ENVIRONMENT ACT PROPOSAL

Proposed Seed Cleaning Facility

Location:
540 3rd Ave S Lots 26 to 35, Block 3, Plan 2554 Swan River, Manitoba

Prepared for:
Agnus Wittman,
Director
Environmental Approvals Branch
Manitoba Conservation and Climate

Prepared by:
Derek Poole, C.E.T.
Project Manager
New Era Ag Technologies

Date: March 12th, 2026

New Era Ag Technologies
507 3rd Ave. South
Box 56, R0L1Z0
Ph: 204-734-6222
Fax: 204-734-6293

March 12th, 2026

Agnus Wittman
Director
Environmental approvals Branch
Manitoba Conservation and Climate
Winnipeg, MB
R3H 0W4

RE: New Era Ag Technologies Environment Act Proposal

Director Wittman,

Please find enclosed the Environment Act Proposal (EAP) submitted on behalf of New Era Ag Technologies. This proposal outlines our plan to construct and operate a new seed cleaning plant at our existing facility, located at 540 3rd Ave S in Swan River, Manitoba.

In support of this application, the following items are enclosed for your review:

- **Completed EAP Form**
- **Environment Act Proposal Report and Support Documents**
- **Application Fee**

The proposed facility will utilize a strictly dry-cleaning process equipped with advanced dust mitigation technologies. Based on the comprehensive assessment provided in the enclosed report, we anticipate the residual environmental effects of this proposed development to be negligible.

If you require any further information or have any questions regarding this submission, please do not hesitate to contact me directly at 1 (204) 734-0031 or via email at Derek@Newerasr.com.

Best Regards,

[redacted]

Derek Poole C.E.T.
Project Manger
New Era AG Technologies

Environment Act Proposal Form

Manitoba

Name of the development:
New Era Ag Technologies Seed Cleaning Plant

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class 1

Legal name of the applicant:
New Era Ag Technologies

Mailing address of the applicant: 507 3rd Ave South

Contact Person: Derek Poole

City: Swan River Province: MB Postal Code: R0L1Z0

Phone Number: (204) 734-6222 Fax: email: Derek@newerasr.com

Location of the development:

Contact Person: Derek Poole

Street Address: 540 3rd Ave South

Legal Description: Lot #3 Block #1 Plan #2554

City/Town: Swan River Province: MB Postal Code: R0L1Z0

Phone Number: (204) 734-6222 Fax: email: Derek@newerasr.com

Name of proponent contact person for purposes of the environmental assessment:
Derek Poole

Phone: (204) 734-6222

Fax:

Mailing address: 507 3rd Ave South
Swan River, MB R0L1Z0

Email address: Derek@newerasr.ca

Webpage address: www.neweraagtech.com

Date: 2026-03-12

Signature of proponent, or corporate principal of corporate proponent:
Dennis Badowski [redacted]

Printed name: Dennis Badowski

PRINT RESET

A complete **Environment Act Proposal (EAP)** consists of the following components:

- ☑ **Cover letter**
- ☑ **Environment Act Proposal Form**
- ☑ **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information)
- ☑ **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:
Director
Environmental Approvals Branch
Environment and Climate Change
Box 35, 14 Fultz Boulevard
Winnipeg MB R3Y 0L6
EABDirector@gov.mb.ca

For more information:
Toll-Free: 1-800-282-8069
Phone: 204-945-8321
Fax: 204-945-5229

https://www.gov.mb.ca/sd/permits_licenses_approvals/eal/licence/index.html

Internal Use Only
$1,000......C1 B-02
$7,500......C2 B-02
$10,000....TT B-02
$60,000.....WD B-02
$120,000...EM B-02

Table of Contents

Executive Summary

New Era Ag Technologies is submitting this Environment Act Proposal (EAP) for the construction and operation of a new, state-of-the-art seed cleaning plant at its existing facility located at 540 3rd Ave S, Swan River, Manitoba. The proposed facility will process a variety of western Canadian crops, including cereals, pulses, and oilseeds, adding significant value to local agricultural commodities.

The development utilizes a completely dry-cleaning process that relies on mechanical separation and advanced optical sorting. Because the process requires no water consumption and uses no chemical or biological additives, there are no anticipated risks to local water bodies or the underlying Swan River Formation aquifers.

The primary environmental consideration for this facility is the management of particulate (dust) emissions. To ensure compliance with provincial air quality standards, the facility incorporates advanced dust mitigation technologies. This includes fully enclosed material conveyance, point-source extraction operating under negative pressure, and high-efficiency Cyclofans capable of removing up to 99% of agricultural dust particles from the airstream.

Furthermore, the operation generates negligible solid waste, as organic by-products (screenings) are collected and diverted for use as animal feed. Noise and potential pests will be strictly managed through the facility's enclosed design, internal policies, and third-party professional monitoring.

Ultimately, the project will yield a net positive socioeconomic impact for the Swan River Valley by providing direct full-time employment and supporting the local tax base, while operating on previously disturbed, industrially zoned land. Based on the assessments provided in this report, the residual environmental effects of the proposed development are expected to be negligible

1. Introduction

New Era Ag Technologies proposes to construct and operate a new seed cleaning plant at its existing facility located at 540 3rd Ave S, Swan River, Manitoba. The facility will process a variety of western Canadian crops including cereals, pulses, and oilseeds. The development will utilize a dry-cleaning process involving mechanical separation and optical sorting. This report shall identify actual and potential site contamination resulting from the seed cleaning operations have on the local environment. Key environmental considerations include particulate (dust) emissions and noise control. The facility has been designed with advanced dust mitigation technologies, including high-efficiency Cyclofans and point-source extraction, ensuring that fugitive dust is contained and emissions meet provincial air quality standards. Based on the assessment provided herein, the residual environmental effects of the proposed development are expected to be negligible.

The project is in planning stages, the facility will be a proposed development. This report shall be completed in accordance with Manitoba Licensing Procedures Regulation (Manitoba Regulation 163/88). This report and information in it has been gathered and analysed by Derek Poole C.E.T, with New Era Ag Technologies.

2. Description of the Development

2.1. Site Location, Tenure, and Ownership

The project is located at the existing New Era site in Swan River, MB (540 3rd Ave S). The site contains existing infrastructure, including a personnel area, electrical rooms, and storage. The new processing equipment will be integrated into a building designed with specific hazardous area classifications (Zone 22) to ensure safety and compliance. The development is located on Lot #1 Block #1 Plan #2554, civic address 540 3rd Ave South. The property the facility is located on is registered under title number 3380323/6. A copy of the Certificate of title is included as Appendix A. The registered owner is New Era Ag Technologies.

2.2. Local Approvals / Zoning

Swan Valley Planning District approved a submitted development application on November 24th, 2024, in order to begin clearing and grubbing. The development is located in Industrial Heavy Zone within the Town of Swan River. A copy of the approved development permit is attached as appendix B.

2.3. The Facility

The facility is a new green field development, occupying approximately 650 square meters of building surrounded by a 11,000 square meter drained gravel pad. Photographs of the development area are included as appendix C.

2.4. Operation

The facility utilizes a physical, dry-cleaning process with no water consumption for processing and no chemical additives. The operational flow is as follows:

2.4.1. Receiving

All raw materials accepted at the facility shall be delivered via truck. All materials are weighed over the scale, and subsequently transported into smoothwall receiving bins in preparation to enter facility for cleaning.

2.4.2. Conveyance

Throughout the facility, raw material flows via enclosed vibratory, drag, bucket, and pneumatic conveyors to the cleaning lines, screening bins, clean bins, and packaging areas.

2.4.3. Primary & Secondary Cleaning

Material passes through a deawner (optional based on commodity) and an air-and-screen machine. High-volume air aspiration removes dust and light particles, while screens remove under/oversized material. Good seed moves through indented cylinder separators, a gravity table, and a destoner to remove density-based contaminants.

2.4.4. Optical Sorting

The final cleaning step utilizes an optical sorter to remove discolored or defective seeds.

2.4.5. Loadout

Clean seed and screenings are transported via gentle handling conveyance to external storage clean bins to be loaded into customer trucks. Packaged toted or bagged products are contained prior to shipping. Transportation of final product is completed by trucking companies retained by New Era Ag Tech.

2.4.6. Air Handling

The facility incorporates specific technologies to manage air quality and combustible dust:

2.4.6.1. **Cyclofans:** Three (3) Cyclofan dust collectors are attached to the cleaning and conveyance equipment. These units separate particulate from the airstream using centrifugal force before discharging air externally.

2.4.6.2. **Filtration:** The optical sorter utilizes a combination cyclonic/filter media dust collector that cleans the air before returning it to the sorter room, eliminating external venting for this stage.

2.4.6.3. **Containment:** All material handling and cleaning equipment is generally enclosed and operates under negative pressure (vacuum) relative to the building, ensuring dust does not escape into the workspace.

2.5. Permits and Approvals

2.5.1. Water & Sewer

Water and Sewer connections will be installed in accordance with the Town of Swan River Water & Sewer Rate By-Law 19/2016. In addition, in accordance to *The Manitoba Municipal act*.

2.5.2. Dangerous Goods Handling and Transportation Act

Licensing under the *Dangerous Goods Handling and Transporation Act* is not required for this facility.

2.5.3. Federal Assessment

The facility does not require an Impact Assessment under the *Impact assessment Act* through the Canadian Environmental Assessment Agency.

2.5.4. Public Consultations

No complaints regarding the operation of the current facility have been received by New Era Ag Technologies from the public. Verbal communication with neighbors have been undertaken to solicit feedback on the proposed operation.

3. Local Site Environment

3.1. Physical & Atmospheric Environment

The site is located within the commercial/industrial sector of Swan River. The surrounding land use is characterized by agricultural services and retail. The topography is generally flat and previously developed.

Air quality in the region is typical of a rural/agricultural setting. Sources of existing emissions include vehicle traffic and adjacent agricultural operations.

3.2. Adjacent Land Use

The development is located in an industrial Heavey zoned area; street access surrounds the property other than the south adjacent property where a log trucking business is in operation. Additional uses in the area are bulk fuel stations, ag retail, and steel manufacturing. There is a green field Industrial Light Zoned area west, along with access to PTH 10N. Across the street to the East are the above mentioned businesses, further east is CN access. No onloading spur of the Main CN line exists currently.

3.3. Site & Regional Drainage

The development area has been stripped and graded with gravel pad. There is surface draining to the north and east of the development. The development surface water on site drains towards drainage ditches located along First Ave South, Ash Street, and 3rd Ave South, which all surround the development.

The development is located with the Swan-Lake Watershed. The area surrounding, and including the municipal industrial park has drainage southeast into the CN rail drain eventually into the Tamarack Creek. The entire surrounding area has regular drainage within the Swan River system watershed.

3.4. Groundwater

The Swan River Formation consists of several sand stone aquifers, these aquifers serve as the the primary source water for municipal, commercial, and industrial use in the region. The aquifer extends east and north from the Manitoba escarpment and underlies the Swan River Valley.

3.5. Geological and Soil Characteristics

An full geotechnical investigation has been performed on the development. P.Machibroda Engineering Ltd. performed the investigation (Appendix D). Results indicate that the general soil profile consists of approximately 400 to 600 mm of surficial fill, followed by variable deposits of glacial till and sand/silt that extend to at least 12.4 meters below the existing ground surface.

The underlying subgrade soils provide strong structural support; the granular deposits (sand, silt, and sand till) are considered dense to very dense, while the cohesive deposits (glacial till and clay) range from very stiff to hard. Cobblestones and boulders are present within the fill and glacial till deposits. Furthermore, based on the consistency of these subgrade soils, the site is classified as Class D for seismic site response in accordance with the 2015 National Building Code of Canada.

It is also noted that the subgrade soils are frost susceptible, with a potential frost penetration depth ranging from 1.8 to 2.4 meters depending on the severity of the winter and surface cover. Extensive groundwater seepage and sloughing conditions were encountered during test drilling. The groundwater table was measured at 1.5 meters below the existing ground surface on September 30, 2020, though higher groundwater levels could be expected during spring thaw or heavy precipitation events

3.6. Climate & Eco Region

The development is located within the humid continental climate zone, characterized by significant seasonal temperature variance. The region experiences short, warm summers and long, cold winters. The valley's physiography—bounded by the Porcupine Mountains to the north and the Duck Mountains to the south—can create localized microclimatic effects, particularly regarding wind patterns and thermal inversions. Meteorological data from Swan River weather Station #2 shows an average mean temperature of 1.8 degrees, and an average precipitation of approx.. 450-550mm.

The development is located within the boreal plains eco-region. Topography shows generally flat to gently undulating lake plains which are remnant of Glacial Lake Agassiz. The valley is bordered by the Duck Mountains (Manitoba Escarpment) to the south and the Porcupine Hills to the north. Vegetation includes a mix of agricultural land and mixed-wood forest. Native cover includes Trembling Aspen, Balsam Poplar, White Spruce, and Balsam Fir. Riparian areas support willow and dogwood shrubs.

3.7. Fish & Aquatic Habitat

Key waterbodies within the region are the Swan River, Woody River, and Swan Lake. Which are home to several sport fishing species such as walleye, Northern Pike, Yellow Perch, Burbot, and White Sucker. Brook Trout and Rainbow Trout are often stocked in tributaries or headwaters near the escarpments. The closest fish bearing waterway is the Swan River, which is just over 1km away.

3.8. Endangered / At Risk Species & Protected Areas

The area surrounding the site is within a municipality and is developed. Therefore there are no nesting areas for at risk species within or in the vicinity of the development. There are no municipal, provincial, or federal protected areas within or in the vicinity of the site.

3.9. Heritage Resources

Due to the developments location the potential for archeological findings is low. There are no heritage resource sites identified within or in the vicinity of the site.

3.10. Indigenous Communities

The First Nation communities in the Region are Sapotawayak Cree Nation, Wuskwi Siphik First Nation, and Minegoziibe Anishenabe. They are not identified within the development.

4. Environmental Effects & Mitigation

4.1. Biophysical Environment

The proposed facility process will be contained within a cleaning facility, and will be developed on a graded gravel structure, which will result in low risks to the biophysical environment. The facility is a cleaning facility, no production, treatment, or manufacturing of materials will be taking place, therefore no chemical or biological material will be present in the facility. The facility footprint is generally confined to previously disturbed industrial land, impacts on native vegetation and wildlife corridors are expected to be negligible.

4.2. Hazardous Material & Activities

The cleaning process is dry, no chemicals, biologicals, or treatments are added into the process. There is no contact wit the pulse and cereal product with water.

No bulk volumes of fuel, lubricants, or other hazardous materials are stored on site, vehicles are taken off-site for maintenance and lubricant service. Spill kits shall be on hand in the event of a fuel or lubricant leak from a vehicle or truck within the development.

Small porpone cylinders are utilized on site for use in propane powered fork lifts.

4.3. Combustion Risks

A dust hazard analyses has been completed on the proposed facility. Collection and disposal techniques and equipment will included in the facility to mitigate any potential combustion risk due to dust. Based on the lack of combustible material used in the construction there are no anticipated environmental or human health risks related to the operation of the facility.

4.4. Solid Waste Generation

The proposed facility will generate little to no solid waste on site. The majority of the raw material inputs are successfully processed into final seed products. Any remaining organic by-products, such as chaff, weed seeds, or cracked grain, will be collected, stored in designated screening bins, and transported off-site to be sold. This approach effectively minimizes landfill contributions and supports a circular agricultural waste economy.

4.5. Particulate Control

Particulate matter (dust) is the most significant pollutant associated with seed cleaning operations. The plant will be equipped with state of the art dust collection system and fitted with cyclo-fans to mitigate the potential dust hazards. A hazard analysis guideline (Appendix E) has been completed by AnCeres to ensure compliance through design and construction.

Cyclo-fan dust collectors are high-efficiency, combined fans and mechanical separator units designed to remove small and large dust particles. They utilize centrifugal force to separate particles from the air stream, achieving separation efficiencies up to 99% for agricultural dust applications.

4.6. Climate Change Impacts

The facility is not expected to emit anywhere near the Environment Canada threshold for reporting requirement which is greater than 50,000 tonnes of carbon dioxide in a calendar year.

4.7. Socioeconomic Impacts

The project is expected to have a net positive socioeconomic impact on the Swan River Valley. It will provides direct full time employment which will support the local tax base. It shall also add value to local crops, allowing farmers to sell processed seed at a premium rather than raw commodities. The project will not impede on local First Nation land or customs, as the development is on private land.

4.8. Rodents and Pests

There are no spoil piles anticipated in the development. Pest control within the facility shall be handled by a 3rd party professional, given the current practises in place in other ag based businesses, there are no anticipated environmental or human health concerns with potential rodent or pests within our development.

4.9. Noise & Odours

Cleaning facilities do generate noise, it shall be managed by PPE policies within the facility. Exterior noise at the facility is expected to be minimal, the development is located within an industrial park where excess noise is commonplace. No strong, pungent, or noxious odors are anticipated at the facility.

4.10. Mould, Moisture & Hazardous Building Materials

Grain storage within the facility will consist only of a staging are for toted beans and grain, which will then be taken to a off site storage facility or loaded immediately and hauled off site. We do not anticipate any issues with mould or moisture within the facility.
This is a new development, all building materials will comply with current codes. There is no concern of any health risk due to hazardous materials being used during construction.

4.11. Restoration and Rehabilitation

Due to the lack of hazardous materials used in construction and operation, the general nature of the development and operation suggests there will be no long term environmental remediation necessary.

5. Monitoring and Reporting

Routine monitoring will be implemented to ensure all environmental mitigation measures remain effective throughout the facility's operation. This will include regular visual inspections and scheduled mechanical maintenance of the Cyclo-fan dust collectors to guarantee they maintain their optimal 99% separation efficiency. Furthermore, continuous monitoring for rodents and pests will be conducted within the facility, managed in coordination with a third-party professional to proactively prevent any localized infestations. Management will maintain an internal log of all equipment inspections, maintenance activities, and pest control measures on-site. Any formal reporting required by the Manitoba Environmental Approvals Branch or the resulting Environment Act Licence will be submitted in accordance with provincial regulations

6. Conclusion

New Era Technologies development will confirm the environmental viability of the proposed seed cleaning facility. Through the implementation of state-of-the-art dust mitigation technologies, adherence to local zoning and provincial environmental standards, and a dry-process design that eliminates water consumption and chemical usage, the project is anticipated to have negligible adverse effects on the local biophysical and atmospheric environment. Ultimately, the facility will provide a net positive socioeconomic impact for the Swan River Valley by adding value to local agricultural commodities while operating safely and sustainably

7. Qualification

This report is prepared by Derek Poole C.E.T., Derek has 16 years experience in municipal government as Director of Public Works, and Chief Administrative Officer, where he was responsible to oversee and complete multiple environmental assessments in regard to Water and Watewater operations; manage contaminated construction and soil sites, and the remediation of contaminated sites within the municipality using industry best practices.

8. References

Government & Regulatory Guidelines

- Environment and Climate Change Canada. (2026). *Historical Climate Data: Swan River Station #2*.
- Environment and Climate Change Canada. (2026). *Greenhouse Gas Reporting Program: General Information*.
- Manitoba Conservation and Climate. (Year of Publication). *Manitoba Ambient Air Quality Criteria*. Environmental Approvals Branch.
- Manitoba Conservation and Water Stewardship. (2011). *Manitoba Water Quality Standards, Objectives and Guidelines*. Water Science and Management Branch.

Technical & Engineering Reports

- P. Machibroda Engineering Ltd. (2020, September 30). *Geotechnical Investigation: Proposed Seed Cleaning Facility, Lots 26 to 35, Block 3, Plan 2554, Swan River, Manitoba* (PMEL File No. 16661). Saskatoon, SK.
- AnCeres. (2024). *Hazard Analysis Guideline: New Era Ag Technologies Seed Cleaning Facility*.

Codes & Standards

- National Research Council of Canada. (2015). *National Building Code of Canada 2015*. Ottawa, ON: Canadian Commission on Building and Fire Codes.
- National Research Council of Canada. (2020). *National Fire Code of Canada 2020*. (Referenced for Zone 22 Hazardous Area Classifications). Ottawa, ON.

9. Appendices

Appendix A: Certificate of Title

STATUS OF TITLE

Manitoba Land Titles Registry

Title Number	**3380334/6**
Title Status	**Accepted**
Client File	31886-016 (New Era)

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

NEW ERA AG TECHNOLOGIES INC.

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

LOTS 15 AND 16 AND LOTS 26 TO 37, BOTH INCLUSIVE, BLOCK 3 PLAN 2554 DLTO
EXC ALL MINES AND MINERALS AS SET FORTH IN THE ORIGINAL GRANT FROM THE CROWN
IN NW 1/4 16-36-27 WPM

The land in this title is, unless the contrary is expressly declared, deemed to be subject to the reservations and restrictions set out in section 58 of *The Real Property Act*.

2. ACTIVE INSTRUMENTS

Instrument Type:	**Caveat**
Registration Number:	**37120/6**
Instrument Status:	**Accepted**
Registration Date:	1980-01-31
From/By:	MANITOBA HYDRO-ELECTRIC BOARD/MANITOBA TELEPHONE SYSTEM
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Easement**
Registration Number:	**1097152/6**
Instrument Status:	**Accepted**
Registration Date:	2014-05-20
From/By:	MTS INC
To:	BRENDA MATTE, AS AGENT
Amount:	
Notes:	LOTS 15 & 16 E PL 55802
Description:	STATUTORY EASEMENT

Instrument Type:	**Mortgage**
Registration Number:	**1140276/6**
Instrument Status:	**Accepted**
Registration Date:	2023-05-05
From/By:	NEW ERA AG TECHNOLOGIES INC.
To:	ROYAL BANK OF CANADA
Amount:	$4,000,000.00
Notes:	No notes
Description:	No description

3. ADDRESSES FOR SERVICE

NEW ERA AG TECHNOLOGIES INC.
BOX 56
SWAN RIVER MB
R0L 1Z0

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Dauphin

6. DUPLICATE TITLE INFORMATION

Duplicate not produced

7. FROM TITLE NUMBERS

3120955/6	All
3120956/6	All
2958679/6	All
3120954/6	All
2958682/6	All

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type: **Request To Issue Title**
Registration Number: **1151107/6**

Registration Date: 2025-10-10
From/By: NEW ERA AG TECHNOLOGIES INC.
To:
Amount:

10. LAND INDEX

Lot 15 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 16 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 26 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 27 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 28 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 29 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 30 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 31 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 32 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 33 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 34 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 35 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 36 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

Lot 37 Block 3 Plan 2554
NW 1/4 16-36-27W EXC M&M

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 3380334/6

Appendix B: Development Permit (Local)

Swan Valley Planning District

Development Application

Name of Applicant:	NEW ERA AG TECH INC
Telephone:	204-734-6222
Mailing Address:	507 3RD AVE SOUTH
Municipality	Town of Swan River

FEE of $75.00 to ACCOMPANY EACH APPLICATION effective March 01, 2021

Location of Proposed Development:

Area	Lot/SEC	Block/TWP	Plan/RGE
	14-16	3	2554
	34-37	3	2584

Description of Proposed Development:

AGRICULTURAL PROCESS PLANT

* LOTS ARE IN PROCESS OF BEING CONSOLIDATED.

Signature of Applicant: [redacted] Date: Nov 15, 2024

OFFICE USE ONLY:

ZONING	Front Setback	Side Yard	Rear Setback
MH			

☑ Proposed development meets local zoning by-laws and development plans.

☐ Proposed development does not meet zoning by-law ______________________;

☐ A zoning variance is required from council pror to the commencement of the project.

☐ A conditional use agreement is required from council pror to the commencement of the project.

Development Officer comments:

Date Received: Nov. 21/24 Date Completed: Nov. 21/24

[redacted]

Ron A. Lewicki
Development Officer
Swan Valley Planning District
P.O. Box#1222
Swan River, MB.
R0L 1Z0

Contact Information:
Phone: 204-281-3485
Fax: 204-734-3161
Email: svpddo@mymts.net

Appendix C: Site Photographs

Green Field Site:

Site Work #1:

Site Work #2:

Site Work #3:

Appendix D: Geotechnical Investigation

GEOTECHNICAL INVESTIGATION

PROPOSED SEED CLEANING FACILITY
LOTS 26 TO 35, BLOCK 3, PLAN 2554
SWAN RIVER, MANITOBA
PMEL FILE NO. 16661
SEPTEMBER 30, 2020

PREPARED FOR:
New Era Ag Technologies

ATTENTION: Dennis Badowski

P.MACHIBRODA ENGINEERING LTD.
DOWN TO EARTH SOLUTIONS

P.MACHIBRODA
ENGINEERING LTD.

PROJECT: Geotechnical Investigation
Proposed Seed Cleaning Facility
Lots 26 to 35, Block 3, Plan 2554
Swan River, Manitoba
PMEL File No. 16661
September 30, 2020

PREPARED FOR: New Era Ag Technologies
507 – 3 Avenue S
Swan River, Manitoba
R0L 1Z0

ATTENTION: Dennis Badowski

DISTRIBUTION: New Era Ag Technologies – One Copy
P. Machibroda Engineering Ltd. – One Copy

806-48th Street East, Saskatoon, SK S7K 3Y4
P: 306.665.8444 | **F**: 306.652.2092 | **E**: pmel.sk@machibroda.com
www.machibroda.com

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1 INTRODUCTION

1.1 GENERAL

The following report has been prepared on the subsurface soil conditions existing at the site of the proposed seed cleaning facility to be constructed along 1 Avenue South on Lots 26 to 35, Block 3, Plan 2554 in Swan River, Manitoba.

The terms of reference for this investigation were presented in P. Machibroda Engineering Ltd. (PMEL) Proposal No. 16661REV1, dated August 13, 2020. Written authorization to proceed with this investigation was provided in the signed Consulting Agreement between PMEL and New Era Ag Technologies Inc., dated August 13, 2020.

1.2 SITE LOCATION AND DESCRIPTION

The subject site is located on a vacant lot between 1 Ave. S and 3 Ave. S near the south limits of Swan River, Manitoba. The site is located in an industrial area of the town with residential properties and downtown Swan River located further to the north and agricultural lands to the east, west and south. The site was relatively flat with an elevation difference of approximately 0.2 m noted between the test holes. A Site Plan showing the location of the study area and test holes has been shown on Drawing No. 16661-1.

2 FIELD INVESTIGATION

The field test drilling and soil sampling was conducted on September 9, 2020.

Four test holes, located as shown on the Site Plan, Drawing No. 16661-1, were dry drilled using our truck-mounted, continuous flight auger drilling rig. The test holes were 150 mm in diameter and extended to depths of 12 to 12.4 m below the existing ground surface. Test hole drill logs, as shown on the attached Field Drill Logs, Drawing Nos. 16661-2 to 5, inclusive, were compiled during test drilling to record the soil stratification, the groundwater conditions and the position of unstable sloughing soils.

Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.

Standard penetration tests (SPT), utilizing a safety hammer with automatic trip were performed during test drilling.

A standpipe piezometer (50 mm diameter slotted PVC pipe) was installed in Test Hole No. 20-3 to monitor the existing groundwater conditions.

The ground surface elevation at each test hole location was referenced to the top of the floor slab of an existing building, located approximately as shown on the Site Plan, Drawing No. 16661-1. A datum elevation of 100.00 m was assumed for the top of the floor.

3 SOIL AND GROUNDWATER CONDITIONS

3.1 SOIL PROFILE

The general soil profile at the test hole locations consisted of approximately 400 to 600 mm of fill at ground surface followed by variable deposits of glacial till and sand/silt that extended to the maximum depth explored with our test holes at this site (i.e., 12.4 m below existing ground surface). Cobbles/boulders and groundwater seepage/sloughing conditions were encountered in each test hole. A discontinuous clay layer was encountered in Test Hole No. 20-2 between 8 to 9 m.

The subgrade soils were strong with the granular deposits of sand/silt and sand till being dense to very dense and the cohesive deposits of glacial till and clay being very stiff to hard.

3.2 GROUNDWATER CONDITIONS, SLOUGHING

Extensive groundwater seepage and sloughing conditions were encountered during test drilling, as shown on the Field Drill Logs, Drawings Nos. 16661-2 to 5, inclusive. A summary of the groundwater levels recorded in the piezometer installed during this investigation has been presented in Table I.

TABLE I RECORDED GROUNDWATER LEVELS

Test Hole No.	Piezometer Rim Elevation (metres)	Ground Surface Elevation (metres)	Groundwater Depth (metres)		Groundwater Elevation (metres)	
			I.A.D.[1]	Sept. 30, 2020	I.A.D.[1]	Sept. 30, 2020
20-3	100.8	99.8	4.1	1.5	95.7	98.3

[1]I.A.D. – Immediately After Drilling

An examination of Table I revealed that the groundwater level was situated approximately 1.5 m below existing grade on September 30, 2020. Higher groundwater conditions could be encountered, particularly during/following precipitation and/or spring thaw.

3.3 COBBLESTONES AND BOULDERS

Cobblestones and boulders were encountered in the fill and glacial till deposits during test drilling, as shown on the Field Drill Logs, Drawing Nos. 16661-2 to 5, inclusive.

Glacial till consists of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. Glacial till inherently contains sorted deposits of the above particle sizes as well as a random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm). Intertill/intratill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the number/depth of piles installed and/or volume of soil excavated.

4 LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, moisture contents, Atterberg limits, unit weights, grain size distribution analysis, organic content and water-soluble sulphates.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. 16661-2 to 5, inclusive. The results of the grain size distribution analyses have been presented on Drawing No. 16661-6.

5 DESIGN RECOMMENDATIONS

Based on the foregoing outline of soil test results, the following foundation considerations and design recommendations have been presented.

5.1 DESIGN CONSIDERATIONS

It is understood that the proposed seed cleaning facility will consist of a warehouse/cleaner building (80 x 120 feet in plan area) and associated in-load/out-load bins, tower, ramp, conveyors, weigh scale, etc. It is likely that the foundation systems for support of the new structures will consist of thickened edge slabs, footings and/or piles.

The subgrade soils consisted of a mix of non-cohesive deposits of sand/silt/sand till and cohesive deposits of silt/clay glacial till. Cobblestones/boulders and groundwater seepage and sloughing conditions were encountered in the subsurface soils during test drilling. The groundwater table was measured at 1.5 m below existing ground surface on September 30, 2020. Higher groundwater levels could be encountered, particularly during and/or following spring thaw or precipitation events.

The subgrade soils are frost susceptible and the potential depth of frost penetration could range from approximately 1.8 to 2.4 m, depending on surface cover and severity of winter. Buried utilities should be based below the depth of frost penetration or protected against frost action with strategically placed insulation.

The subgrade soils will provide strong support for shallow based slabs or footing foundations at this site and should perform satisfactorily. As a minimum, 300 mm of granular base course is recommended to provide a stable working platform and uniform subgrade support beneath thickened edge slabs.

Unheated shallow based foundations will be exposed to potential differential movements associated with frost action. The provision of extruded polystyrene insulation beneath and adjacent to the foundation could be considered to minimize frost induced differential movements.

Pile foundations will encounter construction difficulties during installation due to the dense/hard nature of the subsurface soils and extensive groundwater seepage and sloughing conditions that will be encountered beneath the groundwater table.

Driven piles and helical screw piles will encounter hard driving/high installation torques and will likely terminate at shallow depths. Drilled, cast-in-place concrete friction piles will require temporary casing(s) and may not be feasible in some areas of the site due to extensive deposits of caving sands/silts (i.e., Test Hole No. 20-4). Of the pile options, drilled, cast-in-place concrete belled piles bearing above extensive sand/silt layers at about 4 m below existing grade may be the best suited pile type for this site. Construction difficulties associated with cobbles/boulders and groundwater seepage/sloughing should still be expected if belled piles are installed as a foundation support.

Recommendations have been prepared for site preparation; site classification for seismic site response; limit states resistance factors and serviceability; shallow foundations; deep foundations; grade-supported floor slabs; foundation walls; foundation concrete and gravelled site roads.

5.2 SITE PREPARATION

All vegetation, organic topsoil and deleterious materials should be removed from the construction area. Organics were encountered in the surficial silt fill during the drilling investigation. Based on the results of organic testing on the fill (6% organic content by dry weight), the existing fill material should be overexcavated and removed from the site. A representative of the Geotechnical Consultant should inspect the site during excavation to verify all fill and organics have been removed. Additional information regarding topsoil composition and soil structure is presented in Appendix B.

The general intent of initial site preparation is to make the subgrade suitably stable for construction activities. It is recommended that the subgrade soils within the development footprint are compacted to the below specified densities.

Building Areas	96 percent standard Proctor density at optimum moisture content;
Traffic Areas	96 percent standard Proctor density at optimum moisture content;
Landscape Areas	90 percent standard Proctor density at optimum moisture content.

Soils which meet the required compaction level should be stable to support construction activities.

It is anticipated that conventional site preparation (scarifying, moisture conditioning and re-compacting the soils) will suffice at this site.

In areas with variable subgrade soils, proof rolling may be an acceptable alternative to density testing and should be reviewed by the Geotechnical Consultant.

Soils which are unstable during site preparation and fail to achieve the required compaction will require additional treatment, which may include: over-excavation and replacement and/or geosynthetic stabilization. The need for additional treatment should be reviewed by the Geotechnical Consultant during the field construction with respect to the actual conditions and project requirements.

Fill, required to bring the subgrade surface to the design elevation in construction areas may consist of the on-site silt/sand soils or imported granular fill.

All proposed subgrade fill should be approved by the Geotechnical Consultant prior to placement. The fill should be placed in thin lifts (maximum 150 mm loose) and uniformly compacted to 96 percent of standard Proctor density at optimum moisture content.

Utility trench excavations are susceptible to settlement and should be adequately backfilled and compacted. The magnitude of settlement is directly related to the level of compaction of the backfill material. Well compacted fills will settle a small percentage of the fill thickness whereas poorly compacted fills can settle appreciably, particularly if frozen soils are incorporated in the backfill. Efforts should be made to meet the specified compaction level in areas sensitive to settlement.

The site should be graded to provide positive site drainage away from all work areas and structures prior to, during and following construction.

5.3 SITE CLASSIFICATION FOR SEISMIC SITE RESPONSE

Based on the consistency of the subgrade soils encountered at this site and Table 4.1.8.4A of the 2015 National Building Code, the site classification for seismic site response falls within Class D.

5.4 LIMIT STATES RESISTANCE FACTORS AND SERVICEABILITY

The National Building Code of Canada (NBCC, 2015) requires the use of limit states design for the design of buildings and their structural components, including the design of shallow and deep foundations.

It is expected that the designer is familiar with the limit states design method and only a brief discussion will be presented. For a detailed discussion, it is recommended to review the NBCC (2015) and/or the Canadian Foundation Engineering Manual (CFEM, 2006).

Limit states are defined as those conditions under which a structure ceases to fulfill the function for which it was designed (i.e., unsatisfactory performance). In limit states design, two conditions are assessed with respect to performance, these are:

- ultimate limit states (ULS), and
- serviceability limit states (SLS)

Ultimate limit states are concerned with the collapse mechanisms of the structure (i.e., safety), whereas serviceability limit states consider mechanisms that restrict or constrain the intended use, function or occupancy of the structure.

As per NBCC (2015), the factored soil resistance utilized for foundation design may be determined using the following resistance factors applied to the ultimate resistance values presented in the following subsections of the report.

Shallow foundations:

- Compressive Resistance, $\Phi = 0.5$
- Sliding, Based on Friction (c=0), $\Phi = 0.8$

Deep foundations:

- Compressive Resistance, $\Phi = 0.4$
- Tensile Resistance, $\Phi = 0.3$

The above resistance factors have been provided to reflect that semi-empirical methods were used to derive the soil bearing resistances presented in this report using the laboratory and in-situ data collected during this investigation.

To satisfy serviceability limit states, a settlement analysis of the foundation must also be evaluated to ensure the structures are not negatively impacted by excessive settlement at the design load. Estimated foundation settlements have been provided in Section 5.5 and Section 5.6.2.

Piles exposed to lateral loads are typically designed to restrict lateral deflection of the pile head to tolerable limits. Lateral pile head deflection can be determined using the concepts presented in Section 5.6.3.

5.5 SHALLOW FOUNDATIONS

5.5.1 PERIMETER THICKENED EDGE RAFT

A perimeter thickened edge slab is considered suitable for support of lightly loaded structures and should perform satisfactorily. The following minimum provisions should be incorporated into the design of a heated grade-supported, cast-in-place, reinforced thickened edge slab foundation.

1. All existing fill, deleterious and organic materials shall be removed from the foundation footprint. After removal of any unsuitable material and/or overexcavation required to reach the design subgrade level, scarify and compact the surface of the subgrade to 96 percent of standard Proctor density at optimum moisture content. Overexcavate and replace soft areas with structural granular fill placed and compacted in thin lifts (150 mm loose) to 96 percent of standard Proctor density at optimum moisture content.

2. Subgrade fill, if required, may consist of imported granular fill or on-site soils, placed in thin lifts (maximum 150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content.

3. A minimum of 300 mm of crushed granular base course material is recommended beneath the slab and thickened edge.

4. The granular base course fill should be placed in thin lifts (maximum 150 mm loose) and compacted to 98 percent of standard Proctor density at optimum moisture content.

5. The thickened edge slab, bearing on compacted granular fill over undisturbed, naturally occurring glacial till, may be designed to exert an unfactored ULS bearing pressure of 800 kPa. The SLS bearing pressure to limit foundation settlements to 25 mm or less is 200 kPa. The estimated settlement is based on a thickened edge width of 2 m or less. If a lesser settlement is required and/or larger raft thickening dimension will be constructed, PMEL should re-evaluate the recommended SLS bearing capacity.

6. Extruded polystyrene insulation is recommended alongside the thickened edge foundation to minimize potential uplift due to frost.
7. The insulation should be placed adjacent the foundation a minimum depth of 300 mm below finished grade and should be positively sloped to direct water away from the foundation.
8. The insulation should be a minimum thickness of 50 mm and should extend at least 1.8 m away from the foundation. A vertical sheet of insulation should be fastened to the foundation above the horizontal insulation and should extend up to the insulated exterior wall. For unheated structures, the insulation should extend beneath the entire floor slab area and thickness increased to 100 mm. The exterior insulation should also be extended to 2.1 m away from the foundation.
9. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.
10. Provide positive site drainage away from the foundation.
11. The foundation should not be constructed on desiccated, wet, or frozen subgrade soil or base.
12. Frost should not be allowed to penetrate beneath the foundation just prior to, or during construction.
13. A soil gas membrane (i.e., radon gas and moisture resistant) should be installed between the underside of the floor slab and the granular fill. Care should be taken during and following installation to minimize damaging the membrane.

5.5.2 STANDARD STRIP AND/OR SPREAD FOOTINGS

Construction difficulties associated with groundwater seepage and sloughing may be encountered during construction of footing foundations. Dewatering and/or slope flattening may be required.

The following minimum recommendations should be incorporated into the design of a footing foundation. The recommendations are applicable to footings supporting vertical concentric loading only; footings subject to eccentric/unbalanced loading will require additional assessment.

1. For permanently heated, at-grade structures where heat loss to the foundation is permitted, the footings should be based at a minimum depth of 1.8 m below finished grade. Where a heated basement or crawl-space is constructed, footings should be based at a minimum depth of 1.2 m below finished grade. These minimum depths are applicable only where the building envelope insulation is designed to allow heat loss to the foundation. Where insulation is placed beneath the floor slab, an uninsulated strip width of at least 1 m is recommended adjacent to all exterior grade beams/foundation caps.
2. In unheated areas and/or where heat loss from the building to the foundation is not allowed, footings should be based below the potential depth of frost penetration (i.e., 2.4 m) or protected against frost action with strategically placed extruded polystyrene insulation (PMEL can provide insulation recommendations upon request if shallower foundation depths than recommended are desirable).

3. Footings based on naturally deposited, undisturbed soil may be designed to exert an unfactored ULS bearing pressure of 800 kPa. The SLS bearing pressure to limit settlements to less than 25 mm is 200 kPa. A maximum spread footing dimension of 2 m and a maximum strip footing width of 1 m was considered to determine the SLS bearing pressure; for larger footing sizes, an updated settlement analysis will be required.

4. A representative of the Geotechnical Consultant should inspect the footing excavations prior to construction of the footings to verify that adequate soil conditions exist.

5. A minimum strip footing width of 500 mm is recommended. A minimum dimension of 1,000 mm is recommended for square and rectangular footings.

6. If the subgrade soil is disturbed during excavation below the design depth, then the disturbed soil should be removed to an undisturbed, level surface. Fill, required to raise the subgrade elevation to the underside of the footings, should be concrete.

7. Footings should not be constructed on desiccated, frozen or wet subgrade soil. Frost should not be allowed to penetrate beneath the footings prior to, during or after construction.

8. The finished grade should be landscaped to provide for positive site drainage away from the structure.

5.5.3 Lateral Thrust and Uplift Design

Where footings are subject to uplift and/or lateral loads, the uplift capacity of the footing foundation may be calculated on the basis of the weight of the foundation and the soil above the footing. If the excavated soils are utilized for backfill above the footing, the unit weight of the compacted fill may be taken as 19 kN/m^3, if placed in thin lifts (150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content.

The lateral resistance of the footing foundation may be calculated using the soil parameters presented in Table II.

Table II Footing Soil Parameters

Soil Type	Effective Angle of Internal Friction	Earth Pressure Coefficient			Unit Weight (kN/m^3)	Submerged Unit Weight (kN/m^3)	Undrained Shear Strength (kPa)	Ultimate Coefficient of Friction
		Active (K_a)	Passive (K_p)	At-Rest (K_o)				
Sand/Silt Till	28^o	0.4	2.8	1.0	20.0	10.0	--	0.35

5.5.4 Buoyancy

The groundwater table was measured at a depth of 1.5 m below existing ground surface on September 30, 2020. As groundwater levels can fluctuate seasonally by up to 1 m (with the highest groundwater level occurring during/following spring thaw and/or periods of precipitation), it is recommended that the groundwater level be measured prior to finalizing the foundation design. The uplift hydrostatic pressure acting on the base of footings constructed beneath the groundwater table would be equal to the depth of the foundation extending below the groundwater table multiplied by the unit weight of water (9.81 kN/m^3).

5.6 DEEP FOUNDATIONS

5.6.1 DRILLED CAST-IN-PLACE CONCRETE BELLED PILES

Construction difficulties associated with groundwater seepage/sloughing and the presence of cobbles/boulders in the subsurface deposits should be expected. Temporary casing and/or coring will likely be required during the installation of belled piles at this site.

Drilled, cast-in-place, concrete belled piles should be designed on the basis of end bearing resistance only. The ULS and SLS resistance values for design of belled piles have been presented in Table III.

TABLE III END BEARING RESISTANCE (BELLED PILES)

Depth (metres) [1]	End Bearing Resistance (kPa)	
	Unfactored ULS	SLS
4 to 5 (silt/clay glacial till)	1,250	400

[1] Depth below existing ground level. Belling depth may vary depending on the position of seepage, sloughing, cobbles and boulders. Bells must be based an adequate depth below any sloughing soil zones to ensure that the roof of the bell does not collapse.

<u>Notes:</u>

1. For the purposes of this report, design depths have been referenced to existing grade. The structural engineer must consider finished grade elevation relative to existing grade. If existing grade is altered significantly, PMEL should be consulted to confirm the design parameters.

2. Piles should be reinforced to withstand all axial and lateral forces within the pile.

3. When determining the compressive shaft resistance of the pile, the portion of pile shaft within 1 bell diameter above the base of the bell should be discounted to account for interaction effects between the shaft and the bell.

4. Belled piles designed to resist uplift loading should have a minimum embedment ratio (d/b) of 3, where d = embedment depth and b = bell diameter (m). For bells installed to a shallower depth, the uplift capacity should be reviewed by the Geotechnical Consultant.

5. When determining the uplift resistance of the bell component of the pile, the area used in design is equal to the area of the bell minus the cross-sectional area of the shaft.

6. Concrete should be placed as soon as practical after cleaning the bell. Water should not be allowed to collect at the base of the bell prior to placing concrete. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open for placing of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As casing is extracted, concrete in casing must have adequate head to displace all water in the annular space.

7. The maximum diameter of the bell shall not exceed three times the shaft diameter.

8. Larger pile diameters may be required to facilitate the removal of boulders from the pile hole. Coring through boulders may also be required.

9. The height of the bell should be designed to provide adequate concrete to distribute the unit stresses into the concrete without over-stressing the outer, non-reinforced concrete within the bell.

10. If belled pile groups are used, the space between adjacent bells should be at least half of the largest bell diameter. Settlement analysis will ultimately dictate acceptance of spacing. Lesser spacings should be reviewed by the Geotechnical Consultant.

11. Full time inspection by a representative of the Geotechnical Consultant, employed directly by the Owner, is required to confirm pile bearing capacities and to verify suitable pile base conditions, prior to placing steel and concrete, and to document the installation of each belled pile.

5.6.2 Pile Settlement

With regards to serviceability of pile foundations, assuming good construction practices are followed and the appropriate resistance factors are applied, the settlement of individual piles at the design load will be small and should be within tolerable limits. The anticipated settlement of individual drilled, concrete belled piles should be in the order of 10 to 20 mm.

The above is applicable to individual piles and small pile groups. Larger settlements could be encountered where large pile groups (i.e., breadth of foundation or pile cap is a similar dimension as depth of piles) or bell diameters in excess of about 2.5 to 3 m are constructed. Foundation settlements should be evaluated by the Geotechnical Consultant where large pile groups or large diameter belled piles are constructed.

Pile foundations designed utilizing the provided SLS bearing capacities would perform similarly to pile foundations designed using the provided ULS capacities.

5.6.3 Lateral Thrust Forces

Pile deflection typically governs the design of laterally loaded piles. Subgrade reaction theory may be utilized to estimate lateral pile deflection. The estimated coefficients of horizontal subgrade reaction of the subgrade soils have been presented in Table IV.

Table IV Estimated Coefficients of Horizontal Subgrade Reaction

Zone (metres) [1]	Coefficient of Horizontal Subgrade Reaction, Ks, (kN/m^3)
0 to 1.5D	0
1.5D to 3	15,000z/D
3 to 5	35,000/D

[1] Depth below existing ground level.
Where D = pile diameter and z = depth in m. For large diameter piles (i.e. exceeding 1.0 m) the zone of zero horizontal subgrade reaction should not exceed 1.5 m.

The response of a pile to lateral loads is highly nonlinear. Methods that assume linear behaviour, such as horizontal subgrade reaction theory, are only applicable where pile deflections are small, loading is static and pile materials are linear; these conditions do not exist in most cases and soil-pile interaction modeling (i.e., p-y method) is required to accurately model the pile behaviour.

If a more detailed lateral analysis is deemed warranted, PMEL can model the interaction between the soil and the pile, in accordance with the p-y method. Specific pile details (i.e., loading, type, diameter, length, etc.) will be required in order to perform the analysis.

5.6.4 GRADE BEAMS AND PILE CAPS

Grade beams and pile caps should be reinforced at both top and bottom throughout their entire length/cross section. Grade beams and pile caps exposed to frost action should be constructed to allow for a minimum of 100 mm of net void space between the underside of the grade beam and the subgrade soil (compressible void form).

The finished grade adjacent to all pile caps and grade beams should be such that water runoff is not allowed to infiltrate and collect in the void space.

5.7 GRADE-SUPPORTED FLOOR SLABS

5.7.1 DESIGN RECOMMENDATIONS

The near-surface subgrade soil conditions consisted of fill (containing organics) followed by sand/silt glacial till. All fill material should be removed from the slab footprint to expose naturally occurring glacial till soils. Grade-supported slabs based on glacial till soils should perform satisfactorily provided that some slab movements and cracking can be tolerated.

The following minimum provisions should be incorporated into the design of conventional, heated, grade-supported, cast-in-place, reinforced concrete slabs.

1. Prepare the site in accordance with Section 5.2, Site Preparation. After removal of all fill, level and compact the upper 150 mm of subgrade soil to 96 percent of standard Proctor density at optimum moisture content. Excavate soft subgrade areas and replace with suitable, non-expansive fill, placed and compacted to 96 percent of standard proctor density at optimum moisture content. High-strength geogrid/geotextile may be required to provide soil stabilization and separation where soft/wet soil conditions are encountered. The need for special measures (i.e., over-excavation, geotextile, geogrid, and/or additional gravel fill) in soft/wet areas must be subject to review by the Geotechnical Consultant during field construction.

2. To provide a level working surface and uniform subgrade support, a 150 mm leveling course of crushed granular base course material is recommended beneath the underside of the slab. The granular base course should be compacted to 98 percent of standard Proctor density at optimum moisture content.

3. Subgrade fill, if required, should preferably consist of granular material or the on-site soils, placed in thin lifts (maximum 150 mm loose) and uniformly compacted to 96 percent of standard Proctor density at optimum moisture content.

4. Isolate the slab from foundation walls, columns, etc., by means of separation joints.

5. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.

6. Provide positive site drainage away from the proposed Building. Extend downspouts at least 3 m away from the foundation.

7. Floor slabs should not be constructed on desiccated, wet, or frozen subgrade soil or base.

8. Frost should not be allowed to penetrate beneath the floor slab just prior to, during or after construction.

9. A soil gas membrane (i.e., radon gas and moisture resistant) should be installed between the underside of the floor slab and the granular fill.

5.7.2 SLABS EXPOSED TO FREEZING CONDITIONS

Grade-supported concrete slabs exposed to freezing conditions will be subject to differential movements associated with frost action. Where potential movements are to be minimized (i.e., front entrance), the utilization of rigid polystyrene may be considered. The insulation should have a minimum thickness of 75 mm and should extend sub-horizontally from the grade beam to a minimum distance of 1.8 m beyond the outer edges of the slab. If differential movements cannot be tolerated, the slab should be structurally supported on piles.

5.8 FOUNDATION CONCRETE

The results of water-soluble sulphate testing on soil samples recovered from the subject site have been summarized in Table V.

TABLE V WATER-SOLUBLE SULPHATE TEST RESULTS

Test Hole No.	Depth (metres)	Soil Type	Water Soluble Sulphate (%)	Class of Exposure	Degree of Sulphate Exposure
20-1	1.5-1.9	Till	0.02	--	Negligible
20-1	4.5-4.9	Till	0.12	S-3	Moderate

An examination of Table V revealed that the measured sulphate concentration of the tested soils was between 0.02 and 0.12 percent, which is considered negligible to moderate in terms of potential degree of sulphate attack. As such, sulphate resistant cement is recommended for all concrete in contact with the in-situ soils (i.e., minimum S-3 rating). All concrete at this site should be manufactured in accordance with current CSA standards.

It should be recognized that water soluble sulphate salts, combined with moist soils or low pH soils could render the soil highly corrosive to some types of metals in contact with the soil.

5.9 GRAVELLED SITE ROADS

The following recommendations have been presented to assist with the design of the gravel surfaced areas.

1. Prepare the the site in accordance with Section 5.2, Site Preparation.

2. Scarify the upper 150 mm of the subgrade soil, moisture condition and compact to 96 percent of standard Proctor density at optimum moisture content. Proof roll the prepared subgrade with heavy wheeled equipment to detect soft areas. Soft subgrade areas should be excavated and replaced with granular fill compacted to 96 percent of standard Proctor density at optimum moisture content.

3. Subgrade fill should consist of approved fill placed in thin lifts (150 mm loose, maximum) and compacted to 96 percent of standard Proctor density at optimum moisture content.

4. The following gravel structure has been proposed for the site.

TABLE VI THICKNESS DESIGN FOR GRAVEL ROADWAY STRUCTURES

Gravel Structure	Heavy Truck Traffic (mm)
Granular Base	150
Granular Sub-Base	300
Prepared Subgrade	(150)
Total Thickness	450

5. The above structure is based on providing positive site drainage and maintaining the strength of the subgrade over time. Where site grades are flat, or areas of the site are in cuts, there is potential for the subgrade to weaken if water is allowed to collect and penetrate, leading to potential surface rutting or failures. Increasing the gravel structure or providing geotextile/geogrid reinforcement could be considered to enhance the gravel structure performance.

6. All granular fill placed above the subgrade elevation should be placed in thin lifts (150 mm loose) and compacted to 98 percent of standard Proctor density at optimum moisture content. The granular base and sub-base course material should meet the aggregate gradation requirements presented in Table VII.

TABLE VII AGGREGATE GRADATION REQUIREMENTS – GRAVEL ROADWAYS

Grain Size (mm)	*Percent Passing	
	Base-Course	Sub-Base Course
37.5	--	100
25.0	100	--
19.0	80 - 95	70 - 100
16.0	70 - 90	--
12.5	55 - 83	--
9.5	47 - 75	50 - 95
4.75	33 - 60	35 - 80
2.00	20 - 45	25 - 60
0.850	11 - 30	--
0.425	7 - 21	--
0.180	5 - 14	--
0.075	3 - 8	5 - 12
Plasticity Index (%)	6 max	6 max
% Fracture (Min)	55	20

*MB Infrastructure GBC-I Base Course, GSB-C Sub-Base Course.

7. Positive surface drainage is recommended to minimize the potential for moisture infiltration and subgrade softening. Ditches and culverts should be provided where necessary to provide adequate site drainage. The invert of the ditch should preferably be in the order of 1 m below the edge of the roadway (a lesser depth could be accepted in areas to satisfy lateral constraints).

8. Embankment side slopes should be no steeper than 3 Horizontal to 1 Vertical (3H:1V) with 4H:1V preferred.

9. Periodic maintenance such as surface grading will be required to provide a level riding surface.

6 LIMITATIONS

The presentation of the summary of the field drill logs and foundation design recommendations has been completed as authorized. Four, 150 mm diameter test holes were dry drilled using continuous flight, solid stem auger drilling equipment. Field drill logs were compiled for the Test Holes during test drilling which, we believe, were representative of the subsurface conditions at the Test Hole locations at the time of test drilling. Variations in the subsurface conditions from that shown on the drill logs at locations other than the exact test locations should be anticipated. If conditions should differ from those reported here, then we should be notified immediately in order that we may examine the conditions in the field and reassess our recommendations in the light of any new findings.

The Terms of Reference for this geotechnical investigation did not include any environmental assessment of the site. No detectable evidence of environmentally sensitive materials such as hydrocarbon odour was detected during the actual time of the field test drilling program. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of deep test holes. The test holes were backfilled at the completion of test drilling. Please be advised that some settlement of the backfill materials will occur which may leave a depression or an open hole. It is the responsibility of the client to inspect the site and backfill, as required, to ensure that the ground surface at each Test Hole location is maintained level with the existing grade.

It is recommended that the piezometer be decommissioned once it is no longer needed. Piezometers that are not properly decommissioned could potentially be a future source of liability for the Owner; as such, proper decommissioning is recommended. PMEL will not accept any future liability associated with inadequate decommissioning of piezometers. Costs for decommissioning the piezometer can be provided by PMEL upon request.

This report has been prepared for the exclusive use of New Era Ag Technologies and their agents for specific application to the proposed seed cleaning facility to be constructed on Lots 26 to 35, Block 3, Plan 2554 in Swan River, Manitoba.

It has been prepared in accordance with generally accepted geotechnical engineering practices and no other warranty, express or implied, is made.

Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Party. Governing Agencies such as municipal, provincial, or federal agencies having jurisdictions with respect to this development and/or construction of the facilities described herein have full jurisdiction with respect to the described development. Any other unspecified subsequent development would be considered Third Party and would, therefore, require prior review by PMEL. PMEL accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

The acceptance of responsibility for the design/construction recommendations presented in this report with respect to the foundation system are contingent on adequate and/or full-time inspection (as required, based on site conditions at the time of construction) by a representative of the Geotechnical Consultant. PMEL will not accept any responsibility on this project for any unsatisfactory performance if adequate and/or full-time inspection is not performed by a representative of PMEL.

If this report has been transmitted electronically, it has been digitally secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust that this report fulfills your requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

[redacted]

[redacted]

Kelly Pardoski, P. Eng.

[redacted]

Graham Baxter, P. Eng.
KP/GB:tbs

DRAWINGS

NOTE:
1. THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.
2. THIS DRAWING WAS COMPILED FROM GOOGLE EARTH PRO ©2019, IMAGE ©2019 DIGITALGLOBE, (IMAGERY DATE: 7/14/19).
3. BENCHMARK: TOP OF CONCRETE SLAB LOCATED AT OVERHEAD DOOR OF CHEMICAL SHED, ASSUMED DATUM ELEVATION = 100.000 m.

LEGEND	–PMEL TEST HOLE	–PMEL TEST HOLE (PIEZOMETER INSTALLED)	–BENCHMARK

CONSULTING GEOENVIRONMENTAL GEOTECHNICAL ENGINEERS

P. MACHIBRODA ENGINEERING LTD.

806 – 48th STREET EAST
SASKATOON, SK
S7K 3Y4

DRAWING TITLE: SITE PLAN - TEST HOLE LOCATIONS		
PROJECT: PROPOSED SEED CLEANING FACILITY LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB		
APPROVED BY: GB	DRAWN BY: SD	DRAWING NUMBER: 16661-1
DATE: SEPTEMBER, 2020	SCALE: NOT TO SCALE	

TEST HOLE 20-1

ELEV: 99.6 m

DEPTH (m)	N	U / pp	γw	Pw	Lw	w
~0.5						15.6
~0.9						14.3
~1.9	30					12.6
~3.0						15.5
~4.9	33		22.5			11.6
~6.0						16.3
~7.9	40					19.2
~9.0						15.0
~10.9	37	4.00	20.9			17.9
~11.9		4.25		14	47	20.3

Water level: 97.7 m I.A.D.

FILL, silt, clayey, some sand, firm, low to medium plastic, moist, black, organics.
- 6% organic content at 500 mm.

GLACIAL TILL, sand and silt, some gravel, compact, well graded, fine to medium grained, moist, brown.
- cobbles below 1.0 m.
- silty, dense to very dense below 1.5 m.
- wet, seepage 1.5 to 1.9 m.

GLACIAL TILL, silt, clay, some sand, trace gravel, hard, medium plastic, moist, grey.
- sand lense, seepage, sloughing at 5.0 m.

SAND, silty, trace clay, dense to very dense, poorly graded, fine grained, wet, grey, seepage, sloughing.
- some silt below 7.6 m.
- silty below 8.0 m.

GLACIAL TILL, clay, silty, trace sand, trace gravel, hard, medium plastic, moist, grey.

NOTE:
1. Test Hole sloughed to 1.9 m I.A.D.

LEGEND: TOPSOIL, FILL, GRAVEL, SAND, SILT, CLAY, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γw...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE / SPLIT SPOON / CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SEED CLEANING FACILITY

LOCATION: LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB

NORTHING: 5778352 **EASTING:** 755390

DATE DRILLED: SEP 9/2020

DRAWING NUMBER: 16661-2

TEST HOLE 20-2

DEPTH (m) 0–11; ELEV: 99.7 m

N	U / pp	γw	Pw	Lw	w
			15	30	21.8
					14.4
					12.5
					11.2
42					11.2
					7.6
30	4.00 (pp)	19.2			22.7
					19.7
▽ 91.6 m I.A.D.					
45		19.3			26.5
					17.5

FILL, silt, clayey, sandy, firm, low plastic, moist, black, organics.
−P200 = 43.0% at 500 mm.

GLACIAL TILL, sand and silt, some clay, trace gravel, compact, well graded, fine to medium grained, moist, brown.

−silty, trace clay, cobbles and boulders below 1.7 m.
−dense to very dense below 2.0 m.

−boulder 3.7 to 4.0 m.

GLACIAL TILL, silt and clay, some sand, trace gravel, hard, medium plastic, moist, grey.

−seepage, sloughing at 5.0 m.

SILT AND SAND, trace clay, dense, poorly graded, fine grained, moist, grey.
−silty below 6.5 m.
−wet, seepage, sloughing below 6.7 m.

CLAY, some silt, hard, highly plastic, moist, grey.

SAND, silty, dense to very dense, poorly graded, fine grained, wet, grey, seepage, sloughing.

CONTINUED ON NEXT PAGE

LEGEND:

TOPSOIL, FILL, GRAVEL, SAND, SILT, CLAY, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γw...WET UNIT WEIGHT (kN/m³)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4.....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE | SPLIT SPOON | CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SEED CLEANING FACILITY

LOCATION: LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB

NORTHING: 5778344 **EASTING:** 755374

DATE DRILLED: SEP 9/2020

DRAWING NUMBER: 16661-3

TEST HOLE 20-2

DEPTH (m)	N	U pp	γ_w	Pw	Lw	w	Description
12	31		21.5			18.9	**SAND,** silty, dense to very dense, poorly graded, fine grained, wet, grey, seepage, sloughing.
							GLACIAL TILL, clay, some silt, some sand, trace gravel, hard, medium plastic, moist, grey.
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							

NOTE:
1. Test Hole sloughed to 9.4 m I.A.D.

LEGEND:

TOPSOIL, FILL, GRAVEL, SAND, SILT, CLAY, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m³)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE — SPLIT SPOON — CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SEED CLEANING FACILITY

LOCATION: LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB

NORTHING: 5778344 **EASTING:** 755374

DATE DRILLED: SEP 9/2020

DRAWING NUMBER: 16661-3A

TEST HOLE 20-3

PIEZO. ELEV.= 100.8 m

ELEV: 99.8 m

DEPTH (m) | N | U | γ_w | Pw | Lw | w

pp

Depth (m)	N	pp	γ_w	w
~0.5				15.8
~1.0				12.6
~1.5				9.2
~3.0				13.1
~4.9	25	3.50	20.2	21.9
~6.0				18.7
~7.9	50			19.8
~9.0				17.1
~10.9	36	4.50	20.0	19.8
~11.9		4.50		18.0

50 mm diam. SCH 40, PVC RISER PIPE

98.3 m SEP 30/2020

BENTONITE SEAL

SAND PACKED ANNULUS

50 mm diam. MACHINE SLOTTED SCH 40 PVC WELL SCREEN

95.7 m I.A.D.

SLOUGH

FILL, silt, clayey, sandy, cobbles and boulders, firm, low plastic, moist, black, organics.

GLACIAL TILL, sand, silty, some clay, trace gravel, dense, well graded, fine to medium grained, moist, brown.

–cobbles and boulders below 1.6 m.

GLACIAL TILL, silt and clay, some sand, trace gravel, very stiff, medium plastic, moist, grey.

–seepage, sloughing at 4.4 m.

SAND, silty, dense to very dense, poorly graded, fine grained, wet, grey, seepage, sloughing.

SILT, clayey, very stiff, low to medium plastic, moist, grey.

GLACIAL TILL, clay, silty, some sand, trace gravel, hard, medium plastic, moist, grey.

–some silt below 11.0 m.

NOTE:
1. Test Hole sloughed to 4.2 m I.A.D.

LEGEND:

TOPSOIL, FILL, GRAVEL, SAND, SILT, CLAY, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γ_w...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE | SPLIT SPOON | CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SEED CLEANING FACILITY

LOCATION: LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB

NORTHING: 5778361 **EASTING:** 755368

DATE DRILLED: SEP 9/2020

DRAWING NUMBER: 16661-4

TEST HOLE 20-4

DEPTH (m)

ELEV: 99.7 m

N	U (pp)	γw	Pw	Lw	w
					15.8
					12.5
					11.8
					11.4
66		21.6			10.8
					17.1
40		18.5			18.3
					13.9
32	4.00	21.2			20.6
					18.4
					22.1

96.5 m I.A.D.

FILL, silt, clayey, sandy, cobbles and boulders, firm, low plastic, moist, black, organics.

GLACIAL TILL, sand and silt, some clay, trace gravel, dense to very dense, well graded, fine to medium grained, moist, brown.

−P200 = 57% at 2.0 m.

SILT AND SAND, trace clay, hard, low plastic, moist, grey.

SILT AND SAND, dense to very dense, poorly graded, fine grained, wet, grey, seepage, sloughing.

GLACIAL TILL, clay, some silt, some sand, trace gravel, hard, medium plastic, moist, grey.

SAND AND SILT, trace clay, hard, low plastic, moist, grey.

NOTE:
1. Test Hole sloughed to 4.3 m I.A.D.

LEGEND:

TOPSOIL, FILL, GRAVEL, SAND, SILT, CLAY, GLACIAL TILL

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

Lw...LIQUID LIMIT

Pw...PLASTIC LIMIT

γw...WET UNIT WEIGHT (kN/m^3)

U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)

pp...POCKET PENETROMETER (kg/cm^2)

N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])

SO_4 .....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

P200...% PASSING No. 200 SIEVE

I.A.D.....IMMEDIATELY AFTER DRILLING

▽...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

▼...RECORDED WATER LEVEL (PIEZO)

SHELBY TUBE   SPLIT SPOON   CUTTINGS

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PROPOSED SEED CLEANING FACILITY

LOCATION: LOTS 26-35, BLOCK 3, PLAN 2554, SWAN RIVER, MB

NORTHING: 5778369 **EASTING:** 755385

DATE DRILLED:	DRAWING NUMBER:
SEP 9/2020	16661-5

P.MACHIBRODA ENGINEERING LTD.

ASTM C136: GRAIN SIZE ANALYSIS

Project: Proposed Seed Cleaning Facility
Location: Lots 26-35, Block 3, Plan 2554, Swan River, MB
Project No.: 16661
Date Tested: September 28, 2020
Test Hole No: 20-2
Sample No.: 14
Depth: 2.0

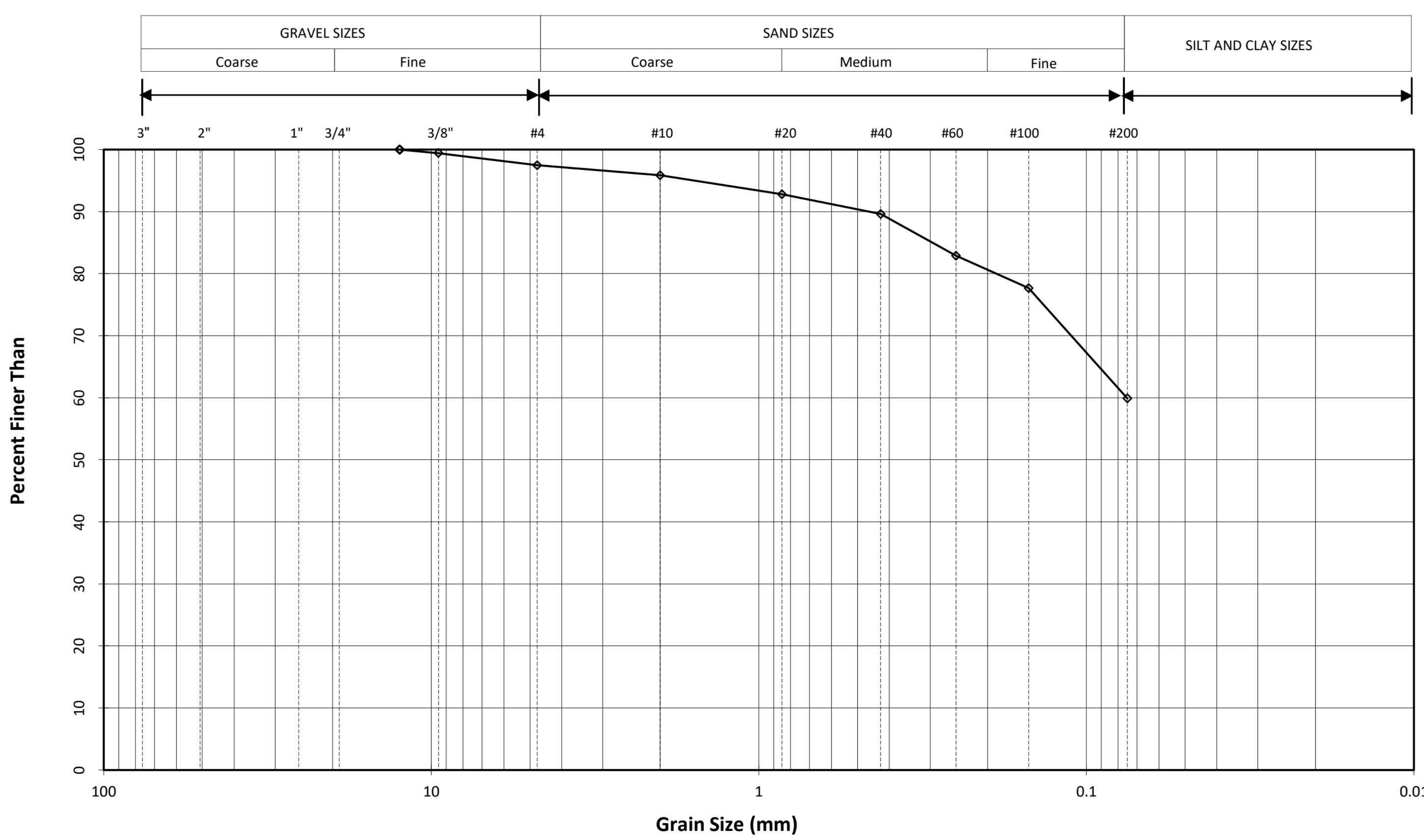
Sieve Analysis:

Sieve	Diameter mm	% Finer
	76.200	100
	63.500	100
	50.000	100
	37.500	100
	25.000	100
	19.000	100
	12.500	100
	9.500	99
	4.750	97
	2.000	96
	0.850	93
	0.425	90
	0.250	83
	0.150	78
	0.075	60

Material Description:

% Gravel Sizes	% Sand Sizes	% Silt and Clay Sizes
3	37	60

Remarks:



CERTIFIED BY CCIL Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

DRAWING NO.

16661-6

WE CERTIFY TESTING PROCEDURES ARE IN ACCORDANCE WITH ASTM C136 AND C117 CSTANDARDS
P. MACHIBRODA ENGINEERING LTD.

PER [redacted]

APPENDIX A

Explanation of Terms on
Test Hole Logs

CLASSIFICATION OF SOILS

Coarse-Grained Soils: Soils containing particles that are visible to the naked eye. They include gravels and sands and are generally referred to as cohesionless or non-cohesive soils. Coarse-grained soils are soils having more than 50 percent of the dry weight larger than particle size 0.080 mm.

Fine-Grained Soils: Soils containing particles that are not visible to the naked eye. They include silts and clays. Fine-grained soils are soils having more than 50 percent of the dry weight smaller than particle size 0.080 mm.

Organic Soils: Soils containing a high natural organic content.

Soil Classification By Particle Size

Soil Type	Particles of Size
Clay	< 0.002 mm
Silt	0.002 – 0.060 mm
Sand	0.06 – 2.0 mm
Gravel	2.0 – 60 mm
Cobbles	60 – 200 mm
Boulders	>200 mm

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse-grained soils: Described in terms of compactness condition and are often interpreted from the results of a Standard Penetration Test (SPT). The standard penetration test is described as the number of blows, N, required to drive a 51 mm outside diameter (O.D.) split barrel sampler into the soil a distance of 0.3 m (from 0.15 m to 0.45 m) with a 63.5 kg weight having a free fall of 0.76 m.

Compactness Condition	SPT N-Index (blows per 0.3 m)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	Over 50

Fine-Grained Soils: Classified in relation to undrained shear strength.

Consistency	Undrained Shear Strength (kPa)	N Value (Approximate)	Field Identification
Very Soft	<12	0-2	Easily penetrated several centimetres by the fist.
Soft	12-25	2-4	Easily penetrated several centimetres by the thumb.
Firm	25-50	4-8	Can be penetrated several centimetres by the thumb with moderate effort.
Stiff	50-100	8-15	Readily indented by the thumb, but penetrated only with great effort.
Very Stiff	100-200	15-30	Readily indented by the thumb nail.
Hard	>200	>30	Indented with difficulty by the thumbnail.

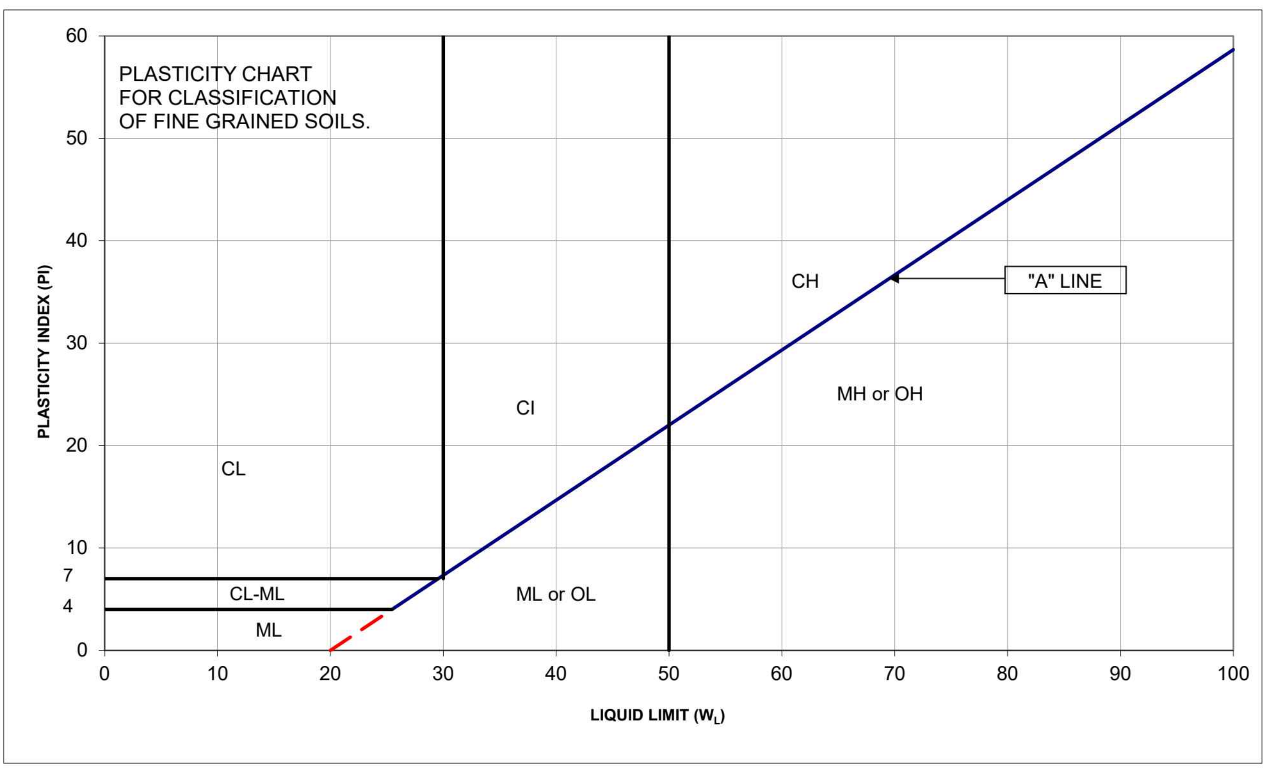
Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

DESCRIPTIVE TERMS COMMONLY USED TO CHARACTERIZE SOILS

Poorly Graded	- predominance of particles of one grain size.
Well Graded	- having no excess of particles in any size range with no intermediate sizes lacking.
Mottled	- marked with different coloured spots.
Nuggety	- structure consisting of small prismatic cubes.
Laminated	- structure consisting of thin layers of varying colour and texture.
Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks.
Fractured	- broken by randomly oriented interconnecting cracks in all 3 dimensions

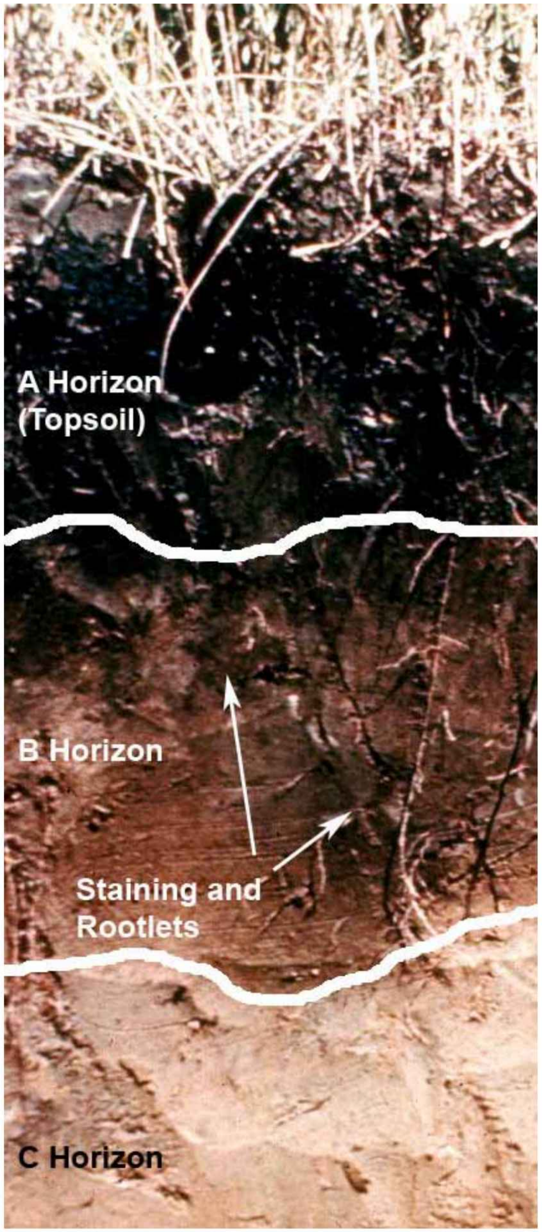
SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR AND OFTEN FIBROUS TEXTURE
COARSE-GRAINED SOILS(MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE)	GRAVELS More than half coarse fraction larger than No. 4 sieve size	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			GP	POORLY-GRADED GRAVELS AND GRAVEL-SAND MIXTURES <5% FINES	NOT MEETING ALL ABOVE REQUIREMENTS FOR GW
		DIRTY GRAVELS	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR PI < 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH PI > 7
	SANDS More than half coarse fraction smaller than No. 4 sieve size	CLEAN SANDS	SW	WELL-GRADED SANDS, GRAVELLY SANDS MIXTURES <5% FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}} = 1 \text{ to } 3$
			SP	POORLY-GRADED SANDS OR GRAVELLY SANDS <5% FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		DIRTY SANDS	SM	SILTY SANDS, SAND-SILT MIXTURES >12% FINES	ATTERBERG LIMITS BELOW "A" LINE OR PI < 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES >12% FINES	ATTERBERG LIMITS ABOVE "A" LINE WITH PI >7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSING NO. 200 SIEVE SIZE)	SILTS Below "A" line on plasticity chart; negligible organic content		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	$W_L < 50$
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	$W_L > 50$
	CLAYS Above 'A" line on plasticity chart; negligible organic content		CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	$W_L < 30$
			CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	$W_L > 30 < 50$
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	$W_L > 50$
	ORGANIC SILTS & ORGANIC CLAYS Below "A" line on plasticity chart		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	$W_L < 50$
			OH	ORGANIC CLAYS OF HIGH PLASTICITY	$W_L > 50$



APPENDIX B

Topsoil, Organic Matter and Organics



A Horizon

The A horizon is the topsoil layer of the soil strata. It is characterized by a build up of organic matter, and a lower unit weight than subsequent layers. The organic matter content of this layer is typically 4-10% by mass.

The colour of this horizon varies from dark black to brown, depending on surface vegetation and climatic conditions.

B Horizon

Typically reddish brown in colour and contains accumulations of matter that have been washed down from the A Horizon. The B horizon is generally composed of clay that has been washed out of the A Horizon, but can also contain iron, calcium and sodium deposits as well.

C Horizon

Unweathered parent soil.

Topsoil is a mixture of mineral soil and organic matter. The organic matter is developed from decaying biological material (leaves, grass, trees, animals, etc.) and contributes to the brown to black colour of the soil. Following the topsoil is the B horizon which is a transition layer, where staining from the overlying topsoil is common. This results in a darker colour of the soil immediately below the organic topsoil layer. Depending on the surface vegetation, rootlets may be present below the depth of topsoil. However it should be recognized that these rootlets are not the same as organic matter in topsoil.

Physically speaking in comparison to mineral soil, topsoil has a significantly lower bulk density and a lower unit weight as compared to the underlying parent soil. This is due to larger pore spaces and non mineral materials in the soil matrix. Along with lower density, topsoil is often spongy and colloidal/fibrous. The following figure is of a typical prairie soil. Each horizon is labelled accordingly to demonstrate a typical soil profile.

Reference

Henry L. 2003. Henry's Handbook of Soil and Water, Henry Perspectives, Saskatoon, SK.

Appendix E: Dust Hazard Analysis Guideline

NEW ERA AG TECHNOLOGIES
SEED CLEANING PLANT

Occupancy Classification Guidance – Process Considerations

PREPARED FOR

Derek Poole
New Era Ag Technologies
507 3rd Ave S
Swan River, MB R0L 1Z0
Date: November 12, 2025

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1.0 Introduction

anCeres Processing Solutions Ltd. is an engineering and project management firm with subject matter expertise in grain processing. anCeres helps clients add value to their grain businesses by facilitating capital investment decision making, optimizing processes and existing operations, managing the design and construction of new facilities, and ensuring regulatory compliance.

New Era Ag Technologies, established in 2013, is a seed and chemical retail serving the Swan River Valley in Manitoba. The company began a research division in 2015 with the objective to provide valuable local data to its retail customers on seed varieties and crop inputs. New Era Ag Research provides agricultural companies an opportunity to develop, test and demonstrate their products. A second retail location was opened in Melfort, Saskatchewan in 2023. New Era plans to construct a seed cleaning plant on its site in Swan River.

The products to be processed are known to be combustible and will have the potential to present dust deflagration and explosion hazards when suspended in air under certain conditions. Dust hazards are a consideration when determining the appropriate occupancy classification of a facility, as defined under the National Building Code. As part of the design and pre-construction regulatory review of the facility, and to identify required safeguards and conditions to mitigate potential combustible dust hazards in accordance with good engineering practice, the company has requested anCeres provide preliminary guidance with respect to combustible dust hazards and risk mitigation, and the implications for occupancy classification.

This document is not a formal DHA, but rather a preliminary guidance document to assist the architect in the appropriate occupancy classification of the facility. Guidance is provided with consideration to DHA methodology outlined in NFPA 652, “Standard on the Fundamentals of Combustible Dust.” Additional industry-specific standards, including NFPA 61, “Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities,” are also of relevance to ensure that the process equipment and facility are designed, constructed and operated in accordance with good engineering practice. The analysis was conducted based on information and drawings developed by anCeres in their role as process designer.

A primary objective of the process design to date has been to ensure that the explosion prevention and mitigation measures which form the basis for facility safety comply with the applicable Codes, standards, and engineering guidelines. This report provides general information about the hazards that exist in grain processing operations, and the risk mitigation measures that have been incorporated in the New Era facility design.

2.0 Codes, Standards and Guidelines

The following codes, standards and guidelines were referenced in the design of the New Era facility, and inform the recommended operating practices to mitigate combustible dust hazards:

1. National Building Code of Canada, 2020
2. National Fire Code of Canada, 2020
3. Canadian Electrical Code, C.22.1-21, 2018
4. Manitoba Electrical Code, 13th Edition, 2018
5. NFPA 51B, Standard for Fire Prevention During Welding, Cutting and Other Hot Work
6. NFPA 61 Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities, 2017 (revision referenced in Division B Table 1.3.1.2 of the NFC 2020)
7. NFPA 68, Standard on Explosion Protection by Deflagration Venting, 2023
8. NFPA 69, Standard on Explosion Prevention Systems, 2019
9. NFPA 77, Recommended Practice on Static Electricity, 2024
10. NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids, 2015 (revision referenced in Division B Table 1.3.1.2 of the NFC 2020)
11. NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas, 2024
12. NFPA 652, Standard on the Fundamentals of Combustible Dust, 2019
13. NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, 2017 (revision referenced in Division B Table 1.3.1.2 of the NFC 2020)
14. OSHA Technical Manual – Section IV, Chapter 6
15. FM Global Data Sheet 5-1 Electrical Equipment in Hazardous (Classified) Locations
16. FM Global Data Sheet 5-8 Static Electricity
17. FM Global Data Sheet 7-73 Dust Collectors and Collection Systems
18. FM Global Data Sheet 7-75 Grain Storage and Milling
19. FM Global Data Sheet 7-76 Prevention and Mitigation of Combustible Dust Explosion and Fire
20. SMACNA Round Industrial Duct Construction Standards
21. ACGIH Industrial Ventilation: A Manual of Recommended Practice for Design, 31st Edition

The Canadian Electrical Code, C.22.1:24 was released in 2024 and has been adopted in some jurisdictions in Canada. Manitoba has not yet adopted the new code, meaning the New Era design is based on the 2018 version of the code and the Manitoba interpretations of the same.

NFPA 61, NFPA 652, NFPA 654 referenced above have been consolidated as of January 2025 into NFPA 660. However, the current NFC and NBC reference the above noted standards. The consolidated NFPA 660 standard does not materially change any of the requirements contained within NFPA 61, NFPA 652 or NFPA 654.

3.0 Combustible Dust

3.1 Combustible Dust

Several technical definitions for combustible dust exist. In Canada, the *Hazardous Products Regulation* (WHMIS 2015) defines combustible dust as " a mixture or substance that is in the form of finely divided solid particles that, upon ignition, is liable to catch fire or explode when dispersed in air". Another example is Alberta's Occupational Health and Safety Code which defines combustible dust as "a dust that can create an explosive atmosphere when it is suspended in air in ignitable concentrations". The Occupational Safety and Health Administration (OSHA) in the United States defines combustible dust as "a solid material composed of distinct particles or pieces, regardless of size, shape, or chemical composition, which presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations". NFPA defines it as “a finely divided combustible particulate solid that presents a flash fire hazard or explosion hazard when suspended in air or the process-specific oxidizing medium over a range of concentrations”. The Canadian Electrical Code (CEC) considers particulate smaller than 500 microns (passing through U.S. #35 standard sieve) a hazard.

Agricultural commodity dusts such as those created by the storage, handling and processing of grain are combustible dusts.

3.2 Combustible Dust Events

Combustible dust hazards exist in three forms: 1) fire, 2) flash fire/deflagration, and 3) explosion. In many cases an initial combustible dust incident can result in a secondary deflagration and/or explosion incident.

There are five elements that can be involved in a hazardous event, and the number of elements present determines the result:

1. Combustible dust (fuel) – combustible dust must be present in sufficient quantities to ignite when exposed to an ignition source. Each commodity and its associated dust have specific combustion characteristics.
2. Oxygen – there must be sufficient oxygen present to support the combustion process. Air generally contains enough oxygen to meet this condition.
3. Ignition source – some form of energy is required to ignite the fuel and oxygen. The ignition source must be larger than the minimum ignition energy of the fuel.
4. Dispersion – in order for a dust deflagration to propagate, fuel must be dispersed in the appropriate concentration, such that combustion energy from one particle is transferred to and ignites adjacent fuel particles.
5. Containment – for an explosion to occur, there must be some resistance to the expansion of the deflagration flame front.

A fire requires three elements: oxygen, fuel, and an ignition source. A deflagration requires four elements: the three elements for fire, plus dust dispersion at the right concentrations in air. A dust explosion requires five elements: the four elements for deflagration, plus confinement (enclosure, such as a silo, dust collector, bin, conveyor, bucket elevator, or room).

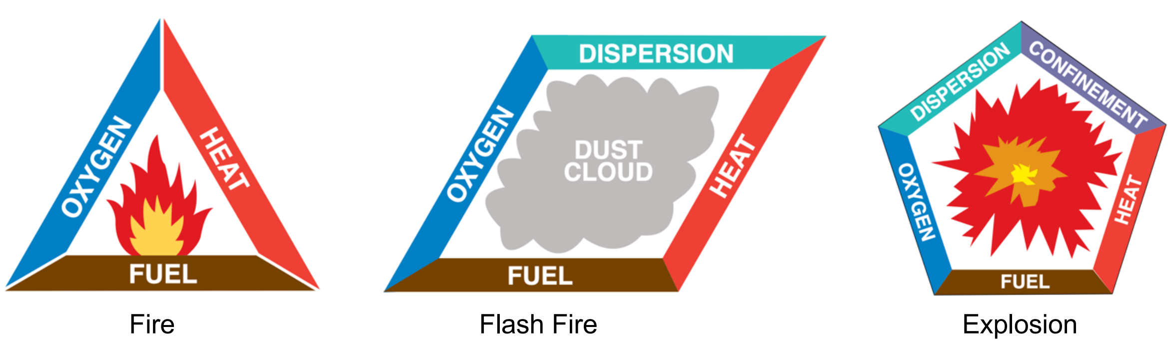


Figure 1: Combustible Dust Event Requirements

3.3 Industry Risk

Historical data published by DustEx Research, Ltd. records the following combustible dust related incidents, injuries and fatalities over a recent 5-year period:

Table 1: Incident Data Overview

	United States					Canada				
	2019	**2020**	**2021**	**2022**	**2023**	**2019**	**2020**	**2021**	**2022**	**2023**
Fire	175	116	98	79	75	22	14	8	9	14
Explosions	37	26	19	26	17	1	7	3	0	2
Injuries	42	35	26	24	21	4	2	9	0	0
Fatalities	1	1	2	1	1	0	0	3	0	0

The historical data shows that wood processing, wood products, agricultural activity and food production make up a large portion of the overall fire and explosion incidents. Agricultural activity and food production typically account for one third to one half of recorded incidents each year, similar to the prevalence of incidents in the wood processing and wood products industries.

With respect to the types of equipment involved in historical incidents, dust collectors, grinders/pulverizers, dryers, storage silos and elevators/conveyors represent most of the primary explosion locations. These pieces of equipment are common in the grain processing industry. The Center for Chemical Processing Safety published the following, based on FM Global insurance event data from 1983-2007:

Table 2: Equipment Involved in Dust Explosions

Equipment Item	Number of Incidents	% of Incidents
Dust Collectors	66	40
Grinders/Pulverizers	22	13
Dryers/Ovens	15	9
Silos	14	8
Conveying Systems	13	8
Mixers/Blenders	5	3
Other or Unknown	31	19
Total	166	100

The agricultural and food processing industry, including grain cleaning, requires careful process design and operation to mitigate the risks of combustible dust deflagration. Review of the process design and an understanding of the resultant risk in a facility is an appropriate consideration when determining occupancy classification.

4.0 Facility and Process Description

4.1 Facility

The new grain cleaning facility is to be constructed near the south end of the New Era site on the west side of 3rd Ave in Swan River. The site is zoned MH (Industrial Heavy). The new facility will be

Figure 2: Facility Location

The building has a 134' x 70' footprint, and an overall building height of approximately 30'. Storage bins on the roof and grain conveyance equipment extend above the roofline. Outside of the main building footprint, immediately north and south of the building envelope, there are two storage bin support structures. Inside the building, process equipment sits on the floor, and there is an equipment access platform for service of the upper end of vertical material handling equipment located near the ceiling. The optical sorters on the main floor are enclosed in climate-controlled rooms. The lower part of vertical material handling equipment, along with mechanical equipment such as air compressors and pneumatic blowers, are located in the basement.

An enclosed room on the main floor houses personnel areas, and a second enclosed room above the personnel areas houses an electrical room.

A mill operator will intermittently access the process area to check equipment. The only continuous personnel presence in the building will be in the personnel area at the east end, main floor. Occupancy will typically be 2-3 people.

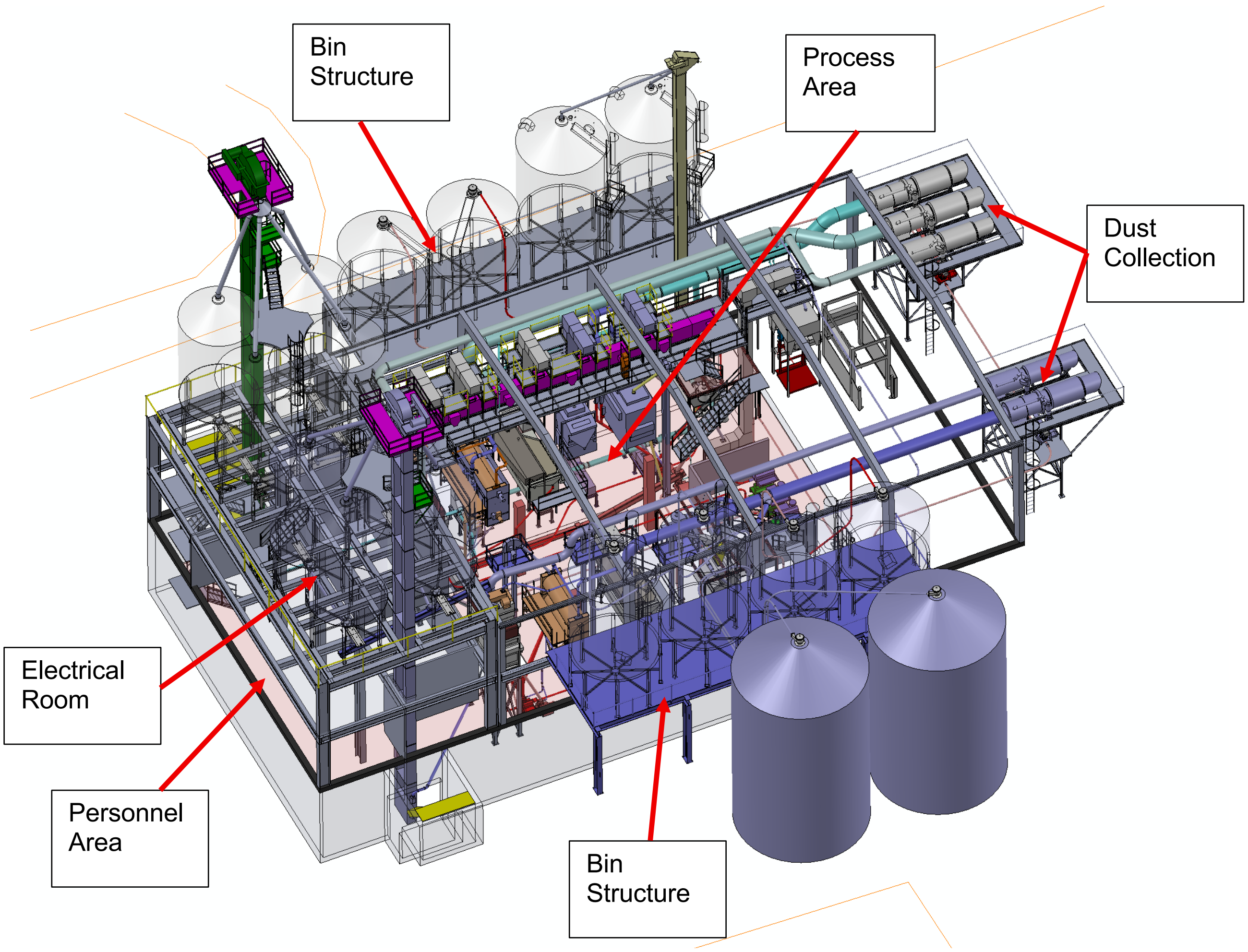


Figure 3: Facility General Arrangement

4.2 PROCESS

Seed is received through dump pits into the boot of bucket elevators that place the grain into storage bins located on the roof of the building. Grain is then metered into the process equipment, where it is first aspirated to remove dust before proceeding through the remaining grain cleaning steps. Processing equipment includes air and screen machines, indented cylinder separators, spirals, gravity tables, destoners, polishers and optical sorters. Clean seed is elevated mechanically or pneumatically, depending on the seed type and breakage sensitivity, and placed into overhead storage bins outside of the building for bulk shipping, or directed to a packaging machine for bagging. Screenings, made up of foreign material and undersized seeds, are conveyed pneumatically from the processing equipment to overhead storage bins outside of the building for bulk shipping. Any packaged material generated in the process is transferred to an on-site warehouse for storage.

Process equipment will be installed in two phases, both within the same building envelope.

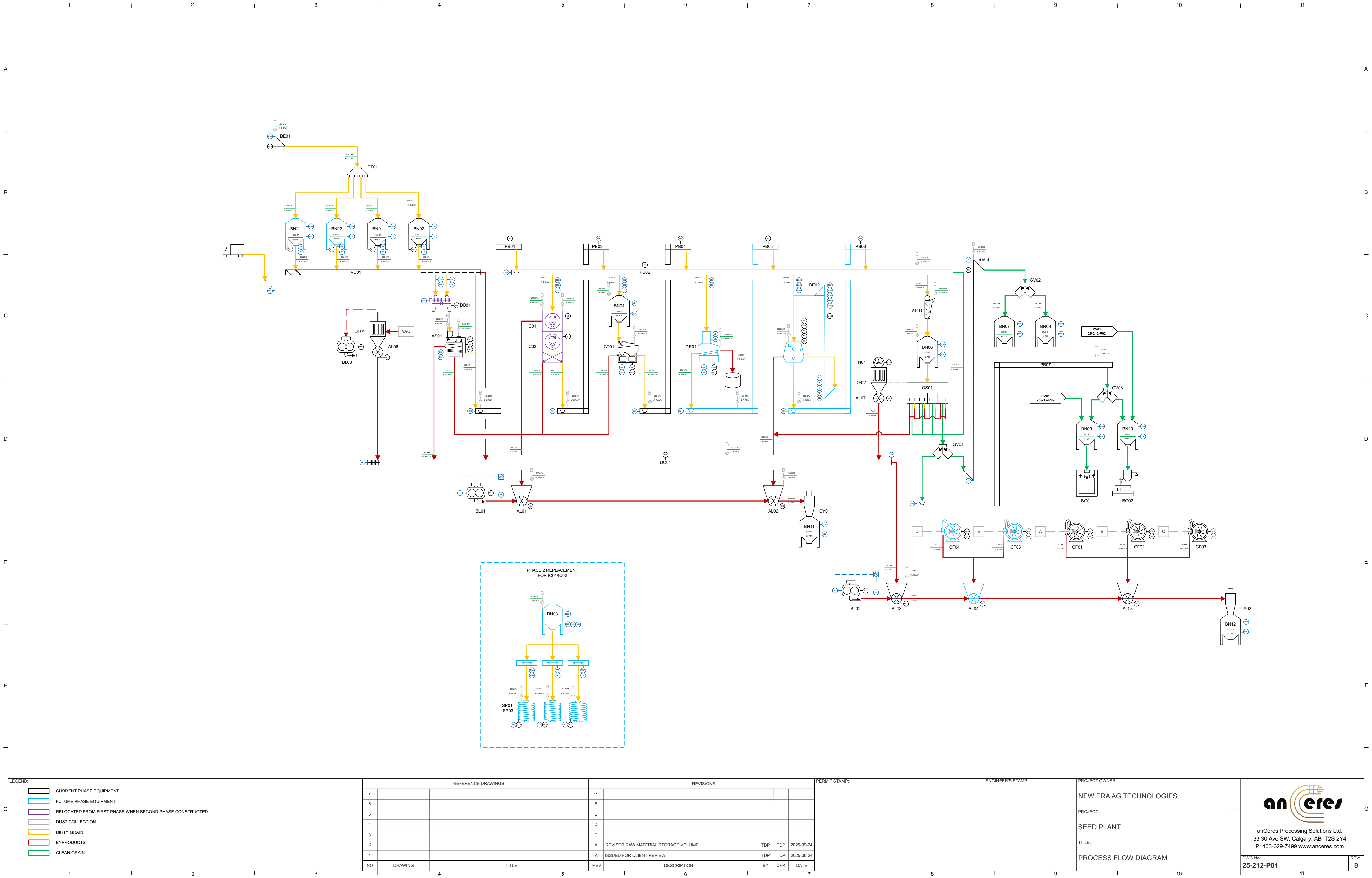


Figure 4: Process Flow Diagram – Phase 1

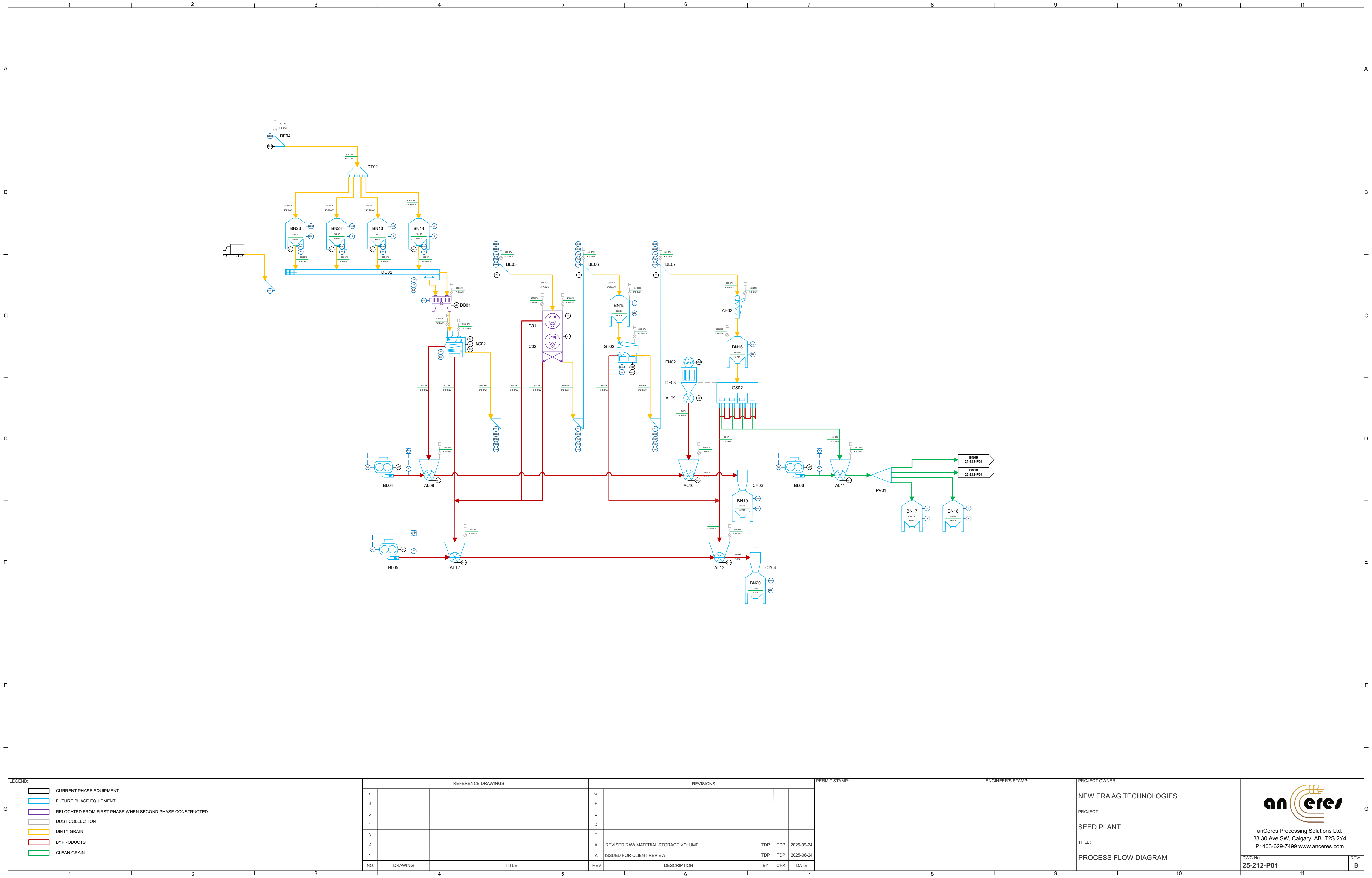


Figure 5: Process Flow Diagram – Phase 2

5.0 Material Hazards

5.1 Methodology

Standardized published test protocols are applicable to a material hazard evaluation. These tests provide insight on potential dust explosion severity and dust ignition sensitivity and sustainability.

Table 3: Dust Explosibility Parameters

Parameter	Typical units	Description	Test Method
P_{max}	(bar g)	Maximum explosion pressure in a constant volume explosion	ASTM E1226
K_{st}	(bar•m/s)	Volume-normalized maximum rate of pressure rise in a constant-volume deflagration	ASTM E1226
MIE	(mJ)	Minimum ignition energy of a dust cloud (electric spark)	ASTM E2019
MEC	(g/m^3)	Minimum explosive dust concentration	ASTM E1515
MIT	(°C)	Minimum ignition temperature of a dust cloud	ASTM E1491
LIT	(°C)	Minimum ignition temperature of a dust layer	ASTM E2021
LOC	(% O_2)	Limiting oxygen concentration	ASTM E2931
BZ	BZ1 – BZ6	Burning behavior of dust layers	EN 17077:2018
ρ	Ω•m	Volume resistivity	ASTM D257

Descriptions of the explosibility parameters outlined in Table 3 are provided below. It is important to note that dust explosibility parameters are not intrinsic properties and are dependent upon several factors including particle size distribution (PSD), moisture content, and agglomeration.

Particle Size

PSD has a dominant influence on dust explosibility as smaller dust particles typically produce greater explosion severity and are more sensitive to ignition. NFPA standards note that combustible particulate solids having a minimum dimension greater than 500 μm generally have a surface-to-volume ratio too low to pose a deflagration hazard. However, exceptions occur, and combustibility should be determined by testing. This is especially true where combustibility can vary significantly depending on several conditions including:

1. Location within the process
2. Type of equipment involved
3. Ambient weather conditions
4. Equipment maintenance status
5. Operator-specific preferences
6. Date of last sample testing
7. Changes in feed stock (including length of time in transit)
8. Changes in product specifications
9. Length of time feed stocks have been in storage
10. Change in process throughput

It is important to recognize that as materials pass through a process, they are prone to further size reduction through various mechanisms of abrasion. Even large particulates that are being conveyed in a process may generate smaller particulates meeting the definition of combustible dust.

Combustion occurs when oxygen is available in sufficient concentration to cause the combustible material to oxidize (burn) when ignited. In general, the finer the dust, the greater total dust cloud surface area. Therefore, a dust cloud with finer particulate will be more combustible and explosive.

Suspended dusts provide greater exposure of dust molecules to oxygen. This reduces the ignition energy needed for combustion by increasing the pre-ignition heating of adjacent dust particles. The rapid heating and ignition of the smaller dust particles increases the combustion rate to other dust particles. The increased combustion propagation results in the creation of stronger deflagration pressures to which surrounding personnel, equipment and structures are exposed.

Moisture

Moisture in dust reduces cloud ignition sensitivity (by increasing MIE, MIT, and MEC) and explosion severity. Some studies on the impact of moisture indicate that the MIE of certain dusts can increase by an order of magnitude as the moisture content is increased from less than 5% to greater than 15%.

However, moisture content cannot be considered an effective explosion preventative safeguard since most ignition sources provide more than enough energy to vaporize ambient moisture in the air and to ignite the dust. For moisture to prevent ignition of dust by common sources, the dust typically has to be so damp that a dust cloud could not be formed.

Agglomeration

Agglomeration relates to the characteristic of particles adhering to one another to form larger particles. Particles that are fibrous and/or hygroscopic can be agglomerative in nature. When these dusts are released in humid conditions, they are likely to agglomerate. When dust agglomerates, the ignition sensitivity, explosion severity, and ease of dispersion are reduced, possibly to the point where a dispersed cloud is no longer explosible.

Dust Hazard Classes

The explosion severity parameters P_{max} and K_{st} are mainly used as input parameters for designing explosion suppression or isolation systems and for determining the required size for explosion vents. These parameters also give an indication of potential explosion violence and can be helpful in assessing the potential consequences of an explosion.

Dusts are typically classified according to their K_{st} value into three classes; St-1, St-2 and St-3.

Table 4: Combustible Dust Hazard Classification

Hazard Class	K_{st}
St-1	<200
St-2	201-300
St-3	>300

The parameters MEC, MIE, and MIT give an indication of the likelihood of dust cloud ignition, while LIT gives an indication of the likelihood of ignition of dust layers. These parameters are used to evaluate the credibility of various ignition scenarios and the need for protection to prevent ignition of a dust cloud or layer. LIT is typically much lower than MIT, meaning that a dust layer present on a hot surface can ignite before a suspended dust cloud, and the resulting fire can then act as an ignition source for the dust cloud.

Minimum explosible concentration (MEC)

The minimum explosible concentration (also referred to as the lower explosibility limit) is the minimum concentration of combustible dust that when dispersed in air, will propagate a deflagration when ignited as determined by ASTM E1515. The lower the MEC value, the greater the ease of formulating a combustible dust atmosphere. The MEC parameter can be used to establish process control limits when using concentration control as a basis for safety. Typical MECs for combustible dusts listed in NFPA standards range from 20 g/m^3 to over 250 g/m^3.

Minimum ignition energy (MIE)

Minimum ignition energy (MIE) is the lowest capacitive spark energy capable of igniting the most ignition sensitive concentration of a combustible dust mixture as determined by ASTM E2019. The lower the value, the greater the likelihood that an ignition source is sufficient to ignite the mixture. MIE can be determined with or without the use of inductance. Testing without the use of inductance better simulates the discharges from static electric sources as the spark duration is shorter and thus the determined energy levels are less conservative. Testing with the use of inductance simulates longer duration discharges from electronic circuitry that can occur from machines or control equipment and provides a more conservative value with lower overall requirements for ignition.

Minimum ignition temperature (MIT)

Minimum ignition temperature (MIT) is the lowest temperature of a hot surface that will cause a dust cloud to ignite and propagate flame as determined by ASTM E1491. The MIT is an important factor in evaluating the ignition sensitivity of powders and dusts and is relevant for defining the maximum operating temperatures for mechanical and electrical equipment in environments where combustible dusts are handled.

Minimum dust layer ignition temperature (LIT)

The minimum dust layer ignition temperature (LIT) is the minimum temperature at which a layer of dust of specific thickness is ignited by a hot surface as determined by ASTM E2021. The LIT is used for defining the maximum operating temperatures for mechanical and electrical equipment in environments where combustible dusts are handled.

Limiting oxygen concentration (LOC)

The limiting oxygen concentration (LOC) is the minimum concentration of oxygen in an inert gas / oxygen / combustible dust mixture capable of supporting the combustion of a dust cloud. The LOC is determined by ASTM E2931. An atmosphere having an oxygen concentration below the LOC is not capable of supporting combustion and thus cannot support a dust flash fire or explosion.

Maximum Pressure (P_{max})

P_{max} is the maximum pressure of the deflagration. Pmax is also an indication of the explosion severity, along with the K_{st} value. P_{max} is normally expressed in units of bar-g. The higher the pressure developed by a dust deflagration, the greater the hazard. Pressure resulting from a deflagration in a vessel will first result in deformation, followed by an explosion, if the P_{max} exceeds the strength of the vessel.

Bulk Resistivity

The bulk or volume resistivity can be determined by measuring the electrical resistance between opposite faces of a volume of powder. The bulk resistivity of the material, commonly expressed in ohm-meter, can then be used to classify the material as either a conductive, dissipative or insulative dust. Conductive (low resistivity) dusts have a bulk resistivity less than 10^6 Ω•m, dissipative (medium resistivity) dusts have a bulk resistivity of 10^6 -10^{10} Ω•m, and insulative (high resistivity) dusts have bulk resistivity greater than 10^{10} Ω•m.

5.2 MATERIALS HANDLED

Grain handled at the New Era facility will include many of the grains grown in Western Canada.

Incoming seed will have relatively large particle size (2-7 mm diameter) and a moisture content typically more than 10% by weight. Raw grain is expected to have a low quantity of fine dust particulate. Raw grain typically contains 0.1-0.5% grain dust (Parnell, 1998).

5.3 Dust Explosibility Test Data

Dust samples have not been collected and tested for the materials being handled at New Era, so parameters for similar dust were taken from literature and are utilized as an estimate for the material being handled at the facility. Parameters obtained are:

Table 5: Dust Explosibility Parameters

	Size	Explosion Severity		Ignition Characteristics				
Dust Sample	Median (μm)	P_{max} (bar g)	K_{st} (bar•m/s)	MEC (g/m^3)	MIE (mJ)	MLT (°C)	MIT	BZ Class
Mixed grain dust [(a)]	33	8.3	170	60-75	10-30			
Mixed grain dust [(b)]	37	9.2	131	125		300	510	4
Mixed grain dust [(c)]	172	8.7	79	60		290	420	3

Source:
[(a)] NFPA 61 Table A.5.2.2
[(b)] GESTIS-DUST-EX, 103
[(c)] GESTIS-DUST-EX, 105

5.4 Material Variability

Raw agricultural commodities are subject to varying growing and harvesting conditions from region to region and year to year. Additionally, the varieties of seed produced in Western Canada are constantly evolving as better seed genetics are developed, and the relative mix of commodities produced changes from year to year because of market conditions. It is therefore expected that material variability will be an inherent and ongoing aspect of the New Era operation.

5.5 Conclusions

The above-described **grain dust samples are classified as explosive dusts of hazard class St-1, the lowest hazard class**.

From an electrical code perspective, grain dusts are Group IIIB dusts when using the zone system for hazardous area classification, or Class II Group G dusts when using the class and division system. This information will be used to appropriately select electrical components used in the installation.

Powder resistivity testing has not been performed for the products being handled at New Era. However, it is understood from the literature that agricultural products such as are being processed are of medium resistivity and are therefore relatively safe during handling. However, the fact that the dusts can be ignited at relatively low ignition energies warrants careful consideration to static dissipation measures during design and construction.

Explosibility parameters for materials vary depending on particle size and shape, moisture content, etc. As such, the values stated in Table 5 should not be taken to be exact characteristics of the products handled at the facility, but they can confirm that these products are explosible and provide an approximation for explosibility parameter values that can be expected for these products.

6.0 Ignition Hazards

As discussed in Combustible Dust, a fire requires three elements: oxygen, fuel, and an ignition source. Because oxygen is always present in grain processing facilities, and grain dust is a known fuel source, understanding and mitigating ignition hazards is a critical aspect of process engineering.

For the incidents recorded in Table 2: Equipment Involved in Dust Explosions, the relative frequency of various sources of ignition are shown below.

Table 6: Ignition Source Frequency

Cause Type	Number of Incidents	% of Incidents
Friction	50	30
Mechanical Spark	38	23
Chemical Action	16	10
Hot Work	13	8
Burner Flame	10	6
Electricity	6	4
Static Electricity	6	4
Overheating	4	2
Hot Surface	2	1
Unknown/No Data	21	13
Total	166	100

The following section provides additional detail about several of the above identified ignition sources.

Friction

Mechanical frictions from bearings, or from parts of equipment rubbing together, are potential ignition sources. Unlubricated bearings, due to either inadequate maintenance procedures or bearings being overlooked or in difficult to access locations, have served as ignition sources.

Powders that are susceptible to rapid decomposition and powder that is trapped between the rubbing surfaces are more likely to be ignited by friction.

Mechanical Sparking

Mechanically generated sparks and resultant hot surfaces are an important potential ignition source to consider in industrial applications. Mechanical sparks may include grinding, impact, and friction sparks that are formed by brief contact between materials (i.e., <5 s). For rotating steel parts in dust-air mixtures, it is generally accepted that that at tip speeds of less than 1 m/s, there is no danger of ignition due to friction sparks or hot surfaces. At tip speeds of 1 to 10 m/s, ignition may occur, and the properties of the materials being handled must be evaluated. At tip speeds greater than 10 m/s, there is a danger of ignition.

Bartknecht established relationships for predicting the ignition of dust-air mixtures resulting from steel grinding sparks based on the MIT and MIE. While not directly applicable to all industrial applications, these relationships provide a first approximation of the relative likelihood that a material is ignited by mechanical sparks. Mechanical sparks are not anticipated during normal operation but may be produced due to mechanical failure of process equipment.

Sparks, hot spots, and thermite impact sparks have been studied by Pederson and Eckhoff. The study concluded that, up to net impact energies of 20,000 mJ, tangential accidental impacts between various types of steel, and between steel and concrete, are unable to ignite clouds of grain and feed dust or flour, even if the dusts are dry. More recent work conducted by Rogers et al. evaluated the ability of single impacts to ignite dusts, including sulfur and aluminum dusts which had measured MIE values of 3 mJ. The results showed that sulfur dust (dispersed by impact) could be ignited by a net impact energy greater than 134 J whereas the other dusts studied were not ignited with impact energies up to 220 mJ. The test data and literature indicate that the impact energy from a single impact between steel objects must be orders of magnitude higher than the MIE to result in ignition, assuming ignition is even possible. This illustrates that ignition due to a single impact spark between steel objects is not a credible event in most foreseeable circumstances.

Thermal Instability and Self-Heating (Chemical Action)

It is important to consider phenomena such as self-heating and thermal instability in which materials are able to produce a temperature high enough themselves to become an ignition source. Self-heating is an increase in temperature due to exothermal internal reactions, thermal instability, or thermal runaway, which rapidly accelerates to high temperatures. Both phenomena are dependent on the material properties of the combustible substance.

Prolonged heating of materials on heated surfaces such as motors or the inside of dryers can start exothermic decomposition that can lead to layer fires or ignite dust clouds present in the area. Smoldering can occur in dust layers that accumulate on hot surfaces. The rate of smoldering is limited by diffusion of air into the material. If these nests become dislodged and exposed to an oxidant (air), they can ignite a dust cloud.

Self-heating may also occur in accumulations of grains, coal, and other natural materials that are biochemically active, where the most common reaction is the oxidation of the material in the presence of air. Exothermic reactions produce heat within the solid, and if the heat gained within the material is greater than the ability of the system to lose the heat to the surroundings, then self-heating will occur. Due to the nature of self-heating, a larger amount of material in one location will result in a greater risk of self-heating.

The likelihood of ignition for smoldering nests or decomposition depends on the material being handled. An organization needs to determine this from historical information or appropriate testing.
Tests such as ASTM D3523, Standard Test Method for Spontaneous Heating Values of Liquids and Solids (Differential Mackey Test) (ASTM 2012), the LIT (ASTM 2013) or reactivity screening tests such as Differential Screening Calorimetry (DSC), Differential Thermal Analysis (DTA), or Accelerating Rate Calorimetry (ARC) are used to determine the potential for smoldering nests or decomposition onset temperatures.

Agricultural materials including grains and grain dusts are typically susceptible to the risk of self-heating/ spontaneous combustion under certain conditions.

Hot Work

Open flames, sparks from welding, grinding and cutting are all strong enough ignition sources to ignite many dusts, even ones having MIE >1000 mJ.

Explanatory material in NFPA 51B Annex A notes that approximately 6 percent of fires in industrial properties, and many fires in other properties have been caused by cutting and welding, primarily with portable equipment in areas not specifically designed or approved for such work. Cutting and certain arc welding operations producer literally thousands of ignitions sources in the form of sparks and hot slag. Electric arcs or oxy-fuel gas flames and hot work pieces are also inherent ignition sources.

Most fires in which cutting and welding are factors have been caused by sparks. These globules of molten metal have scattered horizontally as far as 35 ft (11 m), setting fire to all kinds of combustible materials. They have also fallen through cracks, pipe holes, or other small openings in floors and partitions, starting fires that have reached serious proportions before being noticed.

Electric arcs or oxy-fuel gas flames, in themselves, have rarely caused fire except where they have overheated combustibles in the vicinity of the work or where they have been used on containers that have held combustibles without having been cleaned and purged. In the latter case, an explosion generally resulted.

The heat of the metal being welded or cut has caused fires where the hot pieces were permitted to rest or fall upon combustible materials. Fires and explosions have also been caused where such heat has been transmitted, as in the case of a container, through the metal to a flammable atmosphere or to combustibles within the container.

Electric Arcs and Sparks

Sparks are the discharge of electrons that may or may not expend all the energy in a single discharge. An arc is a continuous stream of electrons bridging a gap between two conductive surfaces in proximity.

The size or intensity of arcs and sparks depends on the resistance of the substance between the points of discharge. Once the voltage is high enough to overcome the dielectric strength of the air, the air will ionize allowing a conductive path for electricity to flow. Due to the high resistively of air, there will generally be enough energy dissipated in an arc or spark to act as an ignition source.

The current or amount of electricity that is flowing will dictate the temperature of the arc. The higher the current, the higher the temperature. The figure shown below from the Fire Safety Management Handbook confirms that even arcs with lower currents have enough heat energy that the likelihood of ignition is high.

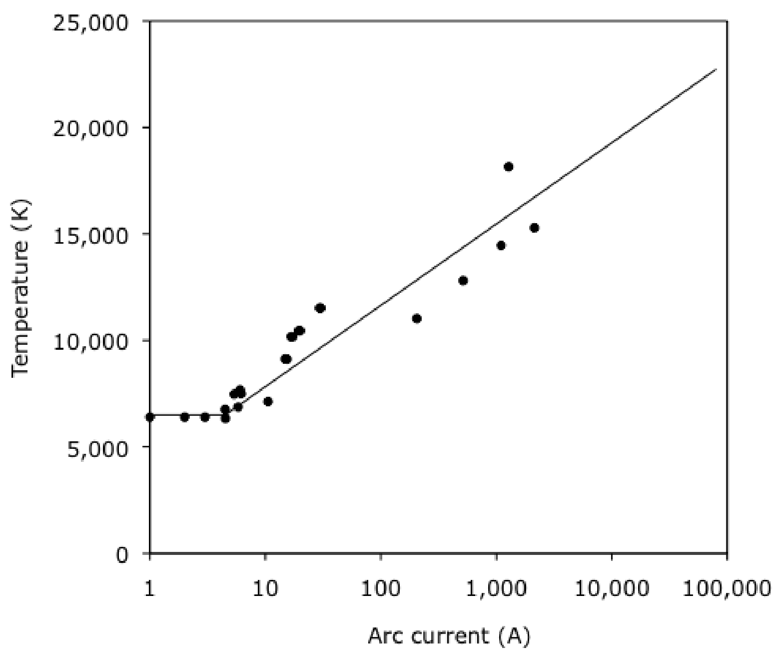


Figure 6: Electric Arc Temperature

Some common examples of arcs and sparks as an ignition source include:

1. Sparking of electric motors, generators, or other electrical rotating equipment
2. Arcing between contacts (i.e. switches and relays)
3. Arcs due to broken, inadequate, or failed insulation
4. Lightning strikes
5. Discharge of a charged capacitor through a gas
6. Poor contacts between conductors, such as poorly fitted light bulbs and their sockets
7. Arcs intentionally created during electric welding

Electrostatic Hazards

Electrostatic hazards present an ignition risk in the handling of particulate solids. When sensitive dusts are handled, electrostatic discharges can result in ignition of suspended dust clouds, and it is important to understand and mitigate these hazards.

Particles are typically charged through repetitive contact. This type of charging occurs extensively in the movement of powders (including pellets, granules, dust particles and other particulate solids), both by surface contact and separation between powders and surfaces, and by contact and separation between individual powder particles. Thus, charging can be expected any time a powder contacts another surface, such as in sieving, pouring, grinding, sliding, and pneumatic conveying. In those operations, the more vigorous the contact, the more charge is generated.

For an electrostatic discharge to be a source of ignition, the following four conditions must be met:

1. An effective means of separating charge must be present.
2. A means of accumulating the separated charges and maintaining a difference of electrical potential must be available.
3. A discharge of the static electricity of adequate energy must occur.
4. The discharge must occur in an ignitable mixture.

NFPA 77 defines five types of discharges that are relevant to the bulk handling of particulate solids. For each type of discharge, an approximate discharge energy can be associated which can be compared to the MIE value for various powders.

1. Corona discharge. A low energy electrical discharge that results from a localized electrical breakdown of gases near sharp conductive edges, needle points, and wires.
2. Brush discharge. A higher energy form of corona discharge characterized by low-frequency bursts or by streamers, which can form between charged nonconductive surfaces and grounded conductors.
3. Bulking brush discharge. A partial surface discharge over the top of solid piles that is created during bulking of powder in containers and that appears as a luminous, branched channel flashing radially from the wall toward the center of the pile.
4. Propagating brush discharge. An energetic discharge caused by electrical breakdown across a dielectric layer having equal and opposite charges on the opposite sides of the layer.
5. Spark. A short-duration electric discharge due to a sudden breakdown of air or some other insulating material separating two conductors at different electric potentials, accompanied by a momentary flash of light.

NFPA 77 Figure 5.5.1, shown in Figure 7: Approximate Energies of Types of Discharges Compared with Minimum Ignition Energies, shows a graph of the energy levels for the various types of static discharge.

The intensity of the charge accumulation in particulate solids will depend on the powder's bulk resistivity. The higher the bulk resistivity, the higher the potential for charge accumulation. Powders can be grouped in three different categories based on bulk resistivity:

1. Low resistivity powders have volume resistivities of up to 10^6 Ω• m, including metals, coal dust, and carbon black.
2. Medium resistivity powders have volume resistivities between 10^6 Ω•m and 10^{10} Ω•m, including many organic powders and agricultural products.
3. High resistivity powders have volume resistivities above 10^{10} Ω•m, including organic powders, synthetic polymers, and quartz.

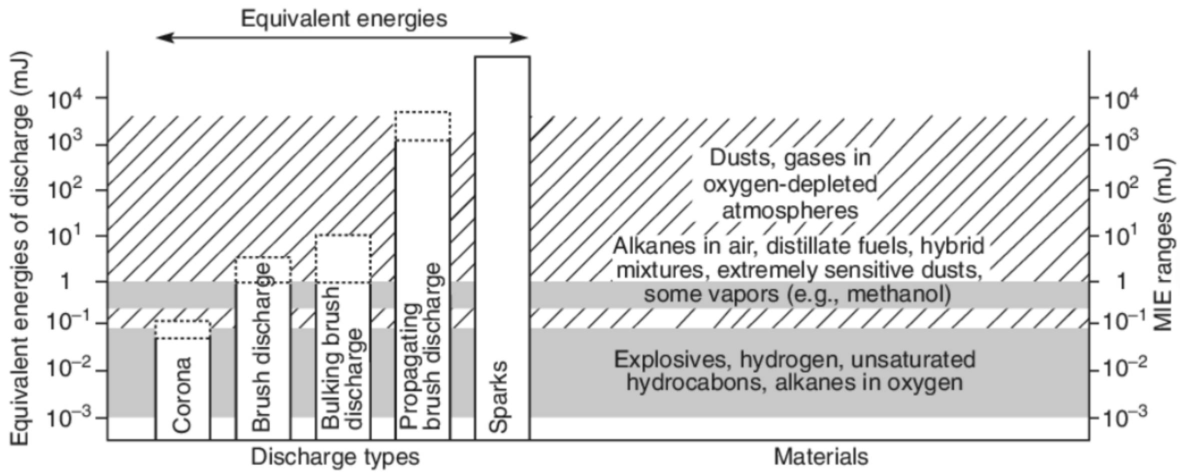


Figure 7: Approximate Energies of Types of Discharges Compared with Minimum Ignition Energies

Where a medium resistivity powder comes to rest in bulk, the charge retained depends on the resistance between the powder and ground. If the powder is placed in a grounded container, charge retention is determined by the bulk volume resistivity of the powder. If the powder is placed in a nonconductive container, charge retention is determined by the resistance of the container. The special significance of medium resistivity powders is that they are relatively safe during handling because they do not produce bulking brush discharges or sparks.

High resistivity powders do not produce spark discharges in themselves, but they can produce other types of discharge, such as corona, brush, bulking brush, and propagating brush discharges. High resistivity powders lose charge at a slow rate determined by their volume resistivity, even in properly grounded containers. Many high resistivity powders are also hydrophobic and, in bulk, can retain charge for hours or even days. High resistivity powders, such as thermoplastic resins, can have bulk resistivities up to about 10^{16} Ω•m.

Hot Surfaces

Hot surfaces in a facility may contribute to ignition of dust clouds or dust layers. Hot equipment surfaces or hot surfaces created by friction (e.g., due to failing bearings or misaligned belts) may reach temperatures high enough to ignite dust layers or dust clouds. Additionally, fire, open flames, hot slag (e.g., created during hot work), and embers could be hot enough to ignite dust clouds and layers. The temperature of an open flame typically ranges from about 500 – 1000˚C, hot slag generated during welding may exceed 1500˚C, and the surface burning temperature of embers has been reported to be on the order of 562 to 720˚C. All have been identified as potential ignition sources of dust clouds.

The buildup of a dust layer on surfaces with elevated temperatures can lead to ignition caused by retained heat from the surfaces. Thicker dust layers (e.g., 0.5 inches as measured using the standard ASTM E2021 dust layer ignition temperature test) may ignite at lower temperatures. Organic dusts are subject to dehydrating and carbonizing over time, which can also lower the ignition temperature of the layer. In addition, dusts saturated in flammable or combustible liquids such as hydraulic, lubricating, or heating oil may be more susceptible to ignition.

7.0 Controls

7.1 Control Options

Controls, including preventative measures, protection measures and mitigation measures, can be incorporated into the equipment, process, and operations to minimize risk.

Preventative measures include approaches such as are described in the OSHA Technical Manual – Section IV, Chapter 6, Appendix L:

1. Dust collection capture of particulate
2. Size separation removal of particulate
3. Tramp metal protection
4. Externally vs internally located bearings
5. Electrical bonding/grounding
6. Conductive equipment components, including belting
7. Fire/oil resistant belts
8. Feed rate control
9. Speed monitoring
10. Alignment monitoring
11. Vibration monitoring
12. Temperature monitoring
13. Flow monitoring
14. Plugged condition/overload monitoring

NFPA 652, NFPA 654, NFPA 61, FM Global FMDS0773, FM Global FMDS0775, FMDS0776 and other similar documents also provide prescriptive requirements for equipment and process design that are intended to prevent deflagrations.

An additional important ignition control is appropriate electrical classification of areas. Electrical equipment used in classified areas is designed, constructed, and installed in a manner such that it will not pose an ignition hazard.

Protection measures, as described in NFPA 68 and NFPA 69, are design approaches that can be used to manage an event if an ignition source introduces energy into the system capable of causing a deflagration:

1. Explosion venting
2. Oxidant concentration reduction
3. Combustion concentration reduction
4. Pre-deflagration detection and extinguishment
5. Deflagration suppression
6. Active isolation
7. Passive isolation
8. Pressure containment
9. Passive suppression using mesh or foam

Administrative measures, such as described in NFPA 61 Chapter 8, NFPA 652 Chapter 8, and NFPA 654 Chapter 8 focus on minimizing risks associated with the human element operation of a facility. Such measures are typically in the form of written programs used to assist in the training and management of operational practices, including:

1. Operating procedures and practices
2. Housekeeping
3. Hot work
4. Personal protective equipment
5. Inspection, testing and maintenance
6. Training and hazard awareness
7. Contractors

8. Emergency planning and response
9. Incident investigations
10. Management of change
11. Documentation retention
12. Management systems review
13. Employee participation
14. Storage of oils, flammable liquids and liquified petroleum gas
15. Warning signs
16. Miscellaneous storage in grain-handling facilities

7.2 Risk Mitigation Strategies Incorporated

The facility and process incorporate the following general risk mitigation strategies:

7.2.1 Non-combustible construction

The building, storage vessels, processing equipment, spouting and ducting are all of non-combustible construction.

7.2.2 Combustible material load limitation

Grain is combustible, although it smoulders rather than burning when in piles. In order to minimize combustible material load in the building, all grain storage with the exception of small surge capacities is located outside of the building envelope. Total grain volume inside the building, including full surge bins and operating volumes in the processing equipment, is in the order of 20 tonnes.

7.2.3 Dust collection capture of particulate

Equipment used in the process is generally enclosed. Most of the equipment has no open product zones where dust could exit the equipment into the cleaning building. The gravity table is an exception, but incorporates a large dust capture hood that draws 270 m^3/min air in from the top of the partially open deck to contain elevated particles, rather than enclosing the space. In addition to being enclosed, all other process equipment is under vacuum relative to the building enclosure because dust collection air is always drawn through it when operating. The process dust collection system is designed in compliance with NFPA 61 and NFPA 91 guidelines, including consideration to the location of dust collection hoods so that the system achieves the maximum dust capture efficiency. Due to the hood placement and the high volume of dust collection installed in the process, any dust created within the equipment is extracted to the dust collection system and does not escape into the general building area.

Following capture, dust laden air is conveyed in sealed ductwork to cyclofan dust collectors, where it is cleaned before being exhausted outside the facility. Cyclofans are intended for low dust loading applications, to a maximum of 12 g/m^3 of air volume (approx. 20% MEC) per the manufacturer's guidelines (Cimbria M05010CF0-00EN). I have calculated the worst-case theoretical dust concentration at New Era as 3.6 g/m^3, which confirms the cyclofans are an appropriate technology selection. Cyclofans rely on a centrifugal separation approach, swirling the dust laden air stream around the outside of the fan housing to strip off the dust before discharging it through an airlock.

7.2.4 Tramp metal protection

The New Era design incorporates a 2" grate on the receiving pits at the elevator, as well as a tramp metal magnet prior to the receiving leg. The grate and magnet remove the majority of tramp metal prior to material processing.

7.2.5 Externally vs internally located bearings

Equipment is compliant with current design guidelines in Canada, USA and Europe, including the placement of bearings externally to product zones where possible.

7.2.6 Electrical bonding/grounding

The electrical design and installation incorporate bonding and grounding in compliance with the CEC, NFCC and NFPA guidelines.

7.2.7 Conductive equipment components, including belting

Equipment used in the New Era design is of conductive metal construction, and the leg belting complies with the NFPA 61 requirement for belting conductivity.

7.2.8 Fire/oil resistant belts

The leg belting fire/oil resistant belting.

7.2.9 Feed rate control

The New Era process incorporates feed rate control in the form of metering conveyors, which regulate the speed at which material is fed to the cleaners. All components downstream of the metering conveyors have been selected to provide material handling capacity that exceeds the feed rate.

7.2.10 Speed monitoring

Conveyance equipment all incorporates speed monitoring, as required in NFPA 61.

7.2.11 Alignment monitoring

The legs incorporate alignment monitoring to detect belt mis-tracking that could cause friction heating.

7.2.12 Temperature monitoring

Per NFPA 61, the legs incorporate bearing temperature monitoring to detect belt friction heating.

7.2.13 Plugged condition/overload monitoring

All conveyance discharge locations and surge bins have level/plug monitors installed to detect upset conditions and shut down the feed. Motor starters all incorporate overload monitoring to detect and shut down equipment that is drawing excess amperage.

7.2.14 Electrical classification

The New Era facility will have an electrical area classification conducted prior to detailed design of the electrical system, and the appropriate electrical components and installation methods will be used to mitigate risk of electrical ignition sources. Generally, grain processing facilities are classified Zone 22, although lower or higher risk may warrant an alternate classification.

7.2.15 Explosion venting

The receiving legs are fitted with explosion venting above the roofline, positioned such that any fireballs vent to a protected area, and don’t pose a secondary fire or explosion risk to any other assets.

7.2.16 Management systems

New Era will have a comprehensive, well documented management program in which employees and contractors are trained. The facility design uses extensive monitoring and control systems, including automated data capture.

Construction of the new facility will include a review of management records, maintenance and housekeeping programs, and the development and training of new operating procedures.

8.0 Resultant Risk Analysis

8.1 Suspended Dust

Published particulate emission factors for various grain handling and processing activities show that the concentration of particulate matter generated is dependent on the process and the type of grain. With the exception of grain drying (which is not a part of the New Era facility), research shows that the volume of dust generated in a process is a maximum of 90 g per tonne of grain.

Table 7: Grain Process Dust Emissions

Emission Source	Total PM (g/t Grain)
Grain receiving	8.3-90[(a), (b), (c), (d), (e)]
Grain cleaning	37.5[(b), (d)]
Internal handling	30.5[(b), (d)]
Grain drying	110-1500[(b), (d)]
Grain shipping	4.0-43.0[(a), (b), d)]

[(a)] Kenkel and Noyes, 1995
[(b)] Midwest Research Institute, 1998
[(c)] Shaw et al., 1998
[(d)] US EPA, 2003
[(e)] Billate et al., 2004

I have calculated theoretical dust concentrations in the process by assuming a worst-case scenario of 90 g/t of dust production in each consecutive process step, per Table 7: Grain Process Dust Emissions, multiplied by the capacity. Dust collection volumes have been selected such that the worst-case combustible dust concentration in the aspiration stream remains below 25% of the lowest MEC shown in Table 5: Dust Explosibility Parameters. The system design maintains negligible risk of a combustible dust environment being present in the processing and material handling equipment.

Dust concentration can be increased in dust collection equipment relative to the processing environment, increasing the risk of deflagration. However, as described above, cyclofans are intended for low dust loading applications, to a maximum of 12 g/m^3 of air volume (approx. 20% MEC) per the manufacturer's guidelines (Cimbria M05010CF0-00EN). Since the dust concentration at New Era is calculated to be a maximum of 3.6 g/m^3, the cyclofans do not pose a combustible dust deflagration risk.

The cleaning building houses grain-based ingredient processing equipment, but the process has been designed to mitigate the risk of any combustible dust escaping the processing equipment and becoming airborne in the building area. Because combustible dust is efficiently captured at the equipment, and then removed through cyclofans before the air is exhausted to atmosphere, there is no risk of a combustible dust environment being created in the processing building itself under normal operation. Additionally, because upset conditions on the equipment might create conditions under which combustible dusts could be forced out of equipment into the processing area, an electronic monitoring and control system has been designed and installed to immediately shut down the process, should upset conditions be detected. I therefore conclude that **the cleaning building will not contain an explosive dust atmosphere**.

8.2 Dust Layers

The primary determinant of risk with respect to dust layers is the presence of an adequate mass of combustible dust in the building compartment, and the primary control method for fugitive dust in a building compartment is housekeeping. Section 8.4 of NFPA 654 describes three elements of a housekeeping program that are critical to mitigating combustible dust risk in a building compartment:

1. the housekeeping frequency shall be established to ensure that the accumulated dust levels on walls, floors, and horizontal surfaces such as equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, such as the interior of electrical enclosures, does not exceed the threshold dust mass/accumulation

2. a planned inspection process shall be implemented to evaluate dust accumulation rates and the housekeeping frequency required to maintain dust accumulations below the threshold dust mass/accumulation
3. the housekeeping procedure shall include specific requirements establishing time to clean local spills or short-term accumulation to allow the elimination of the spilled mass or accumulation

NFPA 61 prescriptively states that the threshold housekeeping accumulation limit shall be 3.2 mm (1/8") over 5 percent of the footprint area. The 1/8" criterion has been used in this report for the analysis of building hazards.

A dust explosion hazard and dust flash-fire hazard are deemed to exist in any building or room where any of the following conditions exist:

1. The total area of nonseparated dust accumulations exceeding the layer depth criterion is greater than 5 percent of the footprint area
2. The area of any single nonseparated dust accumulation exceeding the layer depth criterion is greater than 1000 ft^2 (92.9 m^2).
3. The total volume of nonseparated dust accumulations is greater than the layer depth criterion multiplied by 5 percent of the footprint area
4. The total volume of any single nonseparated dust accumulation is greater than the layer depth criterion multiplied by 1000 ft^2 (92.9 m^2)

The New Era facility is currently in the design phase, so is not yet operating. As such, it is not possible to verify the layer depth of fugitive dust present in the building compartments. However, based on my experience in similar facilities using similar equipment and processes, I have made an engineering judgement as to the likelihood of hazardous levels of fugitive dust. My judgement assumes that the recommended housekeeping practices described in Chapter 8 of NFPA 61 will be implemented in order to maintain fugitive dust levels as low as possible. It is my opinion that the facility is unlikely to exceed the threshold accumulation limit, and the **risk of dust layer accumulations is low**.

8.3 Ignition Risk

Not all operating conditions can be specifically determined, including whether or not the concentration of suspended particulate inside a piece of equipment is within a hazardous range. Similarly, the presence or absence of a credible ignition source must be established, but data for a determination is often limited or non-existent. The Center for Chemical Process Safety has published a table of common equipment and processes, identifying the general susceptibility of each to certain kinds of ignition. Equipment types used in the Canada Malting process are included in the table below. See Ignition Hazards for additional detail about these ignition sources. The fire or explosion probability shown in the table reflects an uncontrolled condition i.e. it does not consider the ignition controls in place at New Era. New Era's facility risk is reduced by the controls incorporated into the design, construction, and operation.

Table 8: Probability Assessment of Process Ignition

	Probability of:	**Probability of Ignition Source**			**Probability of:**
Process Unit	Combustible Atmosphere	ES/Electric	Friction Sparks	Thermal	Fire or Explosion
Conveying					
Dilute phase pneumatic	Varies	High	Low	Low	Low
Bucket elevators	High	Low	High	Low	High
Screw conveyors	Low	Low	Med	Med	Med
Drag conveyors	Low	Low	Med	Low	Low
Separators					
Baghouses	High	High	Low	Low	High
Silos & Bins	High	High	Low	Low	High
Silos & bins < 2m3	High		Low	Low	Med
Screening	Low	High	Low	Low	Low

Review of the table shows that for equipment other than mechanical conveyors, the most likely ignition source is electrostatic or electric sparking. For the New Era facility, however, electrical components to be installed should not be considered a credible ignition source, as part of the design process is to determine the appropriate class of electrical components to be used, thereby eliminating any risk of them starting a fire or deflagration. Similarly, static discharges are not considered a credible ignition source, as part of the design process is to determine whether electrostatic energy poses a risk, and if it does, to implement appropriate bonding and grounding to mitigate the risk.

For the mechanical conveyance equipment, friction is considered the primary ignition risk. New Era's process design incorporates speed monitoring, alignment monitoring, overload monitoring and bearing temperature monitoring as discussed in Risk Mitigation Strategies Incorporated. Because upset conditions on the equipment might create hot surface or friction spark ignition sources, an electronic monitoring and control system has been designed and installed to immediately shut down the process, should upset conditions be detected.

Bucket elevators have been a source of combustible dust deflagration in the grain handling and processing industry. Published research has shown that the dust concentration in bucket elevators can potentially exceed the MEC, particularly when handling bulk raw grain in high-capacity elevators where the belt speed may approach 3.5 m/s. The use of bucket elevators has been limited in the New Era facility design as much as possible. Bucket elevators that are incorporated in the design are equipped with dust collection and monitoring switches to mitigate risk. The first step of the cleaning process incorporates a pre- and post-aspiration, where the dust concentration present in the grain is substantially reduced. Even based on the above calculation of worst-case dust concentration, bucket elevators after the first processing step would not pose a deflagration risk, but the fact that essentially all the dust present has been removed in the preliminary aspiration step further reduces the probability of any event. Furthermore, the bucket elevators other than the receiving legs are operating at approximately 1 m/s, which minimizes air turbulence and dust suspension within the bucket elevator case, and they have an equipment capacity of less than 60 m^3/hr. Although the general exemption for bucket elevators operating at less than 2.5 m/s and 106 m^3/hr has been removed in the most recent revisions of the code, per NFPA 61 A9.3.14.3.3, not all bucket elevators require explosion protection. My analysis has concluded that bucket elevators at New Era, other than the receiving legs, do not warrant the installation of such protection. The receiving legs, however, are fitted with explosion vents above the building roofline, in compliance with NFPA 61 9.3.14.2.2, as warranted by their higher capacity and the fact they are handling raw unprocessed grain. In the unlikely event of a deflagration in a receiving bucket elevator, the pressure wave and fireball would be vented to atmosphere outside of the building, thereby protecting the building and interior processes.

I conclude that **the ignition risk in the process, given the controls in place, is low**.

8.4 Occupancy Risk

The National Building Code of Canada 2020 defines high-hazard industrial occupancy as containing sufficient quantities of highly combustible and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

Medium-hazard industrial occupancy is defined as having a combustible content of more than 50 kg/m^2 of floor area and not classified as a high-hazard industrial occupancy.

Low-hazard industrial occupancy is defined as having a combustible content of less than 50 kg/m^2 of floor area.

Although the grain and grain dust present inside the equipment is combustible, as discussed above, there will not be a deflagrable concentration of suspended dust in the building, nor is it likely that there will be a layer accumulation exceeding the threshold accumulation limit. Furthermore, there is no storage of grain inside the building, and total combustible material load within the equipment and surge hoppers during process operation is in the order of 20,000 kg. Given the building footprint of 872 m^2, **the combustible**

material load is therefore approximately 23 kg/m^2 floor area, which is less than the 50 kg/m^2 limit that defines a low-hazard industrial occupancy.

A-3.1.2.1.(1) of the NBC provides examples of major occupancy classifications, and lists feed mills, flour mills and grain elevators as examples of facilities that may be classified F1 occupancies. However, in the same explanatory note, planing mills and woodworking factories are provided as examples of facilities that may be classified F2 occupancies. It is my opinion that planing mills and woodworking factories are often, but not always, of higher deflagration risk than grain processing facilities. Wood flour produced by wood manufacturing processes is listed in NFPA and GESTIS-DUST-EX databases as a more dangerous dust than mixed grain dust. Several of the data points for wood flour show it to be an St-2 class dust, rather than the lowest risk St-1 class into which grain dust falls. Furthermore, woodworking processes typically involve high speed rotational cutting activities, which have a higher probability of generating sparks and hot surfaces than the low speed rotational and vibratory processes involved in seed cleaning. It is also inherently more difficult to capture generated dust as efficiently in woodworking operations when compared to grain processing operations, since woodworking processes are seldom totally enclosed. Grain processing generally happens inside enclosed equipment, facilitating efficient capture of displaced particulate. My observations conducting dust hazard analyses in both grain processing and woodworking facilities has been that grain operations tend to be, on average, less dusty than woodworking operations. It is my professional opinion that while the examples provided in A-3.1.2.1.(1) are valid in some cases, they should not be applied without a comprehensive analysis of the actual risk associated with the operation.

Aside from the risk posed by combustible dust, the seed cleaning process in the New Era facility does not pose any other unusual risks, and the fire and deflagration risk from combustible dust is low. As noted above, the combustible material load is within the limit defined for F3 Low-Hazard Industrial Occupancy.

9.0 Conclusion

A review of dust hazards and controls was undertaken for the proposed New Era facility that will be constructed in Swan River, MB. The facility will be used to clean grain, and is currently in the design phase.

General findings of the review are:

1. Grain dust is an St-1 class combustible dust, the lowest hazard class
2. The processing equipment to be installed and the dust collection system attached to them have been designed to mitigate the risk of creating a hazardous dust environment in the facility. The cleaning building will not contain an explosive dust atmosphere
3. It is unlikely that the facility will exceed the threshold layer accumulation of 1/8" over 5% of the building area when in operation
4. Ignition risk in the process is considered low
5. Combustible material load in the process will be less than the 50 kg/m^2 limit that defines a low-hazard industrial occupancy
6. Occupancy of the facility is low, typically 2-3 people
7. My professional opinion is that the appropriate occupancy classification of the facility is F3 low-hazard industrial.

If there are any questions with respect to the above analysis, please contact the undersigned for clarification.

[redacted]

Regards,
Trevor Pizzey, P.Eng.
[redacted]

Appendix F: Process Flow Diagram

LEGEND:

- CURRENT PHASE EQUIPMENT
- FUTURE PHASE EQUIPMENT
- RELOCATED FROM FIRST PHASE WHEN SECOND PHASE CONSTRUCTED
- DUST COLLECTION
- DIRTY GRAIN
- BYPRODUCTS
- CLEAN GRAIN

REFERENCE DRAWINGS			REVISIONS				
NO.	DRAWING	TITLE	REV	DESCRIPTION	BY	CHK	DATE
7			G				
6			F				
5			E				
4			D				
3			C				
2			B				
1			A	ISSUED FOR CLIENT REVIEW	TDP	TDP	2025-05-20

PERMIT STAMP:

ENGINEER'S STAMP:

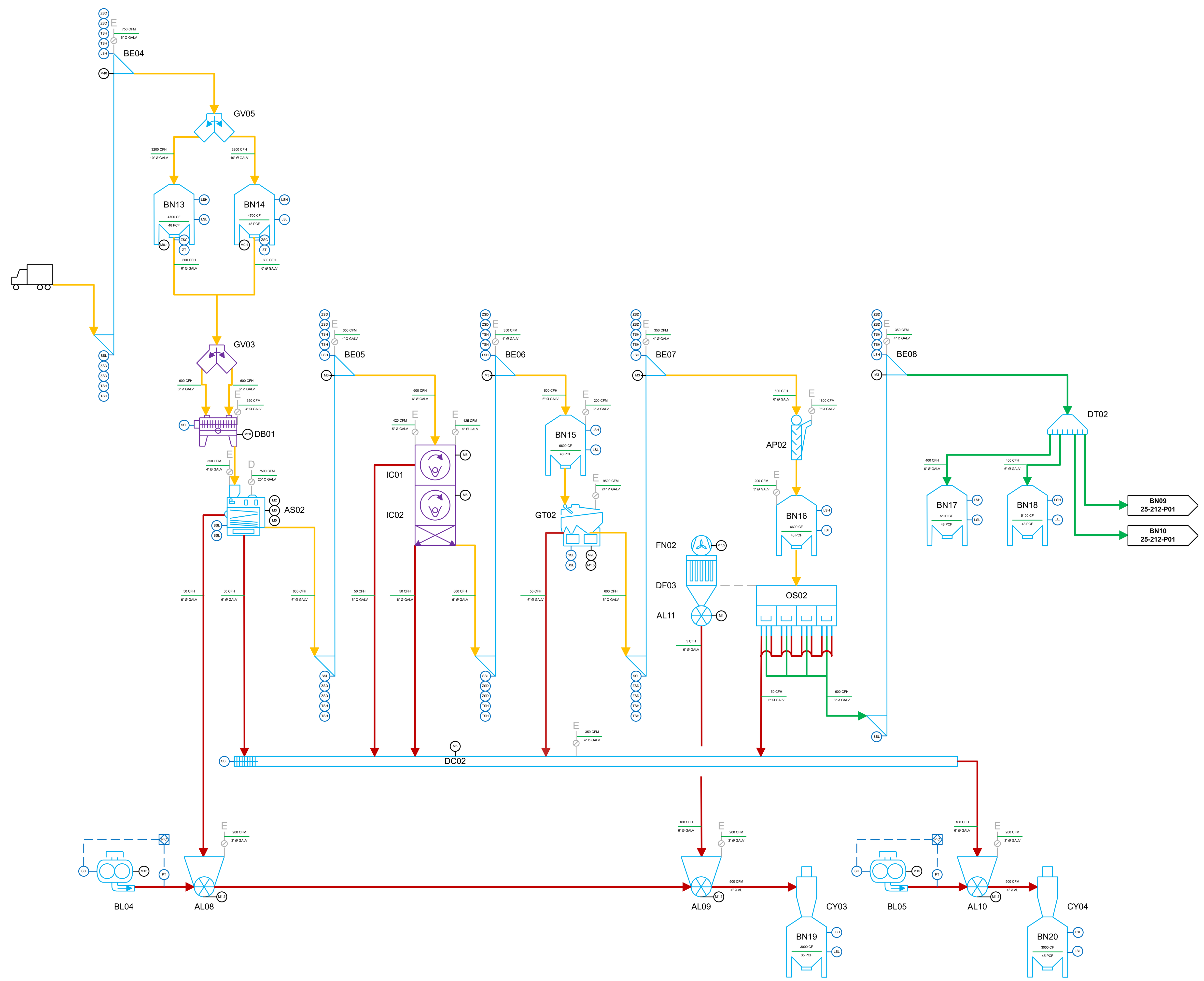
PROJECT OWNER:
NEW ERA AG TECHNOLOGIES

PROJECT:
SEED PLANT

TITLE:
PROCESS FLOW DIAGRAM

anCeres Processing Solutions Ltd.
33 30 Ave SW, Calgary, AB T2S 2Y4
P: 403-629-7499 www.anceres.com

DWG No: 25-212-P01
REV: A



LEGEND:

- CURRENT PHASE EQUIPMENT
- FUTURE PHASE EQUIPMENT
- RELOCATED FROM FIRST PHASE WHEN SECOND PHASE CONSTRUCTED
- DUST COLLECTION
- DIRTY GRAIN
- BYPRODUCTS
- CLEAN GRAIN

REFERENCE DRAWINGS

NO.	DRAWING	TITLE
7		
6		
5		
4		
3		
2		
1		

REVISIONS

REV	DESCRIPTION	BY	CHK	DATE
G				
F				
E				
D				
C				
B				
A	ISSUED FOR CLIENT REVIEW	TDP	TDP	2025-05-20

PERMIT STAMP:

ENGINEER'S STAMP:

PROJECT OWNER:
NEW ERA AG TECHNOLOGIES

PROJECT:
SEED PLANT

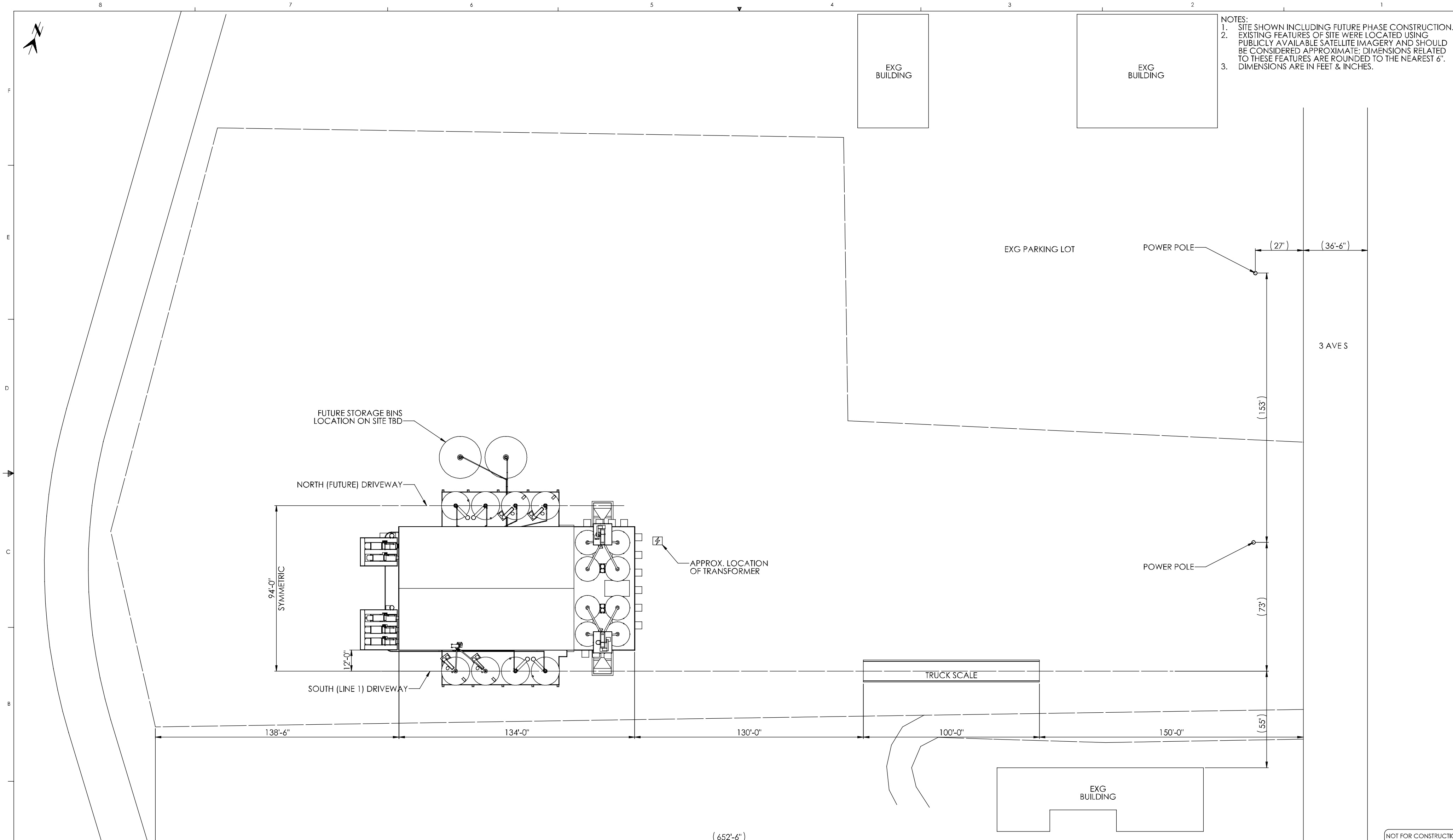
TITLE:
PROCESS FLOW DIAGRAM

anCeres Processing Solutions Ltd.
33 30 Ave SW, Calgary, AB T2S 2Y4
P: 403-629-7499 www.anceres.com

DWG No: 25-212-P01

REV: A

Appendix G: Site Plan



NOTES:
1. SITE SHOWN INCLUDING FUTURE PHASE CONSTRUCTION.
2. EXISTING FEATURES OF SITE WERE LOCATED USING PUBLICLY AVAILABLE SATELLITE IMAGERY AND SHOULD BE CONSIDERED APPROXIMATE; DIMENSIONS RELATED TO THESE FEATURES ARE ROUNDED TO THE NEAREST 6".
3. DIMENSIONS ARE IN FEET & INCHES.

NOT FOR CONSTRUCTION

REV	DESCRIPTION	BY	CHK	DATE
B	CH. LOCATION OF BUILDING AND SCALE ON SITE	EDW		2026-01-06

REVISIONS

REF	NUMBER	DESCRIPTION

REFERENCES

PERMIT STAMP:

PROFESSIONAL STAMP:

PROJECT OWNER: NEW ERA AG TECHNOLOGIES

PROJECT: SEED PLANT

anCeres Processing Solutions Ltd.
3080 85 St SW, Calgary AB, T3H 6C7
403-629-7499

DES. BY		
DRAWN BY	EDW	2025-06-24
CHECKED		

TITLE: GENERAL ARRANGEMENT SITE PLAN

SCALE 1:300 | ANSI D | DWG. No. 25-212-GA-00 | REV: B

Appendix H: Equipment Specifications

EQUIPMENT LIST

Tag	Description	Capacity (Bu/hr)	HP
AS01	**AIR & SCREEN MACHINE**	450-500	5
SP01/SP02/SP03	**SPIRAL SEPERATORS**	450-500	N/A
GT01	**GRAVITY TABLE**	450-500	20
DR01	**DE-STONER**	450-500	10
PL01	**BEAN POLISHER**	450-500	15
AP01	**ASPIRATOR**	450-500	TBD
OSO1	**OPTICAL SORTER**	TBD	TBD
BG01	**TOTER**		TBD
BG02	**BAGGER**		TBD
BS01	**SEWING HEAD**		TBD

CEREAL LINE

Tag	Description	Capacity (Bu/HR)	HP
DB01	**DEBEARDER**	450-500	20
AS02	**AIR & SCREEN MACHINE**	450-500	5
IC01 / IC02	**INDENTED CYLINDERS**	450-500	5
GT02	**GRAVITY TABLE**	450-500	20
AP01	**ASPIRATOR**	450-500	TBD
OS02	**OPTICAL SORTER**		TBD

Appendix I: Draft Emergency Response Plan

Emergency Response Plan

2026

1.0 Objective

The purpose of this Emergency Response Plan is to outline the procedures for mitigating and responding to environmental and safety emergencies at the New Era Ag Technologies seed cleaning facility in Swan River, MB. This plan ensures the protection of personnel, the public, and the local environment.

2.1 Spill Response Protocol (Hydrocarbons and Lubricants) While the facility does not store bulk volumes of fuel or lubricants on-site, there is a minor risk of incidental leaks from transport trucks or facility vehicles.

- **Preparedness:** Commercial spill kits are located at the receiving/loadout bays and the designated forklift storage area.
- **Initial Response:** In the event of a fuel or oil leak, the source of the leak will be immediately isolated (if safe to do so).
- **Containment:** Personnel will deploy absorbent materials (booms, pads, or granular absorbents) from the spill kits to prevent the fluid from migrating to the external gravel pad or municipal drainage ditches.
- **Clean-up and Disposal:** Contaminated absorbent materials and soils will be scooped into sealed, clearly labeled waste drums and transported to a licensed hazardous waste disposal facility (Swan River Landfill has approved facility).
- **Reporting:** Any spill exceeding provincial reporting thresholds will be immediately reported to the Manitoba Environmental Emergency Response line.

2.2 Fire and Combustible Dust Protocol The facility handles agricultural dust, which poses a combustion risk. The building is designed to specific hazardous area classifications (Zone 22). Small propane cylinders are also stored on-site for forklift operation.

- **Preparedness:** The facility is equipped with state-of-the-art dust collection systems (Cyclofans) and operates under a dedicated Hazard Analysis Guideline. Fire extinguishers are strategically located throughout the facility, particularly near the optical sorter, electrical rooms, and propane storage.
- **Initial Response:** In the event of a localized fire or dust ignition, the facility's emergency shutdown system will be activated to stop all conveyance and air handling equipment, isolating the oxygen supply and preventing the spread of embers.

- **Evacuation:** All personnel will evacuate the building immediately via designated emergency exits and muster at the safe zone located at the primary site entrance.

- **Suppression:** Personnel will only attempt to extinguish small, contained fires using on-site extinguishers if trained and safe to do so. For all other instances, the Swan River Fire Department will be dispatched immediately.

3.0 Emergency Contact Information

- **New Era Ag Technologies Site Manager:** Derek Poole [redacted]
- **Swan River Fire Department:** 911 / 204 734-4403
- **RCMP Swan River Detachment:** 911 / 204-734-3454
- **Manitoba Environmental Emergency Response Line:** 1-855-944-4888
- **Town of Swan River Public Works (Utility):** 204-734-4586