Project title:	**Land and Water Management Plan drafting tools for the FMS framework**
Project Reference Number:	FMS007
Research organisation:	Agricultural Reconnaissance Technologies Pty Ltd, Trading as AGRECON
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Australian Government
Sugar Research and Development Corporation

Executive Summary:

During the development of the Sugar FMS program it became apparent that Queensland Government requirements for Land and Water Management Plans were becoming an increasingly significant business concern for many cane growers. The LWMP reporting requirements constitute a sub-set of a broader range of issues that are being addressed within the FMS program.

Furthermore, the image based mapping and reporting functionality of the AgrePRECISE system that will be accessible to every grower that participates in the FMS training program also provides a convenient platform for LWMP reporting. By including additional drafting tools within the existing AgrePRECISE system, two quite different, though complementary, outcomes in relation to LWMP and FMS review, mapping, ongoing monitoring, best practice assessment, reporting and documentation can be achieved in a cost-effective manner using the one convenient and interactive computer based information systems platform. This web-based facility enables canegrowers to enter personal data once, to edit and maintain its currency, to link with a wide array of other data - including imagery, map overlays and biophysical histories - and to generate and readily obtain multiple outcomes from that information.

The first priority of this project was to determine what additional data and functionality was required to facilitate rapid drafting of enterprise specific LWMPs as one outcome of an over-arching FMS program. Additional land and water related issues were identified for attention through supplementary questions within the FMS Review Questionnaire. A unique ranking, rating and coding scheme was used to transform and store responses in a convenient database environment for subsequent analysis and preparation of management plans using an automated LWMP reporting template.

A wide array of primary topographic maps and cadastral data was incorporated into the mapping tool. Negotiations with Queensland Department of Natural Resources and Mines (QDNRM) over access to more expensive imagery, terrain related and other biophysical data are well advanced. Additional functionality was incorporated into the image display and mapping tool to enable canegrowers to locate and digitise field boundaries and a wide range of point, line and area based features as separate overlays. A standard scheme of unique symbols enables users to annotate a pre-determined set of map themes. A generic database has been developed to store geo-linked attributes and farm records in relation to mapped features. The flexibility of this records management system will continue to be improved to accommodate a wide range of crops and agricultural pursuits.

Particular attention has been given to preserving links between issue specific fact sheets, ancillary material and responses to review questionnaires as a basis for automated production of reports, plans and associated map outputs. Geo-referenced imagery, land parcel cadastral boundaries, topographic map features and biophysical data provide a basis for automated compilation and printing of up-to-date maps through a user-friendly interface without having to source or acquire imagery, ancillary map data or technically demanding GIS software.

Policy makers, operations staff and natural resource management assessors from QDNRM continue to provide valuable advice and feedback over statutory requirements, administrative procedures and operational practices for environmental sustainability. Natural resource professionals from CANEGROWERS continue to provide equally valuable advice regarding information access and best practices as well as encouraging caution over unreasonable expectations for environmental outcomes that could jeopardise productivity and profitability. Both parties appreciate the consultative approach that has been taken in canvassing expectations and seeking to identify data sources, functionality and LWMP tools that are practical and beneficial to the environment and community well-being. We attribute successful outcomes and outputs from this project largely to

ongoing advice and detailed commentary from departmental and industry representatives on the focus and wording of individual questions, coding of answers, the format of reports and associated map products.

We have sought advice and received strong support from departmental and industry representatives for an objective, risk-based approach within AgrePRECISE to assessment of farm based practices in relation to LWMP, including an "executive summary" or "report card" to highlight major issues to be addressed, actions that are necessary and implementation time frames. Such a risk-based approach complies with government reporting requirements and approval regimes in Queensland and provides an objective basis for progress towards industry wide environmental compliance and accreditation.

Background:

Many Queensland cane producers are currently required to complete and provide updates on a Land and Water Management Plan in order to obtain ongoing access to irrigation water. The current process to develop these plans is often based on a workshop where questions are answered in writing and maps of important farm features are manually drawn. This is an isolated process not integrally linked to an existing FMS, and the additional information generated for the LWMP is not easily linked back to a broader FMS. Growers often also resent paying QDNRM for the printed base maps and for the assessment process, as it is QDNRM who imposed the requirement, and sometimes must buy the same maps several times for different purposes.

The process is also not very efficient from the perspective of QDNRM. The resulting "plan" is often not a very professional document and can require extensive interpretation by QDNRM staff. There is also no quick way of determining whether any particular application is within the majority that will be readily accepted anyway.

The tools being developed by Agrecon and due to be provided as part of the Sugar FMS program offered the potential to streamline the whole LWMP process, with benefits to all parties.

The LWMP is also the most advanced of the many Queensland government reporting requirements, and others (such as Nutrient and Vegetation Management Plans) are to some degree following the format of LWMP under the One-plan initiative. By developing tools to produce an acceptable LWMP as an outcome of the sugar FMS program the opportunity to add extra reporting requirements should also be achieved quite readily.

Objectives:

1. Provide growers with the relevant information and tools required to draft a LWMP according to Queensland Department of Natural resources and Mines (QDNRM) requirements within a single package that is readily accessible
2. Minimise data entry and LWMP preparation/maintenance time by integrating the information and tools required for LWMP within the broader FMS.

Methodology:

1. Reference map layers

The following digital map data was identified as reasonably accessible from the Queensland government. These datasets were purchased by Agrecon, processed and included within the AgrePRECISE mapping tool:

a) Qld Property Information 2005 CD
b) Land, Vegetation and Water 2005 CD
c) Qld best soils map (Version 1 supplied, to be updated with Version 2 once released)
d) Regional Ecosystems (Version 4 with registered updates supplied, to be updated with Version 5 once released)

Two other datasets were highlighted as being required for LWMP maps, however their variable availability and relatively high cost precluded their inclusion within this project beyond determining their availability for the Central and Burdekin regions. We anticipate that both of these datasets will be included within AgrePRECISE prior to the commencement of the FMS Training program.

a) Recent digital orthorectified air photos - CANEGROWERS have been negotiating with QDNRM to access these where available and this now looks promising through the Rural Water Use Efficiency funding. In addition, several digital photos were ordered over 3 demonstration farms in the Central Region, funded by the local RWUE budget, and another farm is now proposed while awaiting the purchase of broad coverage.
b) Agrecon and CANEGROWERS Mackay have been trying to determine the existence and availability of digital contour mapping and this has now at least been determined for the Central region.

During discussions with QDNRM it has also emerged that the draft LWMP manual for the Mackay region highlights the legislative need for riparian protection zones of differing widths depending upon stream order. The current best digital mapping of streams at 1:100K scale would not appear very precise over the high resolution reference photos. Agrecon is currently determining the resources required to develop a more precise and accurate digital drainage map to be included as a standard layer in the map tool, labelled with stream order and complimented by a pre-drawn buffer width appropriate to the stream order to overlay over the aerial photo.

2. Standard farm layers

The map features required for LWMPs were determined through careful examination of the State and regional guidelines (still under development for the Mackay and Burdekin regions yet). A final list of about 50 layers was determined and has been provisionally agreed to by QDNRM pending some suggested modifications. These have all been included within the AgrePRECISE mapping tool, with unique symbols for both the current and planned version of each layer. Any of these features can be drawn, edited and deleted by the landholder while producing maps required for the LWMP. There are also additional complementary layers available for broader FMS mapping, such as for crop production and farm safety issues.

Whilst not a requirement for this project, the development of standard databases attached to each layer is progressing well with the basic reporting fields for most layers already determined. These will continue to be designed in collaboration with government and industry representatives, including QDNRM with regard to fine tuning the LWMP information requirements and including standard monitoring requirements for future LWMP update reports.

3. Standard map outputs

The AgrePRECISE mapping tool has functionality allowing any map layers to be turned on, any spatial extent to be zoomed/moved to, and a print of the displayed map made. As part of this project a series of standard map templates was also created to simplify this process for growers. Six

maps were initially proposed, however an additional map has been designed following feedback from QDNRM and CANEGROWERS. These maps have a standard format and layout including map numbering, naming and layers referred to in the draft LWMP report along with copyright and data accuracy statements.

4. Review Questionnaire

The Initial Review questionnaire provided as a template for the FMS001 sub-program has also been modified and adapted as an interactive Review Questionnaire within AgrePRECISE, where answers can be digitally stored, edited and used as input to other components of the FMS. This questionnaire was expanded to include more of the information required within the LWMP. Growers completing the questionnaire are first asked which report outcomes are required so that only the required questions are asked. If all report outcomes are selected the full range of questions will be asked and multiple reports, including the draft LWMP, will be produced.

The questions relevant to LWMP have been reviewed by individual growers, CANEGROWERS and QDNRM personnel responsible for LWMP. Feedback to date has been incorporated and there is ongoing revision that is becoming very specific about the types of answer options for individual questions.

An example of the current Review Questionnaire with sample answers entered/selected is attached as Appendix A.

5. Draft LWMP report

A template based on the format of the State Guidelines for LWMP was developed. Where possible, answers to the appropriate questions in the Review Questionnaire are used to include or exclude relevant parts of the report and to automatically insert farm-specific information into the appropriate sections. This is the first stage of producing a farm-specific draft LWMP report in a standard format and requires less work from the landholder to complete.

The second stage of producing a farm-specific draft report, beyond the requirements of this project, is also progressing well. It is hoped that most of this functionality will be operational when the FMS training program commences. Functions includes:

a) reading total area of each crop / irrigation method combination from the landholder's mapped layer to create a crop water use calculation table for each combination – design almost finalised, and expected to be operational in October
b) reading monthly decile rainfall and evaporation values relevant to the property from the nearest 1km^2 grid cell into each crop water use calculation tables, combined with the area of crop to automatically calculate water use requirements – designed, grids currently being developed and expected to be operational in October
c) List of regional NRM plans relevant to the property, automatically determined from the spatial location of the farm – designed and plans identified for the Central region, however determining which targets/outcomes/etc are relevant will take some time
d) Linking information about other mapped features into the report (e.g. capacity and licence number for each bore) – information to be recorded has been designed, but may take some months to implement
e) Potentially linking information about mapped features into the questionnaire and hence the draft LWMP report (e.g. if there are two salinity risk sites the questions about how they are managed should ideally be asked for each site separately) – the desirability and scale for each layer is still being discussed, however the technical implementation should not be difficult once these decisions have been made

An example of the current draft LWMP report with the outcomes from the sample answers entered/selected in the Review Questionnaire sample (Appendix A) is attached as Appendix B.

6. Improved approach

As part of the overall design process it was determined that QDNRM could improve their whole approach to LWMP. Agrecon and CANEGROWERS (regional and Brisbane) have had several meetings with QDNRM to this end and all parties appear pleased with the progress made to date. The objective risk analysis calculator approach within AgrePRECISE has been generally accepted as a very useful tool to credentialise the Sugar FMS program. This will facilitate not only the production of a traditional LWMP report but also an "Executive summary" of risks and how they are being managed/reduced, along with more detail within the report linked to individual Action Plans.

We anticipate that it should not take the sugar industry too long before an accredited Sugar FMS developed using the AgrePRECISE tools will, to some degree at least, be acceptable to QDNRM for their LWMP requirements. Other government reporting requirements in Queensland (such as Management Plans for Nutrient, Drainage, Property Resource, Vegetation, etc) are generally following the guidelines developed for LWMP through the One Plan process so we are confident that the regulatory impost on cane growers will be greatly reduced through the Sugar FMS program.

7. Include the LWMP component within the Sugar FMS training material

The development of the draft LWMP report is really a subset of the broader Sugar FMS functionality. The methods of drawing new map layers, answering the questionnaire and opening the draft report are the same as those already explained for the broader FMS (note that much of this broader training material has yet to be finalised).

Apart from casual reference to additional steps/options that can be completed as part of the FMS the following documents have been drafted specifically for LWMP:

- A list of map layers that must be drawn in order to produce the standard maps required for LWMP
- Fact sheets for many of the additional best management practices and other general questions that appear in the Review Questionnaire only if a draft LWMP report is selected as a desired outcome, although these continue to be improved over time
- A stand-alone guide for growers who have developed their FMS using AgrePRECISE but now wish to update it to produce a draft LWMP

Outputs:

The following outputs were produced from this project. They are all built within AgrePRECISE and have been described in detail above.

1. New layers within the online mapping tool, including standard layers and the ability for landholders to draw their own farm layers required for LWMP in a standard format
2. Interactive Review Questionnaire expanded to include questions and answer options required for LWMP
3. Draft LWMP report template, automatically customised according to answers from the Review Questionnaire
4. Standard LWMP map templates that are easily exported digitally as pdf files and printed

Intellectual Property:

As these tools were developed within the existing AgrePRECISE system the Intellectual Property remains with Agrecon. All datasets purchased for this project were paid for by Agrecon and are licenced to Agrecon, however ongoing licence fees for some datasets may need to be negotiated with the broader sugar industry depending upon how access to AgrePRECISE is funded beyond the initial free period on offer.

Expected Outcomes:

We expect that these tools will enable cane growers who have developed an FMS using AgrePRECISE to quite quickly draw a few extra features on their map, answer a few extra questions, and produce a farm-specific draft LWMP. As many growers will already need to complete a LWMP when they start developing their FMS it is anticipated that they will do both consecutively for little extra effort. This is seen as both a positive outcome for those growers who feel they are being forced to produce a LWMP without real benefits back to them, as the broader FMS information should help them in numerous ways, and as an incentive for growers to adopt a broader FMS.

Future Research Needs:

There is an ongoing need to fine-tune the questionnaire and draft report template, particularly with respect to both regional variations still being developed and changes in QDNRM requirements.

Additional functionality to record and automatically link additional information into the draft LWMP report have been discussed above and will make the whole process even easier for landholders. These will be developed over time by Agrecon as resources permit.

Following the successful implementation of these LWMP tools it is anticipated that there will be demand to include the information requirements for a range of other reports expected from growers. These should be able to be developed at a modest cost, mostly involved in the design and specification of information types, now that the technical functionality is working. Working with government regulators to ensure that smarter methods of reporting that benefit all parties should also be a part of this process.

Recommendations:

1. Agrecon continue to improve the functionality to automatically insert as much information as possible within the draft LWMP report, such as climate data, mapped data and content from regional plans.
2. Representatives of cane growers determine which other reports required of growers are of priority and could be readily added within the same framework, then find resources to facilitate this inclusion
3. The sugar industry continue to negotiate with QDNRM about methods of streamlining the reporting process for LWMP and other similar reports, including the accreditation of the Sugar FMS program. Similar discussions with other regulators should be commenced as determined to be appropriate.

List of Publications:

None.

Attachments

Latest questionnaire and draft report used in meeting this week

Attach example of 7 maps?

Advise Les/Roger we will demo/train them with an SRDC account next Thursday – proof it is operational

Appendix A: Example draft LWMP

Land and Water Management Plan
Draft

for

[Farm name]
[Owner name]

Insert date

Notes for the preparation of the LWMP:

- *This document is provided as a draft template with some of the information relevant to this farm already included. At present this information mostly comes from the answers provided in the completed questionnaire, however the automatic insertion of other relevant information from the farm maps, local climate data and regional plans will be available soon.*
- *Some of this information that has been automatically inserted will need editing to be put in context.*
- *Extra information will need to be added in places, as indicated by italic text such as this. Once the plan is completed all of the italic text should be deleted – it is provided as a guide only.*
- *While this draft includes some of the information required for the final LWMP it is recommended that professional advice be sought to help complete it.*

Contents

1. Property information

1.1 Summary Farm Description

Farm name:	[Farm name]
Owner's name:	[Owners name]
Owner's street/road address:	[Owners address]
Owner's postal address:	[Owners PO]
Owner's phone (office):	[Owners ph.]
Owner's phone (mobile):	[Owners mob. ph.]
Owner's fax:	[Owners fax]
Owner's email:	[Owners email]
Manager's name:	[Managers address]
Manager's street/road address:	[Manager address]
Manager's postal address:	[Manager PO]
Manager's phone (office):	[Managers ph.]
Manager's phone (mobile):	[Managers mob. ph.]
Manager's fax:	[Managers fax]
Manager's email:	[Managers email]
Property street/road address:	[Farm address]
Lot and Plan description:	[Lot and Plan]
Land tenure:	Freehold
Total property area (ha):	100
Area covered by this Plan (ha):	60
Existing irrigation area (ha):	50
Extra irrigation area planned (ha):	10
Existing water entitlement (ML):	500
Extra water entitlement planned (ML):	100

An aerial image and base map of the property is included in Appendix A, Map 1: Property Base Map.

1.2 Permits, Notices and Existing Approvals

The following contracts, including approvals, licences and agreements, affect the property.

Type	Description	Reference	Expiry

List all relevant documents, including type of licence (e.g. irrigation licence), description (e.g. licence from organisation …. to pump …ML per year from bore#1), any reference numbers or codes (e.g. the licence number) and the expiry date if relevant.

2. Landscape Considerations

A map of the farm and surrounding region, showing landscape issues that may affect the property or which the property operations may affect, is included in Appendix A, Map 2: Regional Landscape.

Landscape issues affecting the property

Broader landscape issues and processes that can impact on the enterprise include [Lscape impacts farm].

Describe any processes and issues outside the property that may impact on the irrigation enterprise. This could include:

- *salinity risks*
- *floodplain issues such as development impacts*
- *riparian issues*
- *natural vegetation and biodiversity*

The following regional and local plans affect the farming operations:

List any community natural resource management plans, programs or works being undertaken outside the property that address natural resource management issues that may impact on the property. If applicable, identify issues, targets, outcomes and strategies of the regional plans and show how these have been taken into account in this farm LWMP. Regional plans could include:

- *salinity control programs*
- *catchment management plans*
- *local council flood management plans*

Property impacts on surrounding landscape

Property development that may have an impact on the surrounding environment includes [Farm impacts lscape].

Describe any property development issues or practices that may affect the surrounding landscape, and the likely extent of the impact. Affected landscape features could include:

- *wetlands*
- *mangroves*
- *remnant and other locally significant vegetation*

Property impacts affecting the property

Natural resource issues on the property that have an impact on the enterprise include [Farm impacts farm].

More detail is provided in Section 3, Farm resources, below.

Summarise any natural resource issues on the property that have or may have an impact on your enterprise. This could include:

- *salinity*
- *high and/or rising water tables*

- *erosion*
- *flooding*

3. Farm Resources

3.1 Topography and natural landscape features

A map of the farm topography and natural landscape features is included in Appendix A, Map 3: Farm Topography and Soils. The major features that are relevant to irrigation management are described below.

Springs

Name	Description

Watercourses

Name	Description

Wetlands

Name	Area (ha)	Description

Vegetation

Name	Area (ha)	Description

Add extra rows to each table as required. A table can be deleted if there is no areas with that landscape type on or adjacent to the farm.

Describe broader landform and slope issues, and interrelationships between the topographic and landscape features.

Some of the irrigated land is on the following areas:

- Alluvial plains
- Marine plains

The major landscape risk areas shown on Map 3: Farm Topography and Soils, in Appendix A, are described below:

Soil erosion

Name	Area (ha)	Description

Salinity/waterlogging

Name	Area (ha)	Description

Acid Sulfate Soils

Name	Area (ha)	Description

Add extra rows to each table as required. The table can be deleted if there is no areas with that risk type on or adjacent to the farm. The "Name" is how the landholder refers to

that area, and should be the same as the name given to the area when it was drawn on the map. The description can include the level of degradation or risk.

3.2 Soil types and suitability

The major soil types on the farm are shown in Map 3: Farm Topography and Soils, in Appendix A. Each area is labelled with the Principle Profile Form, where this is known, based on the "Best soils map" from DNRM.

A description of each of these soil types and their land use suitability, based on *(describe the sources of information)*, is attached in Appendix B. A summary of important measures for assessing crop suitability follows:

Soil type	RAW (mm/m)	Infiltration rates (mm/hr)

Of these soil types, the following are currently irrigated or are planned to be irrigated:

Soil type	Crop	Irrigation method	Current area (ha)	Total planned area (ha)

If standard soil fact sheets are not available, describe all soil types to be irrigated according to established standards - plant available water capacity, erodibility, infiltration, rockiness, salinity, wetness, plus other relevant chemical and physical characteristics.

Describe the land use suitability classification for each land use (crop type) on each soil type irrigated, according to established standards.

Describe all soil and landform properties that are a limitation to the chosen land uses.

3.3 Water supply

Groundwater

If groundwater is not used for irrigation, delete the text below and replace with "Groundwater is not used for irrigation"

The following groundwater sources, marked as bores on Map 5: Irrigation Infrastructure, in Appendix A, are used for irrigation:

Bore: *(Insert reference name)*

Depth (m):	
Yield (m/s):	
Water level (m):	
Annual supply (ML):	
Electrical conductivity (EC):	
Sodium Adsorption Ratio (SAR):	
Residual alkali (RA):	
Date of last water quality test:	
Test results:	See Appendix C / No test results available *(delete one)*
Description:	*Include a description of the water quality and how it*

	can affect soils (particularly structure) and the land use, including expected crop yield reductions.

The seasonal depth to shallow water tables can be described as follows:

Wet season: [Depth wet season]m

Dry Season: [Depth dry season]m

Add any other information relevant to groundwater management.

Surface water

If surface water supplies are not used for irrigation, delete the text below and replace with "Surface water is not used for irrigation"

Natural waterways are shown on Map 3: Farm Topography and Soils, in Appendix A.
The following surface water sources are used for irrigation:

Source 1: *(Insert reference name)*

Supplier:	
Annual allocation (ML):	
Announced allocation in recent years (ML):	
Likely allocation this year (ML):	
Electrical conductivity (EC):	
Sodium Adsorption Ratio (SAR):	
Residual alkali (RA):	
Date of last water quality test:	
Test results:	See Appendix C / No test results available *(delete one)*
Description:	*Describe the water quality and how it can affect soils (particularly structure) and the land use, including expected crop yield reductions.*

Treated Effluent

If treated effluent (including grey water or industrial discharge) is not used for irrigation, delete the text below and replace with "Treated effluent is not used for irrigation"

Supplier:	
Annual volume used (ML):	
Licence details:	See Appendix C
Water quality details	See Appendix C
Description:	*Describe the water quality and how it can affect soils (particularly structure) and the land use, including expected crop yield reductions.*

Overland flow

If overland flow is captured and used for irrigation provide details, otherwise write "Overland flow is not used for irrigation".

Mixed Ground/surface water

If using groundwater in conjunction with surface water, describe this use and the expected effect on the quality of irrigation water and crop production. Include:

- *Mixing ratios for groundwater used in conjunction with surface water.*
- *Expected loss of crop productivity (yield reductions) due to poorer quality water.*

4. Farm Design, Layout and Infrastructure

4.1 Current Land Use and Infrastructure

The general land uses and infrastructure of the farm are shown on Map 4: General Infrastructure, and Map 5: Irrigation Infrastructure in Appendix A. This includes both current and proposed features.

Irrigated areas

Furrow irrigation is used on the farm.

Furrow irrigation crop areas include:

Name	Area (ha)	Crop	Row length (m)	Row direction	Grade	Soil types

Describe any design measures intended to address potential degradation of land or water resources from furrow irrigation.

Low pressure overhead irrigation is used on the farm.

Low pressure overhead irrigation crop areas include:

Name	Area (ha)	Crop	Irrigator type	Slope	Soil types

Describe any design measures intended to address potential degradation of land or water resources from low pressure overhead irrigation.

High pressure overhead irrigation is used on the farm.

High pressure overhead irrigation crop areas include:

Name	Area (ha)	Crop	Irrigator type	Slope	Soil types

Describe any design measures intended to address potential degradation of land or water resources from high pressure overhead irrigation.

Drip irrigation is used on the farm.

Drip irrigation crop areas include:

Name	Area (ha)	Crop	Dripper type	Slope	Soil types

Describe any design measures intended to address potential degradation of land or water resources from drip irrigation.

Infrastructure

Describe the main existing infrastructure shown on Map 4 and Map 5.

Describe any measures intended to address potential degradation of land or water resources from farm infrastructure.

4.2 Planned Land Use and Infrastructure

The general land uses and infrastructure of the farm are shown on Map 4: General Infrastructure, and Map 5: Irrigation Infrastructure in Appendix A. This includes both current and proposed features.

Irrigated areas

Planned furrow irrigation crop areas include:

Name	Area (ha)	Crop	Row length (m)	Row direction	Grade	Soil types

Describe the timeframe for the proposed developments. Describe any design measures intended to address potential degradation of land or water resources from planned crop irrigation areas."

Planned low pressure overhead irrigation crop areas include:

Name	Area (ha)	Crop	Bay length (m)	Bay width (m)	Slope	Soil types

Describe the timeframe for the proposed developments. Describe any design measures intended to address potential degradation of land or water resources from planned crop irrigation areas.

Planned high pressure overhead irrigation crop areas include:

Name	Area (ha)	Crop	Irrigator type	Slope	Soil types

Describe the timeframe for the proposed developments. Describe any design measures intended to address potential degradation of land or water resources from planned crop irrigation areas.

Planned drip irrigation crop areas include:

Name	Area (ha)	Crop	Dripper type	Slope	Soil types

Describe the timeframe for the proposed developments. Describe any design measures intended to address potential degradation of land or water resources from planned crop irrigation areas.

Infrastructure

Describe the main planned infrastructure shown on Map 4 and Map 5, including a timetable for the developments.

Describe any measures intended to address potential degradation of land or water resources from farm infrastructure.

4.3 Irrigation system

The irrigated area and infrastructure are shown on Map 5: Irrigation Infrastructure, in Appendix A. This includes both current and proposed features.

The overall irrigation system design considered the following general practices to the extent indicated:

- Irrigation systems used on highly permeable soils are more efficient. - Everywhere
- Irrigation system has capacity to meet peak crop demands. - Always

Add other design practices that you consider relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

A summary of the characteristics of each irrigated crop area is provided in Sections 4.1 (current) and 4.2 (planned) above. Water quality information for each water source is provided in Section 3.3 above.

The following design and development practices are used to manage furrow irrigation crop areas to the extent indicated:

- Furrow irrigated land is laser levelled. - Everywhere
- Soil mapping of high detail is used to determine limitations. - Everywhere
- Irrigation water budgeting is used. - Always
- Irrigation system has capacity to meet peak crop demands. - Always
- Furrow lengths are short if irrigating free-draining soils. - Everywhere
- Furrows are V-shape if irrigating free-draining soils. - Everywhere
- Furrows are compacted if irrigating free-draining soils. - Everywhere

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

The following design and development practices are used to manage low pressure overhead irrigation crop areas to the extent indicated:

- Contour banks are used in steeper crop areas. - Everywhere
- Irrigation water budgeting is used. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

The following design and development practices are used to manage high pressure overhead irrigation crop areas to the extent indicated:

- Contour banks are used in steeper crop areas. - Everywhere
- Irrigation water budgeting is used. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

The following design and development practices are used to manage drip irrigation crop areas to the extent indicated:

- Drip irrigation system is professionally designed and installed. – Everywhere
- Contour banks are used in steeper crop areas. – Everywhere
- Irrigation water budgeting is used - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the irrigation system suits the soil types, slopes, water quality and crops grown. Furrow lengths should account for slopes and soil types or be in accordance with local guidelines. The system should be designed to apply water at rates compatible with soil infiltration rates and soil water holding capacity.

Describe what was considered in selecting the irrigation methods and design, including design capacities of the system.

Where applicable show that the irrigation system accounts for all land types that have different management characteristics.

Describe how the irrigated area is designed to limit erosion (row direction and length, banks, waterways, etc).

Describe any measures intended to overcome deficiencies in the system.

4.4 Pumping, Storage and Distribution

The irrigated area and infrastructure are shown on Map 5: Irrigation Infrastructure, in Appendix A. This includes both current and proposed features.

Describe the type and size of pumps, pipelines, channels and storages.

Describe the capacity of the pumping, storage and distribution system.

Describe how degradation caused by pump installations and associated works is / will be minimised.

Describe how seepage and erosion from channels, pipelines and storages will be prevented, including non-erosive velocity of water flows in channels.

The following design and development practices are used to manage open irrigation channels to the extent indicated:

- Irrigation channels are lined to minimise leakage if required. - Everywhere
- Irrigation earth channel banks have appropriate batter angles to reduce erosion. - Everywhere
- Irrigation earth channel banks are grassed to reduce erosion. - Everywhere

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Above-ground irrigation pipes are used. Irrigation pipes are monitored and managed for leakage. - Everywhere

Underground irrigation pipes are used. Irrigation pipes are monitored and managed for leakage. - Everywhere

For proposed dams or ring tanks describe the design and construction details, how it will be built, associated infrastructure, and how you will minimise or prevent seepage loss, embankment failure, by-wash erosion, and adverse effects on overland flows.

4.5 Field Layout and Erosion Control

The irrigated area and infrastructure are shown on Map 5: Irrigation Infrastructure, in Appendix A. This includes both current and proposed features. A summary of the characteristics of each irrigated crop area is provided in Sections 4.1 (current) and 4.2 (planned) above.

The following farm layout and control structures are used to prevent soil erosion and sediment runoff to the extent indicated:

- Areas needing soil conservation structures have been determined and mapped. - See also Map 3: Farm Topography and Soils, in Appendix A.
- Contour banks are used in steeper crop areas. - Everywhere
- Diversion banks reduce erosive water flowing onto crop land. - Everywhere
- Interceptor drains reduce seepage to crop land with high water tables. - Everywhere
- Other soil conservation structures include: [Other soil con structures]
- Wind breaks and shelter belts are used. - Everywhere

- Tailwater dams, retention ponds and constructed wetlands are used. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the field layout takes variations in slopes and soil types into account.

Describe how the irrigated area is designed to limit erosion (row direction and length, banks, waterways, etc).

Describe current or proposed soil conservation measures to control erosion.

Describe buffer systems and sediment traps in place to filter and capture sediment if erosion occurs.

4.6 Storm water, Drainage and Farm Runoff

The irrigated area and drainage infrastructure are shown on Map 5: Irrigation Infrastructure, in Appendix A. This includes both current and proposed features.

Describe the drainage infrastructure including dams, channels, recycling pits and sumps.

Describe the stormwater containment system and any links with farm storages.

Detail the volume or capacity of all storages and the tailwater and storm water runoff volume that can be stored in these systems. Describe what was considered in determining this volume as well as other design criteria, such as runoff from high-risk areas.

Describe how the volume of water that becomes contaminated runoff is minimised, including soil conservation measures and silt traps. Describe the water quality monitoring sites and program.

The following farming farm design, layout and infrastructure features are used to the extent indicated to help prevent water quality degradation or stream bank instability from storm or irrigation runoff:

- Fertiliser storage areas have adequate weather protection. - Everywhere
- Chemical handling sites are not near water bodies. – Always
- Drains have gentle grassed slopes that are well maintained. - Everywhere
- Stream banks are protected from drain outflow erosion. - Everywhere
- Riparian vegetation meets/exceeds regional recommendations. - Everywhere
- Dense vegetation is maintained along stream banks. - Everywhere
- Riparian vegetation is protected by grass buffer strips. - Everywhere
- Riparian tree cover provides adequate water shading. - Everywhere

Add other practices related to soil conservation, silt traps and runoff control that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

4.7 Flood risk

The known extents of previous floods are marked on Map 3: Farm Topography and Soils, in Appendix A.

Describe the land affected by floods, including frequency, depth, likely flow rate and strategies to manage the impacts of flooding.

Parts of the farm are located on a floodplain. There is a regional floodplain management plan in place.

The following farm design and layout features are used to the extent indicated to help minimise the impacts of flooding:

- Flood-prone areas are protected by flood mitigation structures. - Everywhere
- Drainage works do not alter natural drainage features or impact on groundwater. - Everywhere
- Floodplain structures are consistent with floodplain management plan. - Everywhere
- Floodplain structures avoid diverting flow directly into streams. - Everywhere
- Floodplain structures do not cause erosion. - Everywhere

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

A permit is required to undertake works on the floodplain.

The following percentage of the farm is inundated by floodwater:
Every 1-2 years: 2%
Every 5 years: 5%
Every 10 years: 10%
Less frequently than every 10 years: 87%

5. Farm Management

5.1 Crop Water Requirements

The annual crop water requirements for the proposed irrigation plan are summarised below, for both an average rainfall year and a 10th percentile year (one-year-in-ten dry conditions). Details of the calculations are provided in Appendix D.

Crop	Irrigation method	Area (ha)	Water required in an average rainfall year		Water required in a dry year	
			ML/ha/yr	ML/yr	ML/ha/yr	ML/yr
All irrigated areas						

Note that the "Crop" types listed should include all irrigated land uses, such as cover crops and pasture grasses.

Describe strategies to manage water during wetter and drier years.

5.2 Soil and Erosion Management

The following in-field farming practices are used to the extent indicated to minimise or prevent soil erosion and maintain/improve soil structure and health:

- Harvest trash is retained where possible. - Always
- Minimum tillage is used. - Always
- Controlled traffic systems are used. - Everywhere
- Harvest on very wet soil is avoided. - Always

Minimum tillage during planting generally includes:

- Spraying 1 times
- Ripping 2 times
- Hoeing 3 times

The following information applies to controlled traffic systems used for cane production:

- Row width planted on: [Row width plant cane]
- Cane plants within each row: Triple
- Spacing between plants: [Space between cane plants]
- Harvest wheel base: [Wheel base plant]
- Wheel base for general farm operations: [Wheel base general]

Add other practices that you consider to be relevant, particularly for specific crops. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

More specific information about irrigation practices is provided in sections 5.3 and 5.4 below.

5.3 Irrigation Application

A summary of the characteristics of each irrigated crop area is provided in Sections 4.1 (current) and 4.2 (planned), while the irrigation system design is outlined in section 4.3.

Furrow Irrigation

Furrow irrigation is used. [Furrow irri. description]

The following farming practices are used to manage furrow irrigation applications to the extent indicated:

- Irrigation application accounts for soil type variations. - Everywhere
- Soil moisture is monitored after planting. - Very regularly
- Irrigation scheduling is used. – Always. [Furrow irri. scheduling]

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Overhead Irrigation – low pressure

Low pressure overhead irrigation is used. [Low P irri. description]

The following farming practices are used to manage low pressure overhead irrigation applications to teh extent indicated:

- Irrigation equipment limitations are managed efficiently. - Always
- Irrigation scheduling is used. – Always. [Low P irri. scheduling]
- Irrigation system has capacity to meet peak crop demands. - Everywhere
- Soil moisture is monitored after planting. - Very regularly
- Overhead irrigation is done in favourable weather. - Always
- Irrigation application accounts for soil type variations. - Everywhere
- Overhead irrigation rates are appropriate. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption

Overhead Irrigation – high pressure

High pressure overhead irrigation is used. [High P irri. description]

The following farming practices are used to manage high pressure overhead irrigation applications to the extent indicated:

- Irrigation equipment limitations are managed efficiently. - Always
- Irrigation scheduling is used. – Always. [High P irri. scheduling]
- Irrigation system has capacity to meet peak crop demands. - Everywhere
- Soil moisture is monitored after planting. - Very regularly
- Overhead irrigation is done in favourable weather. - Always
- Irrigation application accounts for soil type variations. - Everywhere
- Overhead irrigation rates are appropriate. - Always
- High pressure overhead irrigators use tapered nozzles at higher wind speeds. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Drip irrigation

Drip irrigation is used. [Drip irri. description]

The following farming practices are used to manage drip irrigation applications to the extent indicated:

- Irrigation equipment limitations are managed efficiently. - Always
- Irrigation scheduling is used. – Always. [Drip irri. scheduling]
- Irrigation system has capacity to meet peak crop demands. - Everywhere
- Soil moisture is monitored after planting. - Very regularly
- Irrigation application accounts for soil type variations. - Everywhere
- Drip irrigation is applied in small amounts frequently. - Always
- Drip irrigation is stopped before deep drainage occurs. - Always

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Other irrigation systems

[Other irri systems]

Add any additional general information about irrigation water application management not included above.

5.4 Irrigation System Performance

Furrow Irrigation

The following farming practices are used for efficient performance of furrow irrigation to the extent indicated:

- Irrigation application accounts for soil type variations. - Everywhere
- Furrow irrigation water progress is monitored. - Always
- Irrigation water quality is regularly monitored. - Very regularly

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the furrow irrigation system is efficient and is checked to maintain system performance.

Overhead Irrigation – low pressure

The following farming practices are used for efficient performance of low pressure overhead irrigation systems to the extent indicated:

- Irrigation pipes are monitored and managed for leakage. - Always
- Overhead irrigation equipment is regularly maintained. – Always. [Low P equip. maint.]
- Irrigation application accounts for soil type variations. - Everywhere
- Overhead irrigation performance is monitored. - Very regularly. [Low P performance monitoring]

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the low pressure overhead irrigation system is efficient and is checked to maintain system performance.

Overhead Irrigation – high pressure

The following farming practices are used for efficient performance of high pressure overhead irrigation systems to the extent indicated:

- Irrigation pipes are monitored and managed for leakage. - Always
- Overhead irrigation equipment is regularly maintained. – Always. [High P equip. maint.]
- Irrigation application accounts for soil type variations. - Everywhere
- Overhead irrigation performance is monitored. - Very regularly. [High P performance monitoring]

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the high pressure overhead irrigation system is efficient and is checked to maintain system performance.

Drip irrigation

The following farming practices are used for efficient performance of drip irrigation systems to the extent indicated:

- Irrigation pipes are monitored and managed for leakage. - Always
- Drip irrigation system is regularly maintained. – Always. [Drip irri. maint.]
- Irrigation application accounts for soil type variations. - Everywhere
- Drip irrigation performance is monitored. - Very regularly. [Drip performance monitoring]

Add other practices that you consider to be relevant. Also add explanations for each practice where appropriate, particularly providing justification for any practices that are rarely or never done and/or a timetable for their planned adoption.

Describe how the drip irrigation system is efficient and is checked to maintain system performance.

Other irrigation systems

[Other irri systems]

Add any additional information about irrigation system operation and maintenance used to achieve efficient performance not included above.

5.5 Chemical, Fertiliser and Fuel Management

Fertilisers

Fertiliser storage sites are marked as “Chemical stores” on Map 4: General Infrastructure, in Appendix A. They are labelled as *(insert name(s) of the site(s) as labelled on the map).*

The following practices are used to manage the transportation and storage of fertilisers, to the extent indicated, to avoid water contamination:

- Minimal fertiliser is stored on the property. – Always
- Fertiliser storage areas have adequate weather protection. – Everywhere

The following practices are used to manage the application of fertilisers, to the extent indicated, to avoid water contamination:

- Soil tests are taken and reviewed for fertiliser planning. - From each soil type in every fallow block
- Leaf analyses are taken and reviewed for fertiliser planning.
- Cover crops such as legumes are used where possible. - Everywhere
- Knowledge of soil nutrition management is maintained.
- Advice is obtained on fertiliser needs.
- Fertiliser applications are timed appropriately. - Always
- Fertiliser is applied close to plants. - Always
- Fertiliser is applied at variable rates across the crop area. - Always
- Fertiliser is applied when rapid uptake will occur. - Always
- Drains have gentle grassed slopes that are well maintained. - Everywhere
- Fertiliser application equipment is maintained, calibrated and checked. - Always
- Fertilizer applications are recorded. - Always
- Fertiliser handling procedures are known and followed
- Soil mapping of high detail is used to determine limitations. - Everywhere

The following more specific practices are used to apply fertiliser to ratoon cane to promote rapid uptake and avoid runoff and water contamination:

- Fertiliser is applied to ratoon cane before shoot emergence:
    - By irrigation
    - By irrigation & cultivation
- Fertiliser is applied to ratoon cane when the canopy is < 30cm high:
    - By irrigation
    - By irrigation & cultivation
- Fertiliser is applied to ratoon cane when the canopy is approx. 50cm high:
    - By irrigation
    - By irrigation & cultivation
- Fertiliser is applied to ratoon cane when the canopy is > 60cm high:
    - By irrigation
    - By irrigation & cultivation

Provide any additional information relevant to fertiliser management.

Agricultural chemicals

Chemical storage sites are marked as “Chemical stores” on Map 4: General Infrastructure, in Appendix A. They are labelled as *(insert name(s) of the site(s) as labelled on the map).*

The following practices are used to manage the transportation and storage of chemicals, to the extent indicated, to avoid water contamination:

- Chemical storage areas are not flood-prone. - Floods less frequently than every 50 years
- Chemical storage areas are away from water bodies. - Everywhere
- Chemical storage areas are fully bunded. - Everywhere
- Chemical storage areas are free of flammable materials. - Always
- Chemical storage areas are fire proof. - Everywhere
- Chemical storage areas have appropriate warning signage. - Everywhere
- Chemical storage areas have appropriate safety information. - Everywhere

- Chemicals are stored apart if incompatible. - Always
- Chemicals are transported safely. - Always

Chemical applications are done by the farm manager, employee(s), contractor(s), others - [Other sprayers].

The following practices are used to manage the application of chemicals, to the extent indicated, to avoid water contamination:

- All Chemical handlers have appropriate accreditation. [Chemical accreditation]
- Licences of chemical application contractors are verified. - Always
- Chemical spray contractors are supervised. - Always
- MSDS are held and maintained for chemicals used. - All
- MSDS are readily available to all chemical users. - Always
- Chemicals are only mixed as required. - Always
- Chemicals of low solubility and persistence are used.
- Chemical application equipment is maintained, calibrated and checked. - Regularly
- Chemicals are applied according to requirements and recommendations. - Always
- Chemical applications are timed appropriately. - Always
- Chemical spray-free buffer areas protect water bodies. - Always
- Chemical spray records are kept as required. - Always
- Chemicals are transported safely. - Always

Provide any additional information relevant to chemical management.

Fuels

Fuel storage sites are marked as “Fuel stores” on Map 4: General Infrastructure, in Appendix A.

The following practices are used to manage the storage of fuels, oils and solvents, to the extent indicated, to avoid water contamination:

- Fuel storage tanks are well maintained.
- Fuel storage tanks are fully bunded. - Everywhere
- Fuel storage areas are free of flamable materials. - Always
- Fuels are stored away from fertilisers and chemicals. - Always
- Oil/solvent storage areas are locked. - Always
- Oil/solvent storage areas are fully bunded. - Everywhere
- Oil/solvent storage areas are free of flamable materials. - Always
- Oxidising agents (chlorine) are stored separately from oils/solvents. - Always

Provide any additional information relevant to fuel management.

Waste Management

The following practices are used to manage waste materials and containers from fertilisers, agricultural chemicals, fuels, oils and solvents to avoid water contamination:

- Used oil is recycled. [Oil recycling]
- Used oil filters are recycled. [Oil filter recycling]
- Used batteries are recycled. [Battery recycling]

- Used tyres are recycled. [Tyre recycling]
- Used drums are recycled. [Drum recycling]
- Used fertiliser bags are recycled. Fertiliser bag recycling]
- Waste materials are stored securely. - Always
- Waste that is non-recyclable is disposed of properly. - Always

Provide any additional information relevant to waste management.

5.6 Riparian Zone Management

The farm has approximately 200m of riparian land, or length of stream bank. Approximately 180m of riparian land is considered to be in a stable condition. Approximately 20m of riparian land is considered to be in an unstable condition. The average width of riparian vegetation is 6m.

The location of waterways and their adjoining riparian land are shown on Map 3: Farm Topography and Soils, in Appendix A.

Describe the riparian areas of the farm, including names of creeks and rivers.

The following farming practices are used to the extent indicated to manage the riparian zone of natural waterways:

- Riparian vegetation meets/exceeds regional recommendations. - Everywhere
- Riparian rehabilitation is done where required. - Everywhere
- Dense vegetation is maintained along stream banks. - Everywhere
- Riparian vegetation is protected from livestock. - Everywhere
- Riparian vegetation is protected from fires. – Always
- Riparian vegetation is protected by grass buffer strips. - Everywhere
- Riparian tree cover provides adequate water shading. - Everywhere
- Chemicals used for spraying water weeds are registered for use in waterways. - Always
- Chemical handling sites are not near water bodies. - Always

Add any additional information about natural waterways management not included above.

5.7 Farm Runoff, Drainage and Water Quality

Refer to your regional guidelines.

5.8 Monitoring and Reporting

The monitoring points on the farm are shown on Map 6: Monitoring Sites, in Appendix A.

The following monitoring is undertaken as part of the farm monitoring program to the extent indicated:

- In salinity / high groundwater risk areas, Irrigation water quality is regularly monitored.
- Soil tests are taken and reviewed for fertiliser planning. - From each soil type in every fallow block
- Leaf analyses are taken and reviewed for fertiliser planning.

- Groundwater levels are monitored. - Regularly. [Gwr level monitoring]
- Groundwater quality is monitored. - Regularly. [Gwr quality monitoring]
- For above-ground pipes: Irrigation pipes are monitored and managed for leakage. - Everywhere
- For underground pipes: Irrigation pipes are monitored and managed for leakage. - Everywhere
- Irrigation water quality is regularly monitored. - Very regularly

6. Other Matters to Consider

Refer to your regional guidelines

Additional sub-sections of section 5 above are included in some regional guidelines for regionally-significant issues and need to be discussed with QDNRM. These include:

- *Floodplain Management*
- *Groundwater and Salinity Management*
- *Acid Sulfate Soils*

7. Acknowledgements

This Plan was drafted with the assistance of templates and information from Agrecon's AgrePRECISE program [*insert version number*] on [*insert date*]. *Add any additional sources of assistance.*

Appendix A. Farm Maps

1. **Property Base Map**
2. **Regional Landscape**
3. **Farm Topography and Soils**
4. **General Infrastructure**
5. **Irrigation Infrastructure**
6. **Monitoring Sites**

Appendix B. Soil Profiles

List the soil types for which fact sheets are attached after this page.

If possible, attach a soils fact sheet for every soil type that occurs on the farm, but at least include those that are irrigated.

Appendix C. Test Results

List the test result sheets that are attached after this page, including reference to the test site location if that is not clear from the test results sheet.

Attach a copy of any water quality test results.

Appendix D. Crop Water Requirements

List each crop type and irrigation method combination for which a crop water requirement table should be calculated and attached after this page. Use the format shown below:

D.1. [*Crop*] water requirements for [*A*] ha [*Irrigation method*] irrigated
D.2. [*Crop*] water requirements for [*A*] ha [*Irrigation method*] irrigated
etc

Attach a crop water requirement calculation sheet for each crop/irrigation method combination based on the template provided.

D.1. [*Crop*] water requirements for [*A*] ha [*Irrigation method*] irrigated

a) In an average rainfall year

Month	Evaporation (mm)	Crop factor	Water required (mm)	Rainfall (mm)	Effective rainfall (mm)	Irrigation required (mm)	Irrigation required (ML)
	E	CF	WR= ExCF	R	ER= Rx0.75	IR(mm)= WR-ER	IR(ML)= IR(mm)x A/100
Jan							
Feb							
Mar							
Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Annual total:							
Crop season (*months*) total:							

b) In a dry year (10th percentile, or 1-in-10 year low rainfall)

Month	Evaporation (mm)	Crop factor	Water required (mm)	Rainfall (mm)	Effective rainfall (mm)	Irrigation required (mm)	Irrigation required (ML)
Jan							
Feb							
Mar							
Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Annual total:							
Crop season (*months*) total:							

Appendix A: Example completed Review Questionnaire

QUESTIONNAIRE

1. Farm Information

Property description

1.1 What are the required report outcomes?

☐Draft FMS Operations Manual

☑Draft QDNRM Land & Water Management Plan

1.2 Property name
[Farm name]

1.3 Who owns the property?
[Owners name]

1.4 Owner's street address
[Owners address]

1.5 Owner's postal address
[Owners PO]

1.6 Owner's telephone number (office)
[Owners ph.]

1.7 Owner's telephone number (mobile)
[Owners mob. ph.]

1.8 Owner's fax number
[Owners fax]

1.9 Owner's email address
[Owners email]

1.10 Who manages the property?

❍Same as owner ⦿Other

1.10.1 Manager's street address
[Managers address]

1.10.2 Manager's postal address
[Manager PO]

1.10.3 Manager's telephone number (office)
[Managers ph.]

1.10.4 Manager's telephone number (mobile)
[Managers mob. ph.]

1.10.5 Manager's fax number
[Managers fax]

1.10.6 Manager's email address
[Managers email]

1.11 Property street/road address
[Farm address]

1.12 Lot and Plan description
[Lot and Plan]

1.13 Land tenure (leasehold or freehold)

❍Leasehold ⦿Freehold

1.14 Total property area (ha):
100

1.15 Existing irrigation area (ha):
50

1.16 Extra irrigation area planned (ha):
10

1.17 Area covered by this Plan (ha):
60

1.18 Existing irrigation water entitlement (ML):
500

1.19 Extra water entitlement planned (ML):
100

Operations overview

1.20 Does the farm have irrigated perennial crops (including pastures)?

☑Yes ☐No

1.20.1 Which crops?

☑Sugar ☑List others
[Irri. peren. crops]

1.21 Does the farm have non-irrigated perennial crops (including pastures)?

☑Yes ☐No

1.21.1 Which crops?

☑Sugar ☑List others
[Non-irri. peren. crops]

1.22 Does the farm have irrigated annual crops (including pastures)?

☑Yes ☐No

1.22.1 Which crops?

☑List others
[Irri. annual crops]

1.23 Does the farm have non-irrigated annual crops (including pastures)?

☑Yes ☐No

1.23.1 Which crops?

☑List others
[Non-irri. annual crops]

1.24 Does the farm run livestock commercially?

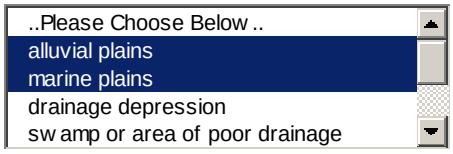
☑Yes ☐No

1.24.1 List them
[Livestock types]

1.25 Summarise the development goals for the coming years
[Development goals]

Landscape considerations

1.26 Is the irrigated land any of the following categories? (hold down the Ctrl key to select more than one)



1.27 Is any of the farm located on a floodplain?

⦿Yes ❍No ❍Unsure

1.27.1 Is there a regional floodplain management plan in place?

⦿Yes ❍No

1.27.1.1 Floodplain structures are consistent with floodplain management plan

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

1.27.2 Do you require a permit to undertake works on the floodplain?

⦿Yes ❍No ❍Unsure

1.27.3 Floodplain structures avoid diverting flow directly into streams

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

1.27.4 Floodplain structures avoid erosive flooding

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

1.28 Is any of the farm subject to flooding?

⦿Yes ❍No ❍Unsure

1.28.1 What percentage of the farm is inundated by floodwater every 1-2 years?

2

1.28.1 What percentage of the farm is inundated by floodwater every 5 years?

5

1.28.1 What percentage of the farm is inundated by floodwater every 10 years?

10

1.28.1 What percentage of the farm is inundated by floodwater more than every 10 years?

87

1.29 Briefly describe natural resource issues on the property that have an impact on your enterprise.

[Farm impacts farm]

1.30 Briefly describe broader landscape issues and processes that can have an impact on the enterprise.

[Lscape impacts farm]

1.31 Briefly describe specific property development that may have an impact on the surrounding environment, the likely extent of those impacts and how they will be managed.

[Farm impacts lscape]

2. Land and Soil Management

2.1 Areas needing soil conservation structures have been determined and mapped.

⦿Yes and present ❍Yes and absent ❍No

2.1.1 Contour banks are used in steeper crop areas

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.1.2 Diversion banks reduce erosive water flowing onto cropland

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.1.3 Interceptor drains reduce seepage to crop land with high water tables.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.1.4 Briefly describe other soil conservation structures used:

[Other soil con structures]

2.2 Acid soil occurrence has been determined and mapped.

⦿Yes and present ❍Yes and absent ❍No

2.2.1 Soil additives or ameliorants are applied if appropriate

⦿Always ❍Mostly ❍Sometimes ❍Never

2.2.2 Briefly describe other acid soil management practices used:

[Other acid soil bmps]

2.3 Salinity / high groundwater risk areas have been determined and mapped.

⦿Yes and present ❍Yes and absent ❍No

2.3.1 Irrigation scheduling is used

⦿Yes ❍No ❍N/A

2.3.2 Drainage plan is designed with local professional advice

⦿Yes ❍No ❍N/A

2.3.3 Irrigation water quality is regularly tested

⦿Yes ❍No ❍N/A

2.3.4 Briefly describe other salinity management practices used:

[Other salinity bmps]

2.4 Acid sulfate soil occurrence has been determined and mapped.

⦿Yes and present ❍Yes and absent ❍No

2.4.1 ASS are managed within an approved drainage management plan

⦿Yes ❍No ❍N/A

2.4.2 Excavator operators are trained in handling ASS and aware of the farm ASS risks

⦿Yes ❍No ❍N/A

2.4.3 Are any drains affected by ASS?

⦿Yes ❍No

2.4.3.1 ASS-affected drains are carefully maintained to prevent acid production

⦿Yes ❍No

2.4.3.2 ASS-affected drains have regular weed control

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

2.4.3.3 ASS-affected drain condition and water quality is monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

2.4.4 Briefly describe other acid sulfate soil management practices used:

[Other ASS bmps]

2.5 Sodic soil occurrence has been determined and mapped.

⦿Yes and present ❍Yes and absent ❍No

2.5.1 Soil additives or ameliorants are applied if appropriate

⦿Always ❍Mostly ❍Sometimes ❍Never

2.5.2 Briefly describe other sodic soil management practices used:

[Other sodicity bmps]

2.6 Harvest trash is retained where possible

⦿Always ❍Mostly ❍Sometimes ❍Never

2.7 Minimum tillage is used

⦿Always ❍Mostly ❍Sometimes ❍Never

2.7.1 Which operations are used during planting and how many times

☑Spray 1 ☑Rip 2 ☑Hoe 3

2.8 Tailwater dams, retention ponds and constructed wetlands are used

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.9 Wind breaks and shelter belts are used

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.10 Controlled traffic systems are used

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

2.10.1 What row width do you plant cane on?

[Row width plant cane]

2.10.2 How do you plant cane within a row?

☐Single ☑Double ☐Triple

2.10.3 What is the spacing between cane plants?

[Space between cane plants]

2.10.4 What wheel base is cane harvested on?

[Wheel base plant]

2.10.5 What wheel base are general cane operations done on?

[Wheel base general]

2.11Harvest on very wet soil is avoided

⦿Always ❍Mostly ❍Sometimes ❍Never

3. Nutrition Management

3.1 Soil tests are taken and reviewed for fertiliser planning

⦿From each soil type in every fallow block ❍From every fallow block ❍Occasionally ❍No

3.2 Leaf analyses are taken and reviewed for fertiliser planning

⦿Yes ❍Yes but needs improvement ❍No

3.3 Cover crops such as legumes are used where possible

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

3.4 Knowledge of soil nutrition management is maintained

⦿Yes ❍Yes but needs improvement ❍No

3.5 Advice is obtained on fertiliser needs

⦿Yes ❍Yes but needs improvement ❍No

3.6 Fertiliser applications are timed appropriately.

⦿Always ❍Mostly ❍Sometimes ❍Never

3.7 Fertiliser is applied when rapid uptake will occur

⦿Always ❍Mostly ❍Sometimes ❍Never

3.8 Fertiliser is applied close to plants

⦿Always ❍Mostly ❍Sometimes ❍Never

3.9 Fertiliser is applied at variable rates across the crop area

⦿Always ❍Mostly ❍Sometimes ❍Never

3.10 Drains have gentle grassed slopes that are well maintained

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

3.11 Minimal fertiliser is stored on the property

⦿Always ❍Mostly ❍Sometimes ❍Never

3.12 Fertiliser storage areas have adequate weather protection

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

3.13 Fertiliser application equipment is maintained, calibrated and checked

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

3.14 Records of all fertiliser applications are kept

⦿Always ❍Mostly ❍Sometimes ❍Never

3.15 Fertiliser handling procedures are known and followed

⦿Yes ❍Yes but needs improvement ❍No

3.16 Detailed soil mapping is used to determine limitations

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

3.17 Is fertiliser applied to ratoon cane before shoot emergence?

..Please Choose Below ..
No
By irrigation
By irrigation & cultivation
By sub-surface placement beside stool (single application)

3.18 Is fertiliser applied to ratoon cane when the canopy is <30cm high?

..Please Choose Below ..
No
By irrigation
By irrigation & cultivation
By sub-surface placement beside stool (single application)

3.19 Is fertiliser applied to ratoon cane when the canopy is approx. 50cm high?

..Please Choose Below ..
No
By irrigation
By irrigation & cultivation
By sub-surface placement beside stool (single application)

3.20 Is fertiliser applied to ratoon cane when the canopy is >60cm high?

..Please Choose Below ..
No
By irrigation
By irrigation & cultivation
By sub-surface placement beside stool (single application)

4. Water Management

Natural waterways

4.1 Does the farm have any land beside waterways or waterbodies (e.g. banks of creeks, rivers, lakes, wetlands)?

⦿Yes ❍No

4.1.1 What is the total length of riparian land (m)? (Measured as the approximate length of water's edge, so if a creek runs through the farm include the length of both banks but if the creek borders the farm count just the one bank)

200

4.1.2 What length of riparian land is stable (little/no evidence of erosion, slumping, etc)

180

4.1.3 What length of riparian land is unstable (areas of bare soil, active erosion, slumping, etc)

20

4.1.4 What is the average width of riparian vegetation (m)

6

4.1.5 Riparian vegetation meets/exceeds regional recommendations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.6 Riparian rehabilitation is done where required

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.7 Dense vegetation is maintained along stream banks

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.8 Riparian vegetation is protected from livestock

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.9 Riparian vegetation is protected from fires

⦿Always ❍Mostly ❍Sometimes ❍Never

4.1.10 Riparian vegetation is protected by grass buffer strips

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.11 Riparian tree cover provides adequate water shading

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.1.12 Only use chemicals registered for use in waterways when spraying water weeds.

⦿Always ❍Mostly ❍Sometimes ❍Never ❍N/A

4.1.13 Chemical handling sites are not near water bodies

⦿Always ❍Mostly ❍Sometimes ❍Never ❍N/A

Groundwater

4.2 Are there any shallow water tables of concern (<2m from the surface normally, or <5m on highly permeable soils)?

⦿Yes ❍No ❍Unsure

4.3 Groundwater levels are monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.3.1 Briefly describe the groundwater level monitoring program:

[Gwr level monitoring]

4.4 Briefly describe the depth to shallow water tables during the wet season:

[Depth wet season]

4.5 Briefly describe the depth to shallow water tables during the dry season:

[Depth dry season]

4.6 Groundwater quality is monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.6.1 Briefly describe the groundwater quality monitoring program:

[Gwr quality monitoring]

Furrow irrigation

4.7 Is furrow irrigation used?

⦿Yes ❍No

4.7.1 Briefly describe (including area of each crop):

[Furrow irri. description]

4.7.2 Furrow irrigated land is laser levelled

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.7.3 Soil mapping of high detail is used to determine limitations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.7.4 Irrigation water budgeting is used

⦿Always ❍Mostly ❍Sometimes ❍Never

4.7.5 Irrigation system has capacity to meet peak crop demands.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.7.6 Irrigation application accounts for soil type variations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.7.7 Soil moisture is monitored after planting

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.7.8 Irrigation scheduling is used.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.7.8.1 Briefly describe (specific to furrow irrigation):

[Furrow irri. scheduling]

4.7.9 Furrow irrigation water progress is monitored.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.7.10 Irrigation tailwater is stored and recycled.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.7.11 Irrigation water quality is regularly tested.

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.7.12 Is there any furrow irrigation on free-draining soils?

⦿Yes ❍No

4.7.12.1 Furrow lengths are short if irrigating free-draining soils

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.7.12.2 Furrows are V-shape if irrigating free-draining soils

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.7.12.3 Furrows are compacted if irrigating free-draining soils

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.8 Are new areas of furrow irrigation planned?

⦿Yes ❍No

Low pressure overhead irrigation

4.9 Is low pressure overhead irrigation used?

⦿Yes ❍No

4.9.1 Briefly describe (including area of each crop):

[Low P irri. description]

4.9.2 Contour banks are used in steeper crop areas.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.9.3 Irrigation water budgeting is used

⦿Always ❍Mostly ❍Sometimes ❍Never

4.9.4 Irrigation equipment limitations are managed efficiently.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.9.5 Irrigation pipes are monitored and managed for leakage.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.9.6 Irrigation scheduling is used.

⦿Always ❍Mostly ❍Sometimes ❍Never

3.9.6.1 Briefly describe (specific to low pressure overhead irrigation):

[Low P irri. scheduling]

4.9.7 Irrigation system has capacity to meet peak crop demands.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.9.8 Overhead irrigation equipment is regularly maintained

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.9.8.1 Briefly describe (specific to low pressure overhead irrigation):

[Low P equip. maint.]

4.9.9 Soil moisture is monitored after planting.

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.9.10 Overhead irrigation is done in favourable weather

⦿Always ❍Mostly ❍Sometimes ❍Never

4.9.11 Irrigation application accounts for soil type variations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.9.12 Overhead irrigation rates are appropriate

⦿Always ❍Mostly ❍Sometimes ❍Never

4.9.13 Overhead irrigation performance is monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

3.9.13.1 Briefly describe (specific to low pressure overhead irrigation):
[Low P performance monitoring]

4.9.14 Irrigation tailwater is stored and recycled.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.10 Are new areas of low pressure overhead irrigation planned?

⦿Yes ❍No

High pressure overhead irrigation

4.11 Is high pressure overhead irrigation used?

⦿Yes ❍No

4.11.1 Briefly describe (including area of each crop):
[High P irri. description]

4.11.2 Contour banks are used in steeper crop areas.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.11.3 Irrigation water budgeting is used

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.4 Irrigation equipment limitations are managed efficiently.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.5 Irrigation pipes are monitored and managed for leakage.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.6 Irrigation scheduling is used.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.6.1 Briefly describe (specific to high pressure overhead irrigation):
[High P irri. scheduling]

4.11.7 Irrigation system has capacity to meet peak crop demands.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.11.8 Overhead irrigation equipment is regularly maintained

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.11.8.1 Briefly describe (specific to high pressure overhead irrigation):
[High P equip. maint.]

4.11.9 Soil moisture is monitored after planting.

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.11.10 Overhead irrigation is done in favourable weather

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.11 Irrigation application accounts for soil type variations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.11.12 Overhead irrigation rates are appropriate

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.13 High pressure overhead irrigators use tapered nozzles at higher wind speeds

⦿Always ❍Mostly ❍Sometimes ❍Never

4.11.14 Overhead irrigation performance is monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.11.14.1 Briefly describe (specific to high pressure overhead irrigation):

[High P performance monitoring]

4.11.15 Irrigation tailwater is stored and recycled.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.12 Are new areas of high pressure overhead irrigation planned?

⦿Yes ❍No

Drip irrigation

4.13 Is low pressure overhead irrigation used?

⦿Yes ❍No

4.13.1 Briefly describe (including area of each crop):

[Drip irri. description]

4.13.2 Drip irrigation system is professionally designed and installed

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.13.3 Contour banks are used in steeper crop areas.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.13.4 Irrigation water budgeting is used

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.5 Irrigation equipment limitations are managed efficiently.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.6 Irrigation pipes are monitored and managed for leakage.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.7 Irrigation scheduling is used.

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.7.1 Briefly describe (specific to drip irrigation):

[Drip irri. scheduling]

4.13.8 Irrigation system has capacity to meet peak crop demands.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.13.9 Drip irrigation system is regularly maintained

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.13.9.1 Briefly describe (specific to drip irrigation):

[Drip irri. maint.]

4.13.10 Soil moisture is monitored after planting.

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.13.11 Irrigation application accounts for soil type variations.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.13.12 Drip irrigation is applied in small amounts frequently

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.13 Drip irrigation performance is monitored

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

4.13.13.1 Briefly describe (specific to drip irrigation):

[Drip performance monitoring]

4.13.14 Drip irrigation is stopped before deep drainage occurs

⦿Always ❍Mostly ❍Sometimes ❍Never

4.13.15 Irrigation tailwater is stored and recycled.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.14 Are new areas of drip irrigation planned?

⦿Yes ❍No

General irrigation

4.15 Are any other irrigation systems used?

⦿Yes ❍No

4.15.1 Briefly describe (including area of each crop):

[Other irri systems]

4.16 Irrigated land has appropriate characteristics

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.17 Irrigation systems used on highly permeable soils are more efficient

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.18 Irrigation system has capacity to meet peak crop demands

⦿Everywhere ❍Most places ❍Some places ❍Nowhere ❍N/A

4.19 Stream-side pump sites are located and maintained to avoid erosion.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere ❍N/A

4.20 Irrigation water of poor quality is used with care

⦿Always ❍Mostly ❍Sometimes ❍Never

4.21 Are open irrigation channels used?

⦿Yes ❍No

4.21.1 Irrigation channels are lined to minimise leakage

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.21.2 Irrigation channel banks have appropriate batter angles to reduce erosion

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.21.3 Irrigation channel banks are grassed to reduce erosion

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.22 Are above-ground pipes used?

⦿Yes ❍No

4.22.1 Irrigation pipes are monitored and managed for leakage

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.23 Are underground pipes used?

⦿Yes ❍No

4.23.1 Irrigation pipes are monitored and managed for leakage

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

Drainage?? Some questions fit better in section 2?

4.24 Flood-prone areas are protected by flood mitigation structures

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.25 Frequently flooded areas are not cultivated

⦿Always ❍Mostly ❍Sometimes ❍Never

4.26 Flood-prone areas have minimum/strategic tillage

⦿Always ❍Mostly ❍Sometimes ❍Never

4.27 Drainage works do not alter natural drainage features or impact on groundwater

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

4.28 Stream banks are protected from drain outflow erosion.

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

8. Pest and Disease Management

Chemical handling and application

8.1 Are agricultural chemicals used on the farm?

⦿Yes ❍No

8.1.1 Who undertakes chemical spray operations on the farm?

☑Manager ☑Employee ☑Contractor

☑Other accredited person (describe)

[Other sprayers]

8.1.1.1 Licences of chemical application contractors are verified

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.1.2 Chemical spray contractors are supervised

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.2 Chemical handlers have appropriate accreditation

⦿All ❍Some ❍None

8.1.2.1 Briefly describe the accreditation:

[Chemical accreditation]

8.1.3 MSDS are held and maintained for chemicals used

⦿All ❍Most ❍Some ❍None

8.1.4 MSDS are readily available to all chemical users

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.5 Only the required amount of chemicals are mixed

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.6 Chemicals of low solubility and persistence are used

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.7 Chemical application equipment is maintained, calibrated and checked

⦿Very regularly ❍Regularly ❍Irregularly ❍Never

8.1.8 Chemicals are applied according to recommendations

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.9 Chemical applications are timed appropriately

⦿Always ❍Mostly ❍Sometimes ❍Never

8.1.10 Chemical spray-free buffer areas protect water bodies

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

8.1.11 Chemical spray records are kept as required

⦿Always ❍Mostly ❍Sometimes ❍Never

9. Infrastructure and Equipment

Fuel/Oil/Solvent storage

9.1 Is fuel stored on the property?

⦿Yes ❍No

9.1.1 Fuel storage tanks are well maintained

⦿Yes ❍No

9.1.2 Fuel storage tanks are fully bunded

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.1.3 Fuel storage areas are free of flamable materials

⦿Always ❍Mostly ❍Sometimes ❍Never

9.1.4 Fuels are stored away from fertilisers and chemicals

⦿Always ❍Mostly ❍Sometimes ❍Never

9.2 Are oils/solvents stored on the property?

⦿Yes ❍No

9.2.1 Oil/solvent storage areas are locked

⦿Always ❍Mostly ❍Sometimes ❍Never

9.2.2 Oil/solvent storage areas are fully bunded

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.2.3 Oil/solvent storage areas are free of flamable materials

⦿Always ❍Mostly ❍Sometimes ❍Never

9.2.4 Oxidising agents (chlorine) are stored separately from oils/solvents

⦿Always ❍Mostly ❍Sometimes ❍Never

Chemical storage and transportation

9.3 Are agricultural chemicals stored on the property?

⦿Yes ❍No

9.3.1 Chemical storage areas are not flood-prone

❍Flood every 10 years or less

❍Flood every 10-50 years

⦿Floods less frequently than every 50 years

9.3.2 Chemical storage areas are away from water bodies

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.3.3 Chemical storage areas are fully bunded

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.3.4 Chemical storage areas are free of flammable materials

⦿Always ❍Mostly ❍Sometimes ❍Never

9.3.5 Chemical storage areas are fire proof

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.3.6 Chemical storage areas have appropriate warning signage

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.3.7 Chemical storage areas have appropriate safety information

⦿Everywhere ❍Most places ❍Some places ❍Nowhere

9.3.8 Chemicals are stored apart if incompatible

⦿Always ❍Mostly ❍Sometimes ❍Never

9.3.9 Chemicals are transported safely

⦿Always ❍Mostly ❍Sometimes ❍Never

Waste Management

9.4 Used oil is appropriately recycled

⦿Yes ❍No

9.5 Briefly describe:

[Oil recycling]

9.6 Used oil filters are appropriately recycled

⦿Yes ❍No

9.7 Briefly describe:

[Oil filter recycling]

9.8 Used batteries are appropriately recycled

⦿Yes ❍No

9.9 Briefly describe:

[Battery recycling]

9.10 Used tyres are appropriately recycled

⦿Yes ❍No

9.11 Briefly describe:

[Tyre recycling]

9.12 Used drums are appropriately recycled

⦿Yes ❍No

9.13 Briefly describe:

[Drum recycling]

9.14 Used fertiliser bags are appropriately recycled

⦿Yes ❍No

9.15 Briefly describe:

[Fertiliser bag recycling]

9.16 Waste materials are stored securely.

⦿Always ❍Mostly ❍Sometimes ❍Never

9.17 Non-recyclable waste is disposed of properly.

⦿Always ❍Mostly ❍Sometimes ❍Never