

July 5, 2016

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Alberta Energy Regulator
Suite 1000, 250-5th Street SW
Calgary, Alberta T2P 0R4

Attention: Dr. Fikre Debela
Science Specialist, Land Conservation and Reclamation –
Closure and Liability Branch

Dear Dr. Debela

Re: Pembina Pipeline Corporation
Fox Creek to Namao Pipeline Expansion Project
AER Decision 2016 ABAER 004 – Condition #7
Approval 356633-00-00 – Clause 3.1.30
Updated Clubroot Management Plan Submission – Revision 2

Please find attached Pembina's updated clubroot management plan to reflect Alberta Energy Regulator's (AER) decision and EPEA approval for an additional classification including additional cleaning requirements. This revision also includes clarifications as discussed with AER.

The Fox Creek to Namao clubroot management plan has been revised to reflect the following categories as required by AER:

- Not detected (Green) will be identified as Low Risk.
- Detected (Red) will be split into two categories
 - High Risk (Red) where clubroot sampling has detected clubroot within a right-of-way sample
 - Moderate Risk (Yellow) where clubroot was not detected in a right-of-way sample but was encountered elsewhere in the field

In addition to the above classification, an additional cleaning requirement will also be implemented when moving from Red to Yellow fields. Three levels of cleaning will be undertaken when topsoil handling equipment moves between these particular fields as directed by the AER.

Pembina recognizes the implementation of this plan will be the first large scale project that will utilize a detailed sampling program and extensive multi-crew and wash station process. Pembina commits to execute this project with the additional AER requirements which have been incorporated into the attached project specific clubroot management plan.

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We trust the updated plan is to the satisfaction of the Director and look for approval of the same in a timely manner.

If you have any questions or concerns about the information, please contact me at (403) 231-3157 or pmiles@pembina.com.

Regards,

Peter Miles
Supervisor, Regulatory Affairs

Enclosure

cc: Craig Day, Senior Manager, Major Projects, Environment-Pembina Pipeline Corporation
Kevin Evans, Consultant, Environment-Pembina Pipeline Corporation
Balmeet Toor, Supervisor, Environment-Pembina Pipeline Corporation

Concordance Table with Approval Conditions

3.1.31 The clubroot management plan shall include...	Section within Pembina Clubroot Management Plan
a) A sampling method that identifies three levels for designating clubroot presence in fields: low, moderate, or high.	Section 3.0, Para. 5 High, Moderate (clubroot detected only in an off right-of-way sample) and Low Risk designated with three colour codes – Red, Yellow and Green..
b) Level 3 disinfecting cleaning when topsoil stripping equipment is moving from high- to moderate- or low-risk fields.	Section 5.1, Para. 3; Table 4; Figure 4b, Figure 6a and Figure 8a When a crew is moving from a high risk to moderate risk field (red to yellow) three levels of cleaning will be under taken - mechanical cleaning, power wash and disinfecting bleach.
c) Equipment moving between high-risk or moderate-risk fields have: i) level 3 cleaning when equipment is being moved between different landowners, and ii) level 2 or 1 cleaning when equipment is being moved between fields owned by the same landowner and the landowner agrees.	Section 3.0, Para. 4; Appendix B Cover Letter for Report to Landowner i) as per response b) above and Landowners are provided detailed results of the sampling conducted on their property along with the cleaning protocols undertaken during the sampling process. They are informed of the status of the clubroot detected, detected or not detected, and that a crew dedicated to handling topsoil of similar detection status will be utilized. The information is provided to the landowners confidentially unless they direct us to provide the information to their occupants or others. The landowners are provided an opportunity to discuss with Pembina and its consultants the sampling protocol, the results and the means by which clubroot mitigation will be undertaken ii) as per response b) above and the Plan treats each field based on clubroot detection not land ownership
d) The use of high-risk mitigation measures when there is uncertainty regarding the presence of clubroot.	Section 5.3, Para. 4

	Where samples have not been taken within a field, the field will be treated as green when the equipment enters the field and considered red when equipment leaves the field.
e) Level 1 cleaning of all equipment moving between clubroot-detected fields, regardless of the direction of travel.	Section 5.3, Para. 2 As a minimum, all topsoil handling equipment, trucks, hydrovac units, quads, footwear, etc. that comes into contact with topsoil within a clubroot detected field will be cleaned at a minimum level 1 cleaning between clubroot detected fields regardless of the direction of travel. Before equipment moves from a clubroot detected to a clubroot not detected field it will undergo a level 3 cleaning.
f) Sampling for clubroot and cleaning of equipment between fields rather than only between quarter sections.	Section 3.0, Para. 2 Section 5.0, Para. 2 Section 5.3



Fox Creek to Namao Expansion
Pipeline Project
Clubroot Management Plan

Revision 2
July 5, 2016

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1.0 Clubroot Management Plan

The following clubroot management plan (the “Plan”) is intended to provide Pembina Pipeline Corporation (“Pembina”) employees, contractors and subcontractors with an understanding and expectation of environmental protection measures related to clubroot management practices during the construction of the Fox Creek to Namao Expansion Pipeline Project (the “Project”).

The purpose of the Plan is to:

- Describe clubroot mitigation measures that will be implemented during pipeline construction activities from survey through final cleanup;
- Describe how mitigation measures outlined in the Environmental Protection Plan (the “EPP”) are linked to the clubroot management plan; and
- Outline roles and responsibilities of project personnel during construction.

The clubroot mitigation strategies described in the Plan will reduce the potential for spread of the clubroot pathogen during the movement of topsoil. These strategies are consistent with mitigation plans for other soil-borne plant pathogens, pests and noxious weeds.

The Plan applies to the pipeline right-of-way (the “ROW”) and associated facilities, construction staging and laydown areas, parking areas, and other locations where topsoil handling occurs.

2.0 Clubroot Overview

Clubroot is a soil-borne infectious disease of canola and related cruciferous plants (canola and cabbage family). It has developed into a serious pest in Alberta. Clubroot is caused by *Plasmodiophora brassicae*, a soil-borne parasite of plants. Clubroot causes reduced seed yield in infected plants. It can be identified by swollen and misshapen (i.e., galled) plant roots and stunting, yellowing and/or wilting of the top growth of plants. Badly affected plants may die prematurely. An example of a clubroot-infected plant is provided in Figure 1.



Figure 1: Clubroot Gall on Canola. Image Courtesy of Krista Zuzak, University of Alberta.

2.1 Clubroot Transmission

Various events and conditions can contribute to clubroot transmission. Primary methods of transmission of clubroot spores to non-infected land tracts are by:

- Human activity (eg. farming practices and industry);
- Wind erosion; and
- Water erosion.

During pipeline activities, the principal mitigation for clubroot transmission is to avoid movement of topsoil between fields. Topsoil transfer by wind and water erosion is addressed in the EPP. Mitigation measures are described for wind and water erosion. Such measures form part of the strategy to control the potential spread of clubroot.

2.2 Clubroot Distribution

Clubroot is present in many of the agricultural regions of the world (including agricultural regions of Canada). It is particularly well documented in Alberta. Figure 2 provides observations of clubroot throughout Alberta thanks to the surveying efforts of growers, municipalities, the University of Alberta and others (Strelkov et al. 2014).

At the field level, clubroot has a non-uniform or “patchy” distribution, often distinguishable in canola fields through areas of premature crop ripening (Canola Council of Canada 2016). In fields with no history of clubroot, the infected patches are most often found at field entrances and along access routes where equipment carrying infected soil first deposits loose soil within the field. In those fields where clubroot is prevalent, highly infected patches are commonly found in areas with increased moisture, such as low spots, within ephemeral drainages, or near sloughs. (Canola Council of Canada 2016).

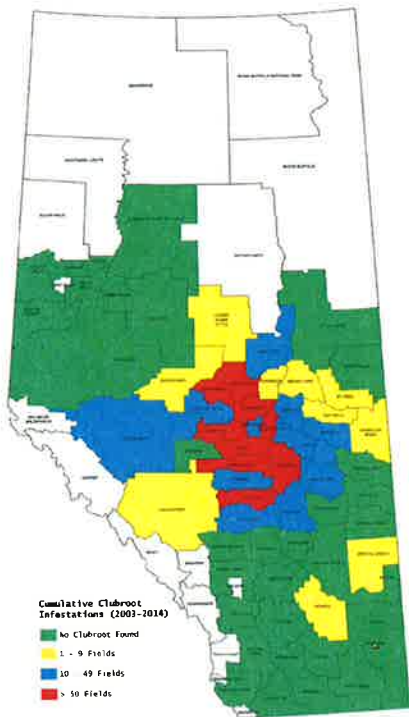


Figure 2: Observations of Clubroot of Canola in Alberta (Strelkov et al. 2014).

Where clubroot is detected within a field, there is a high likelihood that it is present elsewhere within that field, particularly where the field has been cultivated (Wallenhammar *et al.* 2012). A single infected canola root can produce and release billions of resting spores into the soil which may be able to survive for up to 17 years. (Howard 2013, Wallenhammar 1996). It has been reported that only between 1,000 and 100,000 spores per gram of soil are required to initiate infection in canola roots (Howard 2013, Strelkov and Hwang 2014). The absence of the pathogen from a particular soil sample may not necessarily indicate it's absence from the field in which it was collected (Cao *et al.* 2007). Given the practical constraints of soil sampling patterns and sampling density, the detection of clubroot at one or more composite sampling sites within a field suggests risk of clubroot infection at other locations within the same field (Strelkov *et al.* 2005, Strelkov and Hwang 2014).

3.0 Pre-construction Sampling and Landowner Reports

Prior to conducting sampling for clubroot, questionnaires are distributed to landowners to gather information pertinent to that parcel including whether there is a change in agricultural use within the parcel, crop rotations, landowner clubroot management protocols and field entrance locations. This information is provided on a volunteer basis.

The objective of the pre-construction sampling program is to identify fields that are infected with the clubroot pathogen. Within the program, fields are defined as areas designated for the production of crops (Canadian Food Inspection Agency 2013a, 2013b). A parcel is identified as the individual legal land

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division with clubroot detection status delineated at the separation between fields. Samples are collected at regular intervals along the ROW and at locations that have a high probability of harboring clubroot. A more detailed clubroot soil sampling procedure is provided in Appendix A.

Individual clubroot sampling reports are prepared for each land parcel, which may include multiple agricultural uses or fields within the parcel (e.g. cultivated and pasture), for confidential distribution to the respective landowners (Appendix B). The Landowner clubroot sampling report contains:

- Cover letter to landowner describing results of sampling and mitigations for those fields;
- Map of soil sample locations;
- List of soil sampling locations, and results of the laboratory analysis;
- Documentation of the cleaning protocols utilized during sampling; and
- A subset of the photographic record for each field and the cleaning protocols.

The landowner reports are provided to the landowners in advance of construction. They allow for the landowners to view the areas in their fields that the sampling program was undertaken and the results of the programs. The landowner then has the opportunity to discuss the results of the sampling program with Pembina construction expertise and the mitigation approach on their land, relative to those findings.

The results of pre-construction sampling are mapped for information and construction planning purposes. Fields where clubroot has been detected will be identified by either a **yellow** (moderate risk due to presence in the field but not detected on the right-of-way) or a **red** colour coding (high risk where clubroot was detected in a right-of-way sample). Fields where clubroot has not been detected will be shown as **green or low risk**. This *Red - Yellow - Green Mapping* is provided to construction management personnel to delineate the status of each field and the resultant mitigation to be applied depending on the direction of travel for the topsoil handling equipment.

4.0 Documentation and Compliance Measures

Compliance during construction is facilitated through sharing information with key personnel on clubroot results, providing training through orientations and task specific instruction, monitoring clubroot management activities, and adherence to the EPP for each respective pipeline activity. A summary of the documentation that directs the Plan is provided in Table 1. This supporting information, in conjunction with industry best practices from the EPP as outlined in Table 2, form the basis for execution of the Plan by key personnel. Roles and responsibilities of the construction team to ensure the success of the Plan, are provided in Table 3. Documentation including lab clubroot sampling analysis and landowner reports will be stored in Pembina's Corporate StakeTracker (eg. CS Explorer) while construction cleaning logs will be stored in Corporate environmental and project folders and depicted in the appropriate as-builts reports and drawings. All construction cleaning records will be accompanied by geo-referenced photographs for each piece of equipment that receives three levels of cleaning. The clubroot resting spores are extremely long lived, with a half-life of about 4 years, but they can survive in soil for up to 20 years, therefore all records will be maintained by Pembina for at least 20 years from date of sampling. Clubroot sampling should be repeated on clubroot undetected parcels after 2 growing

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seasons from the original sample date (eg. sampled summer 2015 therefore re-sampling required prior to work in summer 2017), should additional activities be required.

Table 1: Clubroot Management Documentation

Component	Supporting Documentation
<i>Industry Guidelines and Regulations (included but not limited to)</i>	<ul style="list-style-type: none"> • The Alberta Clubroot Management Plan (Alberta Clubroot Management Committee 2014); • Canola Council of Canada Clubroot Management Plan (Canola Council of Canada 2015); • Best Management Practices – Clubroot Disease Management (CAPP 2008); and • Alberta Agricultural Pests Act (Government of Alberta 2014) and Pest and Nuisance Control Regulation (Government of Alberta 2011).
<i>Clubroot Results</i>	<ul style="list-style-type: none"> • Key personnel will be provided with the pre-construction clubroot survey results –referred to as “Red – Yellow - Green Mapping”.

The environmental measures for the Project to reduce the potential for spread of clubroot are summarized in Table 2. These construction procedures and activities during topsoil handling activities will require clubroot management protocols.

Table 2: Clubroot Management Plan – Compliance/Concordance with the EPP

[illegible]

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Table 3 provides the roles and responsibilities of Project personnel with respect to clubroot management.

Table 3: Clubroot Management Roles and Responsibilities

Role	Responsibility
<i>Pembina Construction Manager</i>	<ul style="list-style-type: none"> • Ensure that clubroot mitigation measures identified within the Plan and the EPP are followed and adhered to. • Ensure environmental orientations and training is provided to all site personnel. • Address any construction concerns or non-compliance to the Plan identified by Pembina or its contactors. • Expedite non-compliance resolutions and work stoppages if required.
<i>Environmental Inspector or Designate</i>	<ul style="list-style-type: none"> • Support the implementation of the Plan and the EPP (Table 2). • Facilitate environmental orientations and training for all site personal. • Ensure equipment is inspected and verified clean prior to going to site. • Audit Contractor cleaning records and ensure all cleaning logs are incorporated into the Corporate and Environmental As Built files. • Provide expert advice and guidance on decisions or course of action to address clubroot concerns. • Document any procedure exceptions or modifications.
<i>Pembina Contractors and Sub-contractors</i>	<ul style="list-style-type: none"> • Conduct activities in adherence to the Plan and communicate non-compliance to the Pembina project construction manager and environmental inspector. • Complete pertinent environmental orientations and training (including Clubroot Orientation Sign Off Appendix C). • Complete cleaning logs for all topsoil handling equipment as per the Plan. • Ensure all proper signage maintained at cleaning stations

5.0 Construction Activities

The principal risk of transmission of clubroot between fields is by the movement of topsoil. Pre-construction surveys (environmental, surveying, hydrovac, line locates) will abide by the Pembina Personal Clubroot Cleaning Plan (Appendix D) to reduce the transfer of topsoil prior to construction. Prior to the start of construction, all construction equipment and mats will be cleaned and disinfected.

During construction, equipment should be clean and free of topsoil and plant debris that may be contaminated with clubroot when moving between fields. Pembina will use the following strategies to accomplish this:

- Utilize Dedicated Topsoil Handling Equipment between fields with common clubroot detection status (e.g., from high risk to high risk); and/or
- Clean and Disinfect Topsoil Handling Equipment at the designated level when moving between fields from clubroot detected fields (i.e., moderate or high risk) to non-detected fields (i.e. low risk), or when moving from a field where clubroot was detected on the right-of-way (high risk) to a field where clubroot was found in the field but not detected on the right-of-way (moderate risk)

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5.1 Dedicated Topsoil Handling Crews

As part of the cleaning implementation process, Pembina may employ a topsoil handling approach where two separate topsoil handling equipment crews are used during topsoil stripping and replacement.

These crews may be described as:

- “Green crew” will operate on clubroot non-detected fields; and
- “Yellow or Red crew” will operate on clubroot detected fields.

This strategy mobilizes a crew from one grouping of similar fields to another. In those situations, topsoil handling equipment will undergo a mechanical cleaning using shovels, brushes and hand tools (Level 1) upon exiting each field before being loaded onto low-boy trailers and transported to another field of similar designation. Should a red crew move from a field where clubroot was detected on right-of-way to a field where clubroot was only detected off right-of-way, the topsoil handling equipment will be mechanically cleaned, power washed and disinfected (1 – 2% bleach solution).

Equipment will not be transported from red (high risk) or yellow (moderate risk) fields to green (low risk) fields without undergoing three levels of cleaning before entering the green field.

Trailers utilized to transport equipment will also be cleaned to a similar level as the equipment that it hauls.

5.2 Cleaning and Disinfecting Topsoil Handling Equipment

The cleaning protocols are in alignment with the methods outlined in the Alberta Clubroot Management Plan (2014), the Best Management Practices – Clubroot Disease Management (CAPP 2008), and Canola Council of Canada Clubroot Management Plan (Canola Council of Canada 2015).

Cleaning stations will be located to clean and disinfect topsoil handling equipment. Topsoil handling equipment may include tractors, hydrovacs, clearing equipments, mulchers, graders, bulldozers and excavators. Access mats will also be cleaned and disinfected to Company Plan standards. Cleaning includes physical soil and plant debris removal, power washing and/or disinfecting equipment. The typical cleaning station design and procedures is found in Appendix E.

Equipment cleaning records (including photos, date, type and level of cleaning) will be collected during the Project construction and maintained for QA/QC purposes. Audits will be performed by the Environmental Inspector to ensure compliance with the Plan.

Three levels of topsoil handling equipment cleaning may be used in combination with designated red and green topsoil handling crew mobilization as required:

Level 1	Mechanical	Physical removal of topsoil and plant debris (mechanical cleaning) from topsoil handling equipment utilizing shovels, brushes and hand tools.
Level 2	Wash	Pressure washing; the use of compressed air should be avoided (Rennie, et al. 2015)
Level 3	Disinfect	Application of a bleach solution. A 1 to 2% chlorine bleach solution is applied to the point of runoff on all topsoil handling equipment where contact with topsoil may have occurred. Bleach-treated surfaces will be kept wet for 15 minutes to allow sufficient time to disinfect the equipment.

5.3 Cleaning Protocols when Moving from Field to Field

Based on the *Red - Yellow - Green Mapping*, several cleaning scenarios are possible when topsoil handling equipment moves from one field to another. When the mobilization of a designated topsoil handling crew to a field of similar detection, additional cleaning may be required.

Figure 3 to Figure 9 illustrate the scenarios of cleaning station placement and the cleaning level required when topsoil handling crews move from field to field during both the topsoil stripping and replacement phases. Green fields indicate those that have not tested positive for clubroot and red fields indicate those where clubroot has been detected on the right-of-way. Yellow fields are those where clubroot has been detected in some area of the field but not the right-of-way. As a minimum, mechanical (Level 1) cleaning will be conducted between all parcel boundaries and changes in land use (e.g. cultivated to pasture) where the detection status is the same between fields.

Table 4: Clubroot Cleaning Required Based on Direction of Travel

Direction of Travel			Cleaning Required
Low Risk (Green)	To	Low Risk (Green)	Mechanical Cleaning (Figure 3)
Low Risk	To	High Risk (Red- detected ON right-of-way)	Mechanical Cleaning (Figure 4a)
High Risk	To	Low Risk	Mechanical Cleaning, Pressure wash and disinfect (Figure 4b)
High Risk	To	High Risk	Mechanical Cleaning (Figure 5)
Moderate Risk (yellow - detected OFF right-of-way)	To	Low Risk	Mechanical Cleaning, Pressure Wash, Disinfect (Figure 6a)
Low Risk	To	Moderate Risk	Mechanical Cleaning (Figure 6b)
Moderate Risk	To	Moderate Risk	Mechanical Cleaning (Figure 7)
High Risk	To	Moderate Risk	Mechanical Cleaning, Disinfect (Figure 8a)
Moderate Risk	To	High Risk	Mechanical Cleaning (Figure 8b)

Should field conditions dictate a change in direction for the topsoil handling equipment, the table above and the following figures will be referenced to ensure the correct cleaning procedures are followed.

Where a field has not been sampled for clubroot and the landowner has not provided information with respect to previous sample results, the field will be treated as clubroot not detected (Low Risk) when entering the field for topsoil handling. Prior to moving to an adjacent field, or to another location that is clubroot not detected, the topsoil handling equipment will receive three levels of cleaning.

Field 1

Field 2

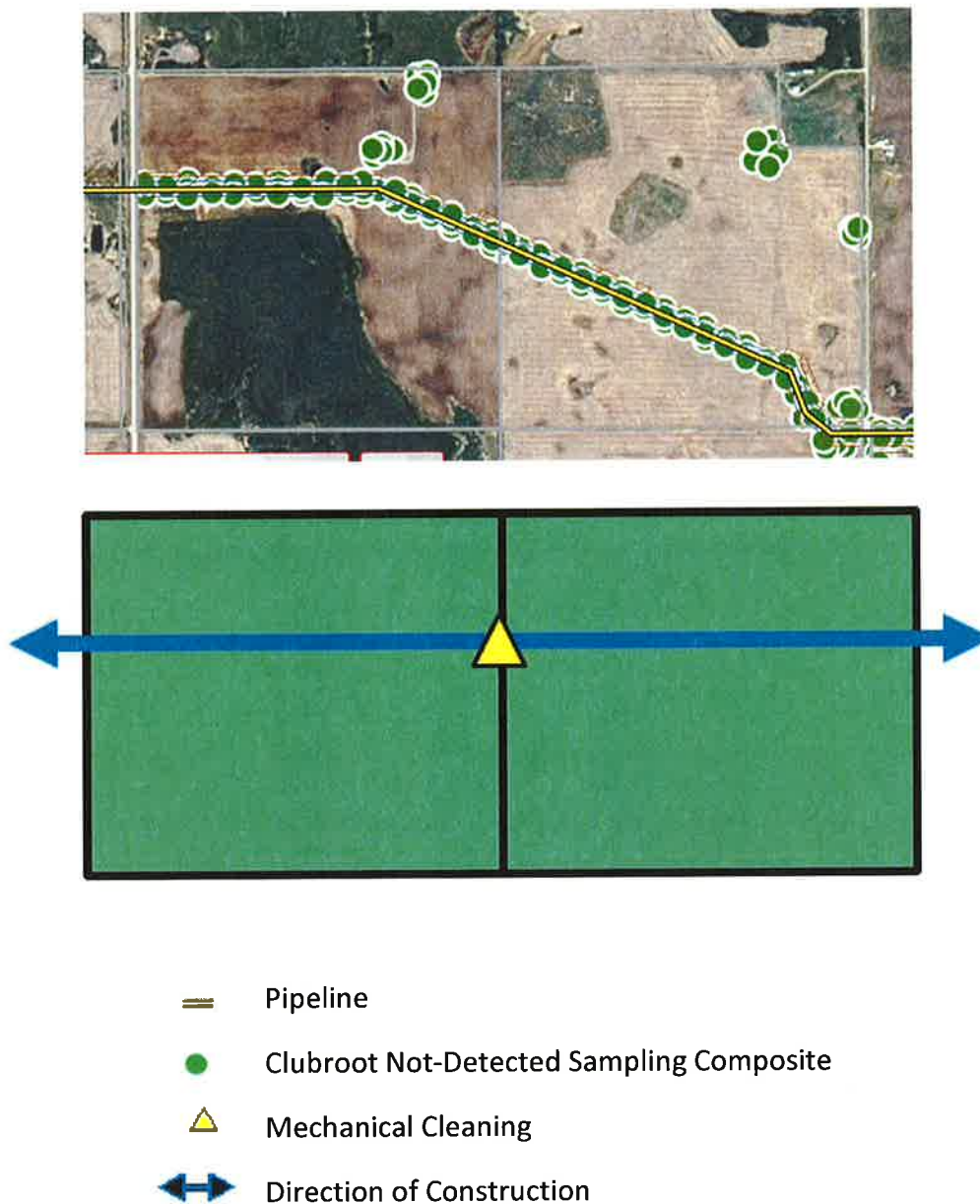


Figure 3: Low Risk to Low Risk (Green to Green)

- a. When the direction of topsoil handling is from Low risk to Low risk the equipment will be mechanically cleaned prior to moving to the adjacent field.

Field 1

Field 2

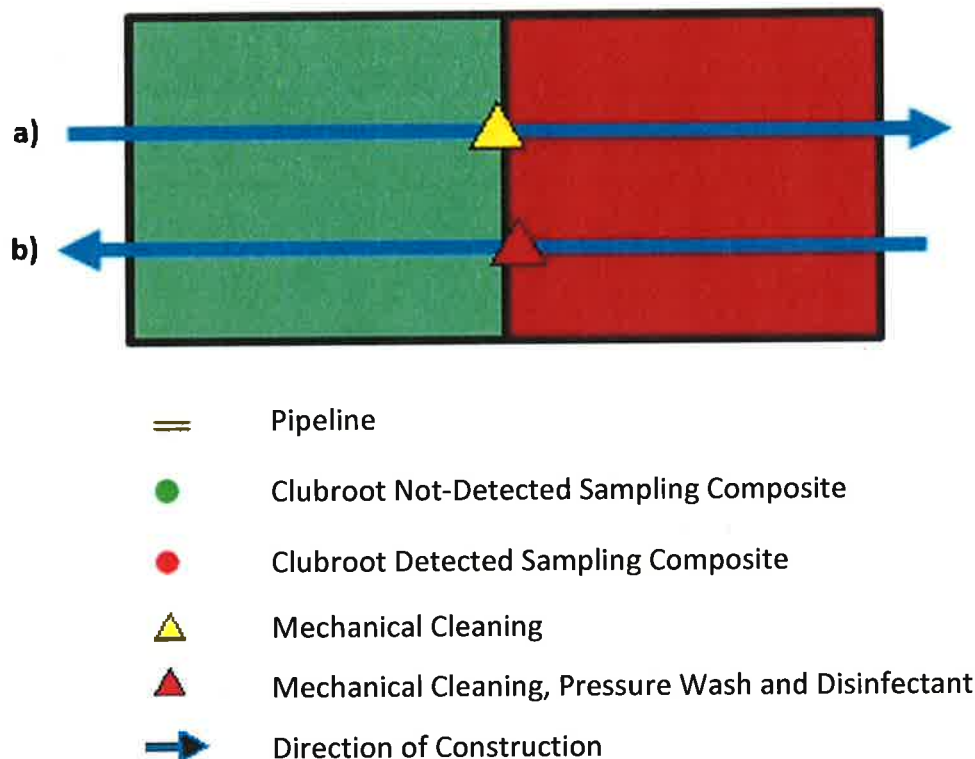


Figure 4: Low Risk to High Risk (Green to Red); High Risk to Low Risk (Red to Green)

- a. When the direction of topsoil handling is from High risk to Low risk the equipment will be mechanically cleaned, pressure washed and disinfected.
- b. When the direction of topsoil handling is from Low risk to High risk the equipment will be mechanically cleaned.

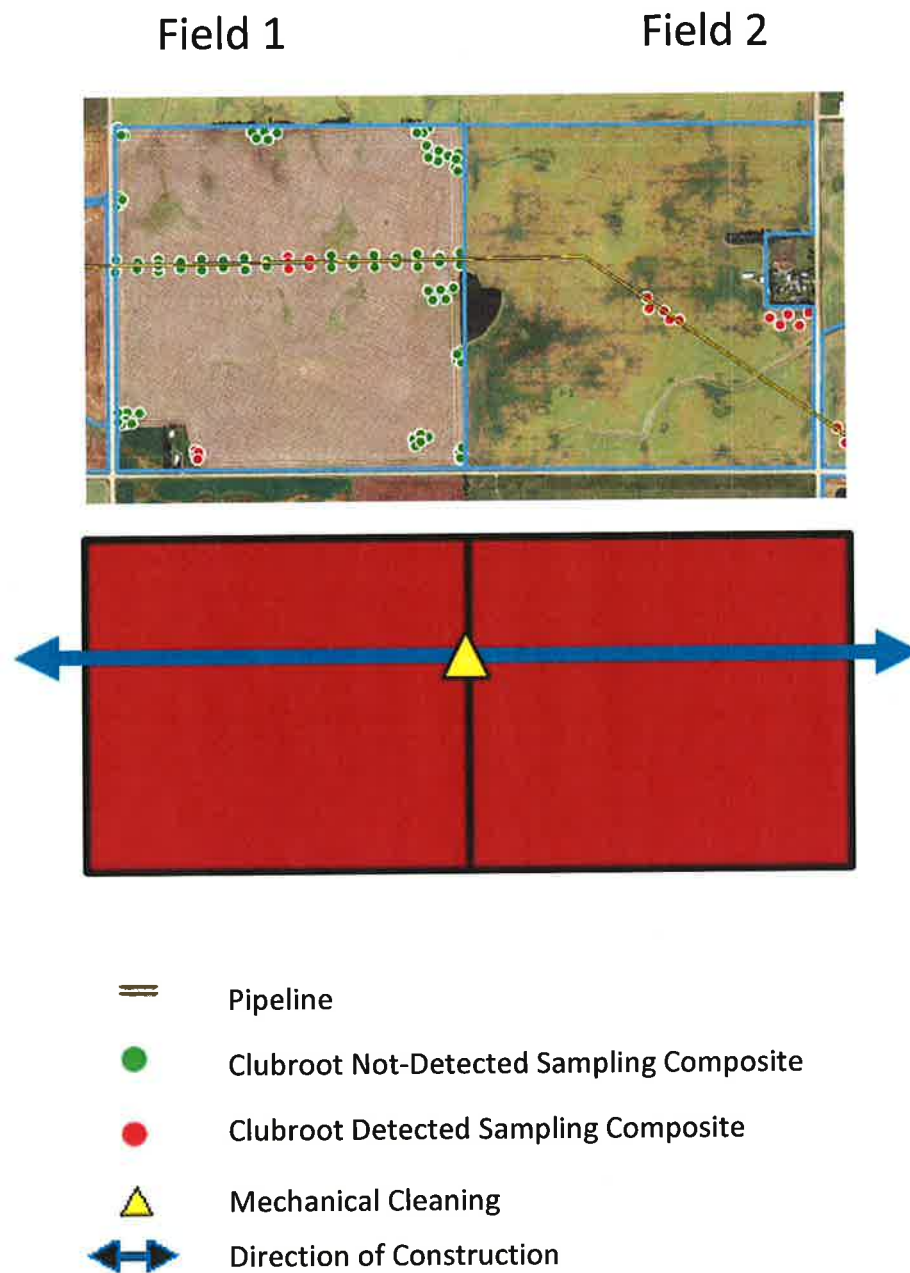


Figure 5: High Risk to High Risk (Red to Red)

- When the direction of topsoil handling is from High risk to High risk the equipment will be mechanically cleaned.

Field 1

Field 2

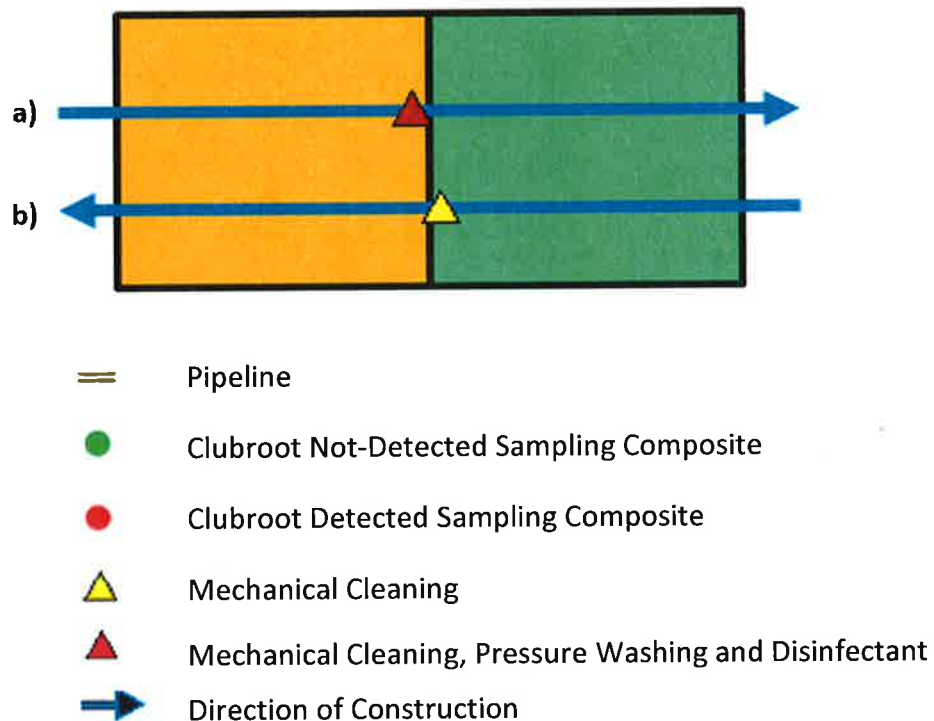


Figure 6: Moderate Risk to Low Risk (Yellow to Green); Low Risk to Moderate Risk (Green to Yellow)

- a. When the direction of topsoil handling is from Moderate risk to Low risk the equipment will be mechanically cleaned, pressure washed and disinfected.
- b. When the direction of topsoil handling is from Low risk to Moderate risk the equipment will be mechanically cleaned.

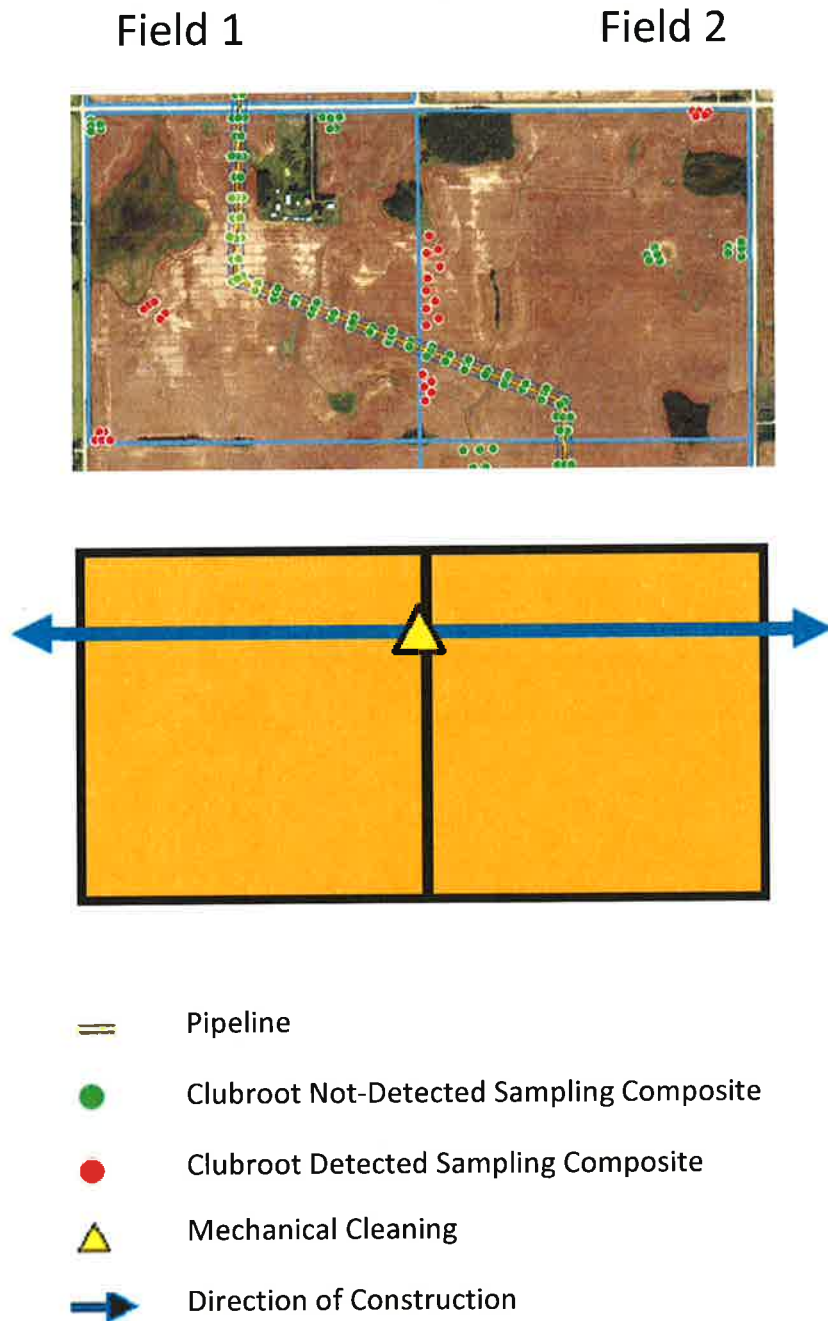
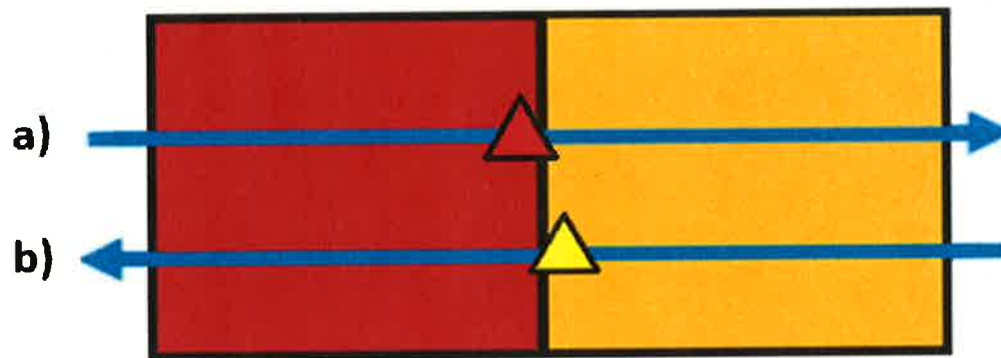


Figure 7: Moderate Risk to Moderate Risk (Yellow to Yellow)

- a. When the direction of topsoil handling is from Moderate risk to Moderate risk the equipment will be mechanically cleaned.

Field 1

Field 2









-  Pipeline
-  Clubroot Not-Detected Sampling Composite
-  Clubroot Detected Sampling Composite
-  Mechanical Cleaning
-  Mechanical Cleaning, Pressure Washing and Disinfectant
-  Direction of Construction

Figure 8: High Risk to Moderate Risk (Red to Yellow); Moderate Risk to High Risk (Yellow to Red)

- a. When the direction of topsoil handling is from High risk to Moderate risk the equipment will be mechanically cleaned, pressure washed and disinfected.
- b. When the direction of topsoil handling is from Moderate risk to High risk the equipment will be mechanically cleaned.

Field 1

Field 2



- Pipeline
- Clubroot Not-detected Sampling Composite
- Clubroot Detected Sampling Composite
- Level 1 Cleaning Station
- Direction of Construction

Figure 9: Low risk to Low risk Through High Risk - Green Crew Equipment is Moved Between Two Clubroot Non-Detected Fields Separated by a Topsoil Stripped Clubroot Detected Field.

In this particular example where there is no access to an isolated field, the removal of topsoil provides mitigation for movement of equipment on subsoil. The following steps are undertaken:

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1. The equipment would enter from the west or south side of the high risk field, and strip the topsoil from the adjacent low risk field;
2. The topsoil handling equipment would complete the stripping operation and execute a mechanical cleaning before entering the high risk clubroot detected field.
3. Once the topsoil has been stripped from the high risk field, the contractor may execute the three levels of cleaning prior to progressing to the next low risk field that has not been stripped.
4. Alternatively as outlined in Figure 7 they may return back through the stripped right-of-way executing a mechanical cleaning before entering the stripped area of the low risk clubroot non-detected field.
5. The topsoil handling equipment may be mobilized to a high risk clubroot detected field or returned to a cleaning station where the three levels of cleaning would be required prior to returning to a low risk clubroot non-detected field.

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5.4 Clubroot Cleaning Checklist

A checklist is provided in Appendix E and provides a reference and documentation tool for task specific clubroot mitigations for construction personnel. The checklist will be used to document compliance with the Plan.

6.0 Contact List

Contact	Location	Phone Number
Pembina Project Manager		
Construction Manager		
Land Agent		
Environmental Planner		
Clubroot Monitor		
Cleaning Station Sub-contractor		

7.0 References

- 1) Alberta Clubroot Management Committee. 2014. Alberta Clubroot Management Plan. Government of Alberta, Alberta Agriculture and Rural Development. Website: [http://www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/agdex11519](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex11519). Accessed: July 2015.
- 2) Canadian Food Inspection Agency. 2013a. Producer Guide - National Voluntary Farm-Level Biosecurity Standard for the Grains and Oil Seed Industry – A Guide for Implementing Proactive Biosecurity into Farm Management. CFIA P0863-13, 51p.
- 3) Canadian Food Inspection Agency. 2013b. National Voluntary Farm-Level Biosecurity Standard for the Grains and Oil Seed Industry. CFIA P0841-13, 29p.
- 4) Cao, T., Tewari, J. and Strelkov, S.E. 2007. Molecular detection of *Plasmodiophora brassicae*, causal agent of clubroot crucifers in plant and soil. Plant Dis. 91: 80-87.
- 5) CAPP Clubroot Management Plan Committee. 2008. Clubroot Disease Management, Best Management Practices. Canadian Association of Petroleum Producers. Website: [file:///C:/Users/drennie/Downloads/139848%20\(3\).pdf](file:///C:/Users/drennie/Downloads/139848%20(3).pdf). Accessed: July 2015.
- 6) Howard, R. 2013. Clubroot of Canola in Alberta : Disease occurrence and risk mitigation strategies for infested soil.
- 7) Kim, C.-H., W.-D. Cho and H.-M. Kim. 2000. Distribution of *Plasmodiophora brassicae* Causing Clubroot Disease of Chinese Cabbage in Soil. Plant Disease Research 6(1). Pp. 27-32.
- 8) Government of Alberta. 2014. Agricultural Pests Act. Revised Statutes of Alberta 2000 Chapter A-8. Alberta Queen's Printer. Website: http://www.qp.alberta.ca/1266.cfm?page=a08.cfm&leg_type=Acts&isbncln=9780779782642. Accessed: July 2015.
- 9) Government of Alberta. 2011. Agricultural Pests Act. Pest and Nuisance Control Regulation. Alberta Regulation 184/2001. Alberta Queen's Printer. Website: http://www.qp.alberta.ca/1266.cfm?page=2001_184.cfm&leg_type=Regs&isbncln=9780779746255. Accessed: July 2015.
- 10) Canola Council of Canada. 2016. Identify Clubroot. Website: http://archive.canola-council.org/clubroot/identify_clubroot.aspx#identification. Accessed: June 2016.
- 11) Canola Council of Canada. 2015. Clubroot Management Plan. Website: <http://archive.canola-council.org/clubroot/>. Accessed: August 2015.
- 12) Government of Canada. 2015. Plant Protection Act. Minister of Justice. Website: <http://laws-lois.justice.gc.ca/PDF/P-14.8.pdf>. Accessed: August 2015.
- 13) Rennie, D.C., M.D. Holtz, T.K. Turkington, J.M. Leboldus, S. Hwang, R.J. Howard, S.E. Strelkov. 2015. Movement of *Plasmodiophora brassicae* resting spores in windblown dust. Canadian Journal of Plant Pathology. 37:2. pp188-196.
- 14) Strelkov, S.E. and S.F. Hwang. 2014. Clubroot in the Canadian canola crop : 10 years into the outbreak. Canadian Journal of Plant Pathology 36 (Supplement 1): 27-36.

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- 15) Strelkov, S. , E., Cao, T. Manolii, V.P. Lange, R.M., Smith-Degenhardt, E., Orchard, D. and Tewari, J.P. 2006. Incidence of clubroot on canola in Alberta in 2005. Can. Plant Dis. Surv. 86:91-93.
- 16) Strelkov, S. E. et al. 2014. The Occurrence of Clubroot on Canola in Alberta in 2014. The Canadian Phytopathological Society. Canadian Plant Disease Survey, Disease Highlights. Pp. 158-161.
- 17) Wallenhammar, A. C. 1996. Prevalence of *Plasmodiophora brassicae* in a Spring Oilseed Rape Growing Area in Central Sweden and Factors Influencing Soil Infestation Levels. Plant Pathology. 45. Pp. 710-719.
- 18) Wallenhammar, A.C., C. Almquist, M. Soderstrom and A. Jonsson. 2012. In-field distribution of *Plasmodiophora brassicae* measured using quantitative real-time PCR. Plant Pathology (2012) 61, 16-28.

Appendix A

Soil Sampling Work Instructions and Sampling Details

1.0 Clubroot Soil Sampling Procedure

Pre-construction soil sampling will be conducted to establish a baseline of clubroot infection in all white area parcels within the project affected lands.

The sampling program includes:

- Rationale for selecting sample locations;
- Defined methodology for sample collection;
- Personal and equipment cleaning procedures;
- Quality Assurance/Quality Control processes;
- Data management plan;
- Communication of results.

2.0 Soil Sample Locations

Soil samples will be collected from a 'W' pattern across the proposed alignment and access routes, where each sample is a composite of the sub-samples collected at the vertexes of the 'W' (Figure A-1).

2.1 Right-of-Way Sampling

Right of way sample locations commence near the start of the right-of-way within a field. The first three sub-samples of the 'W' pattern are initiated every 100 meters along the length of the right-of-way. The remaining two sub-samples of the 'W' are offset 50 meters from the first three sub-samples.

The right-of-way sampling will follow the approximate design in (Figure A-1).

The sample locations on the right-of-way may be adjusted using the professional experience of the sampling crew to ensure the following:

- Points are only within the right-of-way;
- Points are arranged according to the design in (Figure A-1);
- The sampling interval starts and ends adjacent to the field boundary;
- Overlapping sample points are removed;
- Samples are not placed in non-agricultural areas; and,
- Land use change is documented and the samples collected from each field are kept separate including analysis and reporting.

2.2 Field Entrances and Drainages

The sampling within a parcel will consist of a 'W' sample at field entrances, at prominent drainage areas or areas of suspected or evident infrastructure and industrial development. Every field entrance will be surveyed; however not all drainages or developments will be sampled.

The following criteria were used to define field entrances:

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- Evidence of tracks, compacted ground, or crop disturbed by vehicles and equipment;
- Gravel or paved roadside pullouts into the fields; and,
- Trails or access extending into cultivated areas from properties and homesteads.

The field entrance and drainage sampling design will follow the approximate design in (Figure A-1).

The objective is to sample within 50 meters of the field entrance, which statistically improves the chances of detecting the presence of clubroot (e.g., the highest probability of finding clubroot is within 300 meters of the entrance or closer, as observed by Cao et al. [2009]).

Sampling locations are identified during a desktop review and a representative sample set will be reviewed prior to executing the field program. Additional entrances or drainage areas may be identified and sampled at the discretion of the field staff in consultation with the Pembina Environment Lead.

The following criteria or sources of information may be used to determine additional sampling areas:

- Sampling locations to be identified through review of publically available aerial imagery, including:
 - Low or depressed areas;
 - Prominent drainage areas; and,
 - Other high risk clubroot areas such as access routes, evidence of previous disturbances or construction activity.
- Additional sampling locations identified in the field, this might include features not identified through aerial imagery review:
 - Obscured field entrances, prominent drainages, and low areas;
 - Areas with clubroot symptomatic plants; and,
 - Areas of depressed plant growth.

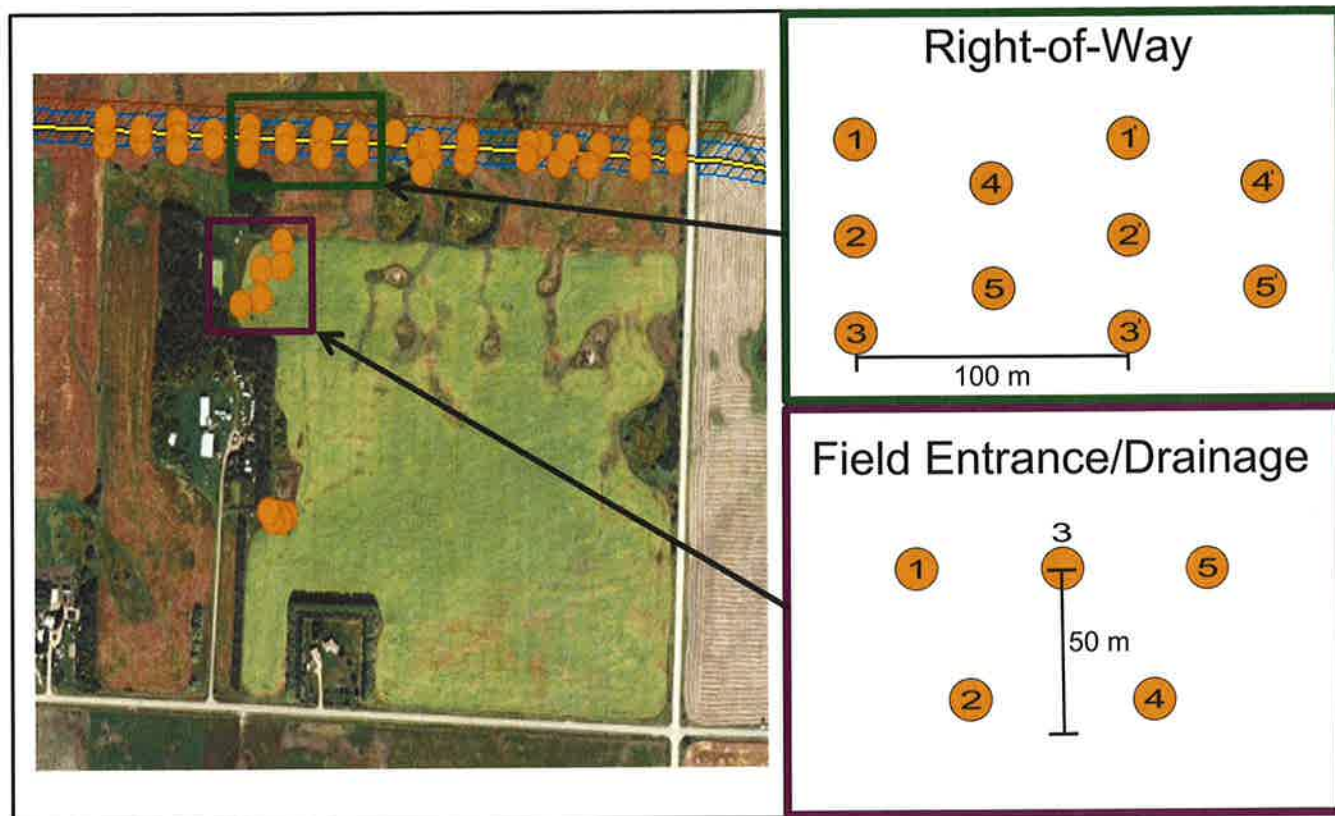


Figure A-1: Illustration of the 'W' sample design used along the right of way, field entrances and drainages.

3.0 Soil Sampling Procedures

3.1 Sample Collection Methodology

Conduct pre-construction soil sampling prior to seeding or post-harvest, where possible to minimize disruption to farming practices.

After the soil sample sites have been selected, staff will follow the sampling protocol that includes:

- Land access and verification of travel plans within the field(s);
- The cleaning protocol for sampling equipment and vehicles;
- Pre-determined sampling points, in a digital format. The sampling points will be grouped into pre-determined composite samples (i.e., five individual sample locations will result in one composite sample);
- Roles and responsibilities of field crew members, including sample collection, coordination of field operations, and sample delivery;
- Navigation protocols (e.g., sample locations will be navigated to and recorded using a GPS unit capable of 2-5 m accuracy);

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- Data to be recorded at each field from which soil samples are taken (e.g., field reference number [tract]; sample reference number and bar codes; GPS location of each sampling point; name of the person who collected the sample; and date of sampling);
- Collection of photographic evidence of execution of cleaning protocols followed by field crew and sample collection; and,
- Delivery of samples to the laboratory designated by Pembina, and chain of custody procedures.

Each soil sampling crew will be equipped with the information necessary to accurately and reliably locate the pre-selected sampling locations. This will be achieved with data and alignment sheets or with a tablet loaded with the pre-selected sampling points, aerial imagery and land access information. The crew member collecting the sample will navigate to within approximately 2 to 5 meters of the pre-selected soil sampling point, collect the sample, record the point on the data sheet or tablet, and continue to the next sampling point.

A field coordinator may support the two-person field crews for the safe and efficient collection of soil samples, and for adherence to Project quality criteria. Field crews with a tablet will be able to monitor, in real time, which land tracts field crews have entered, where they completed the cleaning procedures, how many samples were collected.

3.2 Personal and Equipment Cleaning

Sampling crews will adhere to the specific, field level, biosecurity procedures recommended by approved laboratories for clubroot soil sampling protocols. They will be equipped with disposable gloves for sampling, a stiff bristle brush and spray equipment for removing larger amounts of soil, and a 1 to 2% bleach solution mister for boots and tools. Biosecurity procedures will be used at each parcel boundary and/or land use change.

The cleaning and disinfecting equipment will be kept in the field truck and carried while sampling if needed within the field. All wastes will be contained within plastic garbage bags and removed from site for disposal. Extra biosecurity decontamination equipment will be stored in trucks for easy accessibility.

The use of all-terrain motorized vehicles is not required as a part of the sampling program. Work plans will be adjusted, based on the weather, to reduce biosecurity risks. If rain is encountered, work will be focused on pasture or other vegetated fields where decontamination can be more easily completed under wet conditions. Cultivated fields with bare soil will be avoided in wet conditions.

3.3 Soil Sampling Quality Assurance and Quality Control

Ensure systematic quality assurance processes and quality control measures are in place to confirm and document the quality of data, results and deliverables. The clubroot testing laboratory should be ISO 9001:2008 (Quality Management System) certified and have in place a separate quality assurance and quality control system to manage the quality of their laboratory processes.

3.3.1 Quality Assurance (QA)

3.3.1.1 Field Sampling, Data Collection and Biosecurity QA

The following quality assurance processes have been integrated into the clubroot soil sampling program to manage, assure and document:

- Standardized Equipment Cleaning and Disinfection Procedures and Documentation;
- Standardized Sampling Methodology;
- Sampling Documentation;
- Standardized Data Management and Reporting;
- Standardized and Validated Data Entry; and,
- Standardized Chain-of-Custody and Sample Management.

3.3.1.2 Soil Analysis QA

Soil sub-sample locations are documented in the field using standardized digital forms. This documentation includes a quality control sign off by the field supervisor. Sample bags are identified and tracked using a unique numbering system and bar code.

Standard laboratory assay controls that assure the quality of analytical results should include the use of:

- Positive DNA template and no DNA template to determine positive results and exclude false-positive and false-negative errors;
- Assay quality assurance parameters and standards (melt curve analysis);
- Robust assay design with high specificity reagents; and,
- Certificate of Analysis.

3.3.1.3 Quality Control (QC)

All collected data undergoes a field level review to ensure no errors are generated during data entry. Project coordinator or project management, monitor data collection through an online spatial viewer and can address any data collection errors as they arise. All data, field and analytical is reviewed for technical accuracy and completeness before submission to Pembina environmental personnel.

3.3.1.4 Reporting of QA/QC

Consolidated field reports will be produced for all landowners and will provide data collected at the respective property and QA/QC documentation. This report will include:

- Pembina Land representatives will provide a cover letter describing results and corresponding mitigations where reporting to the landowner is required. All sampling will be reported to the landowner.
- Landowner information, property imagery, project footprint, sample and biosecurity locations;
- Summary of collected data and laboratory results;
- Subset of photo record of soil samples;
- Summary of biosecurity documentation;
- Subset of photo record of biosecurity procedures; and,
- Ensured confidentiality between the landowner and Pembina.

3.4 Data Management

An integrated geographical information system (GIS) will be used to capture, track, view, and present project information (Figure A-2). The goals of this approach are the following:

- Coordinate land access communication and landowner consent confirmation;
- Simplify sample collection to increase accuracy and productivity;
- Automate data transfer from the field to a project database;
- Automate quality assurance steps to reduce errors;
- Show project information, in real time, in an online spatial viewer, so the following tasks can be completed accurately in real time:
 - Identify any data collection problems and errors;
 - Identify any land tracts that require re-visiting; and,
 - Allow Pembina project management team to view and track progress of field crews.
- Automate progress reporting so the project manager or coordinator can report on results efficiently.

The project will modify existing, proven data management tools to create a project-specific data management system. These tools are configured to track and consolidate field data, plan sample collection and land access two weeks ahead, and consolidate reporting, as shown in Figure A-2.

Quality Control and Monitoring

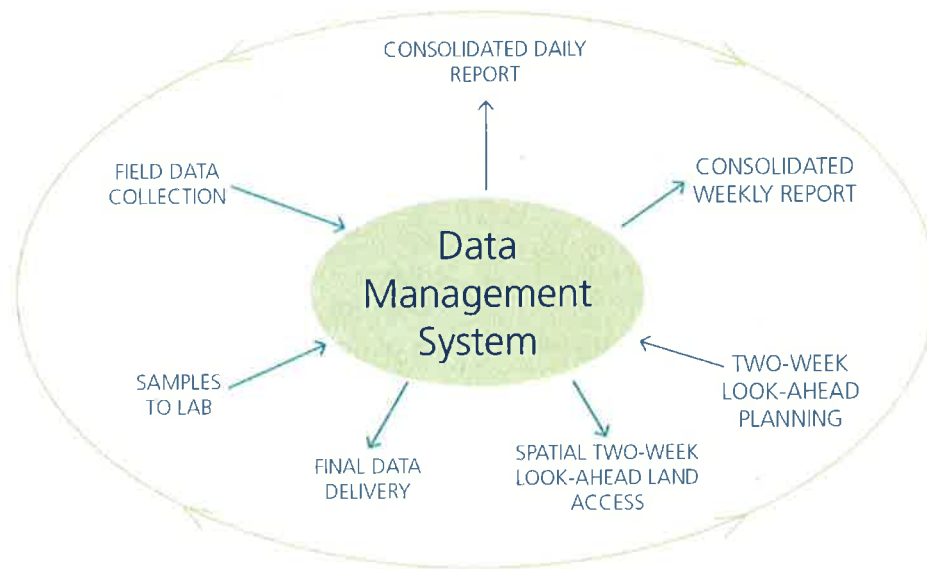


Figure A-2: Quality Control and Monitoring

4.0 Soil Sampling and Analysis Documentation and Communication

Soil sampling documentation and communication plan is supported by the QA/QC plan and provides clear and timely sampling reporting.

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Soil sampling is documented in the following ways:

- Soil sampling data collection form;
- Chain of custody sent to soil testing laboratories;
- Soil testing Certificate of Analysis; and,
- Technical QC review of points.

Soil sampling is communicated in the following ways:

- Laboratory client results portal;
- Daily laboratory sample status reports;
- GIS web map; and,
- Landowner surveying report.

4.1 Soil Sample Analysis

4.1.1.1 Approved Laboratories

Pembina will define the preferred laboratory that will be used for clubroot analysis.

4.1.1.2 Chain of Custody Procedures

Chain of Custody documentation includes:

- Client and laboratory contact information;
- Analysis request details;
- Sample Identification;
- Date Collected;
- Time Collected (if available);
- Relinquished by/Date; and,
- Received by/Date.

Sample information and results are captured by the analytical laboratory's information management system and communicate all results through a client web portal and daily laboratory sample status reports.

4.1.2 Soil Analysis Methodology

Composite soil samples are homogenized. Total deoxyribonucleic acids (DNA) are extracted from a sub-sample of the homogenized soil sample. A polymerase chain reaction (PCR) assay is performed on the DNA extract using clubroot specific priming nucleotides. Any DNA product synthesized during the PCR assay is subjected to melting temperature analysis to confirm the identity.

4.1.3 Soil Analysis Documentation

Results of the soil analysis are provided for export from the laboratory's client web portal. Temporary exports from the laboratory's client web portal are used to automatically update the soil sampling points for communication to Pembina and other downstream consulting uses.

Certificate of analysis are provided for all samples and are stored in the Pembina project work space.

4.2 Clubroot Detection Status

Soil sampling for clubroot will be conducted to detect clubroot in fields intersecting the pipeline ROW and workspaces. Detection of clubroot will be displayed on the GIS platform. Fields where clubroot has been detected on the right-of-way will be identified as high risk with a red colour coding. Fields where clubroot has been detected within the field, but not on the right-of-way will be identified as moderate risk and a yellow colour coding. Fields where clubroot has not been detected will be identified as low risk and shown as green (clubroot undetected). Land use changes within a parcel, may have different sample results and therefore be assigned different mitigations.

All results will remain privileged and confidential.

Clubroot management strategies will be guided by this clubroot baseline survey.

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Appendix B

Sample Landowner Cover Letters and Parcel Report

July 2016



July 5, 2016

'Landowner Address'

RE: SW XX-XX-XX W5 and NE XX-XX-XX W5

Dear XXXX:

Pembina Pipeline Corporation (Pembina) is notifying you the construction of the 'Project' is planned to be initiated in Q3 2016.

Pembina has retained a consultant to assist in the development of a Clubroot Management Plan (the Plan). The Plan will provide guidance to Pembina and its contractors during the pipeline pre-construction, construction and post-construction reclamation and operational activities, to mitigate the risk of clubroot transmission between fields. The protocols include a combination of mechanical cleaning, washing and disinfecting, and mobilizing dedicated topsoil handling equipment. The Plan includes input from Dr. Steven Strelkov, a professor in plant pathology at the University of Alberta and Dr. Ron Howard, a former Research Scientist at the Crop Diversification Centre, Alberta Agriculture and Rural Development

Pembina would like to thank you for your prior consent, to collect soil samples from your field(s). The report summarizing the soil samples collected from your field(s) is provided in Attachment A. Confidentiality between Pembina and each landowner is of utmost importance and we will only be using this data to manage Pembina related activities on the land as directed in the Plan and not shared.

Lab results from your parcel(s), have **detected** the presence of clubroot and therefore Pembina will be utilizing a designated soil handling crew specifically for clubroot positive fields. Where deemed necessary additional mitigations may be utilized (mechanical clean, wash and disinfect) to reduce the potential of transmitting the soil infection to unaffected fields.

Should you have any further questions or concerns that you would like to discuss the results or the clubroot management approach with our Pembina Environmental Advisor, please don't hesitate to call, to arrange a follow up discussion.

Signed by Land Representative

July 2016



July 5, 2016

'Landowner Address'

RE: SW XX-XX-XX W5 and NE XX-XX-XX W5

Dear XXXX:

Pembina Pipeline Corporation (Pembina) is notifying you the construction of the 'Project' is planned to be initiated in Q3 2016.

Pembina has retained a consultant to assist in the development of a Clubroot Management Plan (the Plan). The Plan will provide guidance to Pembina and its contractors during the pipeline pre-construction, construction and post-construction reclamation and operational activities, to mitigate the risk of clubroot transmission between fields. The protocols include a combination of mechanical cleaning, washing and disinfecting, and mobilizing dedicated topsoil handling equipment. The Plan includes input from Dr. Steven Strelkov, a professor in plant pathology at the University of Alberta and Dr. Ron Howard, a former Research Scientist at the Crop Diversification Centre, Alberta Agriculture and Rural Development

Pembina would like to thank you for your prior consent, to collect soil samples from your field(s). The report summarizing the soil samples collected from your field(s) is provided in Attachment A. Confidentiality between Pembina and each landowner is of utmost importance and we will only be using this data to manage Pembina related activities on the land as directed in the Plan and not shared.

Lab results from your parcel(s), have **not detected** the presence of clubroot and therefore

Pembina will be utilizing a designated soil handling crew specifically for fields where clubroot was undetected.

Should you have any further questions or concerns that you would like to discuss the results or the clubroot management approach with our Pembina Environmental Advisor, please don't hesitate to call, to arrange a follow up discussion.

Signed by Land Representative

Pembina Clubroot - Sample Report

Legal Land Description:



Legend:

- Clubroot Sampling Site
- Detected
- Bio-security Stations
- Sampled
- Not Detected
- Route
- Sent to Lab
- Null Status
- Parcels

Technical Review: BB

Project Review: TP

Land Owner:

Date: 6/10/2016
Legal ID:

Page 1 of 6
LINC ID: 23042393



Pembina Clubroot - Sample Report

Samples within Parcel

Sample ID:	Composite Sample Result	Sample Date
03182	Not Detected	5/25/2016
03182	Not Detected	5/25/2016
03091	Detected	5/25/2016
03037	Not Detected	5/25/2016
03178	Not Detected	5/25/2016
03178	Not Detected	5/25/2016
03178	Not Detected	5/25/2016
03178	Not Detected	5/25/2016
03180	Not Detected	5/25/2016
03022	Not Detected	5/25/2016
03137	Not Detected	5/25/2016
03161	Detected	5/25/2016
03170	Not Detected	5/25/2016
03037	Not Detected	5/25/2016
03037	Not Detected	5/25/2016
03167	Not Detected	5/25/2016
03167	Not Detected	5/25/2016
03167	Not Detected	5/25/2016
03180	Not Detected	5/25/2016
03022	Not Detected	5/25/2016
03180	Not Detected	5/25/2016
03137	Not Detected	5/25/2016
03161	Detected	5/25/2016
03161	Detected	5/25/2016
03137	Not Detected	5/25/2016
03137	Not Detected	5/25/2016

Date: 6/10/2016

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Legal ID:   

LINC ID: 23042393





Pembina Clubroot - Sample Report

03161	Detected	5/25/2016
03170	Not Detected	5/25/2016
03170	Not Detected	5/25/2016
03182	Not Detected	5/25/2016
03182	Not Detected	5/25/2016
03091	Detected	5/25/2016
03037	Not Detected	5/25/2016
03037	Not Detected	5/25/2016
03178	Not Detected	5/25/2016
03167	Not Detected	5/25/2016
03167	Not Detected	5/25/2016
03022	Not Detected	5/25/2016
03180	Not Detected	5/25/2016
03170	Not Detected	5/25/2016
03170	Not Detected	5/25/2016
03091	Detected	5/25/2016
03091	Detected	5/25/2016
03182	Not Detected	5/25/2016
03091	Detected	5/25/2016
03022	Not Detected	5/25/2016
03180	Not Detected	5/25/2016
03022	Not Detected	5/25/2016
03137	Not Detected	5/25/2016
03161	Detected	5/25/2016

Date: 6/10/2016

Legal ID:  

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LINC ID: 23042393



Pembina Clubroot - Sample Report

Sample Photos



Sample: 03178



Sample: 03091

Date: 6/10/2016
Legal ID: [REDACTED]

Page 4 of 6
LINC ID: 23042393



Pembina Clubroot - Sample Report

Bio-security Station Photos



Parcel: 23042393 Exit



Parcel: 23042393 Entry

Date: 6/10/2016
Legal ID: [REDACTED]

Page 6 of 6
LINC ID: 23042393



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Appendix C

Sample Clubroot Sign Off Form

SURERUS CLUBROOT MANAGEMENT PLAN SIGN OFF

Thank you for completing the Orientation for the Pembina Namao to RFS Project.

Please acknowledge below with signature, your understanding of the Surerus Clubroot Management Plan in that:

- All landowner information related to the clubroot plan is confidential
- You understand what is necessary to comply with and execute successfully, the clubroot plan
- Failure to comply with the clubroot plan will terminate your employment on the Pembina Namao to RFS Project.

Date: _____

Print Name: _____

Signature: _____

Surerus Representative: _____

Appendix D

Personal Clubroot Cleaning Protocol

Pembina Personal Clubroot Cleaning Protocol

Clubroot Overview

Clubroot is a soil-borne disease, which is found in canola, mustard and other crops in the cabbage family (broccoli, Brussels sprouts, cabbage, cauliflower, radish, and turnip). The disease restricts the absorption of water and nutrients to the plant, which decreases crop yield and quality. Resting spores are capable of surviving in soil for up to 20 years, which can have effects on the lands capacity to produce specific crops. Clubroot is spread mainly through the transport of soil that is infested with spores from field to field. The movement of contaminated soil typically occurs on equipment including: work trucks, off-road vehicles, shovels, farm equipment and footwear.

In all agricultural fields, Pembina is taking a proactive approach in minimizing the spread of clubroot by cleaning all footwear and equipment prior to entering each land parcel. This protocol will be specific to foot or ATV access for pre-construction ground truthing purposes. Pembina employees and contractors will document all cleaning and disinfecting activities, including the date, time, GPS and photographs, with the provided Clubroot Management Form. Certain landowners and municipalities may have specific measures of prevention and may request further action. Always remember to consult Pembina Land Representative prior to commencing work to ensure that the landowner has approved access.

If there are any questions related to this protocol please check with a Pembina Environmental Specialist.

Clubroot Management Procedures

Pembina is following the management plans set forth by Alberta Agriculture and Canadian Association of Petroleum Producers in an effort to decrease the spread of Clubroot spores. The following steps must be taken prior to entering any agricultural parcel;

- Prior to commencing a field program, review available information with respect to previous sampling for clubroot. Should the daily field program include both infected and non-infected fields conduct all activities on non-infected fields before entering infected fields wherever practical.
- Designate a crew lead to be responsible for ensuring that all inspections, cleaning and documentation is carried out each day.
- In advance of commencing daily field program, inspect all equipment and footwear to be sure that is free of any soil and plant material. Where required, send dirty equipment to the local truck or car wash for a Level 2 wash prior to going to site.
- Avoid wet field conditions as much as possible; this includes working in the early morning as the dew will be out and the excess moisture will allow dirt to stick easily.
- Whenever possible, access lands by foot to reduce vehicle (eg. ATV/quad) cleanings.
- Ensure you are cleaning on a site where you will not be re-contaminated (eg. Gravel road/approach).

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- Documentation of procedures performed, must be attached to daily reports.

Level of Cleaning Effort

There are three levels of cleaning activities that are prescribed pending the scenario of land access:

On Foot:

Level 1	Mechanical	Brush any visible soil off rubber boots and hand tools
Level 2	Wash	Wash rubber boots and tools in clean water in large storage bin
Level 3	Disinfect	Spray boots and tools with 1-2% bleach solution and allow to dry for 15 minutes (ensure all appropriate PPE is worn (gloves, protective eyewear and long sleeves)

With an ATV (include footwear and tools):

Level 1	Mechanical	Brush any visible soil off ATV in a safe, secure location (gravel approach/road prior to entry)
Level 2	Wash	Wash ATV at a car wash
Level 3	Disinfect	Spray all equipment with 1-2% bleach solution and allow to dry for 15 minutes (ensure all appropriate PPE is worn (gloves, protective eyewear and long sleeves)

Refer to attached **Flow Chart** on when to implement Level 1, 2 and 3 cleaning.

Preparing the 1-2% Bleach Solution required for Level 3 disinfection:

- When mixing the solution, ensure you are in a well-ventilated area.
- Place the empty Sprayer in the large storage bin to contain possible spills.
- Measure out 1L of Clorox Concentrated Bleach into the Sprayer.
- Add 4L of water to the Sprayer. The solution should be at a ratio of 1:4 to achieve the required concentration. Should regular Clorox be used, reduce water to 3 litres.
- Prepare additional solution as needed.

Applying the Solution:

- Ensure the cap is tightened.
- To begin pressurizing, be sure the shut-off lever is not depressed. Pump the handle up and down in a smooth motion. Operating pressure is reached when pumping becomes difficult, which is no more than 5 – 7 full pumps. *Do not over-pressurize.*
- Determine wind direction. Direct nozzle away from you and squeeze shut-off lever to begin spraying.
- To maintain pressure while spraying, operate pump handle every 8 seconds, or as needed.
- Leave disinfectant solution on off-road vehicles, equipment, tools and footwear for 15 minutes prior to use.
- If there is a possibility of freezing temperatures, bring the solution indoors in a well ventilated area. Do not let the solution freeze.

References:

Alberta Clubroot Management Plan, Alberta Clubroot Management Committee, Revised August 2014. [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex11519/\\$file/140-638-2 WEB.pdf?OpenElement](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex11519/$file/140-638-2_WEB.pdf?OpenElement)

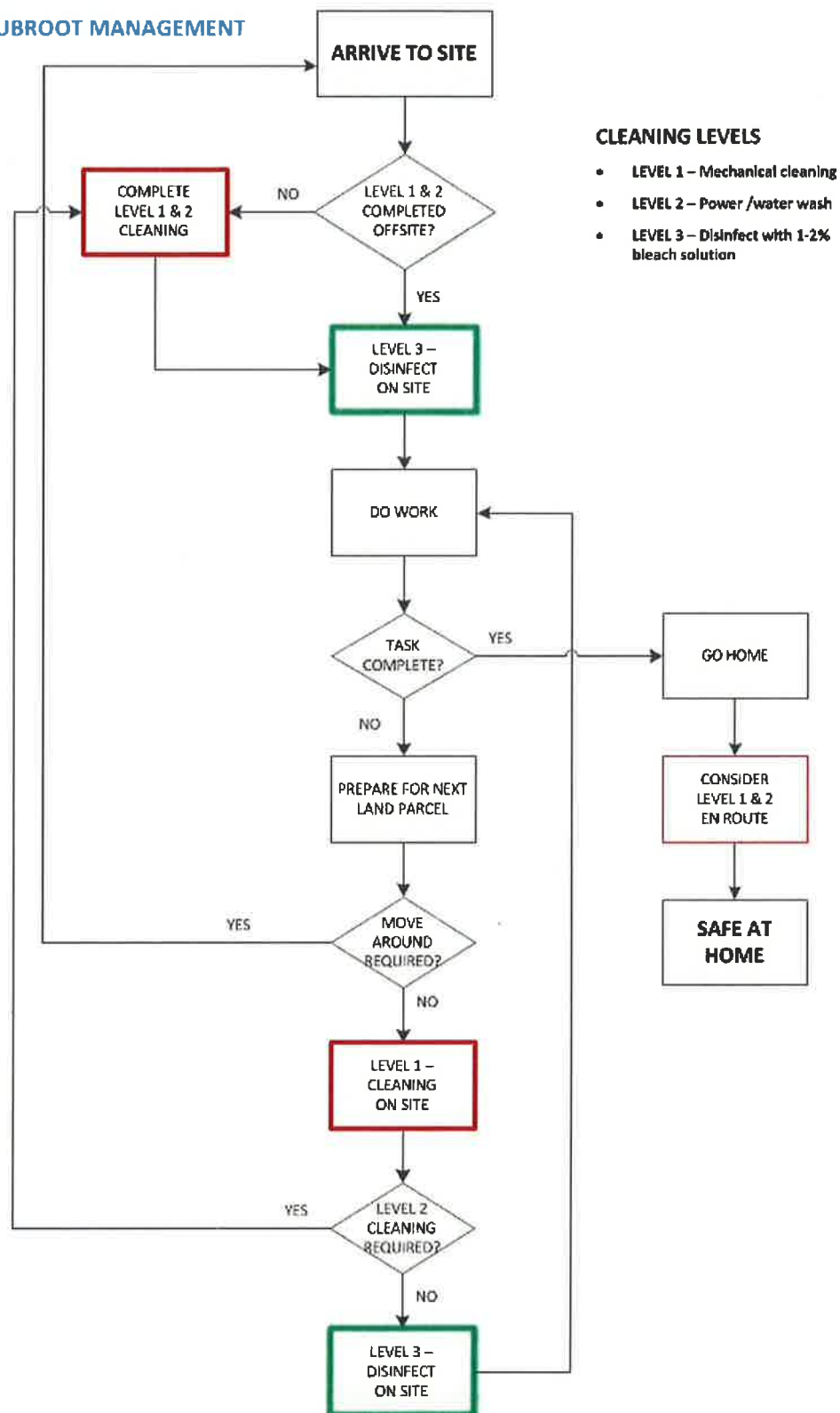
Clubroot Disease Management, Best Management Practices, July 2008.
<http://www.capp.ca/publications-and-statistics/publications/139848>

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Flow Chart for Cleaning

PERSONAL CLUBROOT MANAGEMENT



Clubroot Management Field Verification Document

Clubroot Cleaning Protocol

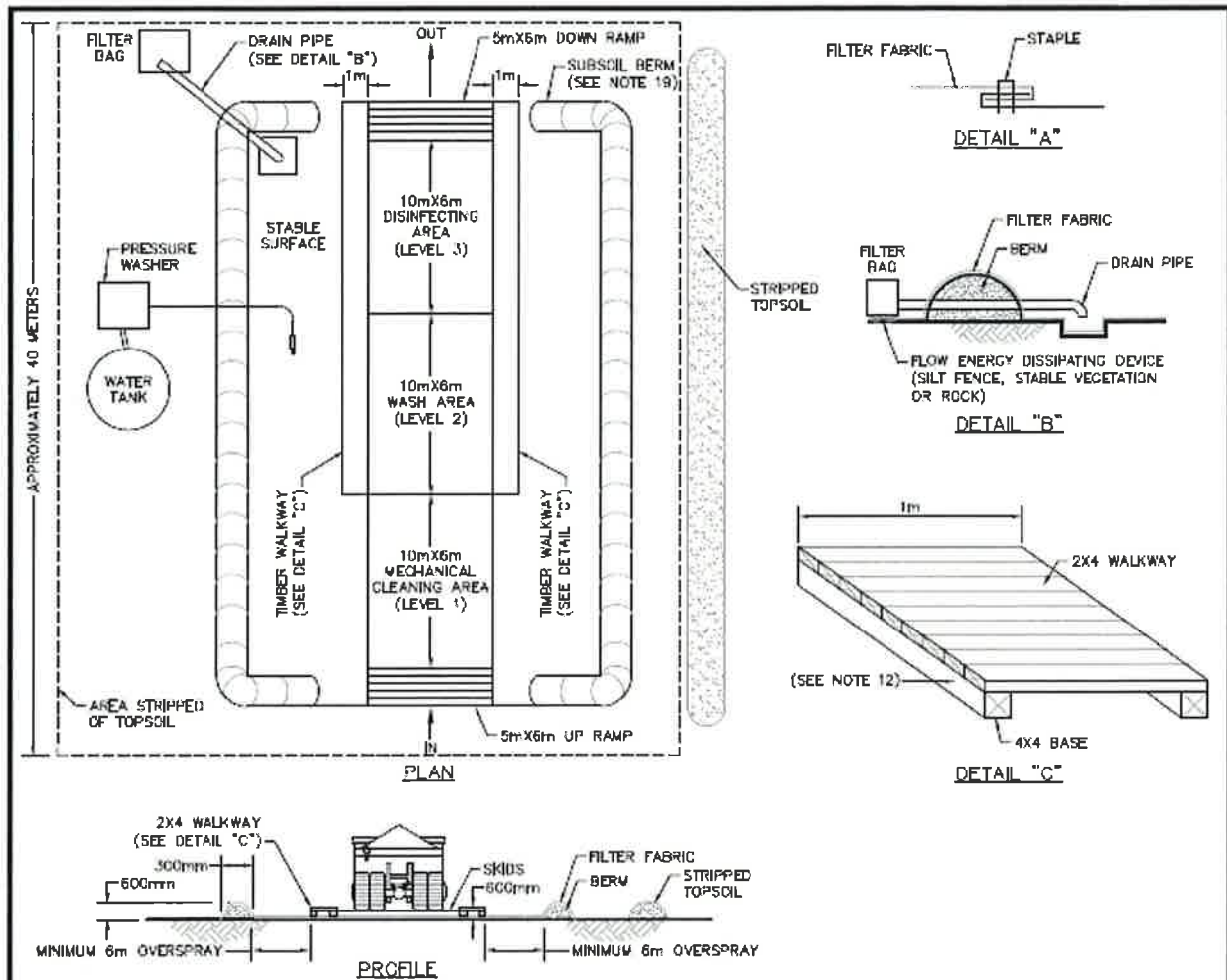
Form must be filled out prior to entering each field in **the White Area of the Project**
*Cleaning executed in accordance with the measures outlined
 in the Personal Clubroot Cleaning Protocol*

Date/Time:		Weather:	
Project Name:		Ground Conditions:	Wet / Moist / Dry
Landowner:		LSD:	
Comments:			
Mark All Items Cleaned Prior to Entry		Mark All Items Disinfected Prior to Entry	
Hand Tools	<input type="checkbox"/>	Hand Tools	<input type="checkbox"/>
Work Boots	<input type="checkbox"/>	Work Boots	<input type="checkbox"/>
PPE	<input type="checkbox"/>	PPE	<input type="checkbox"/>
Quad/ATV	<input type="checkbox"/>	Quad/ATV	<input type="checkbox"/>
Other:		Other:	
	<input type="checkbox"/>		<input type="checkbox"/>
	<input type="checkbox"/>		<input type="checkbox"/>
	<input type="checkbox"/>		<input type="checkbox"/>
G.P.S. Pictures of Cleaning Attached?		G.P.S. Pictures of Disinfecting Attached?	
<input type="checkbox"/>		<input type="checkbox"/>	
Print Name		Signature	
Lead:		Lead:	

Submit all completed forms and attachments to Pembina Environmental Lead at end of field program.

Appendix E

Cleaning Station Design

**NOTES:**

1. ALL EQUIPMENT TO BE DISINFECTED WITH 1-2% BLEACH SOLUTION FOLLOWED BY 15 MINUTE SOAK.
2. ENTIRE AREA INCLUDING APPROACH TO THE STATION AND EXIT AREA MUST BE TOPSOIL STRIPPED AND LOCATED CLOSE TO PARCEL BOUNDARY TO AVOID RECONTAMINATION.
3. 0.6MX0.6M SUBSOIL BERM AROUND PERIMETER EXCEPT FOR ENTRY AND EXIT. EXCAVATE BERM SUBSOIL FROM WITHIN THE STATION.
4. USE ADDITIONAL RAMPS AS REQUIRED TO GAIN SAFE ACCESS UNDER EQUIPMENT.
5. ALTERNATIVES TO SWAMP MATS MAY BE CONSIDERED BY PEMBINA.
6. SIZE OF STATION SHALL BE ADEQUATE TO ACCOMMODATE THE MAXIMUM SIZE OF EQUIPMENT EXPECTED.
7. FILTER FABRIC TO BE INSTALLED AS A CONTINUOUS PIECE AND PLACED OVER THE TOP AND TO THE OUTSIDE EDGE OF THE BERMS AND FIRMLY FASTENED IN PLACE. THE EDGES OF PARALLEL PIECES SHALL BE OVERLAPPED A MINIMUM OF 300MM (SHINGLE STYLE), AND FOLDED OVER (SEE DETAIL A). STAPLE THROUGH THE OVERLAPPED AREA EVERY 300MM.
8. FILTER FABRIC SHALL BE NON-WOVEN POLYPROPYLENE, WITH AN APPARENT OPENING SIZE OF 0.212MM TO 0.30MM, 90KG GRAB STRENGTH, AND 0.23KG/M UNIT WEIGHT, OR BETTER. IN AREAS THAT ARE NOT ROCKY, CONTRACTOR MAY CHOOSE TO USE NON-WOVEN POLYPROPYLENE, 75KG GRAB STRENGTH, AND 0.17KG/M UNIT WEIGHT. ALTERNATIVES MAY BE CONSIDERED BY PEMBINA.
9. TIMBER WALKWAYS SHALL BE BUILT IN SECTIONS FOR EASY RELOCATION AND REMOVAL.
10. TIMBER MATS OR SKIDS ARE TO BE POWERWASHED BETWEEN EACH PIECE OF EQUIPMENT TO REMOVE LOOSE SOIL. PRESSURE WASH SYSTEM MUST BE APPROVED BY PEMBINA.
11. PRIOR TO LEVEL 2 CLEANING/POWERWASH, USE ABSORBENT PADS TO CLEAN MACHINE OF ANY CONTAMINANT (I.E. HYDRAULIC LEAKS, DIESEL).
12. HYDROVAC AREA AS NECESSARY TO PREVENT EXCESSIVE MUD BUILD UP AND SPREAD CONTENTS ON THE SPOIL SIDE ONLY OF THE RIGHT-OF-WAY IN SAME QUARTER SECTION. PEMBINA MAY SPECIFY OTHER REQUIREMENTS FOR DISPOSAL OF WASH SLURRY.
13. WATER USED FOR CLEANING MUST NEVER BE RELEASED WITHIN 100 METERS OF A WATER COURSE OR WETLAND.
14. FILTER FABRIC WILL BE REMOVED TO AN ACCEPTABLE LANDFILL WHEN THE WASH STATION IS DISMANTLED.
15. THE DEPRESSION WILL BE BACKFILLED WITH BERMED MATERIAL. ANY SOILS CONTAMINATED BY PETROLEUM BASED OR OTHER UNDESIRABLE MATERIALS FROM CLEAN OFF STATIONS SHALL BE REMOVED IN ACCORDANCE WITH APPLICABLE REQUIREMENTS. PEMBINA WILL SAMPLE WASTE TO DETERMINE OFF-SITE DISPOSAL REQUIREMENTS.
16. TOPSOIL WILL BE RETURNED AND THE AREA RECLAIMED.
17. CLEANING SITES WILL BE MONITORED DURING THE POST CONSTRUCTION MONITORING PROGRAM AND WEEDS CONTROLLED AS REQUIRED.

Pembina Pipeline Corporation
**CONSTRUCTION TYPICAL
EQUIPMENT WASH STATION**

DR. BY AWM	DATE 24-AUG-2015	FILE NO. A	A.F.E. NO.	DWG. NO. E1.01-16A	REV. NO.
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July 2016



Appendix F

Sanitization Station Checklist

Sanitization Station Checklist

Date	
Legal Land Description	
Parcel ID	
Pembina Representative	
Surerus Representative	
Weather	
General Field Conditions	

The following were inspected after cleaning:

	Yes	No	N/A	Comments
Tires				
Wheel hubs				
Axles				
Bumpers				
Mud flaps				
Truck box				
Vehicle Body				
Front				
Left Side				
Rear				
Right Side				
Undercarriage				
Tracks				
Track Undercarriage				
Sprockets				
Grousers				
Rollers				
Rails				
Blade/Bucket				
Boom				
Was there evidence of hydrocarbon sheen in the sump after washing?				

Level of Cleaning Completed	Pembina Representative Initials	Surerus Representative Initials
Level 1		
Level 2		
Level 3		
Destination of equipment following cleaning?		
Mobilization by trailer?		
Next parcel LSD?		