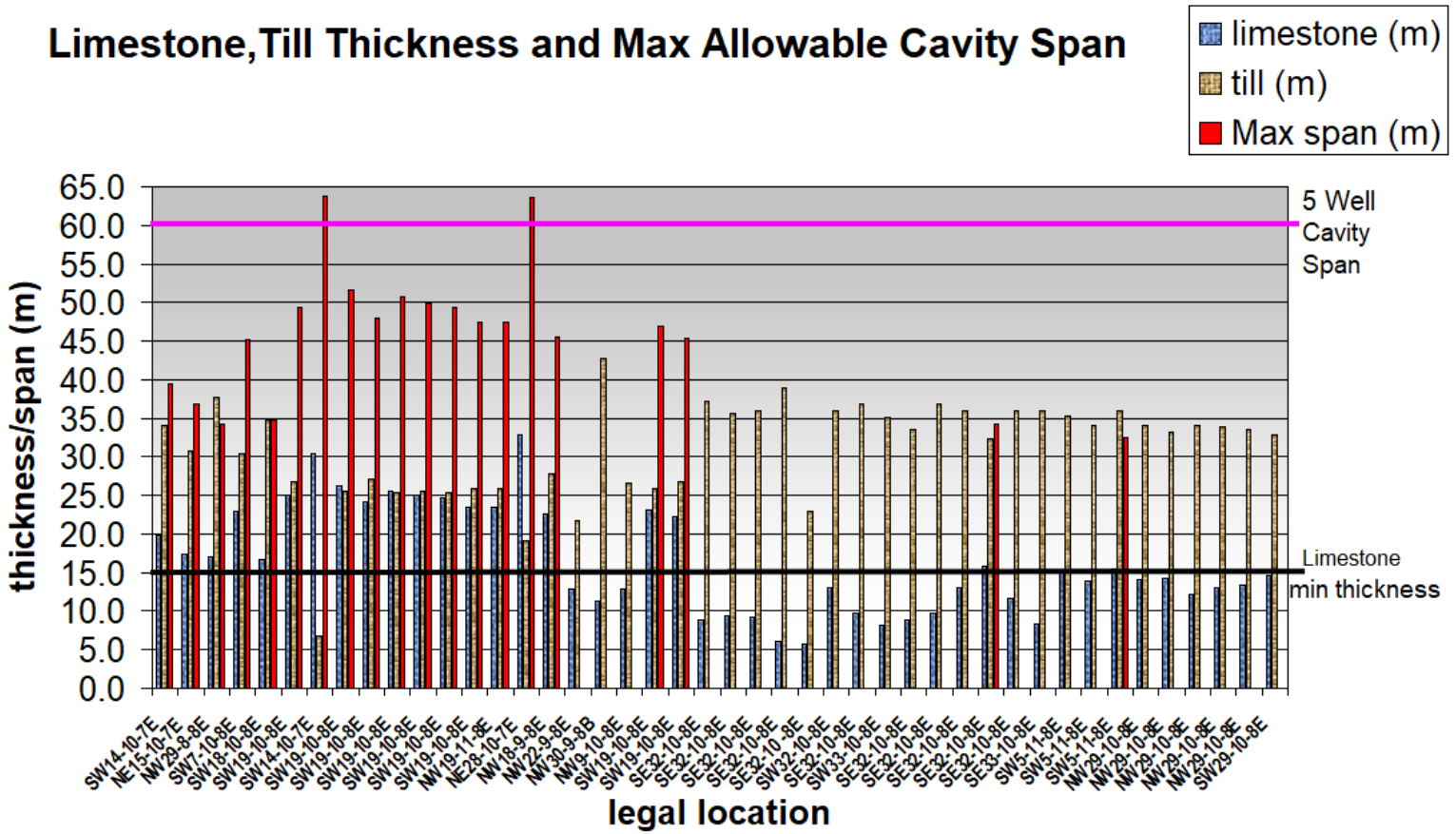
Linear Fitting of Stantec Table 9 Data



Brief Supporting the Motion for Six Material Actions to be completed by Sio Silica and Section 35 Indigenous Consultation to be held before continuation of CEC Hearing

D. M. LeNeveu, M.Sc. Bsc.(hons. physics), B.Ed. Oct. 20, 2022

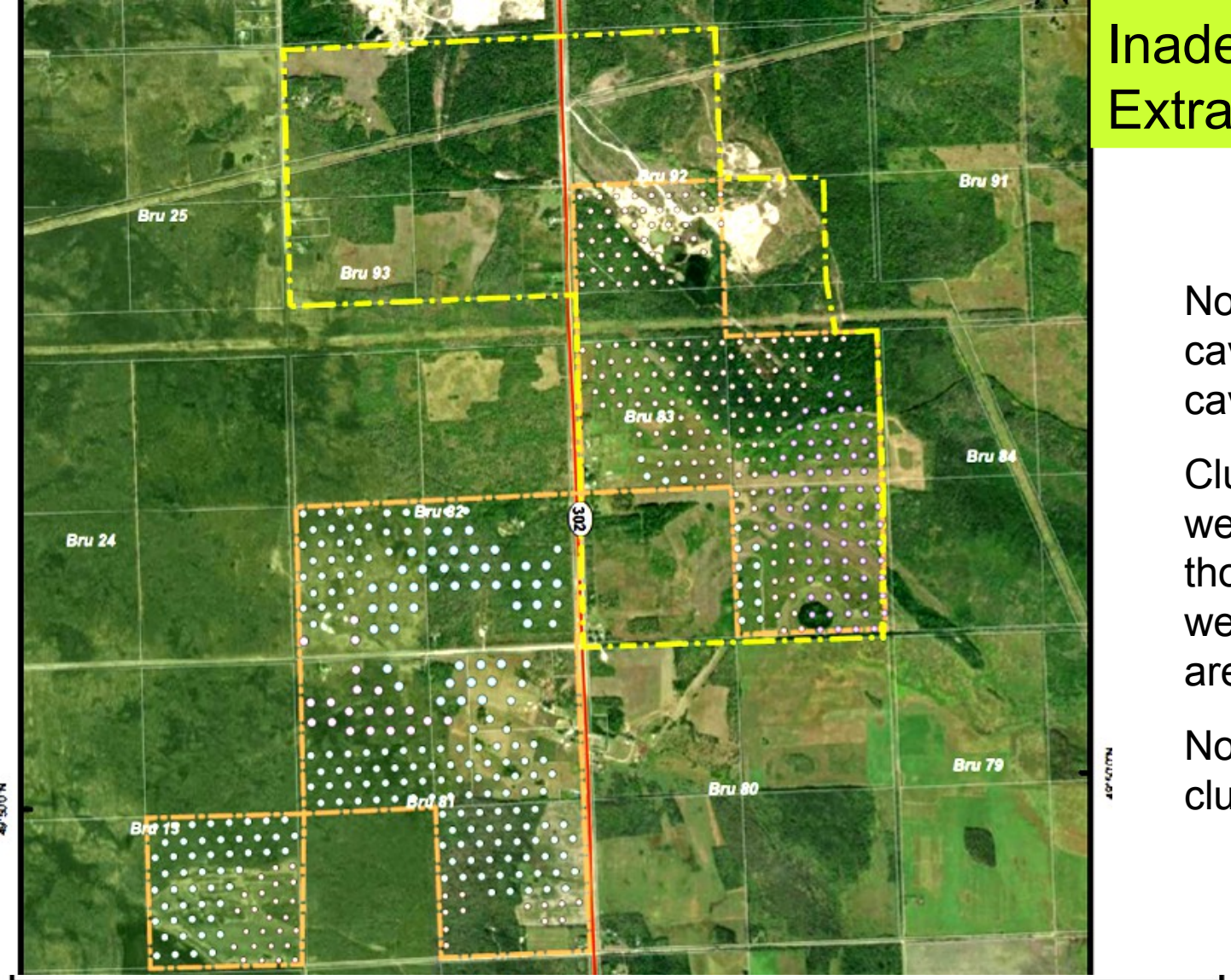
Max Allowable Cavity Span from Stantec Table 9 and MB Groundwater Well Information Reports



Histogram by D.M. LeNeveu from analysis of Stantec Table 9 and MB well information reports data

LeNeveu https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_1.pdf

Inadequate Revised Extraction Plan



- No specification of cavity span and cavity spacing
- Clusters with more wells are east of those with less wells in many Bru areas
- No information on cluster dates

Map Features

Mine Production Clusters
Number of Wells Per Cluster
1 Well
2 Wells
3 Wells
4 Wells
5 Wells
Original Project Area - 649Ha
Proposed New Project Area - 633 Ha

0 225 450 900 1,350 1,800 Meters

Sio SILICA

Revised Extraction Plan

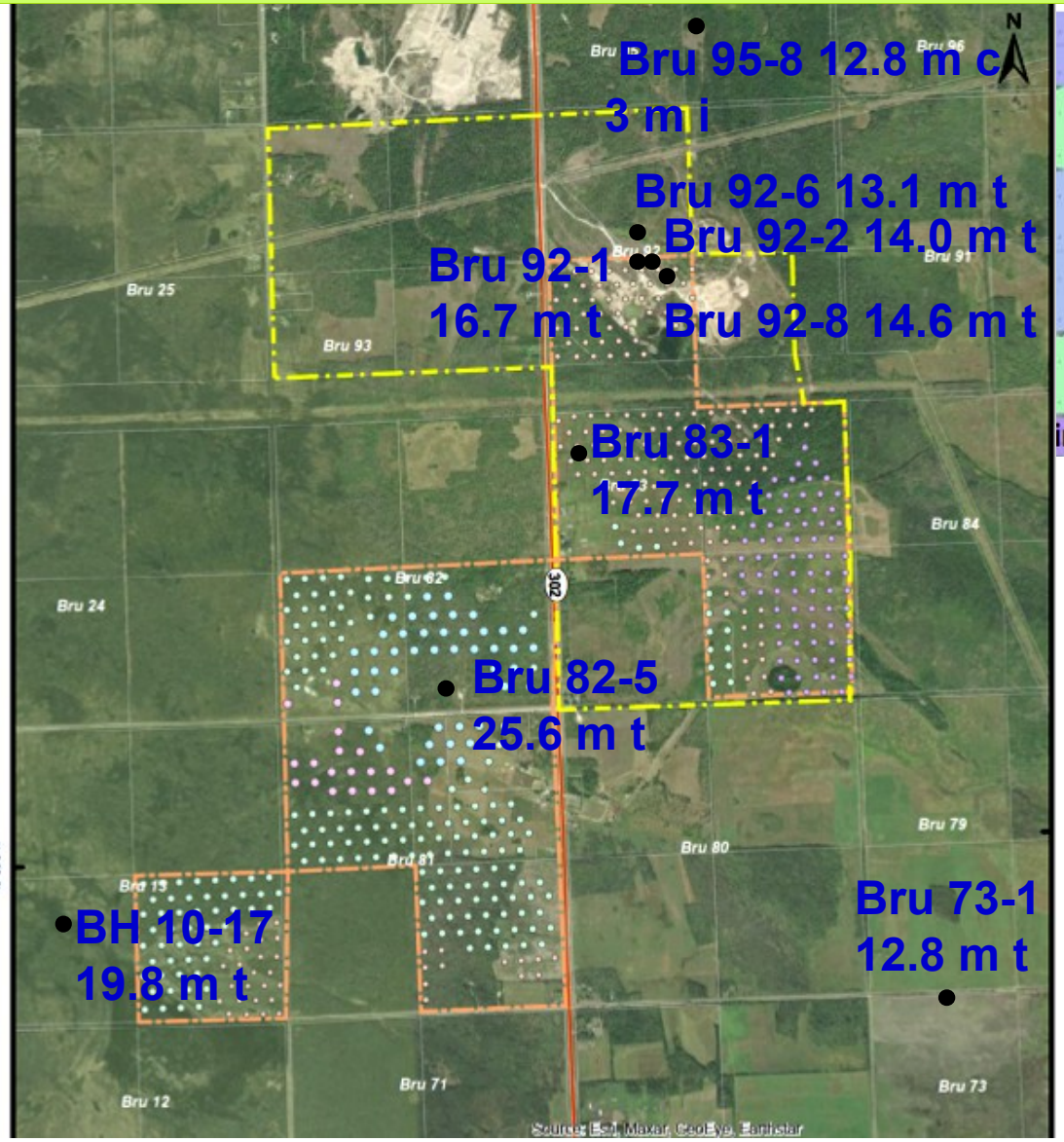
Projection - NAD 83 UTM Zone 14

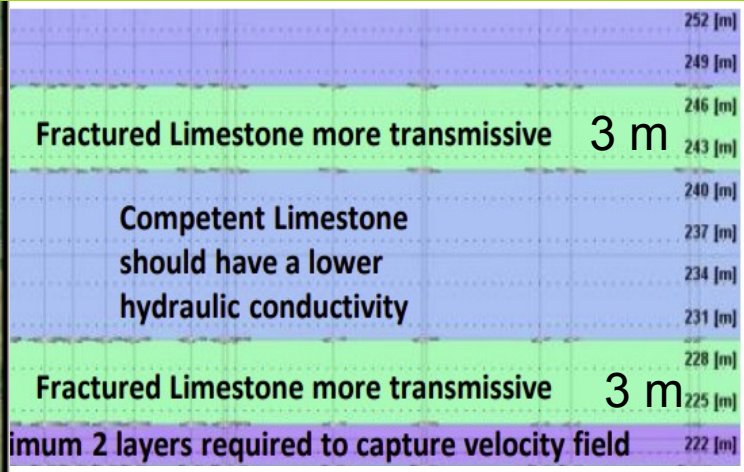
Drawn by TN 01/2023

Attachment A Sio Silica revised extraction plan Jan. 24, 2023.

limestone

Competent Limestone thickness east of highway 302 is less than 15 meters





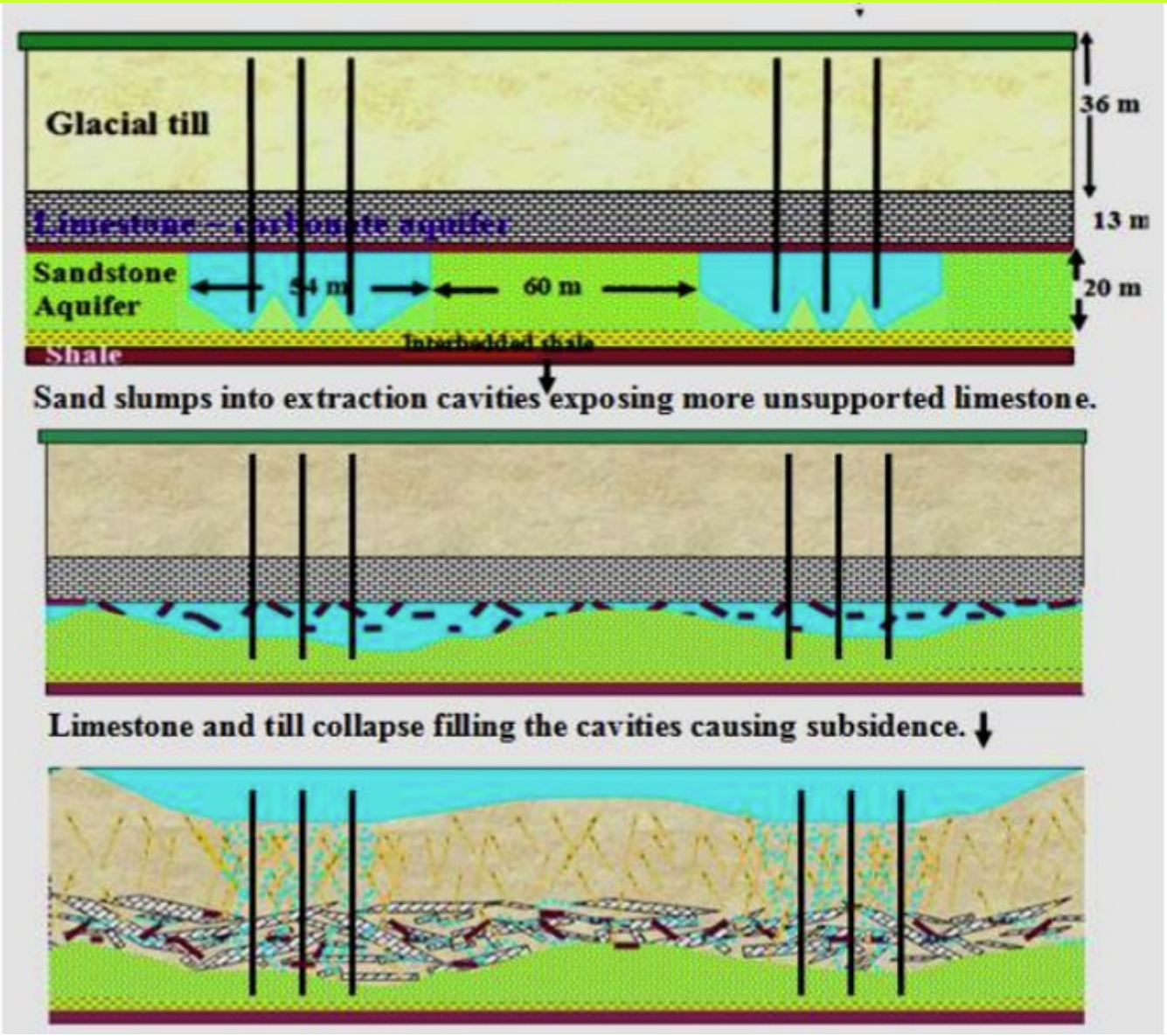
CEC Hearing Vivian Sands Project MBEN/OLS Hydrogeological Evidence Presentation Louis-Charles Boutin, 8 March 2023

t- total c-competent i-incompetent

Documented August 2021 in LeNeveu public comments

Source: *Attachment A Sio Silica revised extraction plan Jan. 24, 2023, limestone thickness from MB Groundwater well information reports*

Sand pillar slumping Limestone collapse



LeNeveu public comments https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_4.pdf

Sinkholes from underground abandoned coal mine in Wyoming

Subsidence and sinkholes at Sheridan,Wyoming from an abandoned underground coal mine

The Figure was reproduced from Effects of Coal Mine Subsidence in the Sheridan, Wyoming, Area By C. Richard Dunrud and Frank W. Osterwald Geological Survey Professional Paper 1164, 1980

Non compliance with Pressure Measurement Requirement during Re-injection of Water

6. The injection well construction must be such that it completely hydraulically isolates the overlying carbonate aquifer from the Winnipeg Formation.
7. Continuous measurement of the water pressure in the carbonate aquifer must be conducted through the entire injection test and during any recovery to monitor the isolation between the Winnipeg sandstone aquifer and the overlying carbonate aquifer. The test must cease if breakthrough is evident in the monitoring.

Inadequate Measures to limit Silica Dust Exposure

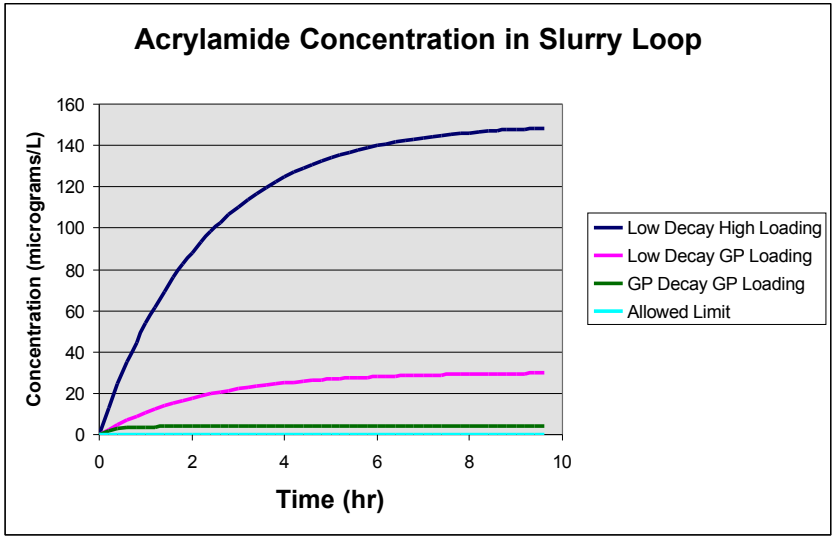
Summer 2021

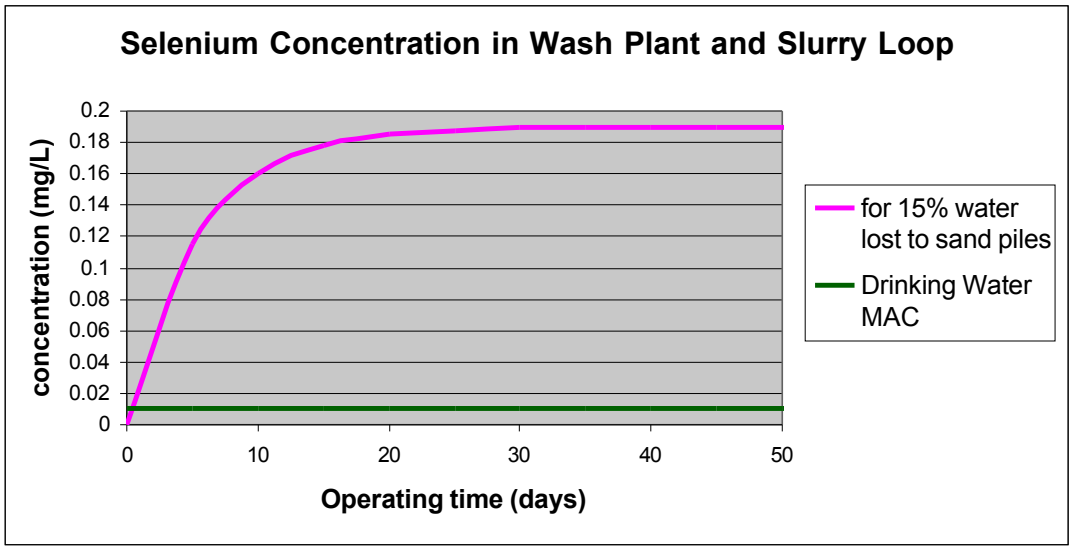
Sio Silica was required to cover exposed sand piles in the spring of 2020 and 2021 following complaints. Summer 2021 piles were left uncovered and workers were again exposed

On June 11, 2020, Steinbach-on-line reported Brent Bullen, Chief Operating Officer of Sio Silica claimed that **stockpiles of silica sand**, derived by mining directly from the Sandstone aquifer, **pose roughly the same threat as the sand along Grand**. (Steinbach Online. Springfield Residents Protest Potentially Hazardous Mine, June 11,2020 https://steinbachonline.com/local/springfield-residents) Sio Silica posted in the response to TAC comments on the public registry 6057.00 for the Vivian Sands Processing Project 2020;

"*Two samples of **raw sand slurry** material were analysed by a third-party laboratory. Results showed **0.67% and 0.45% of particulates less than 11 micrometers in size***"

Accumulation of Acrylamide, Selenium and other Toxins in the slurry line loop





$$C(t) = \left[\frac{M_s}{Q_L + \lambda_a V_p}\right]\left[1 - \exp\left(-\left[\frac{Q_L + \lambda_a V_p}{V_p}\right]t\right)\right] + \frac{Q_L}{V_p}\int_0^t C_i(t')\exp\left(-\left[\frac{Q_L + \lambda_a V_p}{V_p}\right](t - t')\right)dt' \qquad V_p\frac{dC(t)}{dt} = Q_L C_i(t) - Q_L C(t) - M_s - \lambda_a V_p C(t) - C_o V_p \lambda(t)$$

10 USGPM 3.6% 15% water?

Table 7. Slurry loop acrylamide concentration and model parameter values

Water Loss Q_L m^3/hr	Recycle Volume V_p m^3	Acrylamide Loading M_s g/hr	Decay Rate λ_a hr^{-1}	Acrylamide Con. C_s µg/litre	GP Allowed Limit µg/litre
23.7	1325	3.66	4.74×10^{-4}	151	0.5
23.7	1325	0.732	4.74×10^{-4}	30.1	0.5
23.7	1325	0.732	0.125	3.87	0.5

Table 8. Selenium concentration guidelines in mg/L (data from the SIO Silica extraction EAP)

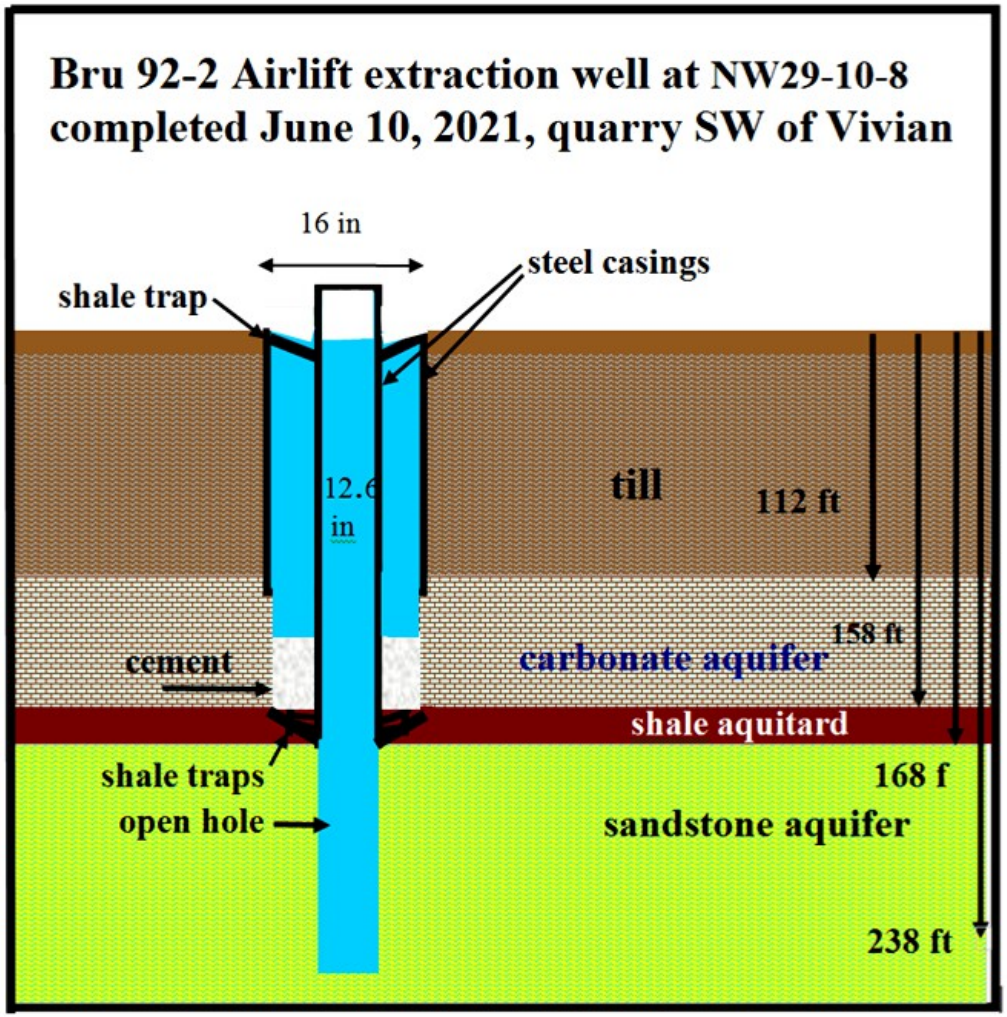
CCME FAL Acute and Chronic (aquatic life)	0.001
CCME Livestock and MWQSOG Livestock	0.05
CCME Irrigation and MWQSOG Irrigation	0.02-0.05
FIGQG Agricultural	0.001
MWQSOG MAC (Manitoba drinking water)	0.01
CDWQ MAC (Canadian drinking water)	0.05

Modelling and illustrations from D.M. LeNeveu Vivian Sands Project Submission

Technical Memorandum, Great Plains Sand, T.Holstrom, March 9,2012 https://www.scottcountymn.gov/DocumentCenter/View/880/Exhibit-M-PDF?bidId=

Selenite is absorbed by iron oxyhydroxides in acidic intermediate Eh reducing solubility, J. Agric. Food chem. Selenium speciation in soil and rice H.A. Li et al. 2010

Bru 92-2 Inadequate Sealing



Location: NW29-10-8E
UTMX:681574.4 UTMY:5526460.6
UTMZ:282
Owner: CANWHITE SANDS
Driller: Friesen Driller
Well Name: BRU 92-2
Date Completed: 2021 Jun 10
Well Use: PRODUCTION/SOUR
WATER USE: Other
Well Status: ACTIVE

WELL LOG (Imperial units)

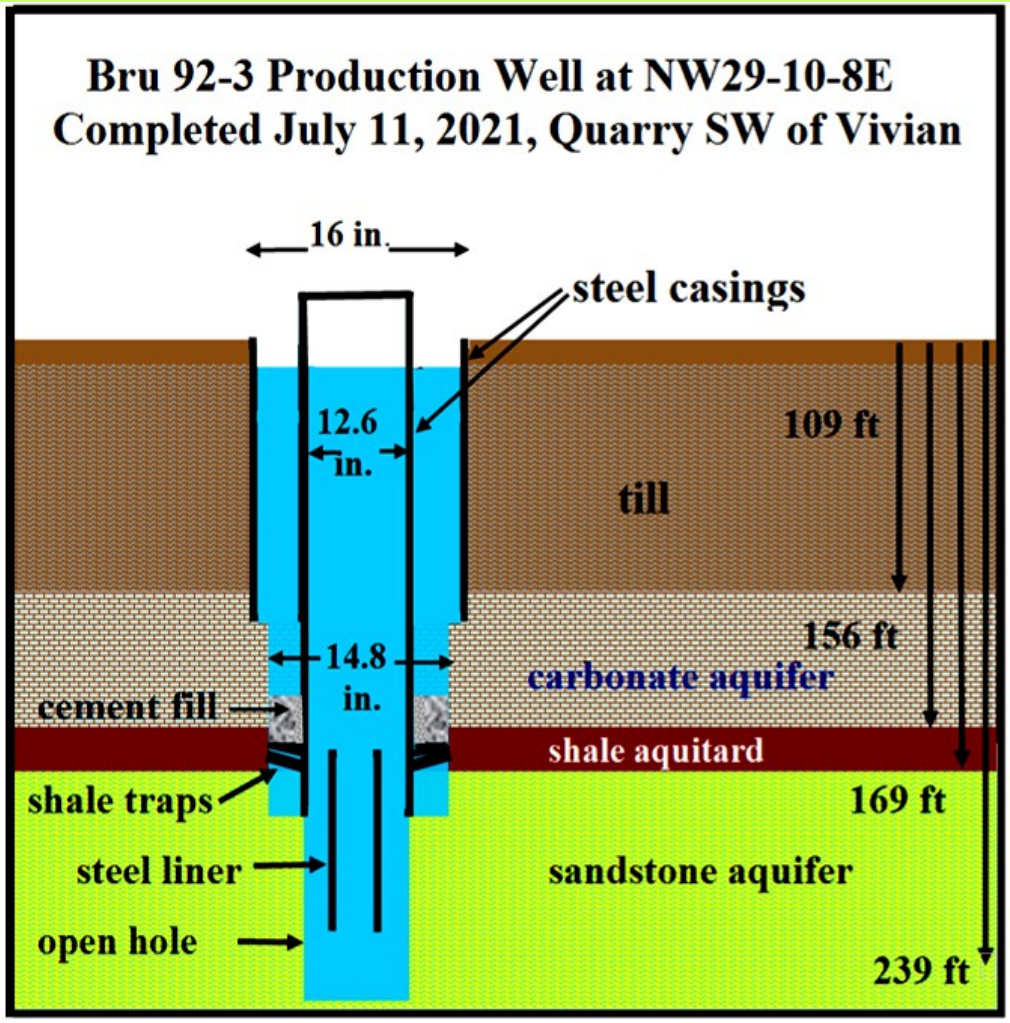
From	To(ft.)	Log
0.0	3	FILL
3.0	20	BROWN TILL
20.0	112	GREY TILL
112.0	158	LIMESTONE
158.0	168	SHALE
168.0	238	SANDSTONE

From	To(ft)	Const.Method	Inside Dia.(in)	Outside Dia.(in)	Material
0.0	115.0	CASING	15.5	16.0	STEEL
0.0	169.0	BOREHOLE	14.8		
0.0	168.0	CASING	12.0	12.6	STEEL
168.0	238.0	OPEN HOLE	11.0		
130.0	158.0	ANNULAR FILL	12.0	14.8	CEMENT
158.0	158.0	ATTACHMENT	12.0		K PACKER
158.0	158.0	ATTACHMENT	12.0		SHALE TRAP
0.0	0.0	ATTACHMENT	16.0		SHALE TRAP
158.0	158.0	ATTACHMENT	12.0		SHALE TRAP

Top of Casing: 2.0 ft above ground

Illustration by D.M. LeNeveu was based on the well information report received from Manitoba Groundwater shown on right. Photograph of well Bru 92-2 was reproduced with permission of photographer.

Bru 92-3 Inadequate Sealing



Location: NW29-10-8E
Owner: CANWHITE SANDS
Driller: Friesen Drillers
Well Name: BRU 92-3
Date Completed: 2021 Jul 11
Well Use: PRODUCTION/SOURCE
WATER USE: Other
Well Status: ACTIVE

WELL LOG (Imperial units)

From	To(ft.)	Log
0.0	3	BROWN GRAVEL
3.0	8	BROWN TILL
8.0	25	GREY SANDY TILL
25.0	109	GREY TILL WITH BOU
109.0	156	BROWN LIMESTONE
156.0	169	GREY AND RED SHALE
169.0	239	WHITE SANDSTONE

WELL CONSTRUCTION

From	To(ft)	Const.Method	Inside Dia.(in)	Outside Dia.(in)	Material
0.0	115.0	CASING	15.5	16.0	STEEL
0.0	189.0	BOREHOLE	14.8		
0.0	188.0	CASING	12.0	12.6	STEEL
189.0	239.0	OPEN HOLE	11.0		
150.0	163.0	ANNULAR FILL			CEMENT
165.0	225.0	LINER	8.0	8.6	STEEL
163.0	163.0	ATTACHMENT			SHALE TRAP
168.0	168.0	ATTACHMENT			SHALE TRAP

Top of Casing: 2.0 ft above ground

Illustration by D.M. LeNeveu was based on the well information report received from Manitoba Groundwater shown on right. Photograph of well Bru 92-3 was reproduced with permission of photographer.

Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials MEND Report 1.20.1, Dec. 2009 Not complied with

To prevent oxidation of samples

- Dry samples at less than 40C
- Prior to and after drying keep samples cool
- Minimize delay before drying
- Maintain anaerobic conditions by storing under nitrogen
- Freeze samples

Sio Silica did not comply with Mine Environment Neutral Drainage (MEND) sample storage guidelines

Initial Sampling Frequency of Disturbed Rock Inadequate

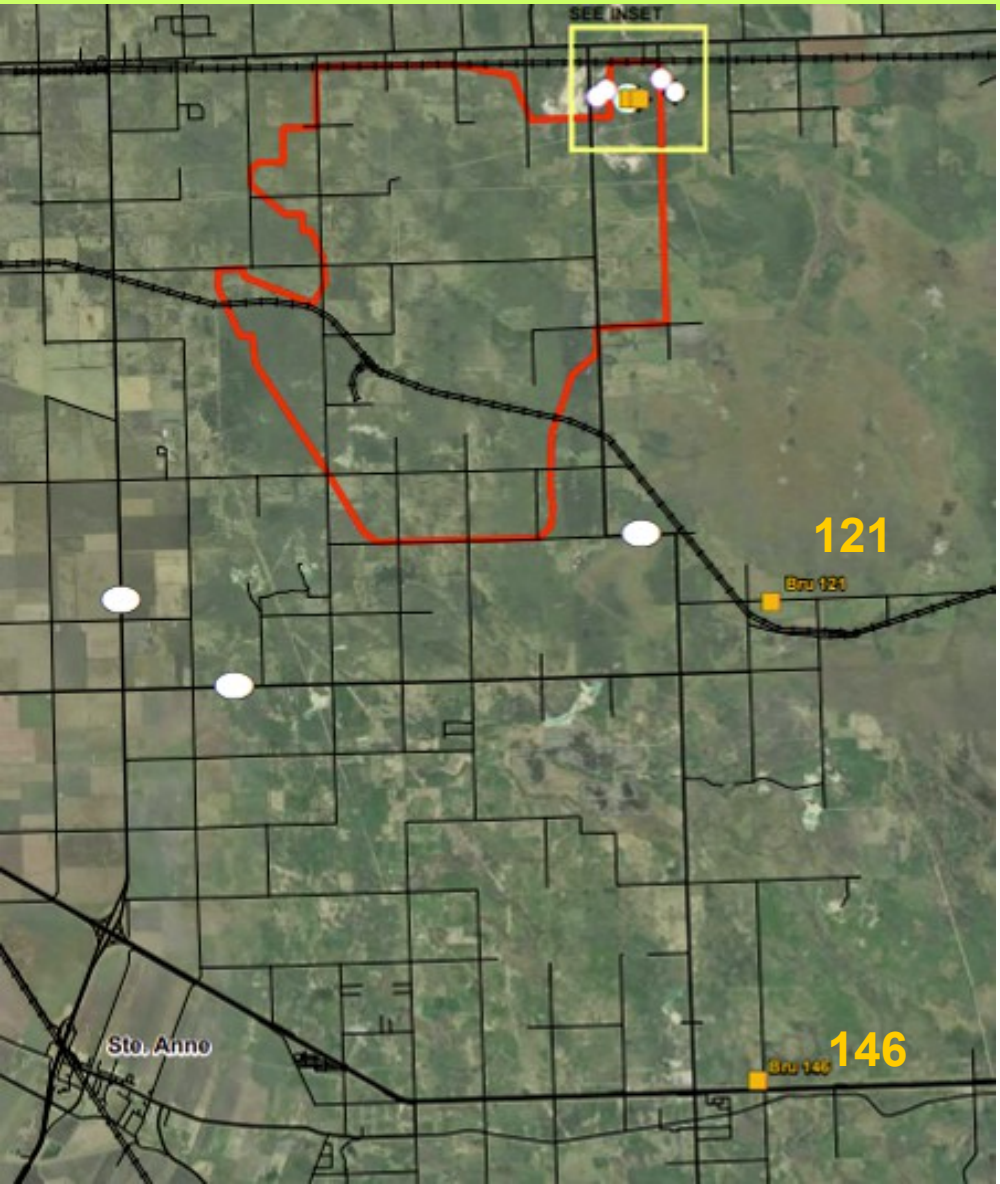
Table 8.2 Suggested initial sampling frequency based on tonnage when sampling without prior information (adapted from BCAMDTF, 1989).

Tonnage of Unit (metric tonnes)	Minimum Number of Samples
< 10,000	3
< 100,000	8
< 1,000,000	26
< 10,000,000	80

- collapsed aquitard ~7.5kt per 40 m cluster and interbedded shale
- concretions, oolite in sand up to 68 kt per year
- sulphide in sand?

(*Reproduced from Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials MEND Report 1.20.1, Dec. 2009 https://mend-nedem.org/wp-content/uploads/1.20.1_PredictionManual.pdf*).

Bru 121-1 Bru 146 outside Project area



Bru 146 drilled Dec. 10 2018

Bru 121-1 flowing well was capped. No sealing information was provided in the well report - left active Feb. 19 2019

Bru 95-3 Sand Sample Exposed to Weathering documented Aug 2021

Sio Silica stated in response to DLN-IR-002c; "*The sand pile from which the Bru 94-3 sand sample was taken was covered by tarp and not exposed to weather for an extended period of time.*"

Google Earth image of original Sio Silica extracted sand piles and photographs of the Sio Silica sand piles taken June 7, 2020 (left) and Nov.14 2020 (right)

Photographs were reproduced with permission of the photographer

Concretions, Shale Waste from Sandstone documented Aug 2021

Oolites and concretions comprise a very small proportion (<5%)of the overall sandstone aquifer https://www.gov.mb.ca/sd/eal/registries/6119/tab2_responses.pdf

Images used with photographer's permission

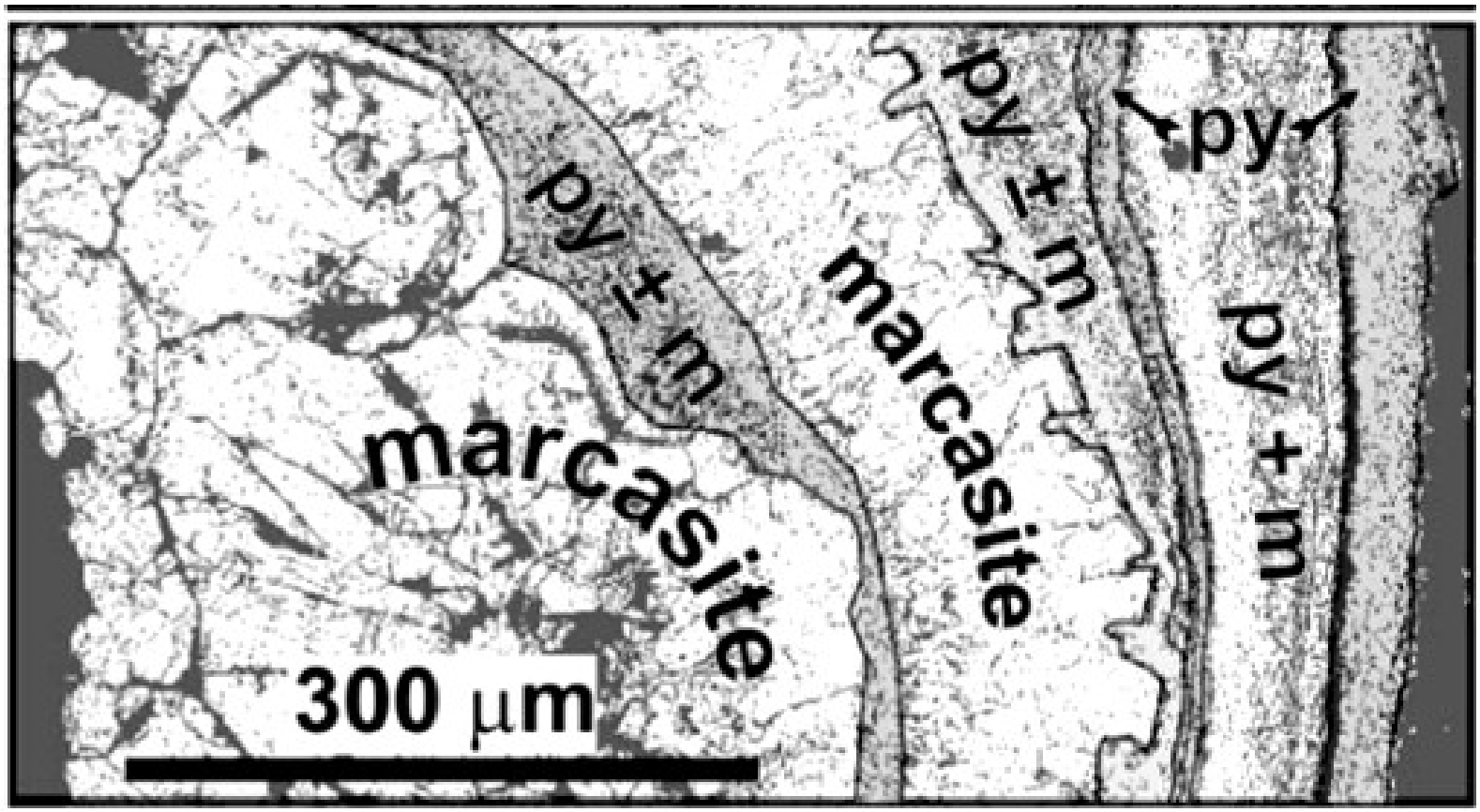
Sio Silica Waste Characterization and Management Plan Feb. 6, 2023 states; "*Winnipeg sandstone will not be a wastestream*"

LeNeveu public comments https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_4.pdf

Shake Flask Tests

- Selenium was identified as a contaminant of potential concern in samples of Red River Carbonate, Winnipeg Shale and one sample of Winnipeg Sandstone (perhaps due to presence of shale fragments). Arsenic and uranium were identified as contaminants of potential concern in one sample of Winnipeg Shale
- All three samples exceeded the applicable guidelines for dissolved selenium in Red River carbonate and Winnipeg Formation shale aquitard.

Marcasite and Pyrite in Silica Sand of the Winnipeg Formation Relevant



Silica sand grains in the Winnipeg Formation showing imbedded marcasite and pyrite.

Source: *Pyrite and Marcasite Coated Grains in the Ordovician Winnipeg Formation, Canada: Jurgen Schieber and Lee Riciputi, Journal of Sedimentary Research, 2005, v. 75, 907–920,* ***https://www.semanticscholar.org/paper/Pyrite-and-Marcasite-Coated-Grains-in-the-Winnipeg-Schieber-Riciputi/c7260c14***

Acid Base Accounting Wanipigow Relevant

Claim Post Resources Inc. – Seymourville – Project 14466-001 – Interim

Table 9: Standard Acid Base Accounting Test Results

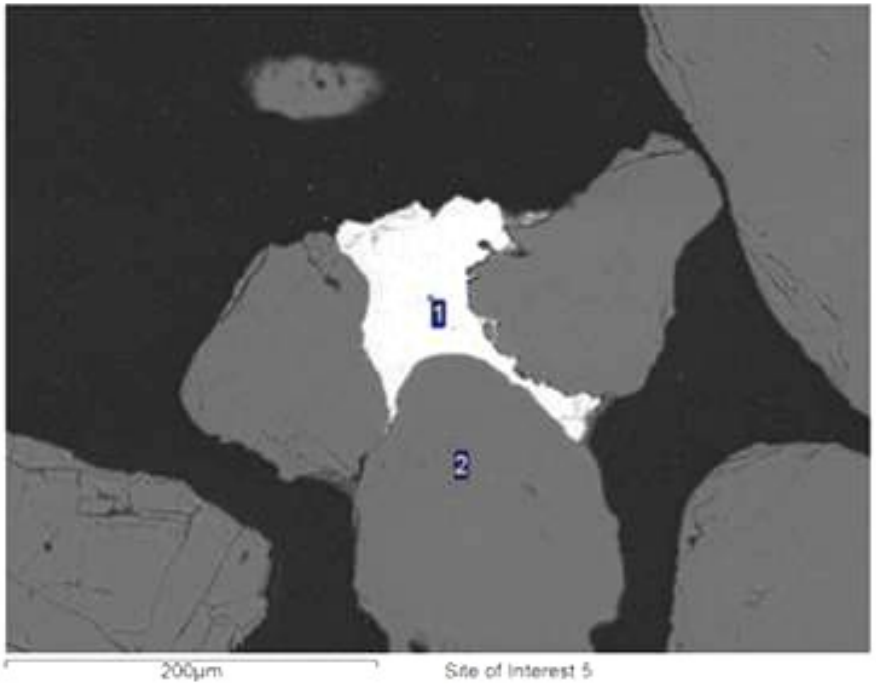
Parameter	Unit	Master Composite A
LIMS		12782-APR14
Paste pH		6.16
Fizz Rate	---	1
Sample weight	g	2.03
HCl added	mL	20.00
HCl	Normality	0.10
NaOH	Normality	0.10
Vol NaOH to pH=7.0	mL	13.41
Final pH		2.08
NP	t $CaCO_3$/1000 t	5.3
AP	t $CaCO_3$/1000 t	7.34
Net NP	t $CaCO_3$/1000 t	-2.01
NP/AP	ratio	0.73
S	%	0.235
Sulphide1	%	0.10
SO_4	%	0.3
C	%	0.044
CO_3	%	0.035
CO_3 NP	t $CaCO_3$/1000 t	0.58
CO_3 Net NP	t $CaCO_3$/1000 t	-6.76
CO_3 NP	ratio	-0.079

90794 tonnes CaCO3 required to neutralize 1.36 million tonnes of silica sand per year for Wanipigow data

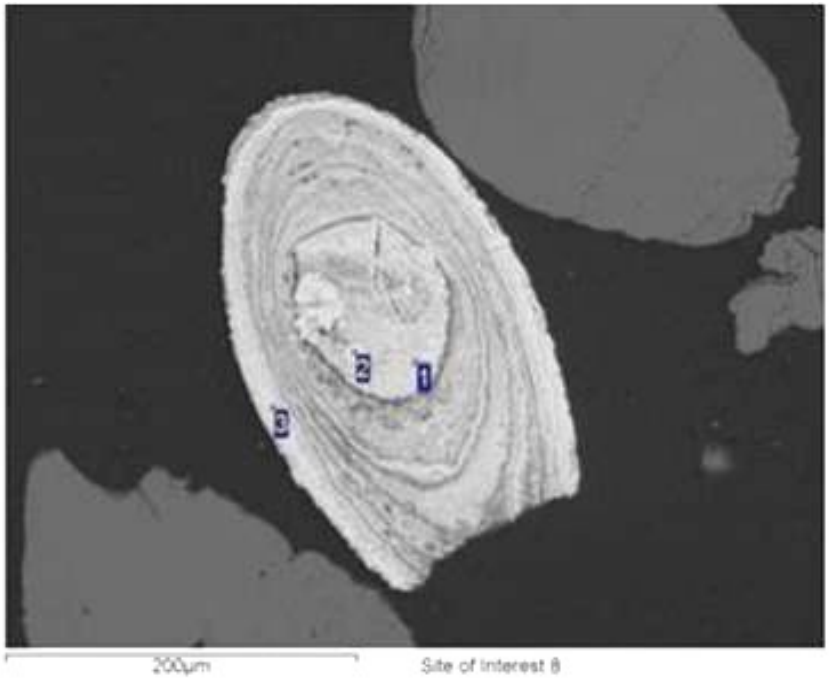
The results were reproduced from the 2014 NI43-101 technical report of Claim Post Resources

Technical report and preliminary economic assessment on the Seymourville Silica Sand Project, Manitoba, Canada for Claim Post Resources Inc., NI-43-101 & 43-101F1, Eugene Puritch, P.Eng., Richard Sutcliffe, P.Geo., Ph.D.,Yungang Wu, P.Geo., David Burga, P.Geo., Jarita Barry, P.Geo., Kenneth Kuchling P.Eng., David Orava, P.Eng., David Anthony, P.Eng., Michael Esposito, P.E., P&E Mining Consultants Inc., Report No. 292, November 1, 2014 sedar.com

Backscatter electron images of Wanipigow sand showing marcasite and pyrite



Backscattered Electron Image of Master Composite 6 Minutes Non-Mag -50/+70 Mesh Quartz grains (grey) are cemented together by pyrite/marcasite (white)



Backscattered Electron Image of Master Composite
6 Minutes Non-Mag -50/+75 Mesh Rounded
pyrite marcasite grains exhibit concentric layering

Pictures in were reproduced from the 2014 NI43-101 technical report of Claim Post Resources sedar.com

Acid Rock Drainage Black Island Quarry for 100 years Relevant

Photos from Black Island Quarry and pH measurement with permission of photographer

Subsurface acid drainage example South Africa

The depletion of gold reserves in the area has meant a cessation of mining activities and related dewatering operations, which has resulted in the flooding of mining voids. AMD is generated when ore and other sulphide-containing mining waste is exposed to oxygen and water. The water in the mining voids thus becomes acidic and contaminated with heavy metals.

Mining Review Africa, AECOM highly commended for Eastern Basin Acid Mine Drainage plant, Tessa Kruger, Feb 1, 2017
https://www.miningreview.com/products-services/aecom-highly-commended-eastern-basin-acid-m

LeNeveu https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_4.pdf

Report of Suspected Violation of Manitoba Groundwater and Water Well Act by the Operation of CanWhite Wells near Vivian Manitoba Feb. 5, 2021, Dismissed by MB Water Branch without investigation

- 10 residents near Vivian complained about well water discolourization and increased iron staining during Sio Silica sand extraction in the area
- Director's response: Our records show that issues related to iron occur naturally in this area. Well owners with concerns about water quality can contact the department directly
- Regarding improperly sealed wells: The wells are now sealed and therefore additional inspection is not possible

Chitosan Ultrafiltration Unacceptable requiring purified acid/base chemicals

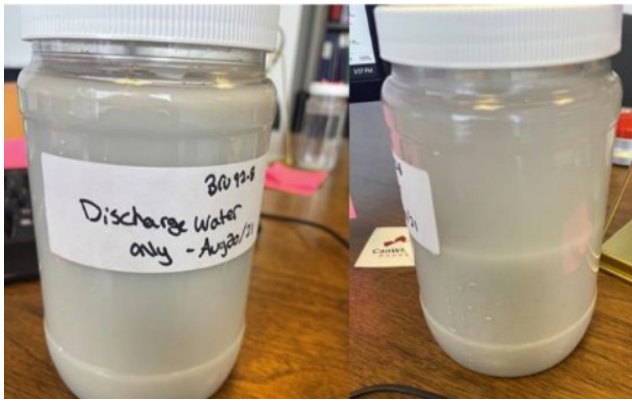
- Chitosan absorption is effective only under acid conditions with pH <6 where it is soluble - becomes insoluble after absorption
- Neutralization and acidification by unwanted chemicals is unacceptable (NaOH, CaCO3, Ca(OH)2, H2SO4)
- 10,00 mg/L TSS in process water (6400 tonnes per year) must be reduced to 1000 mg/L for chitosan filtration
- Removal of chitosan and absorbed species by ultra filtration is not 100%
- co-coagulants often used for heavy metals
- Based on 1 to 1 water to extracted sand ratio and 10000 mg fines/L for 2 stage filtration, 80% water filtered by chitosan, 1.36 million tonnes of sand per year, 6400 tonnes of chitosan filter waste per year exclusive of chitosan

:// Source: Dr. E. Pip submission to CEC http://www.cecmanitoba.ca/.../silic.../doc/ws21dr.evapip.pdf
Process Wastewater Treatment Options Technical Memorandum, Matt Kowalski, PhD, P.Eng., June 24, 2022
Methods for selenium removal from contaminated waters: a review, E. Lichtfouse at al. , Environmental Chemistry Letters, 2022, 20, pp.2019-2041 https hal.science/hal-03626838/file/LichtfouseMethodsECL2022revised.pdf
Removal of heavy metals from wastewater using chitosan, Sewvandi and Adikary, Jan. 2011

Inadequate information on filter press for UV filtration sludge

- ~8 thousand tonnes of solid sludge per year would be required to be removed by the chitosan filtration prior to UV
- Recommended sand drying beds not feasible
- Filter press requires unspecified coagulant chemicals that may be toxic or reduce water quality
- Unspecified waste quantity characterization and disposal

Reference: DNL 14 day rule CEC submission for Vivian Silica Sand Extraction Project D.M. LeNeveu, M.Sc. Feb. 13, 2023
Process Wastewater Treatment Options
Technical Memorandum Matt Kowalski, PhD, P.Eng.



Raw process water shaken and settled

Aquifer sustainability not addressed
What is the loss of aquifer water per year from extraction?

- 15% water loss to sand piles or 10 USGPM per cluster?
- ? Water loss from waste streams- overs unders, wash plant, UV filtration, filter press
- ? Water loss from Chitosan backwashing
- ? Water loss from year end residual water in extraction plant vessels
- Approvals does not require regional scale aquifer sustainability modelling

The Sio Silica hydrogeological model cannot address aquifer sustainability

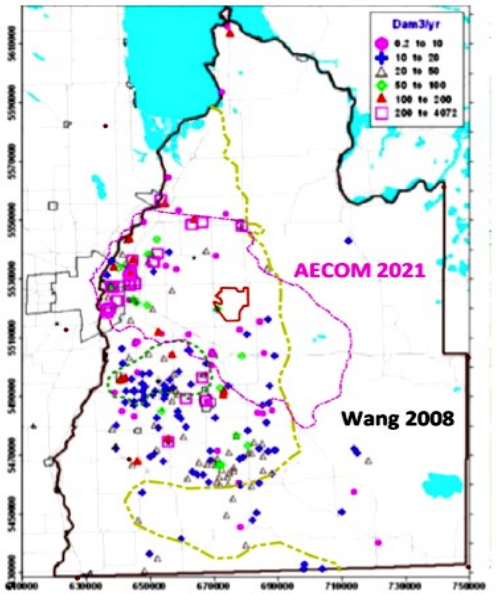


Figure 10 Groundwater License Location

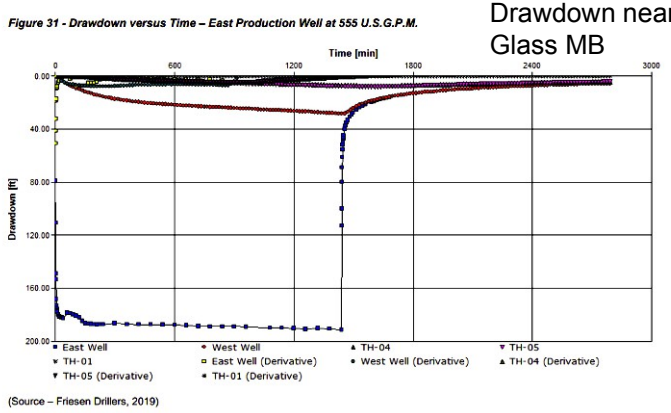
From Wang 2008

Matrix Solutions Inc. ENVIRONMENT & ENGINEERING

CEC Hearing
Vivian Sands Project
MBEN/OLS
Hydrogeological
Evidence Presentation
Louis-Charles Boutin, P. Eng.
Principal Groundwater Engineer
Technical Lead Numerical
Modelling
8 March 2023

Sio model gave known information on drawdown and fast recovery of sandstone aquifer - no water re-injection

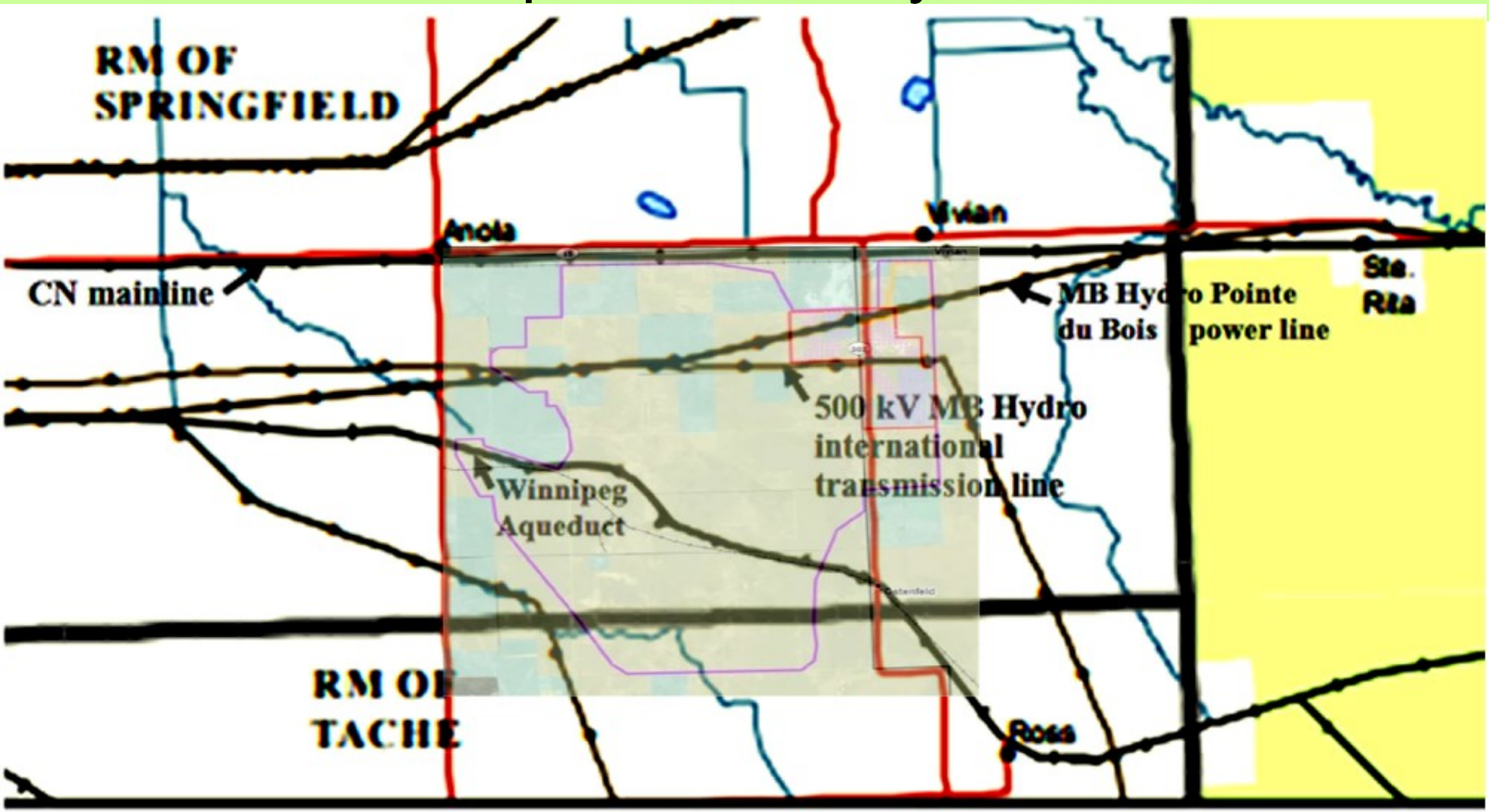
Drawdown near Glass MB



(Source – Friesen Drillers, 2019)

Friesen Driller Supplemental Municipal Groundwater Supply Rural Municipality of Springfield May 2019
https://www.gov.mb.ca/sd/eal/registries/6013springfield/EAPspringfield.pdf

Infrastructure
Permission required from Hydro not obtained



Source: Pointe du Bois Transmission Project Environmental Assessment Report Prepared By: Transmission Planning and Design Division Licensing and Environmental Assessment 4/11/2014 Prepared for: Manitoba Conservation and Water Stewardship, Environmental Approvals Branch https://www.gov.mb.ca/sd/eal/registries/5716mbhydropointedubois/eap/chapt1.intro.pdf *The Bru outline was obtained from the Sio Silica Hydrogeological Report and overlain on the infrastructure map by. D. M. LeNeveu*

LeNeveu public comments https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_4.pdf

RM Noise Lights Bylaws and Accepted Standards Compliance?

Source: Drill Rig Noise Control, eNoise Control, https://www.enoisecontrol.com/contact/

Transcript B. Bullen: we were 52 DB at 100 metres from the noise source It was a DR24 extraction rig DR24 extraction rig (no data available)

Source: https://www.dropbox.com/s/0hfqzckgv68f61o/IMG_0623.mov?dl=0

Eva Pip public comments
https://www.gov.mb.ca/sd/eal/registries/6119/public_comments_5.pdf

CEC Hearing Recommendations

- The government seek a legal opinion with respect to regulations under The Groundwater and Water Well Act and the Drilling Regulation under The Mines and Minerals Act, regarding the interconnection between the Winnipeg Formation and any overlying aquifers,
- The proponent must add to the body of evidence relating to the possible heterogeneity of the geological structures in the production area so that the risks of subsidence and propagation and impact of extraction voids over time are defined to a higher level of confidence. This must include inclined drilling in order to determine if vertical fractures exist in the limestone that could affect the stability of the layer.
- The proponent must carry out full-scale well-cluster extraction tests in order to provide information on the potential effects of extracting the planned 21,000 tonnes of sand from a single cluster. This should be completed from several clusters in different parts of the project area
- During extraction tests, cavities must be monitored to determine their likely long term shape and size and establish whether they are likely to continue to grow over time. A representative number of cavities reflecting the potential variability of geological conditions should be monitored to indicate that the cavities have remained stable over time.
-)The minister appoint a project monitoring committee with membership from municipal and provincial government departments to receive and assess relevant information as the proponent undertakes step-wise development.
- The proponent be required to complete the following detailed plans and distribute them for comment i) Waste Characterization and Management Plan ii) Water Management Plan iii) Progressive Well Abandonment Plan iv) Groundwater Monitoring and Impact Mitigation Plan v) Erosion and Sediment Control Plan vi) Environmental Emergency Response Plan vii)Revegetation Monitoring Plan viii)Heritage Resource Protection Plan ix) Trigger Action Response Plan(s) x) Closure Plan
- The proponent demonstrate the full-scale performance of water-treatment processes for the re-injection of the water that has been separated from the extracted sand.
- Extraction be planned and operated in a manner that is compliant with the engineering limits suggested by the proponent’s experts, required by the Manitoba government and/or as amended based on more data-gathering
- The proponent be required to carry out a risk assessment that considers the probability of worst-case scenarios
- A cumulative effects assessment for the full 24-year life of the project be carried out and its impact be considered in light of other existing and foreseeable projects in the area

Problems to overcome

- Large amounts of contaminated compressed, dissolved, entrained and airlift tube air enters aquifer
- No compressed air scrubbing and microbial filtration
- Inadequate geochemical sampling and characterization
- Omission of pyritic concretions, oolite and interbedded sandstone
- Inadequate sand sampling and acid base accounting tests
- Sand likely pyritic similar to Black Island and Wanipigow
- Massive aquifer contamination of by acids, heavy metals, benzene, oil vapours, selenium
- Inadequate sand slope stability analysis and parameter values leads to limestone collapse and aquifer failure
- Cover collapse through enhanced fractures in limestone
- Not respecting - No Extraction East of 302 due to competent limestone less than 15 meters thick
- Inadequate extraction plan – no cavity span and separation information – ignoring flowing well area
- Inadequate trigger action plan for cavity span
- Likely rapid migration of oxygenated water, gaseous air, heavy metals in limestone
- Leaching of selenium and precipitation of iron and manganese in limestone
- Mixing of carbonate and sandstone waters in cavities with collapsed aquitard destroying valuable soft water and low iron sandstone water
- Chitosan filtration not demonstrated - likely unfeasible due to necessary acid and neutralization chemicals
- Inadequate information and specification of UV filtration filter press and coagulation chemicals
- Sand piles during extraction and worker exposure to silica dust?
- Inadequate measurement of Noise and Light pollution and specification of abatement
- No measurement of process water quality to date
- No requirement to characterize Winnipeg formation waste during production
- No modelling of fate of re-injected water and possible migration into carbonate
- Meaningless hydrogeological tests and modelling applied only to withdrawal of well water which has already been well characterized. The model and testing had no actual re-injection of water
- Slurry line contamination with acrylamide, acid, heavy metals, selenium
- No permission to encroach and cross with slurry lines on Hydro transmission lines
- No permission for slurry line crossing of highway 302 and local RM roads
- No permission for rail loop
- There is evidence high purity silicon metal for solar panels and electronics cannot be made with Sio Silica sand