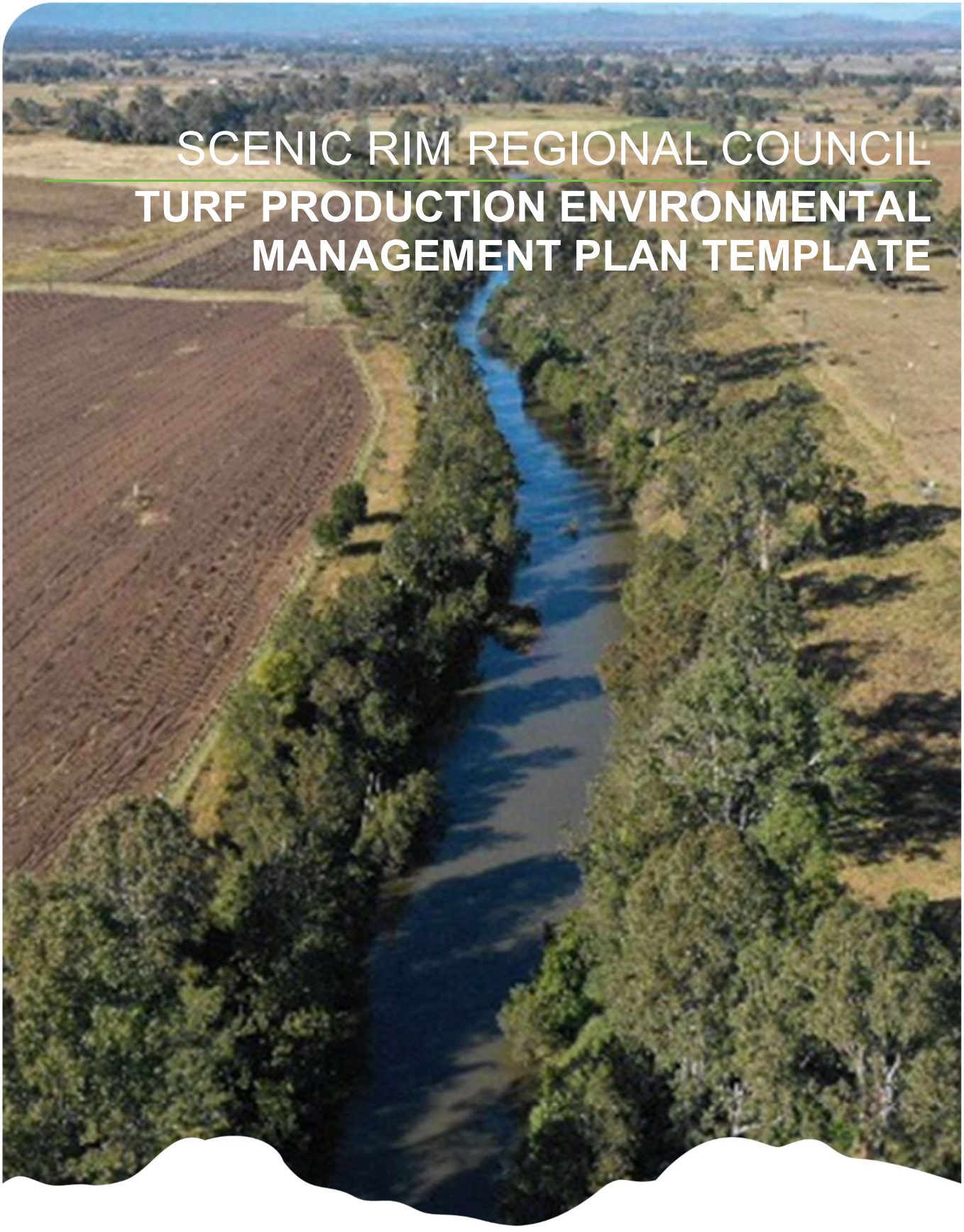


SCENIC RIM REGIONAL COUNCIL

TURF PRODUCTION ENVIRONMENTAL MANAGEMENT PLAN TEMPLATE

SCENIC RIM
REGIONAL COUNCIL

CONTENTS

User guide

Acknowledgements

In development of this Turf Production Environmental Management Plan (EMP) template, the following entities are acknowledged for their contribution:

- All Turf Solutions
- Allenview Turf
- Australian Lawn Concepts
- Australian Sports Turf Association
- City of Logan (Logan City Council)
- Council of Mayors (South East Queensland) (COM(SEQ))
- Engeny Water Management
- Healthy Land and Water
- Jimboomba Turf Group
- Logan Water
- Scenic Rim Regional Council (SRRC)
- Seqwater
- Tinamba Turf
- Turf Queensland

ENGENY

Council of Mayors South East Queensland

CITY OF LOGAN

Introduction

This Turf Production Environmental Management Plan (EMP) template is designed to assist turf producers within the Logan-Albert catchment with the preparation of an EMP. The successful preparation of an EMP will ensure that environmental values relevant to each turf farm are identified, protected and enhanced.

It is highly recommended that this EMP template is used by all turf producers, but particularly by proponents of new turf farms or expansions of existing turf farms where approval under Commonwealth, State and/or local legislation is required. EMPs are often a critical component to development approvals which guide and manage activities, often to avoid environmental harm. The EMP template is not just useful for and during the compliance of environmental approval conditions but also as guidance to comply with general environmental duty.

This EMP template provides general guidance to turf producers preparing EMPs. General guidance is provided on the following:

- Legal and social obligations that turf producers must protect and enhance environmental values
- Identification of potential environmental impacts associated with turf farms and
- Implementation of management measures that will avoid and minimise potential environmental impacts as far as reasonably practicable.

It is noted that the format of individual EMPs may vary from the format presented in this template because of the nature, scale and regulatory context of individual turf farms (e.g. some sections may not be relevant). Furthermore, this EMP template will be revised as the current understanding of social and environmental impacts from turf farms is improved, as legislation and relevant policies are updated, and as research into environmental management measures is progressed.

Why was this EMP template created?

The purpose for the development of the EMP template is to provide guidance and information in supporting the turf industry and to improve environmental practices and land management within the Logan-Albert catchment.

This EMP template has been created as part of the *Resilient Rivers Initiative Regional Strategy 2015-2025* which is a collaboration between the South East Queensland Council of Mayors (COM(SEQ)), the Queensland Government, water utilities, key regional waterway and catchment organisations, and the community. The vision of the strategy is that by 2045, the catchments of South East Queensland will support a resilient, productive, liveable and growing region.

The *Logan-Albert Catchment Action Plan 2017-2020* was completed as part of the Resilient Rivers Initiative and focuses on addressing the high risk of sediment movement from the catchment and its downstream impact on rivers and Moreton Bay. A goal of the action plan is to keep soil on our land and out of our waterways to support agricultural productivity and improve water quality.

Within the Logan-Albert catchment, the mid-Logan reach located between Beaudesert and Cedar Grove Weir is categorised as a high-risk priority area. Turf production is a dominant

land use in this area as well as other areas of the Logan catchment. Many of these farms are in proximity or adjacent to the sensitive riverine environment of the Logan River.

SRRC's Resilient Rivers Initiative Catchment Management Officer, the COM(SEQ) Catchment Investment Program (CIP) manager and a representative from the Australian Sports Turf Association met in 2019 with representatives from Australian Lawn Concepts, All Turf Solutions and local turf farms to discuss the aims and objectives of developing an EMP template for the turf production. These discussions identified an industry need for the EMP template to guide improvements in environmental practices, enable efficiencies in the statutory approvals process and help meet legal and social obligations.

Benefits of using the template

Below are some key reasons why using this template to prepare an EMP is beneficial and highly recommended:

- An EMP is an opportunity to document your business's environmental vision and objectives, as well as to gain a better understanding of your business's legal and social obligations.
- The EMP will identify and document the environmental aspects your business is already addressing and managing as well as outlining the 'baseline' (i.e. current or prior) condition of the land.
- An EMP can assist with achieving better environmental practices. Completion of the template provides an opportunity to critically assess existing practices and identify improvements.
- A properly made EMP can help to identity and address environmental risks in a proactive manner, thereby reducing the risk of high remediation costs associated with unchecked environmental risks, and community and regulatory complaints.
- An EMP is a 'one-stop-shop' for documenting relevant environmental values, risks and management measures.
- This EMP template provides a structured and simplistic approach to identifying and addressing environmental risks associated with individual turf farms.
- An EMP is useful in every stage of farm production (i.e. during planning, design, construction and maintenance/operation phases).
- An EMP can be required as a condition of approval for turf farms.
- A well-developed EMP can help with applications for future grants to fund environmental improvement actions on your property.

How to use this template

This template contains guidance information to create an EMP for your business including the suggested EMP headings and sub-headings for the document. Each section is required to address core aspects of an EMP and inform improved environmental management.

Underneath each heading are text boxes containing instructions, information and links to databases, literature, etc. designed to help the user understand the purpose of each section and how to complete it. Each section also contains guidance information related to specific environmental aspects and their management.

As you complete the EMP template, this section (User guide) should be deleted, and the following items created or updated:

- Title page
- Table of contents
- Lists of tables and figures
- Headers and footers and
- Document control record (update the EMP to a minor version (e.g. 1.1, 1.2) when minor changes are made and to a major version (e.g. 2.0, 3.0) when significant changes are made).

If a section of this template is not relevant to an individual turf farm, it is recommended that the heading or sub-heading be retained with a statement stating why the section is not relevant. This demonstrates that section has been considered and deemed not to be relevant.

If you require assistance or have any questions in relation to this EMP template, please contact the Resilient Rivers Catchment Management Officer on 07 5540 5111.

EMP template

Document control record

Version	*Date*	*Prepared By*	*Reviewed By*	*Approved By*

1 Introduction

1.1 Purpose & scope

ACTIVITY How will this EMP help me achieve this?

Describe the purpose and scope of the Environmental Management Plan (EMP) including why and by whom the EMP has been prepared. Key items to address include:

- If there is a particular purpose the EMP has been completed for (i.e. development approval) or if it has been completed to support ongoing environmental management during operations
- Who is the intended reader/s and who must comply with the management measures outlined in the EMP and
- Who has compiled the plan and their role within the business.

Also, it is important to ensure this section captures the overarching environmental vision and objectives of the business. Prompt questions include:

- What is my future vision for my land and/or my business?

1.2 Limitations

State any limitations that apply, or should apply, to the use of the information in this EMP. This includes any matters in relation to which there is a significant degree or uncertainty or a significant lack of relevant information.

ACTIVITY Disclaimers

This section also provides an opportunity to outline any disclaimers in relation to the use of this EMP. For example, this EMP should be read in conjunction with the development approval in the event of a contradiction between the development approval and this plan, the development approval conditions take precedence.

1.3 Legislation

It is important to note that individual turf farms and the industry are required to comply with certain pieces of environmental legislation. For example, under the *Environmental Protection Act 1994*, everyone in Queensland is legally required to:

- Not carry out an activity that may cause harm without taking measures to prevent or minimise the harm (the 'general environmental duty')
- Inform the relevant authority and landowners when environmental harm has occurred or might occur (the 'duty to notify').

Turf farms may also be required to obtain and/or comply with licences or permits for activities that impact on environmental values, for example extracting water from a river, clearing wildlife habitat and disturbing cultural heritage.

ACTIVITY Legislation, licenses, permits

This is an optional section of the EMP template in which it may be useful to describe if and how your turf farm is required to comply with any legislation, licences or permits. To assist with this, a summary of commonly referred to environmental legislation is provided in Appendix A with the complete catalogue of in force legislation available to view on the Queensland Parliamentary Council website.

Legislation is amended from time to time, so it is important to assess compliance on a regular basis. Contacting the Council planning team is encouraged to assist with ensuring compliance.

2 Administration

2.1 Roles and responsibilities

Assigning roles and responsibilities for implementation of an EMP ensures accountabilities are clearly outlined for environmental management.

ACTIVITY Roles and responsibilities

This section of the EMP should define the roles and responsibilities of personnel in charge of environmental management at the turf farm. The roles and responsibilities of each relevant position should be listed, including the responsibilities of sub-contractors. The names of the responsible personnel do not need to be included position titles are sufficient.

This section is important to demonstrate that the turf producer and those that are required to work in accordance with the EMP understand who is responsible for different key tasks. Some example roles and responsibilities may be:

- Communications and notifications to Council – Manager
- Reporting any environmental incidents – All employees.

ROLE	RESPONSIBILITIES

2.2 Reporting

Environmental reporting is used to understand the condition of various environmental aspects and any changes. Routine reporting can ensure prompt identification of changes and trends which assists with protecting and/or improving environmental management in a proactive manner.

ACTIVITY Environmental reporting

Describe any environmental reporting requirements for the turf farm. Note – this is not suggesting that there are statutory reporting requirements because of completing the EMP, this section will document any existing internal or external environmental reporting processes in place for the turf farm.

Environmental reporting is usually required for two purposes:

- To assist with the effective implementation of the EMP and
- External reporting (e.g. reports for environmental incidents, non-compliances, audits and stakeholders).

The description of reporting requirements in the EMP may include:

- A list of required reports
- The schedule or triggers for preparing each report
- Who each report must be provided to
- An overview of the report content and its uses.

2.3 Environmental training

This section of the EMP should describe the type and scope of environmental training that is available at the turf farm. It is recommended that people involved with the turf farm, including contractors, sub-contractors and visitors, receive environmental training to ensure they understand their environmental responsibilities. The training should be tailored to the role of the individual and may include:

- Understanding the EMP requirements and the individual's role in implementing the EMP
- The potential consequences of not meeting an individual's environmental responsibilities under the EMP
- On-site environmental controls
- Environmental incident and emergency response procedures.

Training can include formal presentations and/or 'toolbox talks' tailored to environmental management. It may also be helpful to refer to any external training that is relevant to certain roles within the farm. For example, external training for herbicide and pesticide application.

ACTIVITY Training records

Training records should be kept and maintained. An example table for record keeping is provided below:

Name of the person receiving the training	*Name of the person conducting the training*	*Date the training was received*	*Summary of the training*

2.4 Emergency contacts and procedures

This section of the EMP should identify the key emergency contacts responsible for managing environmental emergencies associated with the turf farm and their contact details. These personnel should have the power to stop and direct works so that they can effectively manage emergencies. In addition, the EMP should establish procedures for managing environmental emergencies and ensure that those procedures are implemented and maintained.

Potential environmental emergencies and incidents relevant to the turf industry include:

- Spills of hazardous chemicals or substances including fuel, pesticides and herbicides and
- Flooding.

ACTIVITY Emergency contacts

An example table for emergency contacts is provided below:

Environmental Emergency Type	*Emergency Contact*	*Contact Number*
e.g. Chemical Spill		

3 Turf farm description

The intent of this section of the EMP is to provide information about the turf farm as context for Sections 4 and 5 of the EMP.

3.1 Turf farm map

An aerial map of the turf farm and its surrounding environment is often the easiest way to describe the location and key features of the turf farm/s relevant to this EMP.

Maps are useful at visually outlining areas of high environmental value and their proximity to farm operations. This is beneficial to readers to understand the environmental features relevant to their location and roles within the turf farm. In addition to a map, photos of key aspects/areas of the farm are also useful.

It is recommended that the map include the following information:

- Property boundaries
- Growing areas
- Irrigation areas
- On-site drainage channels and water storages
- Off-site water discharge points
- Compost storage areas
- Chemical, fertiliser and fuel storage areas
- Waste disposal/storage areas and
- Key environmental features with the potential to be impacted by turf farm operations (e.g. watercourses, wetlands, vegetation and neighbouring properties).

An example map is shown in Figure 0.2, however the site map created for the EMP should use actual names for the environmental and infrastructure features and surrounding properties.

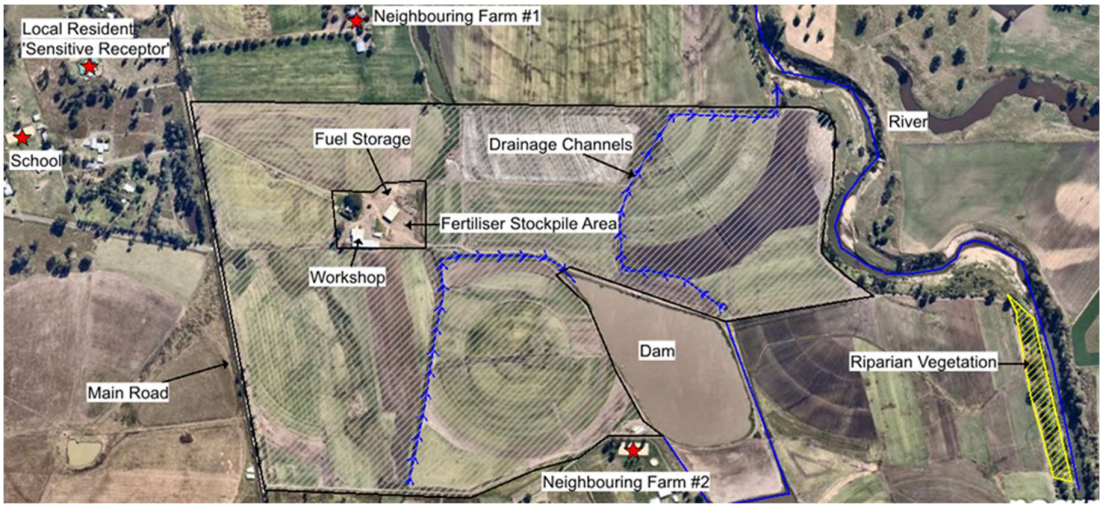


Figure 0.2 Example turf farm map

ACTIVITY Map - Location and key features

MAP

3.2 Turf farm activities

All aspects of turf farming have potential to impact upon the environment therefore it is important to outline the activities undertaken as part of the turf farm to ensure they are assessed and incorporated into the EMP. This will ensure environmental practices and risks are assessed across all aspects of turf operations.

ACTIVITY Current and planned activities

This section of the EMP should list the activities that are or will be undertaken as part of the turf farm. Sufficient level of detail should be provided to understand where and how these activities are completed. Some examples include:

- Planting
- Surface water and groundwater extraction
- Dams, sumps and on-site drainage
- Irrigation
- Fertiliser/organic amendment stockpiling and application
- Pesticide/herbicide application
- Fuel and chemical storage
- Harvesting
- Maintenance of plant and equipment.

For new turf farms and expansions of existing turf farms, the EMP should distinguish between construction and operational activities. A schedule of intended commencement and completion dates should also be provided, including for any construction periods.

3.3 Land use

Understanding the existing and prior uses of the land within and surrounding the turf farm is important to both identify environmental values and outline the 'baseline' (i.e. current or prior) condition of the land.

ACTIVITY Land use

In this section of the EMP, provide a brief description of the previous, current and surrounding land uses (e.g. rural residential, grazing land, cropping land, industrial, commercial, etc.). Some necessary information will include lot on plan, address, tenure and information about any existing roads and easements within or surrounding the site.

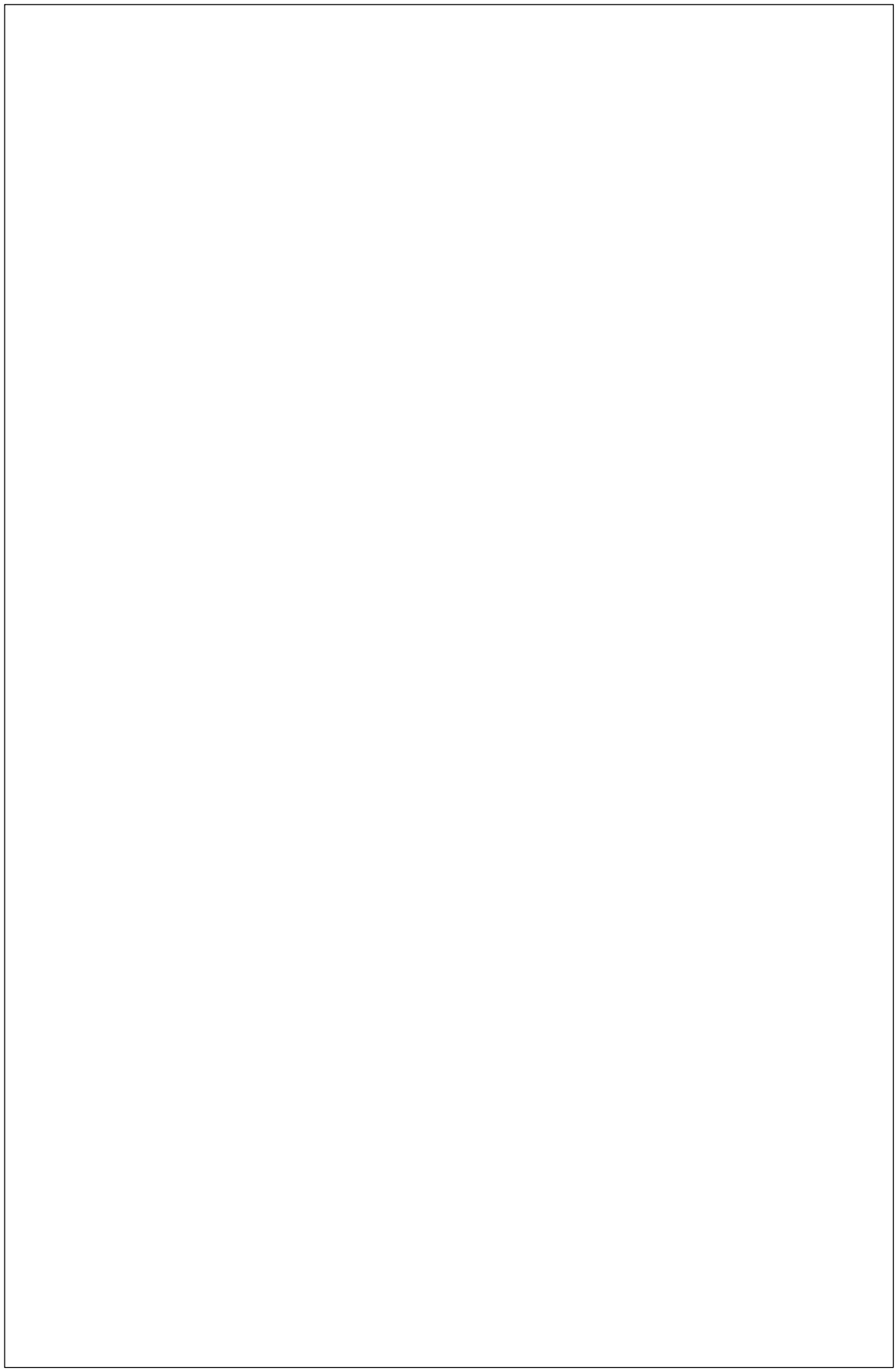
Also identify and describe any protected or 'special' uses of land within or surrounding the site. For example:

- National parks, conservation parks, resources reserves, nature refuges, coordinated conservation areas, wilderness areas, world heritage areas and international agreement areas
- Agricultural areas, priority living areas, strategic environmental areas and strategic cropping areas
- Priority Development Areas and State Development Areas established under the *Economic Development Act 2012* and *State Development and Public Works Organisation Act 1971,* respectively
- Stock routes
- Local planning scheme overlays e.g. environmental significance, regional infrastructure, priority infrastructure areas, water resource catchments, agricultural land.

Queensland Globe may be used to complete this section of the EMP. It may be helpful to embed figures or snips from Queensland Globe in this section of the EMP.

This information is helpful to understand when considering potential environmental impacts. For example, if there is a nature refuge or conservation area nearby to the turf farm, these areas will be more susceptible to environmental impacts than a developed industrial area.

This section can also be used to document the baseline condition of environmental features prior to turf farm commencing or at the time of writing the EMP. An example could include taking photographs of an adjacent waterway to document the condition of its banks and riparian vegetation.



4 Management of potential impacts on environmental values

The intent of this section of the EMP is to:

1. Identify, locate and quantify the potential impacts (direct and indirect) of the turf farm on environmental values, which are the physical, aesthetic, social and cultural values of a location or proposed site and
2. Outline the strategies, controls and monitoring methods used to manage each environmental aspect and avoid or minimise potential environmental impacts.

It is suggested that this information be presented for one environmental value at a time using the sub-headings provided below.

Note that it is not the intent or expectation of this section to have to justify and/or quantify impacts on the environment because of the turf farm. Rather, a properly made EMP will identify relevant environmental values (Section 4), assess the risk or potential for adverse impacts on environmental values because of the turf farm (Sections 4 and 5) and propose measures for avoiding and/or managing potential impacts on environmental values during all stages of the turf farm (Sections 4 and 5).

4.1 Land resources

Land resources refers to management of the land and soil resources within and adjacent to the turf farm and understanding how their properties influence their behaviour and present both environmental benefits and risks.

Management of land and soil is critical to ensuring both quality turf products and ensuring beneficial environmental and financial outcomes including:

- Retention of valuable topsoil resources
- Minimising erosion which leads to sediment generation in receiving waterways
- Maintaining soil health and structure to sustain vegetation growth and
- Correct application rates and types of fertiliser/ameliorants.

Soil properties and their impacts

Understanding the soil types on the turf farm and their physical and chemical properties is important to ensuring optimal product growth and soil testing is often undertaken to inform required fertiliser and ameliorant types and quantities. However, in addition to this, there are certain soil types that can have adverse environmental impacts when not managed correctly, which are described below:

- Retention of valuable topsoil resources
- Sodic and Dispersive Soils – are structurally unstable and highly susceptible to erosion when they come into contact with water. There are several soil types that are commonly associated as being sodic and/or dispersive and soil sodicity is a natural feature of many Queensland soils with approximately 45% considered sodic (Queensland Government, 2020). Testing of the soil cations (including sodium), exchangeable sodium percentage (ESP) and Emerson Aggregate Tests (EAT) are the most accurate ways to measure the potential for dispersion in soil. Visual indications that soils are dispersive or sodic can include:

- Poor vegetation or crop growth
- Poor water infiltration
- Crusting on the surface
- Dense or hard subsoils and
- Cloudy water in puddles.

Dispersive soils can cause the following adverse impacts (IECA, 2008):

- High risk of erosion and unstable soils
- High levels of turbidity in waterways
- Severe rilling of unprotected earthen batters or waterway banks
- Increased susceptibility to tunnel erosion or piping and
- Dispersive soils more readily transport nutrients and metals, bound to the clay particles when washed away.

- Acid Sulfate Soils (ASS) – are saturated with water, almost oxygen-free and contain microscopic crystals of iron sulfide minerals (Queensland Government, 2019). They are more typically found in low-lying coastal areas and saline inland areas. ASS do not pose a significant hazard to humans or the environment in their benign waterlogged and oxygen-free state, however once disturbed and exposed to oxygen, the National Acid Sulfate Soils Guidance manual states they can cause (Water Quality Australia, 2018):

  - mobilisation of metals (for example iron, aluminium, copper, cobalt, zinc), metalloids (for example arsenic), nutrients (for example phosphate) and rare earth elements
  - deoxygenation of water bodies
  - production of noxious gases (for example hydrogen sulfide)
  - production of greenhouse gases and
  - scalding (that is de-vegetation) of landscapes.

These impacts have flow on adverse impacts such as:

- adverse changes to the quality of soil and water. Deterioration of water quality impacts human, irrigation and stock use
- degradation of wetlands and water-dependant ecosystems
- loss of habitat ecosystem complexity and biodiversity
- invasion and dominance of wetlands and waterways by acid-tolerant plants and plankton species
- reduction of soil stability and fertility
- loss of visual amenity caused by rust-coloured stains, scums and slimes
- risk of long-term infrastructure damage through acidic water corroding metallic and concrete structures and
- increased financial burden of treating and remediating affected areas.

Erosion

Erosion is the process of wearing away of the soil surface, commonly caused by running water, rainfall or to a lesser extent wind (IECA, 2008). Erosion is a natural process of the displacement of soil or sediment however excess sediment loss can cause sedimentation within the receiving environment. Typical adverse impacts of erosion include:

- Loss of topsoil resources
- Loss of productive areas through retreat of waterway banks
- Undermining of infrastructure and services and
- Increased financial burden of remediating affected areas.

Typical adverse impacts of sedimentation because of erosion include:

- Loss of aquatic habitats
- Smothering and infilling of waterway channels
- Increased turbidity within water reducing light penetration through the water column
- Degraded water quality impacting aquatic health and
- Increased financial burden of remediating affected areas (e.g. desilting).

Erosion will occur at different rates because of the soil type, intensity of the rainfall or streamflow, gradient of the topography and ground cover factors such as vegetation.

Potential impacts of the turf farm industry on the land and soils

Establishment of a turf farm and its associated infrastructure has potential to impact upon the land and soils in different ways. Direct and obvious influences include land disturbance and earthworks to prepare the surface for farming and/or construction of infrastructure, however there are many potential impacts or influences a turf farm might have including:

- Land disturbance (e.g. vegetation clearing and excavation)
- Release (intentional or otherwise) of contaminants (e.g. fuel, chemicals and wastes) to land
- Poorly designed drainage leading to ponded water which can negatively impact soil quality
- Poorly designed drainage leading to increased erosion of soil
- Increased risk of erosion because of exposed surfaces (i.e. after harvesting) during rainfall
- Over-cultivation or over-compaction of surfaces reduce the porosity of the soil. A reduction in porosity will reduce the infiltration rate and reduce the availability of air, water and nutrients to the plant roots (Turf Accreditation Reference Guideline, 2010) and
- Erosion within waterways that may be impacting upon the turf farm. This impact may not be as a direct or sole result of the turf farm operations but may still be relevant to the EMP.

Typical management and monitoring strategies for land and soils

It is important and far more cost effective to prevent erosion than to manage the loss of sediment although both erosion and sedimentation controls are recommended as part of effective environmental management of disturbance activities. The International Erosion Control Association (IECA) produced the *Best Practice Erosion and Sediment Control Guideline 2008* for Queensland which outlines detailed management practices for erosion and sediment control.

Typical erosion controls include:

- Minimise disturbance extents and retain vegetation or groundcover wherever possible especially in areas not being harvested
- Revegetation (including grass cover)
- Soil binders/surface stabilisers
- Laying of mulch or temporary covers such as geofabric
- Dust suppression (i.e. watering of exposed surfaces like roads)
- Roughening of exposed surfaces
- Considering the weather and climate in scheduling of harvesting and planting to minimise the likelihood of exposed surfaces during rainfall events and

- Effective drainage control to manage runoff including suitably designed drains, waterway crossings and drain outlets.

Typical sedimentation controls include:

- Retaining vegetation buffers particularly along waterways
- Sediment traps and dams
- Mulch or compost bunds
- Vibration grids at entry/exit points for unsealed roads
- Rock filter dams and
- Sediment fences.

Management and amelioration of sodic and/or acid sulfate soils can be complex and disturbance to these soils should be avoided where possible. Where not possible, soil scientists and specialists may be required to assist with treatment.

Monitoring to determine if erosion and sedimentation controls are effective can include:

- Routine visual inspections and photographs of waterways and dam embankments and drain batters
- Sampling of soil chemistry (minimum pH and salinity) to continuously improve and adapt the management of the turf farm operations and
- Sampling for sediment (i.e. total suspended solids) within dams and receiving waterways.

ACTIVITY Land description

This section of the EMP should include a description of the land on which the turf farm is located, including but not limited to:

- Terrain and topography identifying any particularly steep areas or areas already exhibiting erosion. Be sure to note if the erosion existed prior to development of the turf farm. When describing erosion, ensure to include the suspected causes of erosion. For example, erosion associated with a watercourse or erosion due to dispersive soils.
- A description of the known or likely soils, encompassing:
  - Soil types and structure
  - Soil salinity
  - Sodic and/or dispersive soils
  - Presence of acid sulfate soils
  - Soil pH and
  - Erosion potential.

Queensland Globe and the Australian Soil Resource Information System may be used to access public mapping of soil types and potential areas susceptible to acid sulfate soils. Local knowledge, site-specific studies and soil samples should be used where possible to confirm the actual soil types present on the property.

Soil samples and photographs will be helpful for describing the erosion potential or documenting existing erosion. It may be helpful to embed figures or snips from Queensland Globe in the EMP.

ACTIVITY Land resources potential impacts and management measures

This section of the EMP should describe the impacts and management measures related to land resources and soils which can then be risk assessed in Section 5.

- Describe the potential impacts on land resources because of the turf farm or the existing soil types using site-specific and quantitative information wherever possible. Some examples include:
  - Presence of sodic soils reducing water infiltration to soil, increasing runoff or causing surface crusting
  - Runoff from acid sulfate soils degrading downstream water quality and aquatic plants/species

- Erosion from exposed turf farmland (e.g. after harvesting) causing loss of topsoil and sedimentation in downstream waterways
- Erosion within waterways causing loss of topsoil, riparian vegetation and/or productive farmland.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details. For example, the extent of vegetation clearing and excavation, the location and designs for any erosion and sediment controls and types and quantities of fertilisers or soil ameliorants used. Also consider whether each potential impact on land is likely to be short term, last many years, or potentially be irreparable.

  - Sodic soils are tested using dispersion or exchangeable sodium percentage tests. Where they are present, they are treated using gypsum or lime prior to planting.
  - Soil compaction is reduced using a verti-drain or tyne aerator.
  - Soil organic matter is preserved where possible.
  - Vegetation, mulch or matting is used or retained to dissipate raindrop impact in areas at risk of erosion, particularly where turf is not produced.
  - Harvesting of high-risk erosion areas is undertaken at low-risk times where there is low likelihood of rainfall.
  - Runoff is captured by contour banks and grassed drains and store in an on-farm fam or tank for reuse.
  - Grass or vegetation is retained in areas between the farm and off-site drainage and discharge points (i.e. buffer zones).

Erosion of watercourses that may be impacting upon turf operations is a complex environmental issue that will involve multiple stakeholders to assess the cause of the erosion and to develop and approve remediation measures. Recommended minimal management measures for the EMP include:

  - Sodic soils are tested using dispersion or exchangeable sodium percentage tests. Where they are present.
  - Engage relevant stakeholders upon becoming aware of waterway erosion issues. Relevant stakeholders include SRRC's Resilient Rivers Initiative Catchment Management Officer and the landholder if waterway is on privately owned land.
  - Retain a buffer of vegetation between operational areas (including roads) and waterways.

- Describe the monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.2 Surface water & wetlands

Surface water references the features of the environment that store or convey water. This includes natural features of the topography such as waterways (e.g. rivers and creeks), floodplains and wetlands/ponds. A description of these systems and why they are important to protect is provided below.

Waterways

Waterways convey water through the catchment and can range from small creeks to large river systems. Waterways are important to protect because:

- Water within a waterway is a valuable resource used for human and industrial purposes. Cedar Grove Weir, location on the Logan River downstream of many turf farms in the Logan catchment, is an example of where water is stored, extracted and subsequently used for irrigation (Seqwater, 2021).
- Water within a waterway may be extracted and used for turf production via a water licence. Therefore, maintaining the quantity and quality of this water is important for turf production.
- Waterways support aquatic ecosystems and provide a water source wildlife and its habitat.
- Waterways have a natural concentration of sediment, however excess sediment (e.g. due to erosion) adversely impacts aquatic ecosystems and the human/industrial useability of the water. Fine sediment can increase the concentrations of metals and nutrients in the water, while coarse sediment can build up within the waterway bed and cause blockages or alterations to the waterway.
- There are financial risks associated with adverse impacts to waterways. For example, if the water quality is too poor for use for irrigation, an alternative supply of water and/or water treatment may be required.

Waterways have different classifications under legislation which define how environmentally significant a waterway may be and inform what and how changes can be made to a waterway. Queensland Globe can be used to determine the classifications waterways in the vicinity your turf farm. Queensland Globe can also be used to identify which catchment your turf farm is located within.

The Queensland Government maintains a water monitoring network which provides real-time monitoring of water quality and streamflow/levels for the Albert River and Logan River. The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 defines Environmental Values and water quality objectives (e.g. for turbidity, nitrogen, ammonia and phosphorous) for the Albert River and Logan River. These water quality objectives are designed to protect aquatic ecosystems and other human and industrial uses of water within the catchment.

Floodplains

Floodplains refer to the land surrounding waterways that conveys water during significant rain events. For this EMP, it is important to understand if your turf farm is located within the floodplain of a significant waterway such as the Albert River or Logan River and the impacts that flooding might have upon your turf farm and vice versa. For example:

- Flooding can introduce pest and weed species to your turf farm.
- Extended periods of flooding over productive areas can impact upon turf produce quality as well as impact/influence soil properties.
- Flooding can damage infrastructure and cut off access.
- Changes to the topography of your turf farm, and in some cases constructing new infrastructure, can influence the floodplain and cause a change (increase or decrease) in flooding to the surrounding area.

Queensland Globe can be used to assess the historic flood levels in the Logan-Albert catchment, which may indicate how your turf farm may be impacted by flooding and vice versa. The Bureau of Meteorology also maintains a flood warning network for the Logan-Albert catchment which can be a useful reference/monitoring site if your turf farm is likely to be vulnerable to flooding.

Wetlands

Wetlands or ponds are important surface water features that deliver many ecosystem services including water and food supply, filtering of pollutants, regulation of climate and flooding, provision of habitat for biodiversity and recreation and tourism opportunities (DES, 2021). Therefore, like waterways, there are financial, social and environmental reasons for ensuring wetlands are protected.

Queensland Globe can be used to identify wetlands of ecological significance near your turf farm.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also outlines Matters of National Environmental Significance (MNES) which include significant wetlands of international importance. The Protected Matters Search Tool can be used to determine whether wetlands protected by the EPBC Act are known or likely to occur within a specified radius of the turf farm.

Potential impacts of the turf farm industry on surface water

Establishment of a turf farm and its associated infrastructure has potential to impact upon surface water features in different ways. Direct and obvious influences include the management and use of water in dams, drains and irrigation systems, however there are other less visual influences which can include impacts to water quality or overland flow drainage. The typical impacts or influences of a turf farm have been described below.

Water quality

- Poor placement of exposed stockpiled fertiliser/organic amendments can lead to increased nutrient loads and/or metals washing into surface waters during rain events. Poor placement refers to locations near watercourses or locations that are not contained/bunded. Similarly, poor or excess irrigation practices can also lead to increased nutrient loads and/or metals washing into surface waters. Increases in nutrient loads can cause algal blooms and changes to water quality can also impact upon the useability of the waters for turf farmers and other users downstream.
- Erosion of waterways is a potential risk of poorly constructed drainage which can increase the sediment loads in waterways. Factors of poor drainage design leading to erosion can include being too steep, being made of soils susceptible to erosion (refer to Section 5.1) or the concentration of flows into the waterways at the drain outlets.
- Poor placement or management of fuels, chemicals and wastes can lead to accidental release of these contaminants to the environment.

Water resources

- Turf farms often have licences to draw water from adjacent waterways or pipelines for operational use when required. Prolonged periods of drought and/or poor monitoring of this water use may lead to the volumes of water extracted from a waterway exceeding the licence allocation.
- Poor irrigation and water system performance can result in unnecessary water usage which has both environmental but also financial consequences. Turf that lacks a uniform quality because of poor water application can increase labour costs (Turf Queensland, 2010).
- Poor drainage (or lack of) can lead to inefficient water usage on site.

Flooding

- Construction of access tracks or poor placement of infrastructure can prevent or block surface water flows and floodwaters through the turf farm.
- Significant changes to the topography can increase the extent of flooding to surrounding properties.
- Flood flows can transport weed and pest species from upstream and contaminate turfed areas. This can increase the costs associated with pest and weed management.

Typical management and monitoring strategies for surface water

- Using an efficient irrigation system reduces demand on water resources and ensures a consistent, quality turf product. Similarly, metering and monitoring water use can result in financial savings for the business (Turf Queensland, 2010). These maintenance and monitoring strategies can include:

- Monitoring of pumps and irrigation system to ensure no leaks and maintenance of the correct pressure. Monitoring and maintenance of these aspects can help reduce pumping costs (Turf Queensland, 2010)
- Monitoring of water usage (recommended at least quarterly) including water used for cleaning and washing equipment
- Uniform application of the required volumes of irrigated water can ensure optimal product whilst reducing waterlogging and excess water use
- For optimum irrigation efficiency, the design and layout of the system should distribute water evenly, that is at the correct pressure to suit the sprinklers used and quickly enough to ensure the growing area can be irrigated when required (Turf Queensland, 2010).

Advice to ensure efficiency provided by the Turf Accreditation Reference Guideline includes:

- Monitor pressure in the lines using a hand pressure gauge – check that the line pressures correspond to the manufacturer's specifications.
- Clean water filters regularly to prevent blockages and help control algae.
- Maintain all the components of the system (e.g. fix pipeline leaks, clear blockages and ensure the sprinkler heads and pump are operating efficiently).
- Distribute irrigation water uniformly – that is, aim for a distribution uniformity of 85% or more, preventing under or overwatering of plants.
- Make sure that the system's water delivery rate does not exceed the infiltration rate of the soil (e.g. on a clay soil, the delivery rate needs to be slowed or use staggered (pulse) irrigation to allow the moisture to penetrate the soil, avoiding excessive run-off).
- Schedule irrigation with the aim to match the duration of an irrigation event to plant needs and the infiltration rate of the soil. This minimises over or under watering. An effective schedule will 'wet up' the effective root zone without losing water to deep drainage or surface run-off. Consider the duration of individual irrigations, their frequency and the appropriate volume of water to apply (Turf Queensland, 2010).

- Efficient fertiliser application with the aim to match turf crop requirements whilst minimising potential for washing elevated levels of nutrients downstream. There are many factors to be considered in defining efficient fertiliser application however some relevant to water management provided by the Turf Accreditation Reference Guideline include:

  - Maintain and calibrate application equipment (spreaders, spray packs, nozzles, and irrigation systems) to apply the correct fertiliser rates.
  - Check weather conditions (e.g. wind, forecast rainfall, evaporation rates) before applying fertiliser and not applying fertiliser to waterlogged soil. Avoid applying fertiliser on windy days or when heavy rain or extremely hot conditions are expected.
  - Solid fertiliser should be cultivated or watered into the soil.
  - Monitor nutrient levels in recycled irrigation water (see below). Consider any nutrients present when calculating fertiliser rates.

- Consideration to where and how exposed stockpiled fertiliser/organic amendments are managed to reduce off-site impacts. Stockpiles should be located away from waterways and drainage paths and where possible, be bunded (e.g. earthen bund) or covered to prevent rainfall runoff washing elevated levels of nutrients downstream.
- Implement a drainage network to capture water runoff from turfed areas which can be used to supplement water use on site and convey waters in a non-erosive way into receiving waterways. Note that capturing water from natural drainage paths may be subject to approvals (e.g. water licence) and advice should be sought before blocking or impending natural waterways or before construction of water storage dams.

- Monitoring of water quality within site dams is useful to understand the levels of nutrients, salts and metals that are present in the water. This information may be useful when used for irrigation and cultivation of different turf species but can also be compared to the water quality within the surrounding waterways to understand the differences in the water quality and the potential impacts that release of site water may have on the surrounding waterways.

  - Water quality monitoring programs can vary in terms of their scope. Guidance for developing water quality monitoring programs can be found in the QLD Monitoring and Sampling Manual. At a minimum, the EMP should define:

    - Monitoring locations (e.g. dams and/or waterways)
    - Water quality parameters to be monitored (key parameters for turf farms include salinity, pH and nutrients)
    - Monitoring frequency (e.g. 6-monthly, yearly) (Consider what the data is going to be used for and how often you would need the results.)
    - Sampling techniques (e.g. who is doing the sampling and how) (Sampling can be done in the field using probes or other simple testing kits (pH, salinity) or sent to a laboratory for more detailed assessment (nutrients, dissolved ions and metals)).

- Monitoring of weather systems and waterways is a useful tool to assist with many of the management practices described above. The EMP should describe the purpose of any weather monitoring undertaken and define what weather aspects are monitored, how they are monitored and the frequency at which they need to be monitored.

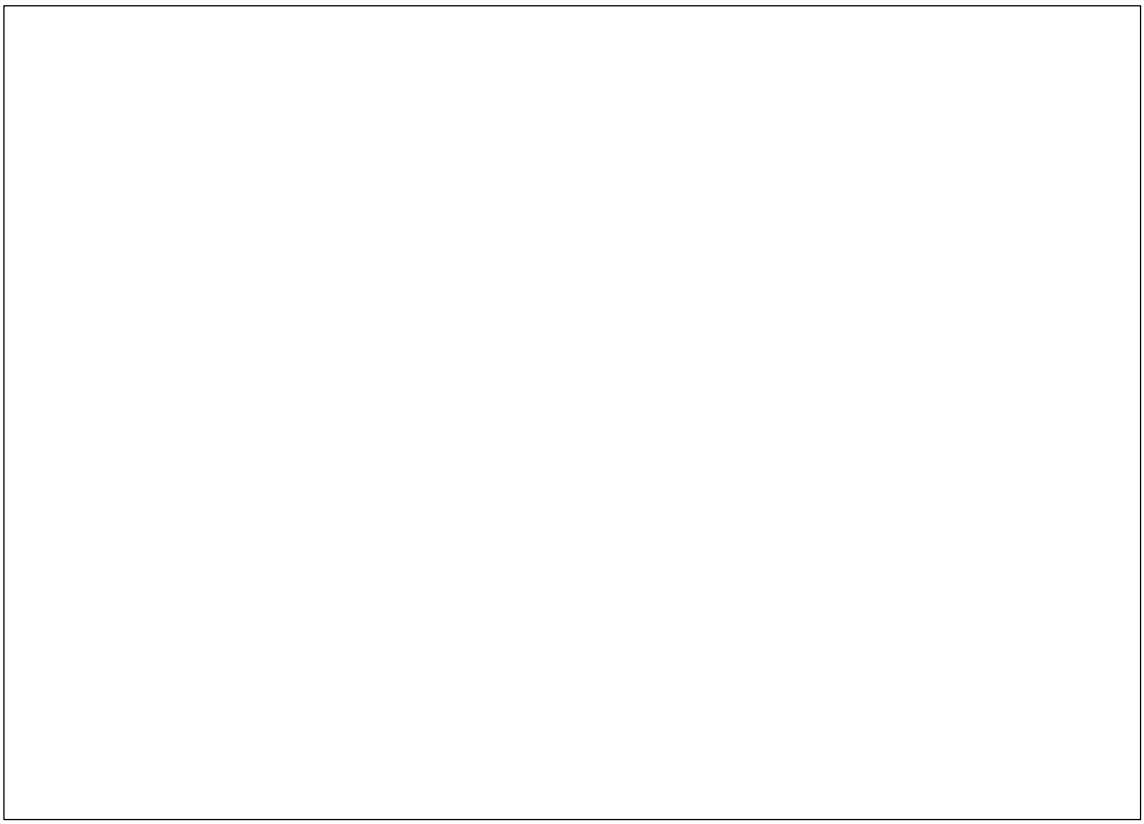
ACTIVITY Surface water

This section of the EMP should define and describe the surface water context for the turf farm.

- Identify and describe the natural surface water and wetland features that exist within or surrounding the turf farm. Identify the catchment that the turf farm is located within. Where data exists, describe the water quality of the surrounding waterways. Describe how flooding interacts with your property.

If there are no surface water or wetland features within or surrounding the turf farm, this should be stated and illustrated on a figure or snip from Queensland Globe.

- Describe the water management system and/or water uses on site (e.g. water licences, drainage, pumps, dams, irrigation practices).



ACTIVITY Surface water potential impacts and management measures

This section of the EMP should describe the impacts and management measures related to surface water which can then be risk assessed in Section 5.

- Describe the potential impacts on watercourses or wetlands because of the turf farm. Some examples include:

  - Elevated nutrient loads and/or metals entering surface water or wetlands because of excess over irrigation
  - Elevated nutrient loads and/or metals entering surface water or wetlands because of runoff from stockpiled fertiliser/organic amendments after significant rainfall events
  - Volume of water extracted from a waterway exceeds the licence allocation
  - Poor irrigation and water system performance resulting in unnecessary water usage and high demand on water resources.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  - Fertiliser stockpiles are located away from waterways in a bunded area.
  - Irrigation and pump equipment is maintained and regularly inspected to ensure no leaks.
  - Water pumped from a waterway is monitored and assessed on a quarterly basis to calculate water usage volumes.
  - Minimise runoff and evaporative losses by ensuring that the water delivery rate does not exceed the infiltration rate of the soil.
  - Irrigation is undertaken in the morning or at night when wind and evaporation rates are lowest.
  - Rainfall is captured within a site drainage network and used to supplement water usage from a waterway.

Describe the monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.3 Groundwater

Groundwater refers to water that is stored or flows below ground often within reservoirs (aquifers). Like surface water, groundwater is a valuable resource to protect as:

- Groundwater is often extracted from bores for human and industrial purposes including for irrigation. Therefore, maintaining the quantity and quality of this water is important for turf production.
- Groundwater can sustain Groundwater Dependant Ecosystems (GDEs) which require access to groundwater on a permanent or intermittent basis. Potential and known GDEs are mapped in Queensland Globe and WetlandMaps. Note that for turf farms adjacent to large waterways such as the Logan River it is likely that there will be alluvial groundwater aquifers mapped.
- There are financial risks associated with adverse impacts to groundwater. For example, if the water quality is too poor for use for irrigation, an alternative supply of water and/or water treatment may be required.

The Queensland Government maintains a water monitoring network which provides real-time monitoring of groundwater bore levels within the Logan-Albert catchment. The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 defines Environmental Values and water quality objectives for groundwaters within the Albert River and Logan River catchments. These water quality objectives are designed to protect aquatic ecosystems and other human and industrial uses of groundwater within the catchment.

The Bureau of Meteorology also maintains the Australian Groundwater Explorer which maps registered bores and some level and water quality information. Queensland Globe also has information on groundwater bores.

Potential impacts of the turf farm industry on groundwater

Establishment of a turf farm and its associated infrastructure has potential to impact upon groundwater in different ways. The typical impacts or influences of a turf farm have been described below:

- Poor or excess irrigation practices can lead to ponding and increased nutrient loads and/or metals infiltrating into groundwaters. Similarly, poor placement of exposed stockpiled fertiliser/organic amendments can lead to increased nutrient loads and/or metals leaching into groundwaters after rain events. Poor placement refers to locations near watercourses or locations that are not contained/bunded. Uncapped bores or gaps between the bore casing and the ground present a pathway for contamination of groundwater.
- Poor placement or management of fuels, chemicals and wastes can lead to accidental release of these contaminants to the environment.
- Poor or excess application of pesticides/herbicides could result in them leaching into groundwaters.
- Turf farms often have licences to draw water from bores for operational use when required. Prolonged periods of drought and/or poor monitoring of this water use may lead to the volumes of water extracted from a waterway exceeding the licence allocation.
- Poor irrigation and water system performance can result in unnecessary groundwater usage which has both environmental but also financial consequences. Turf that lacks a uniform quality because of poor water application can increase labour costs (Turf Queensland, 2010).

Typical management and monitoring strategies for groundwater

- Using an efficient irrigation system reduces demand on groundwater resources and ensures a consistent, quality turf product. Similarly metering and monitoring groundwater use can result in financial savings for the business (Turf Queensland, 2010). These maintenance and monitoring strategies can include:

  - Monitoring of pumps and irrigation system to ensure no leaks and maintenance of the correct pressure can help reduce pumping costs (Turf Queensland, 2010).
  - Monitoring of water usage (recommended at least quarterly) including water used for cleaning and washing equipment.
  - Uniform application of the required volumes of irrigated water can ensure optimal product whilst reducing waterlogging and excess water use.
  - For optimum irrigation efficiency, the design and layout of the system should distribute water evenly, that is at the correct pressure to suit the sprinklers used and quickly enough to ensure the growing area can be irrigated when required (Turf Queensland, 2010).

  Advice to ensure efficiency provided by the Turf Accreditation Reference Guideline includes:
  - Monitor pressure in the lines using a hand pressure gauge – check that the line pressures correspond to the manufacturer's specifications.
  - Clean water filters regularly to prevent blockages and help control algae.
  - Maintain all the components of the system (e.g. fix pipeline leaks, clear blockages and ensure the sprinkler heads and pump are operating efficiently).
  - Distribute irrigation water uniformly – that is, aim for a distribution uniformity of 85% or more, preventing under or overwatering of plants.
  - Make sure that the system's water delivery rate does not exceed the infiltration rate of the soil (e.g. on a clay soil, the delivery rate needs to be slowed or use staggered (pulse) irrigation to allow the moisture to penetrate the soil, avoiding excessive run-off).
  - Scheduling of irrigation with the aim to match the duration of an irrigation event to plant needs and the infiltration rate of the soil. This minimises over or under watering. An effective schedule will 'wet up' the effective root zone without losing water to deep drainage or surface run-off. Consider the duration of individual irrigations, their frequency and the appropriate volume of water to apply (Turf Queensland, 2010).

- Efficient fertiliser application with the aim to match turf crop requirements whilst minimising potential for ponding and leaching of elevated levels of nutrients into groundwaters. There are many factors to be considered in defining efficient fertiliser application however some relevant to groundwater management, provided by the Turf Accreditation Reference Guideline, include:

  - Maintaining and calibrating application equipment (spreaders, spray packs, nozzles, and irrigation systems) to apply the correct fertiliser rates.
  - Check weather conditions (e.g. wind, forecast rainfall, evaporation rates) before applying fertiliser and not applying fertiliser to waterlogged soil. Avoid applying fertiliser on windy days or when heavy rain or extremely hot conditions are expected.
  - Solid fertiliser should be cultivated or watered into the soil.
  - Monitor nutrient levels in recycled irrigation water (see below). Consider any nutrients present when calculating fertiliser rates.

- Consideration to where and how exposed stockpiled fertiliser/organic amendments are managed to reduce off-site impacts. Stockpiles should be located away from waterways

and drainage paths and where possible, be bunded (e.g. earthen bund) or covered to prevent leaching of elevated levels of nutrients into groundwaters.

- Monitoring of groundwater quality within bores is useful to understand the levels of nutrients, salts and metals that are present in the water. This information may be useful when used for irrigation and cultivation of different turf species but can also be compared to the groundwater water quality objectives for the catchment to understand differences in the water quality.

  - Water quality monitoring programs can vary in terms of their scope. Guidance for developing water quality monitoring programs can be found in the QLD Monitoring and Sampling Manual. At a minimum, the EMP should define:

    - Monitoring locations (e.g. bores)
    - What water quality parameters are to be monitored (key parameters for turf farms include salinity, pH and nutrients)
    - Monitoring frequency (e.g. 6-monthly, yearly) (Consider what the data is going to be used for and how often you would need the results)
    - Sampling techniques (e.g. who is doing the sampling and how) (Sampling can be done in the field using probes or other simple testing kits (pH, salinity) or sent to a laboratory for more detailed assessment (nutrients, dissolved ions and metals)).

ACTIVITY Groundwater features

This section of the EMP should include a description of groundwater features that may occur in the vicinity of the turf farm, including but not limited to:

- Presence of GDEs
- Groundwater bores within or adjacent to the turf farm and
- Description of any groundwater that is extracted from bores and used for irrigation or other uses, including volumes, frequency and quality.

Whilst some data is available on Queensland Globe and WetlandMaps, local knowledge and site-specific studies and samples should be used wherever possible. It may be helpful to embed figures or snips from Queensland Globe in the EMP.

MAP

ACTIVITY Surface water potential impacts and management measures

This section is to be completed if the turf farm is underlain by shallow groundwater systems and/or groundwater extraction from bores is occurring or proposed. This section of the EMP should describe the impacts and management measures related to groundwater which can then be risk assessed in Section 5.

- Describe the potential impacts on groundwater because of the turf farm. Some examples include:

  - Leaching of excess nutrient loads and/or metals into groundwater from excess nutrient application or leaching/seepage from stockpiled fertiliser/organic amendments after significant rainfall events or flooding
  - Volume of groundwater extracted from a bore exceeds the licence allocation
  - Excess water from a groundwater bore is used for irrigation resulting in unnecessary water usage.
  - Contamination of groundwater due to uncapped bores or gaps between the bore casing and the ground
  - Leaching of pesticides/herbicides into groundwater from either excess application or inaccurate application.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  - Fertiliser stockpiles are located away from waterways in a bunded area.
  - Irrigation and pump equipment is maintained and regularly inspected to ensure no leaks.
  - Groundwater pumped from a bore is monitored and assessed on a quarterly basis to calculate water usage volumes.
  - Allow turfed areas to free drain to avoid ponding.
  - Minimise runoff and evaporative losses by ensuring that the water delivery rate does not exceed the infiltration rate of the soil.
  - Undertake soil testing to determine soil nutrient requirements and use to calculate fertiliser application rates, with the aim of applying the minimum rate of fertiliser to achieve plant growth and turf quality.
  - Maintain and calibrate fertiliser application equipment to ensure that the desired rate of fertiliser is consistently applied.
  - Check weather conditions before applying fertiliser. Do not apply fertiliser to waterlogged soil. Avoid applying fertiliser on windy days or when heavy rain is expected.
  - Routine groundwater quality sampling with comparisons overtime to ensure no potential contamination.

Describe any monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.4 Flora

Much of Queensland's native wildlife is protected by legislation to ensure its survival and to protect biodiversity. This includes plants, with all native plants protected under the *Nature Conservation Act 1992*. Matters of State Environmental Significance (MSES) are also prescribed under the Environmental Offsets Regulation 2014.

Flora and biodiversity features that are likely to have significant environmental value include features such as:

- Category B regulated vegetation
- Endangered and Of Concern prescribed regional ecosystems
- Essential habitat for plants that are defined as critically endangered wildlife, endangered wildlife, or vulnerable wildlife, under the *Nature Conservation Act 1992*
- Protected plants trigger areas which are areas where endangered, vulnerable or near threatened native plants are present or are likely to be present
- Marine plants
- Koala habitat.

All the above flora and biodiversity features are mapped on Queensland Globe and Property Map of Assessable Vegetation. WildNet Database, Biomaps, Protected Plants Flora Survey Trigger Maps or Atlas of Living Australia can also be used to generate a list of flora that are known or likely to occur within a specified radius.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also outlines Matters of National Environmental Significance (MNES) which include flora and biodiversity features such as National Parks and listed threatened species and communities. The Protected Matters Search Tool can be used to determine whether native plants and vegetation communities protected by the EPBC Act are known or likely to occur within a specified radius of the turf farm.

Note that this is not an exhaustive list of where information about native plants and vegetation communities may be obtained. Information provided through these resources is desktop information only local knowledge and site-specific studies should be used where possible.

Potential impacts of the turf farm industry on flora

The most direct impact turf production will have on flora is clearing of native plants and vegetation communities. More indirect impacts to flora could include:

- Poor application of pesticides/herbicides resulting in runoff or drift that adversely impacts native vegetation
- Poor irrigation and/or application of fertilisers resulting in runoff containing elevated nutrients (from fertiliser/organic amendments) adversely impacting native vegetation.

It is important to note that impacts to flora via runoff or drift may not be constrained to the turf farm property boundary and identification of environmentally sensitive flora should extend to adjacent properties and the receiving environment, particularly where the vegetation is located between the turf farm and a receiving waterway.

Typical management and monitoring strategies for flora

The most effective control to avoid impacts to native vegetation is to minimise clearing of the vegetation as much as practicable. Where clearing cannot be avoided, clearly mark the limits of clearing (e.g. with a fence) to avoid inadvertently clearing native plants and vegetation communities. Cleared areas (not used for turf production) should be replanted with native vegetation as soon as practicable.

In addition to these management strategies, effective irrigation, fertiliser application, stockpiling and herbicide/pesticide application will minimise the potential for adverse impacts to flora because of runoff or drift.

Monitoring of flora condition can be as simple as regular photographs of their condition to detect any notable chance in their condition.

ACTIVITY Native plants and vegetation communities

This section of the EMP should identify and describe native plants and vegetation communities within and surrounding the turf farm including:

- Protected plants and/or their trigger areas
- Regulated vegetation / Regional Ecosystems
- Marine plants
- Koala habitat and
- Any Matters of National Environmental Significance (MNES) protected under the EPBC Act.

If there are no native plants or vegetation communities within or surrounding the turf farm, this should be stated and illustrated on a figure or snip from Queensland Globe or the Property Map of Assessable Vegetation.

ACTIVITY Native vegetation potential impacts and management measures

This section is to be completed if there are native plants or vegetation communities within or surrounding the turf farm, particularly if there is native vegetation located between the farm and an adjacent waterway. This section of the EMP should describe the impacts and management measures related to flora which can then be risk assessed in Section 5.

- Describe the potential impacts on native plants and vegetation communities which have potential to arise from the turf farm. Some examples of potential impacts include:

  - Clearing of native plants and vegetation communities
  - Drift from pesticides/herbicides impacting upon native plants and vegetation communities
  - Runoff containing pesticides/herbicides impacting upon native plants and vegetation communities
  - Runoff containing elevated nutrients (from fertiliser/organic amendments) impacting native plants and vegetation communities.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  - If vegetation clearing is required, clearly mark the limits of clearing to avoid inadvertently clearing fauna habitat.
  - Minimise the clearing extent as far as reasonably practicable.
  - Cleared areas should be replanted with native vegetation as soon as practicable.

Describe any monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.5 Fauna

Like flora, much of Queensland's native wildlife is protected by legislation to ensure its survival and to protect biodiversity. All native birds, reptiles, mammals and amphibians are protected in Queensland, along with a limited range of invertebrates and freshwater fish.

Fauna features that are likely to have significant environmental value include:

- Essential habitat for protected wildlife
- Fish habitat areas
- Biodiversity corridors (State-wide biodiversity corridors are mapped in Queensland Globe. The local planning scheme may include maps of local biodiversity corridors) and
- Koala habitat.

All the above fauna features are mapped on Queensland Globe. WildNet Database, Biomaps or Atlas of Living Australia can also be used to generate a list of threatened fauna species that are known or likely to occur within a specified radius.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also outlines Matters of National Environmental Significance (MNES) which include fauna such as listed migratory and threatened species. The Protected Matters Search Tool can be used to determine whether fauna protected by the EPBC Act are known or likely to occur within a specified radius of the turf farm.

Note that this is not an exhaustive list of where information about protected fauna and fauna habitat may be obtained. Information provided through these resources is desktop information only local knowledge, fauna sightings and site-specific studies should be used where possible.

Potential impacts of the turf farm industry on fauna

The most direct impact turf production will have on fauna is clearing of their habitat or obstruction to fish passage in waterways through the construction of road crossings. However, another indirect impact to fauna could include poor application of pesticides/herbicides resulting in runoff or drift that adversely impacts protected fauna or their habitat.

It is important to note that impacts to fauna and their habitat via runoff or drift may not be constrained to the turf farm property boundary and identification of protected fauna and their habitat should extend to adjacent properties and the receiving environment, particularly where the habitat is located between the turf farm and a receiving waterway.

Typical management and monitoring strategies for fauna

The most effective control to avoid impacts to protected fauna and their habitat is to minimise and/or stage clearing of native vegetation as much as practicable. Where clearing cannot be avoided, clearly mark the limits of clearing (e.g. with a fence) to avoid inadvertently clearing fauna habitat and where required use a fauna spotter during clearing to manage interactions with fauna and/or their habitat (e.g. nests). Maintaining fences on property boundaries can also be effective at limiting interactions between fauna and farm operations.

In addition to these management strategies, effective irrigation, fertiliser application and stockpiling and herbicide/pesticide application will minimise the potential for adverse impacts to fauna because of runoff or drift.

The Accepted development requirements for operational work that is constructing or raising waterway barrier works Guideline provides useful design information for construction of waterway crossings to avoid or minimise impacts to fish passage.

ACTIVITY Protected fauna and fauna habitat

This section of the EMP should identify and describe protected fauna and fauna habitat within and surrounding the turf farm including:

- Biodiversity corridors
- Essential habitat
- Koala habitat
- Fish habitat areas and
- Any Matters of National Environmental Significance (MNES) protected under the EPBC Act.

If no protected fauna or fauna habitat is known or likely to occur in the vicinity of the turf farm, this should be stated and illustrated on a figure or snip from Queensland Globe or one of the other databases listed above.

ACTIVITY Protected fauna potential impacts and management measures

This section is to be completed if there is likely to be native wildlife within or surrounding the turf farm. This section of the EMP should describe the impacts and management measures related to fauna which can then be risk assessed in Section 5.

- Describe the potential impacts on protected fauna and/or their habitat which have potential to arise from the turf farm. Some examples of potential impacts include:

  - Clearing of fauna habitat
  - Drift from pesticides/herbicides impacting upon protected fauna or fauna habitat
  - Runoff containing pesticides/herbicides impacting upon protected fauna or fauna habitat
  - Obstruction of natural waterways (e.g. due to road crossings) preventing or impacting fish passage.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  - If vegetation clearing is required, clearly mark the limits of clearing to avoid inadvertently clearing fauna habitat.
  - Road crossings are constructed at bed level to ensure no obstruction to fish passage.
  - For pesticide/herbicide application:
  - Consider the likely location of native fauna species and fauna habitat when planning pesticide/herbicide application. If possible, maintain a buffer zone between pesticide/herbicide application areas and the likely location of native fauna species and fauna habitat.
  - Provide training to operators on pesticide/herbicide application.
  - Comply with the application instructions for the specific pesticide/herbicide being applied.
  - Select equipment (applicators and nozzles) that will give the correct droplet size range to minimise drift and maximise efficiency. Regularly calibrate equipment.
  - Spray only in favourable weather conditions, i.e. when the wind is blowing steadily and it possible to predict where the spray will go. Stop spraying if the conditions are not right.

- Describe any monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.6 Biosecurity

Biosecurity refers to the management of pest or invasive flora/weed and fauna species. Management of these biosecurity risks is critical to ensuring the environment is safeguarded from the diseases, contamination and adverse impacts that these pest species can cause.

However, in addition, there are financial benefits to proactively managing and preventing the spread of pest or invasive species, for example proactive weed monitoring and treatment would reduce the costs incurred for weed management over the life of the business.

All Queenslanders have a 'general biosecurity obligation' (GBO) under Queensland's *Biosecurity Act 2014*. The GBO requires that everyone is responsible for managing biosecurity risks that are:

- Under their control and
- That they know about or should be expected to know about.

Examples of biosecurity risks that a turf farmer would be 'expected to know about' include:

- Staying informed about the pests and diseases that could affect or be carried by your crops, as well as weeds and pest animals that could be on your property. You are also expected to manage them appropriately.
- If you are a landowner, you are expected to stay informed about the weeds and pest animals (such as wild dogs) that could be on your property. You are also expected to manage them appropriately.
- If you live or work in a highly promoted biosecurity zone (e.g. within a fire ant biosecurity zone), you are expected to know what you can and cannot move into and out of the zone, and what other precautions are required.

Under the GBO, individuals and organisations whose activities pose a biosecurity risk must:

- Take all reasonable and practical steps to prevent or minimise each biosecurity risk
- Minimise the likelihood of causing a 'biosecurity event' and limit the consequences if such an event is caused and
- Prevent or minimise the harmful effects a risk could have, and not do anything that might make any harmful effects worse.

Certain species of invasive plants and animals are listed as 'prohibited' matter (e.g. fire ants). Any sightings of prohibited matter must be reported within 24 hours to Biosecurity Queensland (13 25 23).

A list of invasive plants and animals and more information on their management can be found online and is currently administered by the Department of Agriculture and Fisheries. Interactive online pest distribution maps can be used to understand potential likelihood for pest species in the region and there are several fact sheets also available. There are also dedicated fire ant biosecurity zones.

Local councils will also have their own plans and policies for management of pest species within their regions. The SRRC, for example, has implemented a Scenic Rim Biosecurity Plan. The plan includes strategies and information for the local community. SRRC can also assist with identifying weeds found on your property and the supply of relevant fact sheets or booklets (Weeds of Southern Queensland).

It should be noted that information provided through the above listed resources is indicative only local knowledge or site-specific studies should be used where possible.

Potential impacts of the turf farm industry related to biosecurity

Pest or invasive flora and fauna have the potential to have significant impacts to Queensland's economy, biodiversity and people's lifestyles (DAFF, 2021). Turf farms may be impacted by poor or insufficient management of pest species or potentially cause adverse environmental impacts because of management of pest species. Examples include:

- Lack of or poor management of known pest, weed and disease infestations leading to decline in populations of native flora and fauna or reduction in the usability of the land
- Poor application of pesticides/herbicides resulting in runoff or drift that adversely impacts native vegetation.

Typical management and monitoring strategies for biosecurity

Management and monitoring strategies for invasive pest species will vary depending on the species, contamination and/or diseases that are known or likely to occur within the region. Typical controls that can be effective for all weed or pest species include washing down of machinery moving in and out of the property and/or growing areas, proper waste storage and disposal and using suitably qualified personnel for application of pesticide/herbicides.

ACTIVITY Biosecurity risk

This section of the EMP should identify and describe pest plants and animals, diseases or contaminants associated with the turf farm that might pose a biosecurity risk. Aquatic biosecurity risks should be addressed if the turf farm includes or adjoins a waterway or wetland. It may be helpful to embed photographs and/or maps of identified pest plants and animals, diseases or contaminants in the EMP.

Wherever possible, also identify and describe carriers for pest plants and animals, diseases or contaminants at and around the turf farm. For example:

- Vehicles, and other wheeled or tracked equipment, moving around, and in and out of the site
- Excavating, moving and stockpiling materials
- Flood events – that could transport biosecurity risks into or from the property
- Water extraction and transfer infrastructure such as pumps, pipelines and drainage channels and
- Waste storage and disposal areas which can attract and feed pest animals.

ACTIVITY Biosecurity potential impacts and management measures

This section of the EMP should describe the impacts and management measures related to biosecurity which can then be risk assessed in Section 5.

- Describe the potential impacts on the environment because of pest plants and animals, diseases or contaminants associated with the turf farm. Some examples of potential impacts include:

  - Lack of or poor management of known pest, weed and disease infestations leading to decline in populations of native flora and fauna
  - Lack of or poor management of known pest, weed and disease infestations leading to reduction in the usability of the land
  - Poor application of pesticides/herbicides resulting in runoff or drift that adversely impacts native vegetation.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  - For management of pest infestations:

    - Regularly check and monitor the presence of pests through a combination of methods include observation, inspection and collecting samples for identification.
    - Prevent pest infestations through a combination of measures, including:
      (1) Install protective structures or vegetation between crops and prevailing winds.
      (2) Minimise opportunities for pests to breed in pooled wet areas.
      (3) Eliminate weeds before planting in a new area.

(4) Ensure that materials and machinery moving in and out of growing areas are free of weeds (e.g. make use of a machinery wash down).
(5) Ensure application of pesticides/herbicides by suitably trained persons.

- To avoid drift from pesticides/herbicides:

  - Ensure chemicals are appropriate for the intended use and follow label instructions.
  - Adhere to workplace health and safety laws when working with chemicals.
  - Consider alternative softer chemicals or spot treatments rather than broad application of traditional sprays.
  - Avoid applying chemicals on windy days, or when heavy rain or extremely hot conditions are expected.
  - Maintain and calibrate spray packs to ensure that the correct rates of chemicals are consistently applied to turf.
  - Catch any spray drift using vegetation or unsprayed buffer zones where possible.
  - Use separate designated spray applicators for herbicides and pesticides where possible.

- Describe any monitoring programs implemented to support the above management measures. The description of environmental monitoring programs in this section of the EMP should include the location (including a map), methodology, parameters and frequency of monitoring activities. It should also describe how the monitoring data is implemented to ensure improved environmental and/or commercial outcomes.

Potential impact	Management measures	Monitoring programs

4.7 Cultural Heritage

Indigenous cultural heritage

Under the *Aboriginal Cultural Heritage Act 2003*, anyone carrying out any activity on land (including freehold) anywhere in Queensland is required by law to take all reasonable and practicable measures to ensure their activity does not harm Aboriginal or Torres Strait Islander cultural heritage (called the 'duty of care').

It is important to identify and protect Indigenous Cultural Heritage to respect Aboriginal cultural and traditional practices and to promote an understanding of Aboriginal cultural heritage. Activities involved in recognition, protection and conservation of Aboriginal cultural heritage are important because they allow Aboriginal people to reaffirm their obligations to "law and country" (Department of Aboriginal and Torres Strait Islander Partnerships, 2004).

The Act defines Aboriginal cultural heritage as anything that is:

- a significant Aboriginal area in Queensland
- a significant Aboriginal object or
- evidence, of archaeological or historic significance, of Aboriginal occupation of an area of Queensland.

The Duty of Care Guidelines outline features that are highly likely to have cultural heritage significance. These features include, but are not limited to:

- Ceremonial places: The material remains of past Aboriginal ceremonial activities come in the form of earthen arrangements or bora grounds and their associated connecting pathways, and stone circles, arrangements and mounds.
- Scarred or carved trees: Scars found on large mature trees often indicate the removal of bark by Indigenous people to make material items like canoes, containers, shields and boomerangs. Carved trees feature larger areas of bark that have been removed and carved lines deeply etched into the timber. Carvings include geometric or linear patterns, human figures, animals and birds.
- Burials: Pre-contact Aboriginal burials are commonly found in caves and rock shelters, midden deposits and sand dunes.
- Rock art: Includes engravings, paintings, stencils and drawings. Engravings include designs scratched, pecked or abraded into a rock surface.
- Fish traps and weirs: Stone or wooden constructions designed to capture aquatic animals including fish. Traps are considered as structures made from stone to form a type of pen or enclosure. Weirs are constructions designed to block the natural flow of water in creeks, streams and other watercourses.
- Occupation sites: These are places where the material remains of human occupation are found. Such sites contain discarded stone tools, food remains, ochre, charcoal, stone and clay hearths or ovens, shell middens and shell scatters, including deposits found in rock shelters and caves. These deposits may be buried. Other evidence of occupation sites includes the remains of Aboriginal dwellings or "gunyahs".
- Quarries and artefact scatters: Quarries are places where raw materials such as stone or ochre were obtained through either surface collection or sub-surface quarrying.
- Grinding grooves: Grinding grooves represent the physical evidence of past tool making or food processing activities. They are found near water sources. The presence of long thin grooves may indicate where the edges of stone tools were ground. Food processing activities such as seed grinding can leave shallow circular depressions in rock surfaces.

- Contact Sites: The material remains of Indigenous participation in the development of Queensland after the arrival of European settlers. These include former or current Aboriginal missions, native mounted police barracks and historical camping sites.
- Wells: Rock wells are reliable water sources that have been altered by Indigenous people for the storage of water.

The most common impact a turf farm could have on cultural heritage is unplanned disturbance to an item or place of cultural heritage significance. These disturbances are avoided through pre-clearance surveys and/or training to assist with identification of culturally significant features.

ACTIVITY Duty of care Aboriginal or Torres Strait Islander cultural heritage

To complete this section of the EMP, use the DATSIP cultural heritage database and register to identify Aboriginal or Torres Strait Islander cultural heritage in the vicinity of the turf farm. The Duty of Care Guidelines may then be used to identify reasonable and practicable measures for meeting the duty of care and avoiding harm to Aboriginal or Torres Strait Islander cultural heritage because of the turf farm. Depending on the development, this may involve notifying the Aboriginal Party for the area and seeking their advice and agreement as to how best to manage to avoid or minimise harm to the Aboriginal cultural heritage.

It should be noted that proactive engagement and building relationships with the Aboriginal Party for the area is encouraged regardless of the presence of cultural heritage. Examples of positive engagement include seeking advice on land management and native plant species for revegetation activities.

Non-Indigenous cultural heritage

Non-Indigenous cultural heritage places have been shaped by Queensland's history, environment, resources and people. They comprise places of cultural and natural heritage significance that should be kept, respected and passed on to future generations due to their unique, diverse and irreplaceable nature.

The *Queensland Heritage Act 1992* aims to protect Queensland's heritage from incompatible development and neglect, and conserve it for the benefit of the community and for future generations. The Guideline: Carrying out a heritage survey notes that the presence and inclusion of a non-Indigenous cultural heritage place in a heritage register or local government planning scheme provides the community with greater certainty about how heritage will be protected, however effective heritage conservation does not require historic places to remain 'frozen in time' and never altered. The best method of protection is to use heritage sites in ways that do not degrade their heritage values—to ensure they are well-maintained and contribute to the cultural, economic and social well-being of communities through, for example, tourism, education or adaptive re-use (Department of Environment and Science, 2015.

The most common impact a turf farm could have on cultural heritage is unplanned disturbance to an item or place of cultural heritage significance. These disturbances are avoided through pre-clearance surveys and/or training to assist with identification of culturally significant features.

ACTIVITY Non-Indigenous cultural heritage

To complete this section of the EMP, use the following resources to identify non-Indigenous cultural heritage in the vicinity of the turf farm:

- World Heritage List – natural and cultural places of 'outstanding universal value' selected by the United Nations Educational, Scientific and Cultural Organisation
- National Heritage List – natural and cultural places with outstanding heritage value to the nation that are protected by the EPBC Act
- Commonwealth Heritage List – natural, Indigenous and historic heritage places owned by the Australian Government that are protected by the EPBC Act
- Queensland Heritage Register – non-Indigenous places of cultural heritage significance to Queensland that are protected by the *Queensland Heritage Act 1992*
- Relevant local heritage registers and/or local government planning scheme – places of local heritage significance.

It should be noted that absence of a particular place in a list or register does not mean that it does not have cultural heritage significance. The Guideline: Carrying out a heritage survey provides advice on how to carry out a survey to identify areas of local non-Indigenous cultural heritage significance for entry in a local heritage register and/or inclusion in a planning scheme schedule or overlay.

ACTIVITY Cultural heritage potential impacts and management measures

This section is to be completed if there is Indigenous or non-Indigenous cultural heritage identified, or suspected to be, in the vicinity of the turf farm.

This section of the EMP should describe the impacts and management measures related to cultural heritage which can then be risk assessed in Section 5.

- Describe the potential impacts to Indigenous or non-Indigenous cultural heritage because of the turf farm. For example:
  - Disturbance of Indigenous or non-Indigenous cultural heritage because of vegetation clearing or excavation.

Note that potential impacts on cultural heritage are not expected to change over the life of the turf farm or require ongoing management.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:
  - Conduct surveys of undisturbed areas prior to production and clearing.
  - Engage with local Aboriginal Party for the area prior to clearing activities to obtain advice on land management and presence of Indigenous cultural heritage.
  - Complete checks of online registers to ensure no presence of non-Indigenous cultural heritage places. Register checks to be repeated prior to any new production.
  - All reasonable and practicable measures should be taken to ensure turf production activities do not harm cultural heritage.

If at any time during an activity it is necessary to excavate, relocate, remove or harm Aboriginal cultural heritage, the activity should cease and the Aboriginal Party for the areas should be notified and their advice sought as to how best the excavation/relocation/removal may be managed to avoid or minimise harm to the Aboriginal cultural heritage.

Potential impact	Management measures	Monitoring programs

4.8 Public amenity

Public amenities refer to resources or facilities that are provided by the local government/city councils for public use (e.g. parks, playgrounds). Although turf farms are typically located in rural areas, there is still the potential for members of the public to be impacted by the turf farm particularly in terms of air emissions, odour, noise emissions, vibration and traffic movements.

Sensitive receptors for the public may include dwellings, educational institutions and childcare centres, community buildings, commercial offices, retail facilities, etc and can be identified via aerial maps.

It is important to minimise adverse impacts to public amenities and the public for both environmental and community/reputational reasons.

Potential Impacts of the Turf Farm Industry on Public Amenities/Sensitive Receptors

Potential environmental and community/reputational impacts include:

- Excess dust/haze
- Poor energy system and/or fuel performance leading to increased air (greenhouse gas) emissions
- Odour (potentially from manure) causing complaints from sensitive receptors
- Reduced amenity and sleep
- Disrupted work and learning environments and
- Increased risk of traffic accidents due to increased number of delivery trucks on local roads.

Typical management and monitoring strategies for impacts to public amenities/sensitive receptors

Management and monitoring strategies for impacts to public amenities or sensitive receptors will vary depending on the impact type. In most cases effective environmental management will ensure there is minimal risk of impacts to public amenities or sensitive receptors. Proactive consultation and maintaining relationships with external stakeholders, neighbours and the community will also help reduce the risk of complaints.

Monitoring may include visual observations of dust generation during operations or detection of excess noise or odour at property boundaries.

ACTIVITY Sensitive receptors and public amenities

To complete this section of the EMP:

- Sensitive receptors and public amenities near the turf farm should be identified and described. A map showing their location in relation to the turf farm is recommend. These receptors can also be included in the turf farm map (Refer to Section 3.1).
- Identify plant and equipment at the turf farm that generate noise or air emissions or vibrations. Describe the nature of the emissions (e.g. or noise and vibration, whether the emissions are tonal or impulsive, and for air, whether the emissions come from one source location or are dispersed across site) and the work periods (standard hours or non-standard hours of the day, evening or night).

Map and describe access roads and delivery routes frequented by delivery trucks and other vehicles associated with the turf farm.

MAP

ACTIVITY Sensitive receptors potential impacts and management measures

This section is to be completed if there are sensitive receptors identified in the vicinity of the turf farm. This section of the EMP should describe the impacts and management measures related to public amenities which can then be risk assessed in Section 5.

- List the potential impacts that these receptors/members of the public may experience because of the turf farm. Some examples of potential impacts include:

  - Excess dust/haze
  - Poor energy system and/or fuel performance leading to increased air (greenhouse gas) emissions
  - Odour (potentially from manure)
  - Reduced amenity and sleep
  - Disrupted work and learning environments and
  - Increased risk of traffic accidents due to increased number of delivery trucks on local roads.

Ensure to take into consideration the proximity of sensitive receptors to the turf farm, and the expected magnitude and frequency of noise and air emissions and traffic movements.

- Describe the management measures used to manage these impacts including monitoring programs. Some generic examples are given below however the EMP should describe site-specific details:

  For poor or inefficient energy use:
  - Undertake an energy audit to determine where energy is being used on-farm and in what proportions.
  - Turn off energy using devices when not in use.
  - Properly maintain all vehicles, equipment and machinery, including checking fuel efficiency.
  - Ensure pumps are regularly serviced and running efficiently.
  - Purchase energy-efficient models when replacing equipment.

  For excessive noise or vibration:
  - Limit noisy and vibratory activities to standard working/construction hours where possible.
  - For particularly noisy and/or vibratory activities, consider implementing measures to minimise noise and vibration transference during the activity. For example, using squawkers for reversing vehicles, acoustic sheds or noise barriers.
  - Provide guidance to operators on safe and appropriate working distances for noisy and vibratory activities.

Potential impact	Management measures	Monitoring programs

4.9 Waste

Waste includes anything, other than an end of waste resource, that is either:

- Left over, or an unwanted by-product, from an activity or
- Surplus to the activity generating waste.

Waste from turf farms is likely to include used chemical containers, tyres, timber, batteries, scrap metal, oil and grease, post-harvest green waste, plastic waste (e.g. irrigation pipes, packaging), fencing and building materials, lights and fluorescent tubes.

In Queensland, everyone is responsible for ensuring that waste is managed (i.e. stored, transported, treated and disposed of) in an appropriate manner. This is essential for many reasons including:

- Avoiding or minimising adverse impacts on the environment such as air, land and water pollution.
- Recycling materials reduces demand natural resources and landfills.
- Businesses are legally obliged to manage waste in an appropriate manner under the *Waste Reduction and Recycling Act 2011*.

Waste management hierarchy

The waste management hierarchy may be used to identify and adopt practices that minimise resource use and waste generation, and therefore the risk of environmental harm. As shown in Figure 0.1, the waste management hierarchy is a list of waste management strategies arranged from most preferred to least preferred.

Figure 0.1: Waste management hierarchy

The highest priority, avoiding waste, aims to avoid unnecessary resource consumption through behaviours such as avoiding disposable goods or single-use materials, and selecting materials with the least packaging or that require the fewest resources to produce.

Where avoiding waste is not possible, the next priorities are to re-use, recycle or recover energy from the waste.

Finally, the waste hierarchy recognises that some types of waste, such as hazardous chemicals or asbestos, cannot be safely recycled and that treatment and/or disposal is the most appropriate management option. All waste must only be disposed of at a landfill or facility lawfully able to accept such waste.

Regulated waste

In Queensland, the Environmental Protection Regulation 2019 classifies certain types of waste as ‘regulated waste’. Generators, transporters and receivers of regulated waste must comply with ‘waste tracking requirements’ which include recording and reporting the generation, transportation, treatment and disposal destination of regulated waste.

More information on the waste tracking requirements is available on the Department of Environment and Science’s website. Some activities are exempt from having to comply with the waste tracking requirements, therefore turf farm operators are encouraged to consult with the department to determine whether they are exempt from the waste tracking requirements.

ACTIVITY Types of waste

To complete this section of the EMP, describe the types of waste that will be generated at the turf farm. Where possible, for each type of waste, include the following information:

- The source of the waste
- The rate of waste production (kg, tonnage or m3 per day, week, month or year)
- Whether or not the waste is a 'regulated waste' and
- How the waste will be managed.

It might be helpful to present this information in a table.

Source	Rate	Regulated	Managed

ACTIVITY Waste potential impacts & management measures

To complete this section of the EMP, describe the potential adverse impacts on the environment related to waste from the turf farm. For example:

- Waterway and/or land contamination if waste is not properly contained and
- Unpleasant odours from waste storage areas.

Then describe the management measures that are in place to prevent the above listed management measures from occurring or minimise the consequences if they do occur. For example:

- Waste is stored in appropriately sized containers both on-farm and during transport.
- Waste storage areas are located away from sensitive environmental areas such as waterways. Liquid waste storage areas are bunded.
- Buffer zones and/or screens are installed around waste storage sites to help control any unpleasant odours and exclude animals.

The potential adverse impacts and management measures described here should be risk assessed in Section 0. Different waste types will have different risk levels. High risk wastes deserve a higher level of management to ensure that adverse impacts on the environment are effectively avoided or minimised.

Potential impact	Management measures	Monitoring programs

5 Risk assessment

Once the environmental values and potential impacts of the turf farm are clearly identified (Section 4), a risk assessment should be undertaken for each potential impact. This means that the likelihood and consequences of each potential impact need to be estimated. The matrices provided in Appendix B may be used to estimate likelihood and consequence ratings.

The function of the risk assessment is to ensure that potential impacts are effectively mapped against appropriate management measures. The risk assessment can be helpful to define what the key environmental risks are for each turf farm. Impacts with higher risk ratings usually require more attention and management measures to reduce the risk to an acceptable level.

Follow this process to complete this risk assessment template provided on the following page:

1. Create a row for each risk event / potential impact identified in Section 5 (even if the risk event or potential impact is not something that has ever happened or is considered unlikely to happen).
2. For each risk event, list all the management measures that are, or will be, employed at the turf farm to avoid or minimise the risk event. These management measures should have been already identified and discussed in Section 5.
3. With consideration for the management measures, assign a 'likelihood' that the impact or risk event will occur (refer to Appendix B). A couple of examples have been completed in the below example risk assessment to demonstrate this step.
4. With consideration for the significance and sensitivity of the environmental values within or surrounding the turf farm (as identified in Section 5), assign a 'consequence' of the risk event if it were to occur (refer to Appendix B). A couple of examples have been completed in the below example risk assessment to demonstrate this step.
5. Assign an overall risk rating for each risk event based on the likelihood and consequence (refer to Appendix B).

An example risk assessment is provided below with some pre-populated risk events, potential impacts and management measures that may be relevant to the turf industry. For some complex environmental impacts (e.g. erosion of waterways), multiple stakeholders may be required to help develop and approve the required mitigation measures. For this risk/impact it is recommended that relevant stakeholders are engaged upon becoming aware of waterway erosion issues. Relevant stakeholders include SRRC's Resilient Rivers Initiative Catchment Management Officer.

Note that this table it is not a complete assessment of the risks and management measures associated with turf production. Furthermore, it is merely an example of one approach to risk assessment. More guidance on evaluating and managing risk can be found in AS/NZS ISO 31000:2009 Risk management – Principles and guidelines.

Table 0.1 Example risk assessment and template

Potential impacts / risk event	Potential consequences	Management measures	Likelihood	Consequence	Risk rating
LAND RESOURCES					
Erosion from exposed turf farmland (e.g. after harvesting)	• *Loss of topsoil* • *Waterway sedimentation*	• *Use vegetation, mulch or matting to dissipate raindrop impact in areas at risk of erosion, particularly where turf is not produced.* • *Incorporate organic matter into soil to increase its structural strength and resistance to heavy rain and wind events.* • *Harvest high-risk erosion areas at low-risk, low-rainfall times when possible (e.g. not during February in south-east Queensland).* • *When establishing turf, manage irrigation and fertilisation to ensure quick ground cover.* • *Where practicable, capture runoff using contour banks and grassed drains and store in an on-farm farm or tank for reuse.* • *Grass or retain vegetation in areas between the farm and off-site drainage and discharge points (i.e. buffer zones).*	*Possible*	*Moderate*	*Medium*

Erosion within waterways	• *Loss of topsoil*
	• *Waterway sedimentation*
	• *Loss of productive farmland*
	• *Impacts on public amenities*
	• *Loss of vegetation along waterway*
		• *Engage relevant stakeholders upon becoming aware of erosion issues. Relevant stakeholders can include:*
		  ○ *Catchment Management Officer - Environmental Policy & Services (SRRC)*
		  ○ *Landholder if waterway is on privately owned land*
		• *Wherever possible, retain a buffer of vegetation between operational areas (including roads) and waterways.*
		• *Grass or retain vegetation in areas between the farm and off-site drainage and discharge points (i.e. buffer zones).*
			Highly likely	*Major*	*Severe*

SURFACE WATER & WETLANDS					
Poor irrigation and water system performance	• *High demand for water resources* • *Volume of water pumped/used from waterways exceeds licence allocations* • *Excess water is used for irrigation resulting in unnecessary runoff and water usage*	• *Meter and monitor water usage from all sources.* • *Regularly check pumps and polylines for leaks.* • *Regularly clean water filters to prevent blockages.* • *Ensure that the irrigation system is distributing watering evenly.* • *Minimise runoff and evaporative and deep drainage losses by ensuring that the water delivery rate does not exceed the infiltration rate of the soil.* • *Consider irrigating in the morning or night when wind and evaporation rates are lowest.* • *Capture rainfall from on-farm structures such as sheds and greenhouses.* • *Use high-pressure cleaners for washing machinery.* • *Consider waterless methods of cleaning.*	*Possible*	*Minor*	*Low*
Elevated nutrient loads and/or metals entering waterways from runoff from manure stockpiles adjacent to watercourse with no bunding	• *Waterway eutrophication leading to algal blooms* • *Death of aquatic plants and wildlife*	• *Stockpiles for manure should be placed away from waterways or drainage paths and covered or bunded to prevent runoff after rainfall events.* • *Grass or retain vegetation in areas between the farm and off-site drainage and discharge points (i.e. buffer zones).* • *Testing of soils and/or water for nutrients to inform fertiliser requirements and avoid over-fertilising or unnecessary stockpiling of fertilisers.*	*Likely*	*Moderate*	*Medium*
GROUNDWATER					
Nutrients and/or metals leached into	• *Groundwater contamination*	• *Undertake soil testing to determine soil nutrient requirements and use to calculate fertiliser application rates, with the aim of applying the minimum rate of fertiliser to achieve plant growth and turf quality.* • *Maintain and calibrate fertiliser application equipment to ensure that the desired rate of fertiliser is consistently applied.*	*Unlikely*	*High*	*Medium*

Potential impacts / risk event	Potential consequences	Management measures	Likelihood	Consequence	Risk rating
groundwater from either excess nutrient application or within runoff after rain events or flooding		• *Check weather conditions before applying fertiliser. Do not apply fertiliser to waterlogged soil. Avoid applying fertiliser on windy days or when heavy rain is expected.* • *Capture runoff and store in an on-farm dam or tank for reuse.*			
FLORA					
Clearing of native plants and vegetation communities (beyond approved areas)	• *Loss of native plants and vegetation communities (e.g. loss of mature habitat/hollow bearing trees)* • *Loss of native fauna habitat*	• *If vegetation clearing is required, clearly mark the limits of clearing to avoid inadvertently clearing native plants and vegetation communities.* • *Minimise the clearing extent as far as reasonably practicable.* • *Where possible, cleared areas should be replanted with native vegetation as soon as practicable.* • *Alternative areas may also be planted/revegetated to restore or improve environmental values.*	*Rare*	*Major*	*Medium*
FAUNA					
*Drift from pesticides/ herbicides impacting upon protected fauna **or** fauna habitat*	• *Loss of native fauna species or fauna habitat*	• *Consider the location of native fauna species and fauna habitat when planning pesticide/herbicide application. If possible, maintain a buffer zone between pesticide/herbicide application areas and the location of native fauna species and fauna habitat.* • *Provide training to operators on pesticide/herbicide application.* • *Comply with the application instructions for the specific pesticide/herbicide being applied.* • *Select equipment (applicators and nozzles) that will give the correct droplet size range to minimise drift and maximise efficiency. Regularly calibrate equipment.* • *Spray only in favourable weather conditions, i.e. when the wind is blowing steadily and it is possible to predict where the spray will go. Stop spraying if the conditions are not right.*	*Unlikely*	*Moderate*	*Low*
BIOSECURITY					

Pest, weed and disease infestations	• *Decline in populations of native flora and fauna*
	• *Reduction in the usability of the land and*
	• *Loss of production*
		• *Regularly check and monitor the presence of pests through a combination of methods including observation, inspection and collecting samples for identification.*
		• *Prevent pest infestations through a combination of measures, including:*
		  ○ *Install protective structures or vegetation between crops and prevailing winds.*
		  ○ *Minimise opportunities for pests to breed in pooled wet areas.*
		  ○ *Eliminate weeds before planting in a new area.*
		  ○ *Ensure that materials and machinery moving in and out of growing areas are free of weeds (e.g. make use of machinery wash down).*
		  ○ *Apply pesticides/herbicides by suitably trained people.*
			Possible	*Moderate*	*Medium*

CULTURAL HERITAGE					
Unauthorised vegetation clearing, excavation, etc.	• *Disturbance to cultural heritage*	• *All reasonable and practicable measures should be taken to ensure turf production activities do not harm cultural heritage.* • *If at any time during an activity it is necessary to excavate, relocate, remove or harm Aboriginal cultural heritage, the activity should cease and the Aboriginal Party for the areas should be notified and their advice sought as to how best the excavation/relocation/removal may be managed to avoid or minimise harm to the Aboriginal cultural heritage.*	*Rare*	*Critical*	*High*
PUBLIC AMENITY					
Poor energy system and fuel	• *Excess air (greenhouse gas) emissions*	• *Undertake an energy audit to determine where energy is being used on-farm and in what proportions.* • *Turn off energy using devices when not in use.*	*Possible*	*Minor*	*Low*

Potential impacts / risk event	Potential consequences	Management measures	Likelihood	Consequence	Risk rating
performance		• *Properly maintain all vehicles, equipment and machinery, including checking fuel efficiency.* • *Ensure pumps are regularly serviced and running efficiently.* • *Purchase energy-efficient models when replacing equipment.*			
WASTE					
Inappropriate waste disposal	• *Pollution* • *Unnecessary demand on resources (in the case that recyclable material is disposed of to landfill)*	• *Avoid burning and on-farm waste disposal.* • *On-farm waste storage should be located away from sensitive sites such as waterways and neighbouring properties.* • *Consider buffer zones and/or screens around waste storage sites to help control any unpleasant odours and exclude animals.* • *Contain waste while stored on-farm and in transport.* • *Dispose of waste as a last option.*	*Likely*	*Minor*	*Low*

6 Audit and review

6.1 Environmental auditing

The EMP should include the schedule or triggers for auditing the implementation and effectiveness of the EMP. It should address both internal and external audit requirements including who is responsible for undertaking the audits and reporting the results.

ACTIVITY Audits and reporting

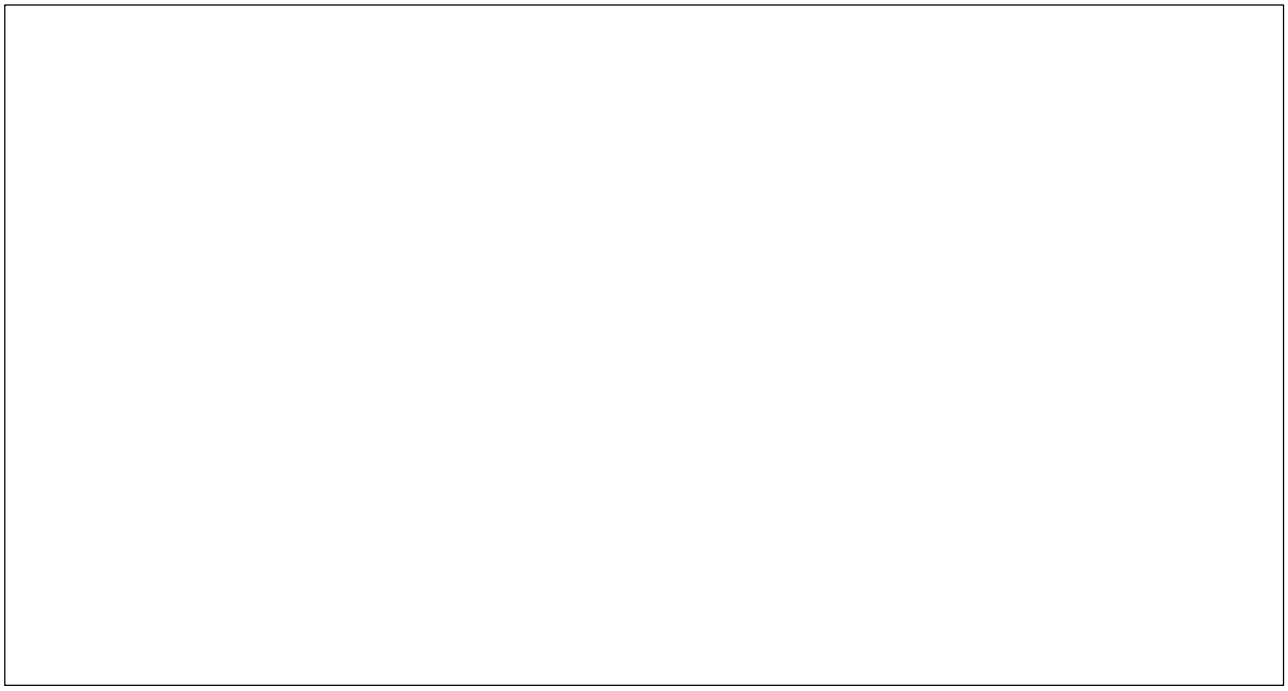
6.2 Environmental management plan review

The EMP should specify the schedule or triggers for reviews of the EMP. A review of the EMP would typically be undertaken:

- Following significant environmental incidents
- Where there is a need to improve performance in an area of environmental impact or
- Periodically, such as once every one, two or five years.

A review should assess whether the EMP is achieving its objectives and the requirements of any relevant approval conditions, considering environmental monitoring records, corrective actions and the results of any audits. During the review process, any reasons for varying the EMP should be documented.

ACTIVITY Plan review



7 References and resources

7.1 References and links

THEME	LINK
Resilient Rivers Initiative	Logan-Albert Catchment Action Plan 2017-2020
	Resilient Rivers Initiative Fact Sheet
Identification of environmental values and their management	Accepted development requirements for operational work that is constructing or raising waterway barrier works Guideline
	Atlas of Living Australia
	Australian Groundwater Explorer
	Australian Soil Resource Information System
	Bureau of Meteorology – Logan-Albert Rivers Flood Map
	Biomaps
	Commonwealth Heritage List
	Cultural Heritage Duty of Care Guidelines
	DAFF Biosecurity Resources
	DATSIP Cultural Heritage Database and Register
	Environmental Protection (Water) Policy 2009 Albert River environmental values and water quality objectives
	Guideline: Carrying out a heritage survey
	IECA Best Practice Erosion and Sediment Control Guideline 2008 (Not publicly available)
	Management of regulated wastes
	Monitoring and Sampling Manual
	National Acid Sulfate Soils Guidance Manual
	National Heritage List
	Property Map of Assessable Vegetation
	Protected Plants Flora Survey Trigger Maps
	Protected Matters Search Tool
	Scenic Rim Biosecurity Plan
	Queensland Globe
	Queensland Heritage Register
	Queensland Government – Acid Sulfate Soils
	Queensland Government – Sodic Soils
	Queensland Parliamentary Council website
	Water Monitoring Information Portal
	WetlandMaps
	WildNet Database

	World Heritage List
Risk assessment	ISO 31000:2009 Risk management — Principles and guidelines
Environmental management plans	DIPNR Guideline for the Preparation of Environmental Management Plans
	DAWE Environmental Management Plan Guidelines
Turf production	Turf Queensland Turf & Irrigation Guide 2nd Edition
	Turf Queensland Knowledge Base
	Best Management Practices for Lawn and Landscape Turf
	DPI Planning for Turf Farms Guideline

7.2 Relevant legislation

Below is a list of environmental legislation that is relevant to the turf production industry. The list includes the main objective and relevance to turf production for each piece of legislation.

Note that this is not an exhaustive list of relevant legislation. It is recommended that professional advice regarding relevant legislation is sought when planning a new turf farm or expansion of an existing turf farm.

LEGISLATION	ADMINISTERING AUTHORITY	OBJECTIVE	RELEVANCE TO TURF PRODUCTION
COMMONWEALTH			
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Agriculture, Water and the Environment	To protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the EPBC Act as matters of national environmental significance	The EPBC Act may be relevant if there are matters of national environmental significance within or surrounding the turf farm.
QUEENSLAND			
Aboriginal Cultural Heritage Act 2003	Department of Aboriginal and Torres Strait Islander Partnerships	To recognise, protect and conserve Aboriginal cultural heritage in the State of Queensland A key feature of the Act is the 'duty of care' by which anyone carrying out any activity on land (including freehold) anywhere in Queensland is required by law to take all reasonable and practicable measures to ensure their activity does not harm Aboriginal Cultural Heritage.	These Acts may be relevant if there are culturally significant items or areas present within or surrounding the turf farm.
Queensland Heritage Act 1992	Department of Environment and Science	To provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations	
Environmental Protection Act 1992 (EP Act)	Department of Environment and Science	To protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains ecological processes (ecologically sustainable development) The following subordinate legislation supports the operation of the EP Act: • Environmental Protection Regulation 2019 • Environmental Protection (Air) Policy 2019 • Environmental Protection (Noise) Policy 2019 and • Environmental Protection (Water and Wetland Biodiversity) Policy 2019	The EP Act may be relevant if there are any 'Environmentally Relevant Activities' associated with the turf farm which requires approval under an Environmental Authority. Furthermore, under the EP Act everyone in Queensland has a 'general environmental duty' (person must not carry out any activity that causes or is likely to cause environmental harm, unless measures to prevent or minimise the harm have been taken) and a 'duty to notify of environmental harm' (to inform the administering authority and landowner or occupier when an incident has occurred that may have caused or threatens serious or material environmental harm).

Environmental Offsets Act 2014	Department of Environment and Science	To counterbalance the significant residual impacts of particular activities on prescribed environmental matters using environmental offsets	An environmental offset may be required as a condition of approval for a turf farm where – following consideration of avoidance and mitigation measures – the development is likely to result in a significant residual impact on a prescribed environmental matter.
Land Act 1994	Department of Environment and Science and Department of Resources	An Act relating to the administration and management of non-freehold land and deeds of grant in trust, and the creation of freehold land	This Act may be relevant if there are multiple land parcels overlaying the turf farm (including easements) and multiple stakeholders/owners involved in managing these parcels of land. This Act is more likely to be relevant during initial turf farm development and not likely to be something requiring ongoing management.
Land Protection (Pest and Stock Route Management) Act 2002	Department of Resources	The Act manages pests on land and the management of the stock route network	This Act may be relevant in the identification and management of both flora and fauna pest species.
Nature Conservation Act 1992	Department of Environment and Science	To create and manage protected areas including national parts, conservation parks, resources reserves, nature refuges, coordinated conservation areas, wilderness areas, world heritage management areas, and protect Queensland's threatened biota The following subordinate legislation supports the operation of the Act: • Nature Conservation (Protected Areas Management) Regulation 2017 and • Nature Conservation (Animals) Regulation 2020.	This Act may be relevant if there are protected plants or animals within or surrounding the turf farm.
Fisheries Act 1994	Department of Agriculture and Fisheries	To provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats	This Act may be relevant if there is a waterway that passes through or adjacent to the turf farm. Any works within these waterways may need to be assessed for obstructions to fish passage.
Biosecurity Act 2014	Department of Agriculture and Fisheries	To safeguard the Queensland economy, agricultural and tourism industries, environment and way of life from pests, diseases and contaminants	Under this Act, all Queenslanders have a 'general biosecurity obligation' (GBO) under the. Under the GBO, individuals and organisations whose activities pose a biosecurity risk must: • Take all reasonable and practical steps to prevent or minimise each biosecurity risk. • Minimise the likelihood or causing a 'biosecurity event' and limit he consequences if such an event is caused. Prevent or minimise the harmful effects a risk could have, and not do anything that might make any harmful effects worse.
Planning Act 2016	Department of State Development, Infrastructure, Local	The QLD Planning Act is the principal law regulating state planning and development and provides a framework for local governments to prepare planning Schemes	The QLD Planning Act may be relevant if turf production becomes assessable and triggers a development approval (DA) for matters of state interest. Some DAs may contain

	Government and Planning		environmental management conditions.
Soil Conservation Act 1986	Department of Resources	An Act relating to the conservation of soil resources and to facilitate the implementation of soil conservation measures by landholders for the mitigation of soil erosion	The Act may be relevant when there are issues related to soil conservation, i.e. large scale erosion of waterways.
Vegetation Management Act 1999	Department of Resources	To regulate the clearing of vegetation in a way that conserves remnant vegetation, conserves vegetation in declared areas, ensures the clearing does not cause land degradation, prevents the loss of biodiversity, maintains ecological processes, reduces greenhouse gas emissions and allows for sustainable land use	The Vegetation Management Act may be relevant if there is vegetation clearing is required for the turf farm.
Water Act 2000	Department of Resources	To provide a framework for the allocation and use of surface water and groundwater in Queensland, including regulating major water impoundments (e.g. dams and weirs) and extraction through pumping for irrigation and other uses	The Water Act may be relevant if a turf producer uses water from a natural watercourse or groundwater from a bore in their operations. Generally, the use of this water is licenced and the water licence may have specific conditions that are relevant to include within an EMP.
Waste Reduction and Recycling Act 2011 (WRR Act)	Department of Environment and Science	To promote waste avoidance and reduction and to encourage resource recovery and efficiency The following subordinate legislation supports the operation of the EP Act: Waste Reduction and Recycling Regulation 2011.	The WRR Act may be relevant if regulated waste transport, treatment and/or disposal is associated with the turf farm. It is also a regulatory requirement that activities which will generate, transport or receive waste to do so in accordance with the waste and resource management hierarchy in the WRR Act: avoid, reduce, re-use, recycle, recover, treat and dispose.
LOCAL			
Scenic Rim Planning Scheme 2020	Scenic Rim Regional Council	Outline the intentions for future development within these council areas and provide a framework and assessment process for development	These planning schemes may be relevant if turf production becomes assessable and triggers a development approval (DA) under the local planning scheme. Some DAs may contain environmental management conditions.
Logan Planning Scheme 2015	Logan City Council/ City of Logan		

7.3 Conditions of approval

If this EMP is being prepared to satisfy approval or licence conditions, it may be useful to prepare a table or list with the following information and include it in the EMP:

- The approval/licence condition the EMP is intended to address
- The EMP sections that address the approval conditions and
- A summary of key commitments relating to each approval condition.

7.4 Risk evaluation matrices

Included below is a qualitative risk assessment methodology that can be applied to the environmental risks associated with turf farms. It is provided as an example of one approach to risk assessment. Further guidance on evaluating and managing risk can be found in *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*.

- Following significant environmental incidents

Likelihood and consequence

Each environmental risk should be given a rating in terms of likelihood and consequence using the criteria in the tables below:

QUALITATIVE MEASURE OF LIKELIHOOD (HOW LIKELY IT IS THAT THIS EVENT/ISSUE WILL OCCUR AFTER CONTROL STRATEGIES HAVE BEEN PUT IN PLACE)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the turf farm
Possible	Might occur during the life of the turf farm
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

QUALITATIVE MEASURE OF CONSEQUENCES (WHAT WILL BE THE CONSEQUENCE/RESULT IF THIS ISSUE DOES OCCUR)	
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing loss of environmental amenity
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Risk rating

The table below determines whether a risk is low, medium, high or severe based on the likelihood and consequence rating. The risk rating can be used as a guide to the amount of time and resources that will be required to manage each risk. Risks with low-risk ratings will usually require significantly less management than medium, high and severe risks. This is usually reflected in the EMP where risks with high-risk ratings require more detailed information regarding:

- The description of the risk
- The measures and commitments to minimise and manage the risk
- The performance objectives and monitoring programs and
- Trigger values for additional action, review and reporting.

Likelihood	Consequence				
	Minor	**Moderate**	**High**	**Major**	**Critical**
Highly likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

SCENIC RIM

REGIONAL COUNCIL

PO Box 25 | 82 Brisbane Street,
Beaudesert QLD 4285
Telephone 07 5540 5111
scenicrim.qld.gov.au