



Fox Creek to Namao Expansion
Pipeline Project
Clubroot Management Plan

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Cleaning Checklist

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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).

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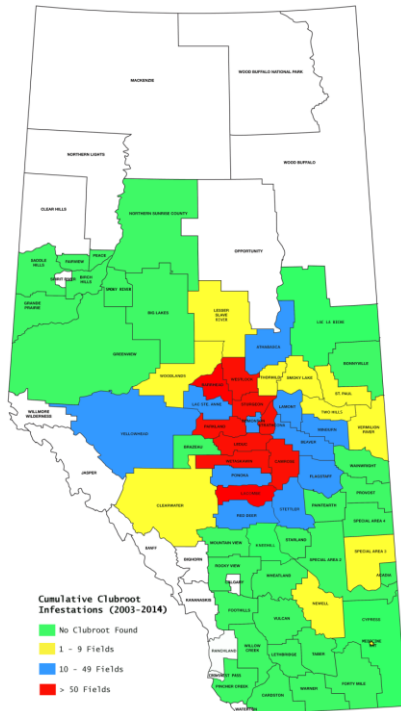


Figure 2: Observations of Clubroot of Canola in Alberta (Strelkov et al. 2014).

3.0 Pre-construction Sampling and Landowner Reports

Prior to conducting field sampling, questionnaires are distributed to landowners to gather information pertinent to that parcel (land use and crop rotations, landowner clubroot management protocols, field entrance locations). This information would be provided on a volunteer basis.

The objective of the pre-construction sampling program is to identify fields that are infected with the clubroot pathogen. 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 for confidential distribution to the respective landowners. The Landowner clubroot sampling report contains:

- Cover letter to landowner describing results of sampling and mitigations for those parcels;
- 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 photograph record for each land parcel and the cleaning protocols.

The results of pre-construction sampling are mapped for information and construction planning purposes. Parcels where clubroot has been detected will be identified by a **red** colour coding. Parcels where clubroot has not been detected will be shown as **green**. This **Red - Green Mapping** is provided to construction management personnel to delineate the status of each parcel and the resultant mitigation to be applied.

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 a level 3 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 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 - 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 Mangement Plan – Compliance/Concordance with the EPP

EPP August 2015 (Rev. 32)	
Issue and Mitigation	EPP Reference
RoW Preparation – Surveying, Access, and Clearing <ul style="list-style-type: none"> • Crop Disease Concerns 	Section 7 7.2, 7.4
Topsoil Salvage and Grading <ul style="list-style-type: none"> ○ reduce topsoil/subsoil admixing; ○ control wind and water erosion of topsoil; • Crop Disease Concerns • Soil Handling Contingency Measures • Grading • Minimum Grade Application • Staging Areas • Soil and Organic Debris • Topsoil Salvage – Depth • Topsoil Salvage – Variable Widths • Topsoil Salvage Width – Full RoW • Topsoil Salvage Width – Trench and Spoil • Topsoil Salvage Width – Trench Plus • Three-lift Soils Handling • Topsoil - Subsoil Separation • Wind Erosion • Sedimentation Control Winter Frozen Soil Conditions – Additional Considerations <ul style="list-style-type: none"> • Topsoil Salvage Width – Trench Plus • Snow Management • Avoid Admixing 	Section 8 8.1.4 8.1.5 8.1.6 to 8.1.11 8.1.12 8.1.14 8.1.15 8.1.18, 8.1.19 8.1.20 8.1.21 8.1.22 8.1.23 8.1.24, 8.1.25 8.1.27 8.1.30 8.1.32 8.2.1, 8.2.2 8.2.5 8.2.6
Backfilling <ul style="list-style-type: none"> • Backfill Trench • Backfill Trench – Three-lift Soils 	Section 10 10.5 – 10.7 10.8
Soil Handling Continency Measures	Section 16 16.1
Soil Erosion Continency Measures	16.2

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 B). • 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 parcels is by the movement of topsoil. Pre-construction surveys (environmental, surveying, hydrovac, line locates) will abide by the Pembina Personal Clubroot Cleaning Plan (Appendix C) to reduce the transfer of topsoil prior to construction.

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

- Utilize Dedicated Topsoil Handling Equipment between parcels with common clubroot detection status (i.e., red or green status); and/or
- Clean and Disinfect Topsoil Handling Equipment when moving from clubroot detected parcels (i.e., red) to non-detected parcels (i.e. green)

5.1 Dedicated Topsoil Handling Crews

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

These crews may be described as:

- “Green crew” will operate on clubroot non-detected parcels; and
- “Red crew” will operate on clubroot detected parcels.

This strategy mobilizes a crew, either red or green, from one grouping of similar land parcels to another. In those situations, topsoil handling equipment will undergo a mechanical cleaning using shovels, brushes and hand tools (Level 1) upon exiting each parcel before being loaded onto low-boy trailers and transported to another area of similar designation (i.e. red parcel or green parcel). Equipment will not be transported from red parcels to green parcels without undergoing Level 3 cleaning before entering the green parcel. Trailers will also be designated to either a green crew or red crew.

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 D.

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 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	Mechanical cleaning with pressure washing
Level 3	Disinfect	Mechanical cleaning, pressure washing and the 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 Parcel to Parcel

Based on the *Red - Green Mapping*, several cleaning scenarios are possible when topsoil handling equipment moves from one parcel to another. When the mobilization of a designated topsoil handling crew (i.e., red crew or green crew) to their respective detected or non-detected clubroot fields is not feasible, a cleaning station may be required.

Figure 3 to Figure 7 illustrate the scenarios of cleaning station placement and the cleaning level required when topsoil handling crews move from parcel to parcel during both the topsoil stripping and replacement phases. Green parcels indicate those that have not tested positive for clubroot and red parcels indicate those where clubroot has been detected. As a minimum, Level 1 cleaning will be conducted between all parcel boundaries and changes in land use.

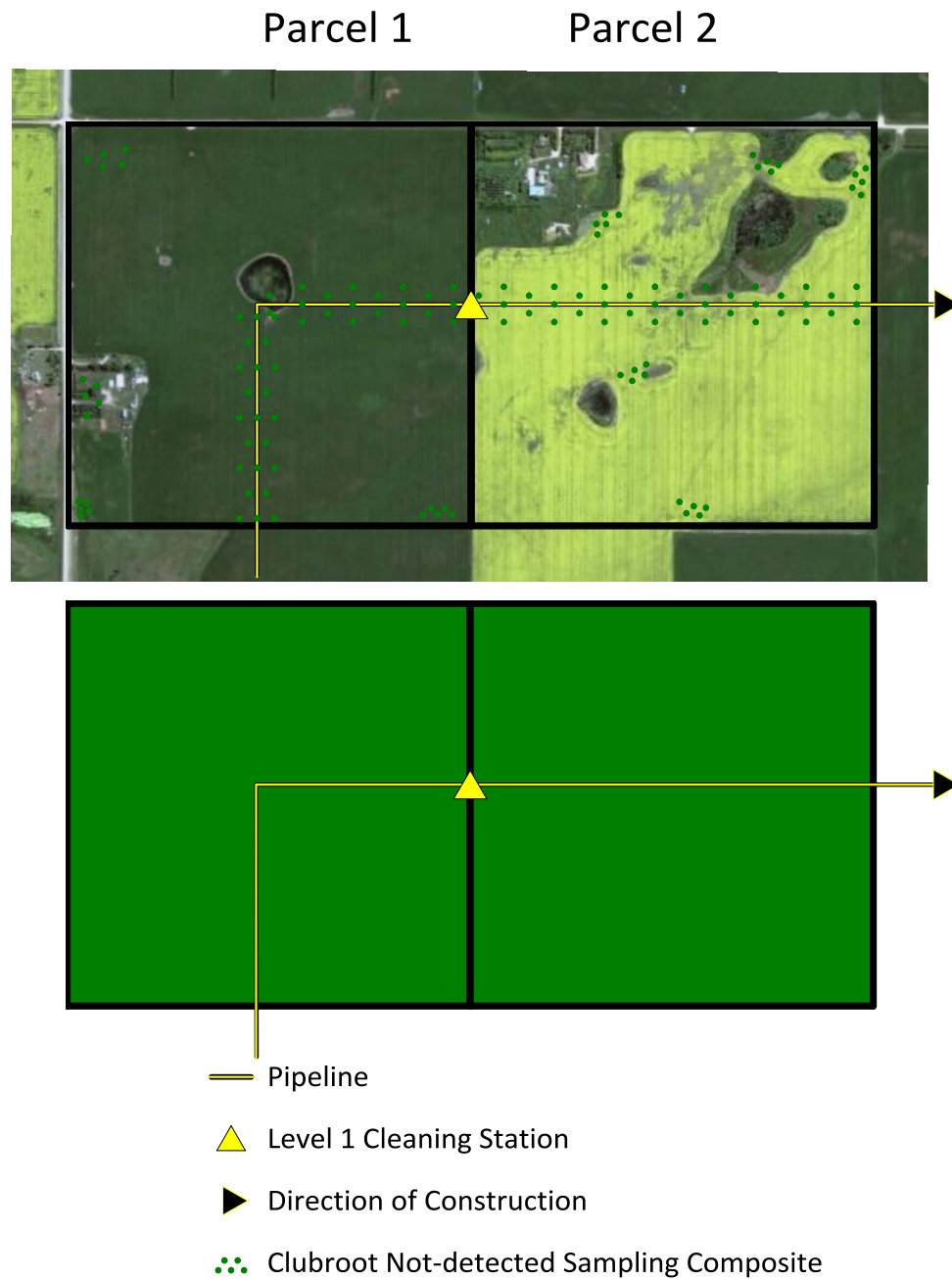


Figure 3: Green to Green – Green Crew Equipment is Moved Between Two Clubroot Non-Detected Parcels. Level 1 Cleaning Station is Required.

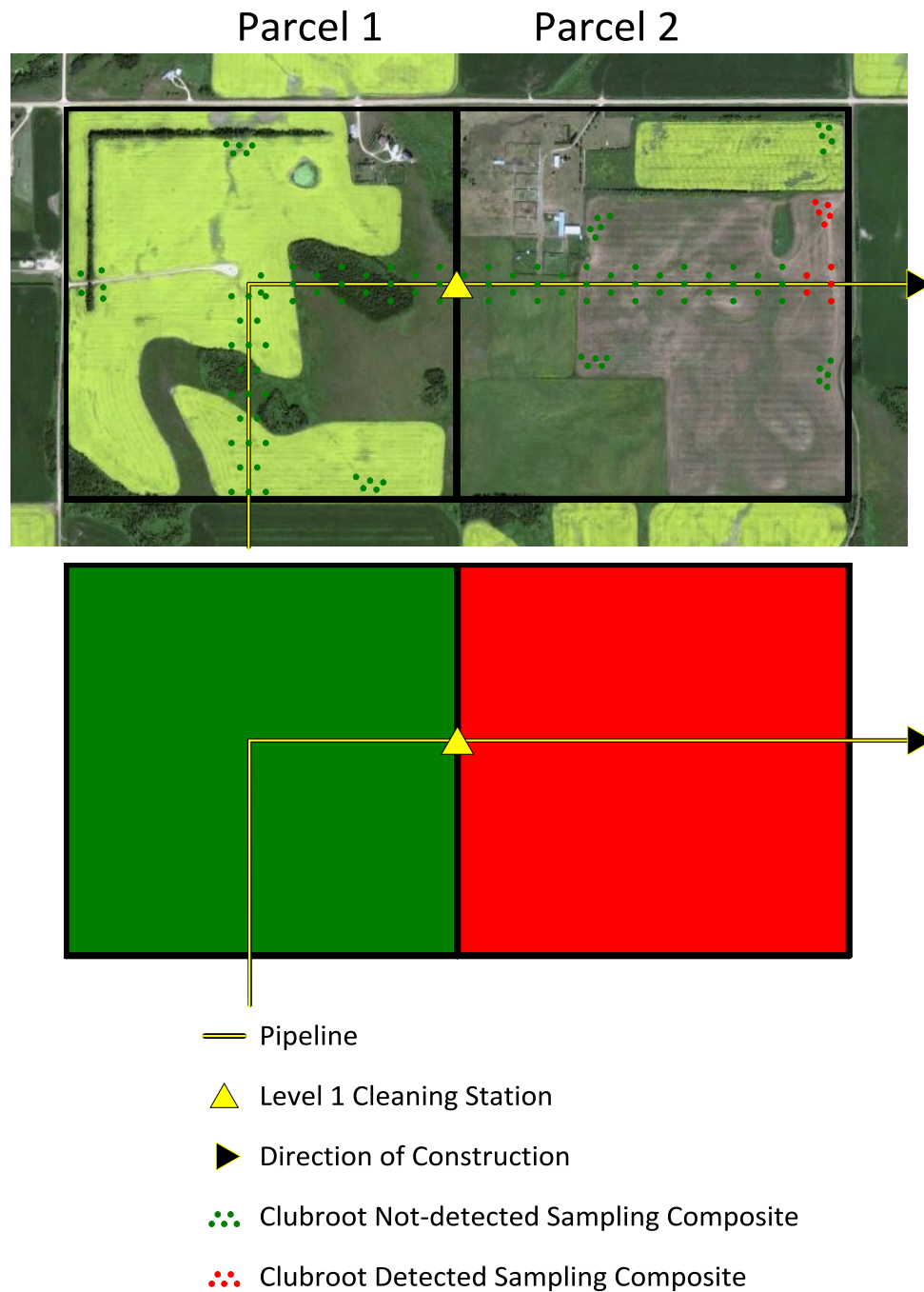


Figure 4: Green to Red – Green Crew Equipment is Moved From a Clubroot Non-Detected Parcel to a Clubroot Detected Parcel. Level 1 Cleaning Station is Required.

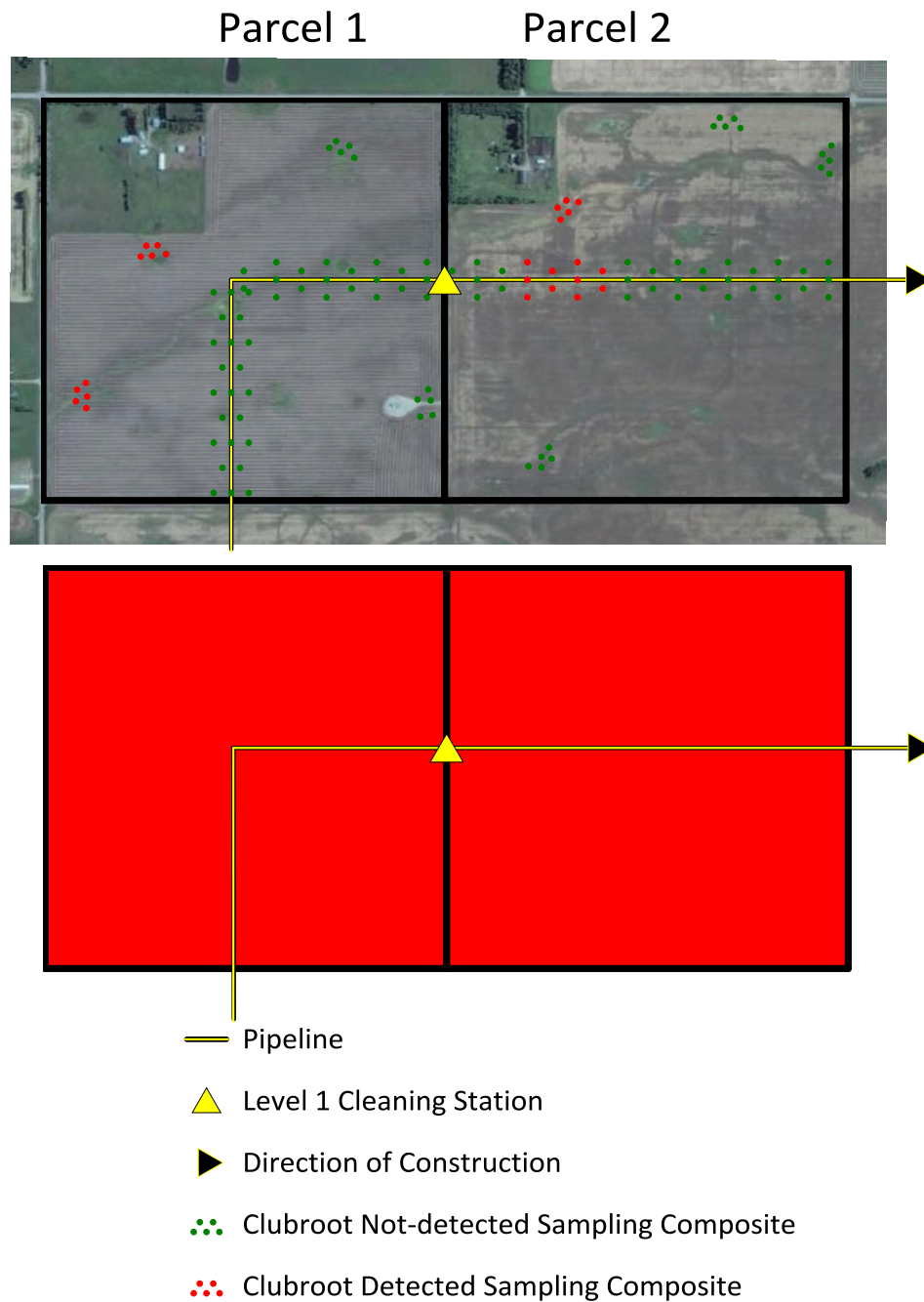


Figure 5: Red to Red - Red Crew Equipment is Moved Between Two Clubroot Detected Parcels. Level 1 Cleaning Station is Required.

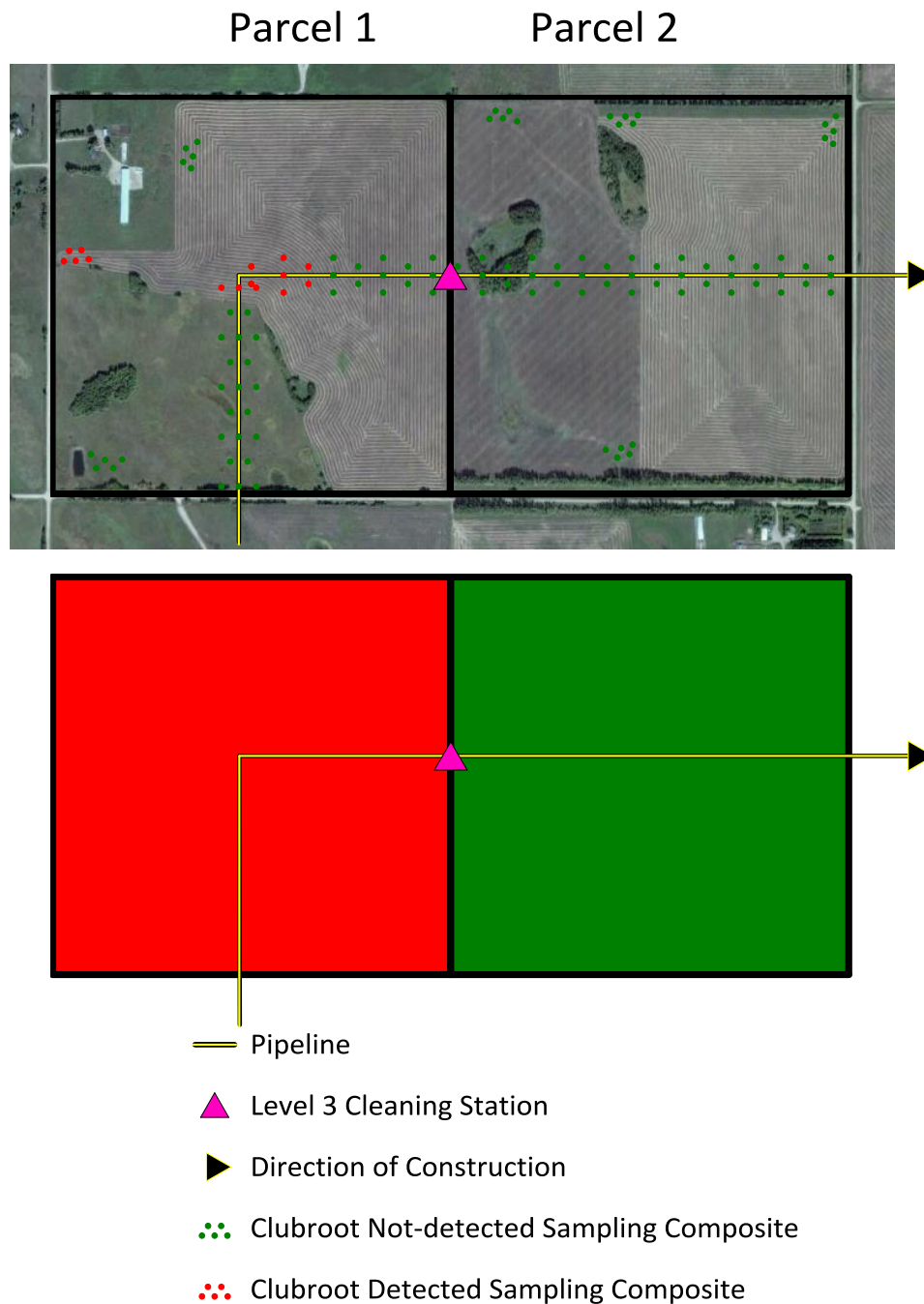


Figure 6: Red to Green - Red Crew Equipment is Moved From a Clubroot Detected Parcel Into a Clubroot Non-Detected Parcel. Level 3 Cleaning Station is Required.

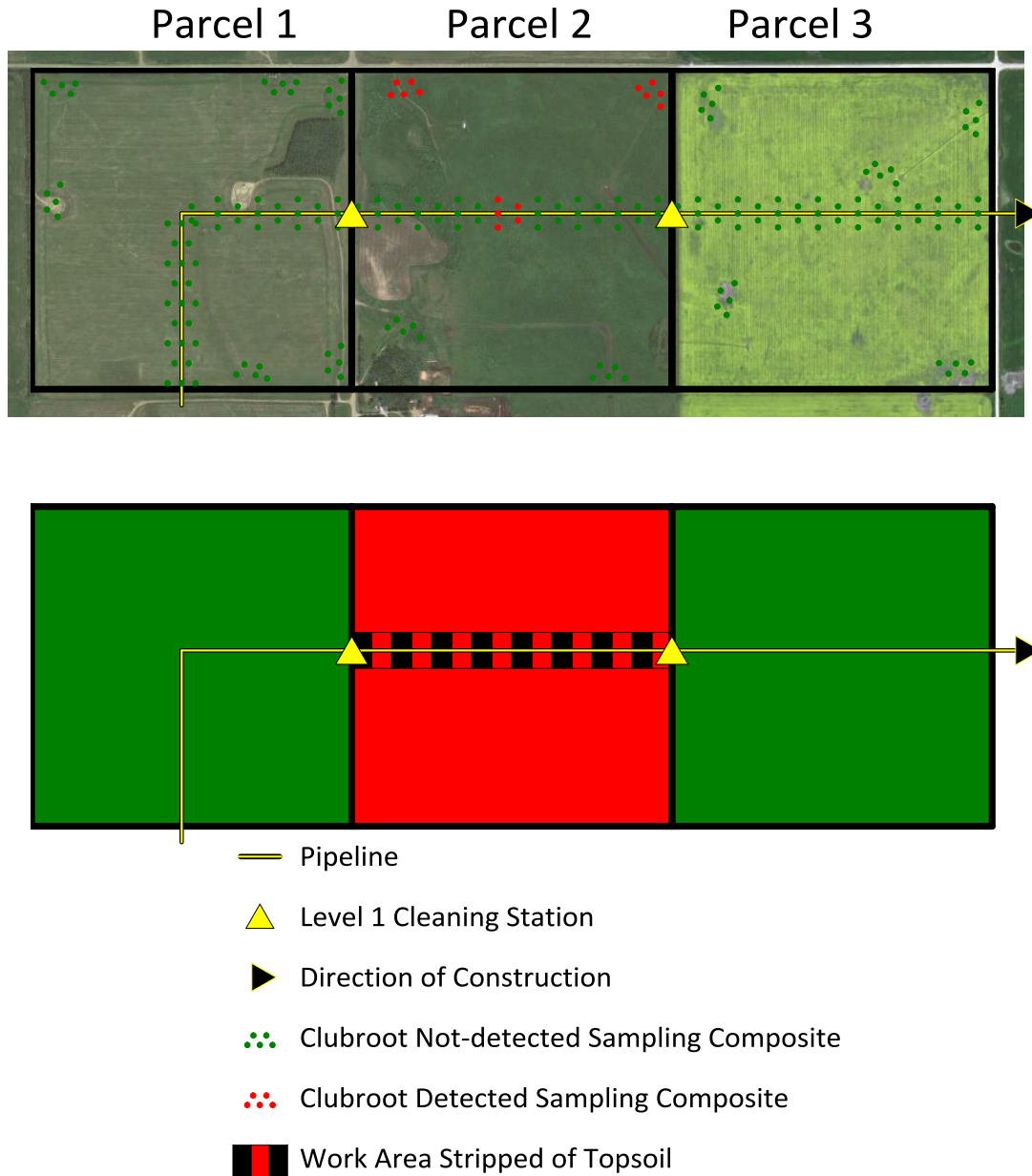


Figure 7: Green to Green Through One Red - Green Crew Equipment is Moved Between Two Clubroot Non-Detected Parcels Separated by a Topsoil Stripped Clubroot Detected Parcel. The removal of topsoil provides mitigation for movement of equipment on subsoil. Level 1 Cleaning Station is Required Between Each Parcel.

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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.
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- 4) 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.
- 5) 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.
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- 7) 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.
- 8) 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.
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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 quarter section. 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 parcel 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 land parcel 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 sample 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.

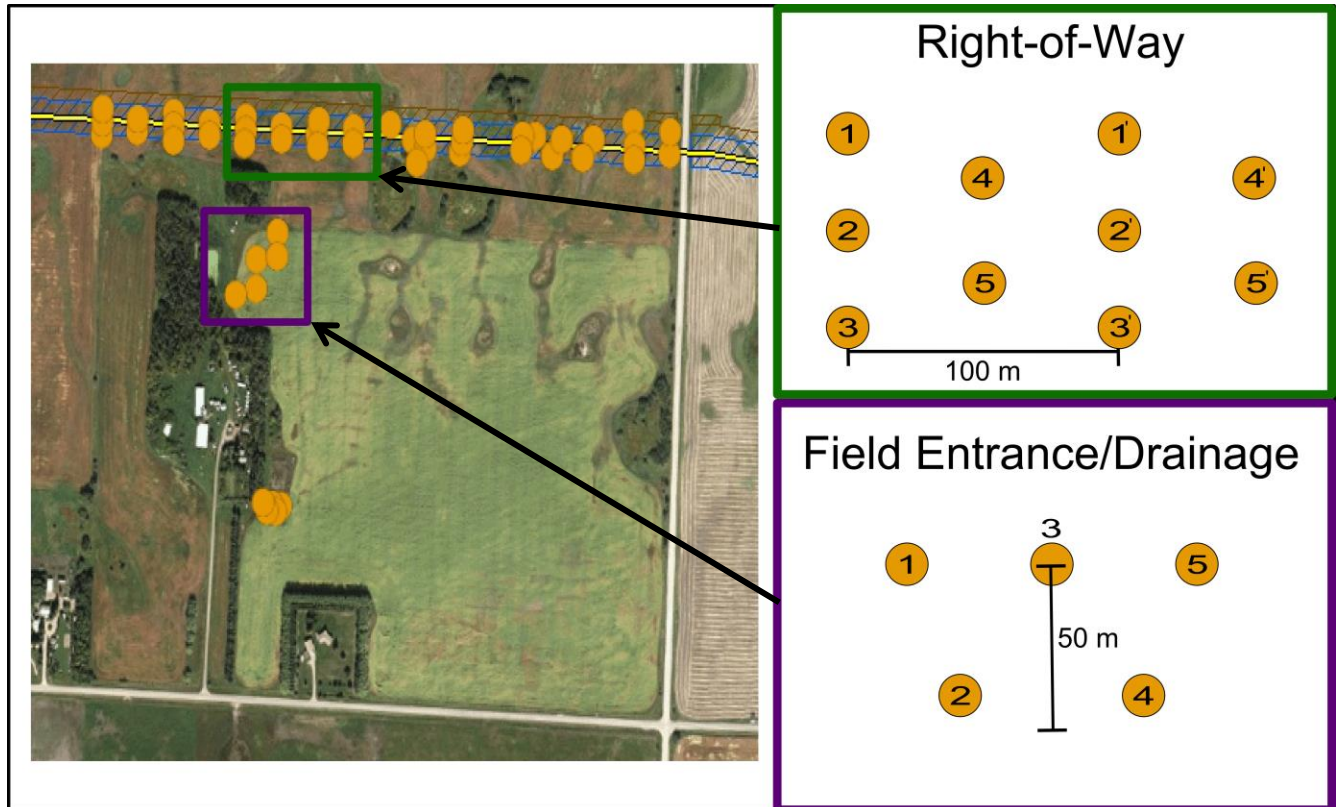


Figure A-1: Illustration of the 'W' sample design used along the right of way, field entrances and drainages.

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 parcel(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 parcel 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 parcels 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.

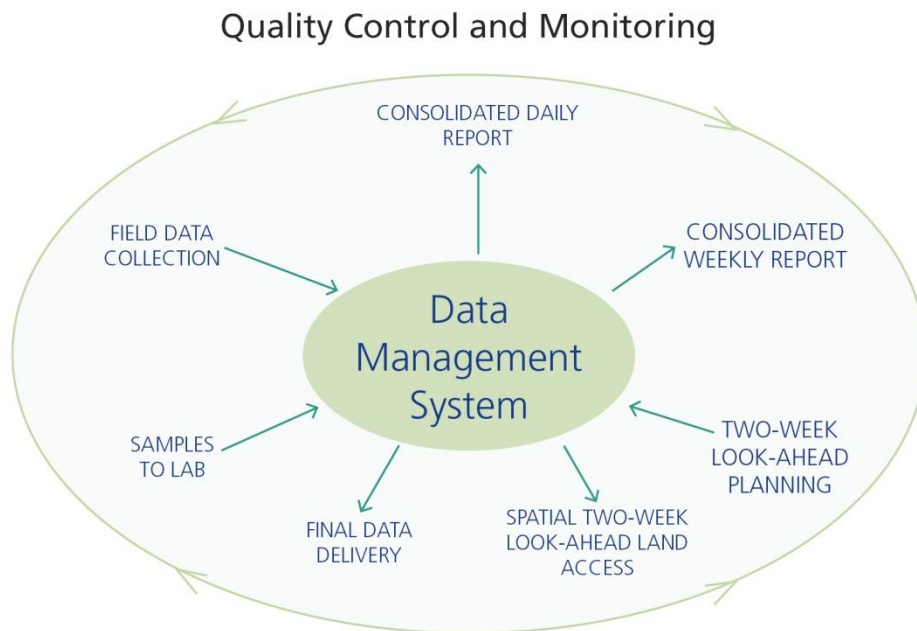


Figure A-2: Quality Control and Monitoring

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.

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 land parcels intersecting the pipeline ROW and workspaces. Detection of clubroot will be displayed on the GIS platform. Parcels where clubroot has been detected will be identified by a red colour coding. Parcels where clubroot has not been detected will be 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

Clubroot Sign Off Form



CLUBROOT MANAGEMENT PLAN SIGN OFF

Thank you for completing the Orientation for the Pembina Project.

Please acknowledge below with signature, your understanding of the Pembina 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 Project.

Date: _____

Print Name: _____

Signature: _____

Contractor Representative: _____

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Appendix C

Personal Cleaning Procedures

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.

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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.

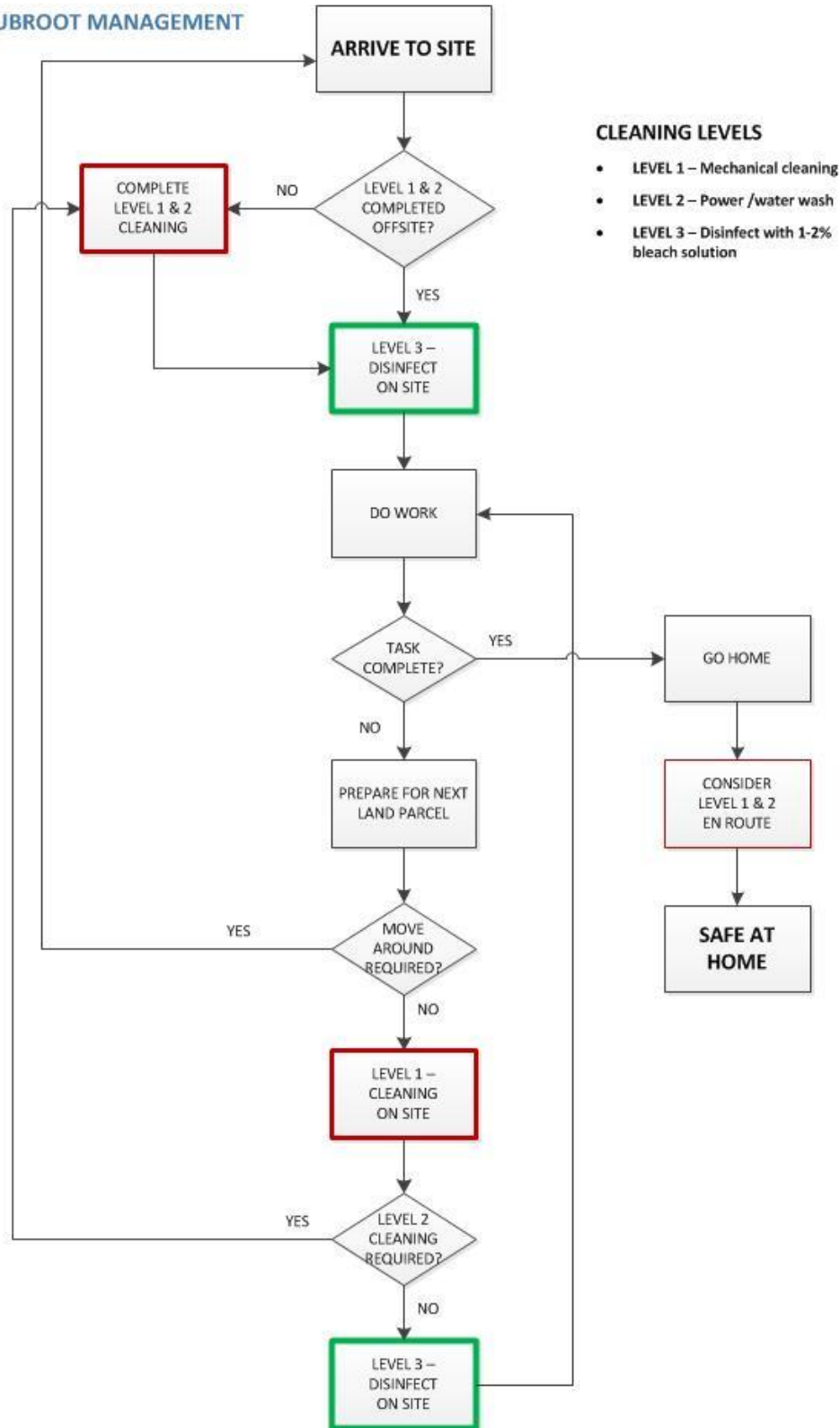
<http://www.capp.ca/publications-and-statistics/publications/139848>

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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

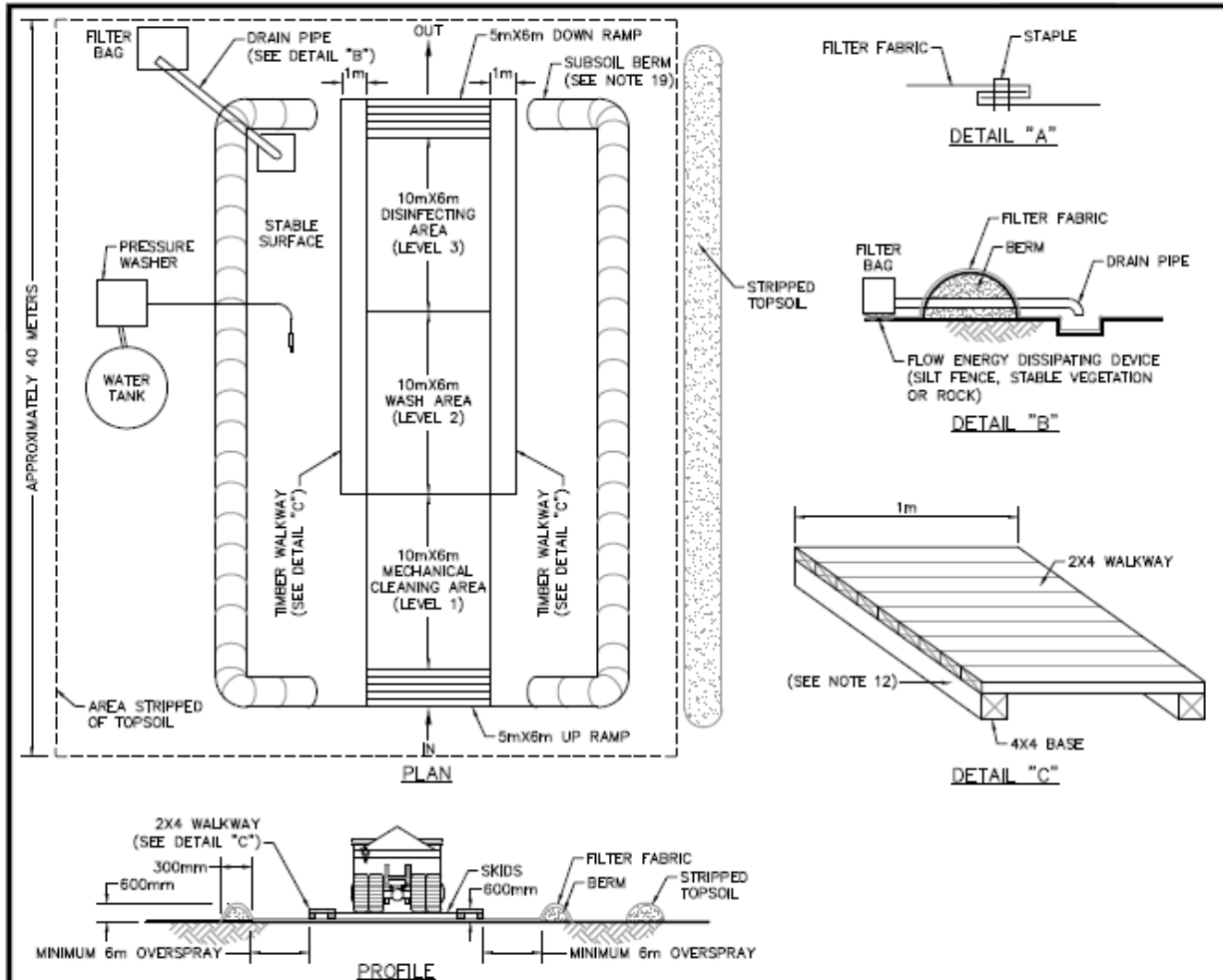
Date/Time:		Weather:	
Project Name:		Ground Conditions:	Wet / Moist / Dry
Landowner:		LSD:	
Comments:			
Mark All Items Cleaned Prior to Entry		Mark All Items Disinfected Prior to Entry	
Hand Tools	<input type="checkbox"/>	Hand Tools	<input type="checkbox"/>
Work Boots	<input type="checkbox"/>	Work Boots	<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 D

Cleaning Station Design

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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 0.150MM, 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.
CHK BY MAM					
APPR. BY ACS	SCALE N.T.S.	PRINT ISSUED FOR REVIEW		SHEET NO. 1114	E

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Appendix E

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?		