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Queensland Government

Department of Environment and Resource Management
Petroleum and Gas Unit
PO Box 15155 CITY EAST QLD 4002

Environmental Authority (Petroleum Activities) Permit Number PEN100369209

Section 310M *Environmental Protection Act 1994*

This environmental authority is granted under the Environmental Protection Act 1994 and includes conditions to minimise environmental harm caused, or likely to be caused, by the authorised petroleum activities. An environmental authority (petroleum activities) may be for petroleum activities authorised (under the Petroleum and Gas (Production and Safety) Act 2004, Petroleum Act 1923 or Petroleum (Submerged Lands) Act 1982) to occur under one of the following petroleum authorities: authority to prospect; petroleum lease, data acquisition authority, water monitoring authority, petroleum facility licence, survey licence or pipeline licence. In general, a petroleum activity means an activity that, under the relevant petroleum legislation, is an authorised activity, rehabilitation, remediation, and includes facilitation and supporting activities and any action taken to prevent environmental harm.

Under the provisions of the *Environmental Protection Act 1994*, this environmental authority (petroleum activities) is issued to:

Surat Gladstone Pipeline Pty Ltd
Level 13 AMP Place
10 Eagle Street
BRISBANE QLD 4000

in respect of carrying out level 1 and level 2 petroleum activities under Section 23 of the *Environmental Protection Regulation (2008)*.

Authorised Level 1 petroleum activities under Schedule 5 of the *Environmental Protection Regulation (2008)* include:

Schedule 5 Activity	Description
5	**Constructing a new pipeline of more than 150km under a petroleum authority**
8	**A petroleum activity, other than a petroleum activity mentioned in items 1 to 7, that includes a chapter 4 activity for which an aggregate environmental score is stated, including:** **ERA 8 (1)(a), chemical storage,** consists of storing 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 in containers of at least 10m^3; **ERA 15, fuel burning,** consists of using fuel burning equipment that is capable of burning at least 50kg of fuel in an hour; **ERA 63 (1)(a), (3)(2)(b), sewage treatment,** consists of operating one or more sewage treatment works, other than no-release works, with a total daily peak design capacity of more than 100 to 1500 EP; **ERA 64 (1)(b), (3)(3), water treatment,** consists of treating 10ML or more of raw water in a day.

on the relevant petroleum authorities identified below:

Relevant petroleum tenement(s)	Project Name	Location Description
Petroleum Pipeline Licence 144	**Surat to Gladstone Pipeline**	**Refer to Appendix 3 – Approved Plans**

This environmental authority (petroleum activities) [the "authority"] is subject to the condition that the holder carry out the above environmentally relevant activities in accordance with the conditions listed below.

This authority takes effect from **date of issue.**

This authority remains in force unless it is cancelled, surrendered or suspended.

The anniversary date of this authority is 18 January.

Signed

18 JANUARY 2010
Date

Parma Nand
Delegate of Administering Authority
Environmental Protection Act 1994

Note: This environmental authority document is not proof of the current status of the environmental authority. The current status of the environmental authority may be ascertained by contacting the Administering Authority.

This environmental authority incorporates the following schedules of conditions relevant to various issues:

Schedule A - General
Schedule B - Air
Schedule C - Water
Schedule D - Noise
Schedule E - Waste
Schedule F - Land
Schedule G - Environmentally Sensitive Areas
Schedule H - Declared Wild River Areas
Schedule I - Petroleum Pipelines
Schedule J - Regulated Dams
Schedule K - Monitoring Programs
Schedule L - Community Issues
Schedule M - Notification procedures

Appendix 1 – Definitions
Appendix 2 – Environmentally Sensitive Areas
Appendix 3 – Map of PPL144
Appendix 4 – Determining Hazard Categories for Regulated Dams

SCHEDULE A GENERAL CONDITIONS

PREVENT AND/OR MINIMISE LIKELIHOOD OF ENVIRONMENTAL HARM

(A1) This authority does not authorise environmental harm unless a condition contained within this authority explicitly authorises that harm. Where there is no condition or the authority is silent on a matter, the lack of a condition or silence shall not be construed as authorising harm.

(A2) In carrying out petroleum activities the holder of this authority must prevent and / or minimise the likelihood of environmental harm being caused.

MAINTENANCE OF MEASURES, PLANT AND EQUIPMENT

(A3) The holder of this authority must:

a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this authority; and

b) maintain such measures, plant and equipment in a proper and efficient condition; and

c) operate such measures, plant and equipment in a proper and efficient manner.

(A4) All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this authority must be calibrated, appropriately operated and maintained.

(A5) No change, replacement or alteration of any plant or equipment is permitted if the change, replacement or alteration increases the environmental harm caused by the petroleum activities.

(A6) The holder of this authority must ensure that daily operation and maintenance of all plant and equipment relating to the authorised petroleum activities are carried out by suitability qualified, competent and experienced person(s).

(A7) All analyses and tests required to be conducted under this authority must be carried out by a laboratory that has NATA certification for such analyses and tests, except as otherwise authorised by the administering authority.

COMPLIANCE WITH AUSTRALIAN PIPELINE INDUSTRY ASSOCIATION CODE OF ENVIRONMENTAL PRACTICE

(A8) The holder of this authority must undertake petroleum activities in relation to the operation of petroleum pipelines in accordance with the Australian Pipeline Industry Association *Code of Environmental Practice – Onshore Pipelines*, October 2005 (the Code) or subsequent versions thereof. To the extent of any inconsistency between the conditions of this environmental authority and the Code, the conditions of this authority prevail.

FINANCIAL ASSURANCE

(A9) The holder of this authority must provide a financial assurance in the amount and form required by the administering authority for the construction, operation and decommissioning of the relevant petroleum pipeline at the time of the submission of the original or any amended work program or development plan. The calculation of financial assurance must be calculated in accordance with the guideline "Financial assurance for petroleum activities".

(A10) The financial assurance is to remain in force until the administering authority is satisfied that no claim is likely to be made on the assurance.

DEFINITIONS

(A11) Words and phrases used in this authority are defined in Appendix 1 – Definitions. Where a definition for a term used in this authority is sought and the term is not defined within this authority, the definitions in the *Environmental Protection Act 1994*, its Regulation and Environmental Protection Policies must be used.

ENVIRONMENTAL MANAGEMENT PLAN

(A12) An Environmental Management Plan (EM plan) must be implemented that provides for the effective management of the actual and potential impacts resulting from the carrying out of the petroleum activities. Documentation relating to the EM plan must be kept.

(A13) The EM plan required by condition (A12) must address, at least, the following:

1. Describe each of the following:
   (a) each relevant resource authority for the environmental authority;
   (b) all relevant petroleum activities;
   (c) the land on which the activities are to be carried out;
   (d) the environmental values likely to be affected by the activities; and
   (e) the potential adverse and beneficial impacts of the activities on the environmental values.
2. State the environmental protection commitments the applicant proposes for the activities to protect or enhance the environmental values under best practice environmental management;
3. Include a rehabilitation program for land proposed to be disturbed under each relevant resource authority for the application; and
4. State a proposed amount of financial assurance for the environmental authority as part of the rehabilitation program.
5. Training staff in the awareness of environmental issues related to carrying out the petroleum activities, which must include at least:
   (a) The environmental policy of the authority holder, so that all persons that carry out the petroleum activities are aware of all relevant commitments to environmental management;
   (b) Any relevant environmental objectives and targets, so that all staff are aware of the relevant performance objectives and can work towards these;
   (c) Control procedures to be implemented for routine operations for day to day activities to minimise the likelihood of environmental harm, however occasioned or caused;
   (d) Contingency plans and emergency procedures to be implemented for non-routine situations to deal with foreseeable risks and hazards, including corrective responses to prevent and mitigate environmental harm (including any necessary site rehabilitation);
   (e) Organisational structure and responsibility to ensure that roles, responsibilities and authorities are appropriately defined to ensure effective management of environmental issues;
   (f) Effective communication procedures to ensure two-way communication on environmental matters between operational staff and higher management;
   (g) Obligations with respect to monitoring, notification and record keeping obligations under the EM plan and relevant approvals; and
   (h) Monitoring of the release of contaminants into the environment including procedures, methods and record keeping.
6. The conduct of periodic reviews of environmental performance and procedures adopted, not less frequently than annually; and
7. A program for continuous improvement.

SCHEDULE B ENVIRONMENTAL NUISANCE

(B1) The release of odour, dust or any other airborne contaminant(s), or light from the petroleum activity must not cause an environmental nuisance at any sensitive place or commercial place.

NOISE

(B2) Prior to undertaking petroleum activities that are likely to impact upon a sensitive or commercial place, the holder of this authority must investigate potential noise emissions from the proposed petroleum activities and determine if noise emissions are likely to exceed the limits set in Condition (B3).

(B3) If noise emissions are likely to exceed the limits specified in Schedule B, Table 1, then the holder must take appropriate measures to either relocate the petroleum activity or incorporate noise abatement and / attenuation measures to mitigate those impacts. These measures must be in place prior to undertaking the proposed petroleum activity.

(B4) Noise emitted from any aspect of the petroleum activities must not exceed the noise levels, specified in Schedule B, Table 1 at any sensitive or commercial place, other than those owned by the holder of this authority.

(B5) In the event of a complaint regarding noise from the petroleum activities at a sensitive or commercial place, the holder of this authority must conduct an appropriate investigation and must implement remedial action, if the noise from the petroleum activities exceeds the noise limits in Schedule B, Table 1 at the sensitive or commercial place.

(B6) The method of measurement and reporting of noise levels must comply with the latest edition of the Environmental Protection Agency's Noise Measurement Manual or the most recent version of AS1055 Acoustics – Description and measurement of environmental noise and the EPA guideline, Assessment of low frequency noise and the EcoAccess guideline, Planning for noise control.

ALTERNATIVE ARRANGEMENTS AVAILABLE WHEN NOISE EMISSIONS MAY CAUSE NUSIANCE FOR LIMITED PERIODS

(B7) Where the holder of this authority has, at their cost, made alternative arrangements to the satisfaction of and with the written agreement of each person affected by nuisance noise emissions at a sensitive or commercial place, then the requirements specified in Table F1- Noise Limits will not apply at that sensitive or commercial place for the period of the alternative arrangements.

(B8) As a minimum each written agreement of an alternative arrangement must state:

1. the location of the sensitive or commercial place;
2. the names of the affected persons;
3. the nature of the alternative arrangement(s) (e.g. provision of alternative accommodation); and
4. the period of the alternative arrangement(s).

SCHEDULE B TABLE 1 – NOISE LIMITS

Sensitive place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
$L_{A90, adj, 15 mins}$	lesser of bg+3 or 48	lesser of bg+0 or 40	bg+0	bg+0	bg+0	bg+0
$L_{A10, adj, 15 mins}$	lesser of bg+5 or 50	lesser of bg+5 or 45	bg+0	lesser of bg+5 or 45	lesser of bg+5 or 40	bg+0
$L_{A1, adj, 15 mins}$	lesser of bg+10 or 55	lesser of bg+10 or 50	lesser of bg+5 or 45	lesser of bg+10 or 50	lesser of bg+10 or 45	lesser of bg+5 or 40
Commercial place						
Noise level dB(A) measured as:	Monday to Saturday			Sundays and public holidays		
	7am to 6pm	6pm to 10pm	10pm to 7am	9am to 6pm	6pm to 10pm	10pm to 9am
$L_{A90, adj, 15 mins}$	lesser of bg+5 or 50	bg+0	bg+0	lesser of bg+3 or 43	bg+0	bg+0
$L_{A10, adj, 15 mins}$	lesser of bg+10 or 55	lesser of bg+10 or 50	lesser of bg+5 or 45	lesser of bg+10 or 50	lesser of bg+10 or 45	lesser of bg+5 or 40
$L_{A1, adj, 15 mins}$	lesser of bg+15 or 60	lesser of bg+15 or 55	lesser of bg+10 or 50	lesser of bg+15 or 55	lesser of bg+15 or 50	lesser of bg+10 or 45

- bg = background noise level
- In the event that measured bg is less than 25 dB(A), then 25 dB(A) is to be substituted for the measured level
- If the background is higher than the number shown on the second line in any box, the limit is to be background plus 0.

BLASTING ACTIVITIES

(B9) All blasting must be carried out in a proper manner by a competent person in accordance with best practice environmental management and Australian Standard 2187 to minimise the likelihood of any adverse effects being caused by airblast overpressure and/or ground borne vibrations at any sensitive or commercial place.

(B10) Noise from blasting operations must not exceed an airblast overpressure level, when measured at or extrapolated to any noise sensitive or commercial place, of 115 dB (linear peak) for nine (9) out of any ten (10) consecutive blasts initiated nor 120 dB (linear peak) at any time.

(B11) Ground-borne vibration peak particle velocity caused by blasting operations, when measured at or extrapolated to any noise sensitive or commercial place, must not exceed more than 5 mm per second for nine (9) out of any ten (10) consecutive blasts initiated, nor 10 mm per second at any time.

BLAST AND VIBRATION MONITORING

(B12) Should complaints about blasting and/or vibration be received or when requested by the Administering Authority, monitoring and recording of air blast overpressure and ground borne vibration (as relevant to the complaint) must be undertaken to investigate any complaint of nuisance, and the results notified within 14 days to the administering authority. Monitoring must include:

1. maximum instantaneous charge;
2. location of the blast within the site (including any bench level);

3. airblast overpressure level (dB Linear Peak);
4. peak particle velocity (mms-1);
5. location, date and time of recording;
6. measurement instrumentation and procedure;
7. meteorological conditions for blast monitoring (including temperature, relative humidity, temperature gradient, cloud cover, wind speed and direction); and
8. distance/s from blast site to potentially noise-affected building/s or structure/s.

SCHEDULE C WATER MANAGEMENT

RELEASE TO WATERS

(C1) The holder of this authority must ensure that the petroleum activities do not result in the release of contaminants to waters.

RELEASE TO LAND

(C2) The holder of this authority may allow pipeline trench water to be released to land for disposal provided that the water does not have any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm.

(C3) Subject to Condition (C2), the holder of this authority must ensure that the release of trench water to land must be carried out in a manner that ensures that:

1. vegetation is not damaged;
2. soil erosion and soil structure damage is avoided;
3. the quality of groundwater is not adversely affected; and
4. there are no releases of trench water to any surface waters.

MANAGEMENT OF HYDROSTATIC TEST WATER

(C4) The holder of this authority must ensure that:

1. hydrostatic test water is not released to waters;
2. hydrostatic test water containing chemical additives is not released to land without written consent from the administering authority; and
3. hydrostatic test water released to land does not exceed the water quality limits specified in Schedule C – Table 1.

SCHEDULE C – TABLE 1 – LIMITS FOR THE DISPOSAL OF HYDROSTATIC TEST WATER TO LAND

Parameter	Maximum Value
pH	6.5-8.5 (Range)
Arsenic (mg/L)	2.0
Cadmium (mg/L)	0.05
Chromium (mg/L)	1
Copper (mg/L)	5
Iron (mg/L)	10
Lead (mg/L)	5
Manganese	10
Zinc (mg/L)	5
Nitrogen (mg/L)	35
Phosphorus (mg/L)	10
Electrical Conductivity (uS/cm)	2000

(C5) The release of hydrostatic test water authorised by Condition (C4(3)) must be located at least 100m from the nearest watercourse and carried out in a manner that ensures that:

1. vegetation is not damaged;
2. soil erosion and soil structure damage is avoided;
3. the quality of groundwater is not adversely impacted; and
4. discharge of hydrotest water is controlled to prevent water runoff from the nominated discharge areas.

DETERMINING WATER QUALITY CONTAMINANTS

(C6) All determinations of the quality of contaminants released must be made in accordance with methods prescribed in the latest edition of the Department of Environment and Resource Management *Monitoring and Sampling Manual,* 2009, and carried out on samples that are representative of the discharge.

CONTAMINANT RELEASES TO GROUNDWATER

(C7) There must be no release of contaminants to groundwater.

CONTAMINANT RELEASES TO SURFACE WATER

(C7) There must be no release of contaminants to surface water.

SCHEDULE D WASTE MANAGEMENT

(D1) The holder of this authority must ensure that petroleum activities do not result in the release or likely release of contaminants to the environment from the storage, conditioning, treatment and disposal of regulated waste materials.

(D2) The holder of this authority must ensure that petroleum activities do not result in the release or likely release of a hazardous contaminant to the environment.

(D3) Any spillage of hazardous waste or other contaminants that may cause environmental harm, must be effectively contained and cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise thereby releasing such waste or contaminants to any land or waters.

(D4) The holder of this authority must as soon as practicable remove and dispose of all regulated waste to a licensed waste disposal facility or recycling facility.

(D5) All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.

(D6) When regulated waste is removed from within the boundary of the petroleum tenure and transported by the holder of this authority, a record must be kept of the following:

1. date of waste transport;
2. quantity of waste removed and transported;
3. type of waste removed and transported;
4. route selected for transport of waste;
5. quantity of waste delivered; and
6. any incidents (e.g. spillage) that may have occurred on route.

(D7) If a person removes regulated waste associated with activities within the operational land and disposes of such waste in a manner which is not authorised or is improper or unlawful then, as soon as practicable, notify the administering authority of all relevant facts, matters and circumstances known concerning the disposal.

(D8) The holder of this authority must implement a Waste Management Plan consistent with the Environmental Protection (Waste) Policy 2000.

(D9) The Waste Management Plan must address at least the following matters:

1. The types and amounts of waste generated;
2. How the waste will be dealt with, including a description of the types and amounts of waste that will be dealt with under each of the waste management practices mentioned in the waste management hierarchy (section 10 of the Environmental Protection (Waste Management) Policy 2000);
3. Procedures for dealing with accidents, spills and other incidents that may impact on waste management; and
4. How often the performance of the waste management practices will be assessed (i.e. at least annually); and
5. The indicators or other criteria on which the performance of the waste management practices will be assessed.

(D10) There must be no treatment and disposal of sewage conducted under this environmental authority.

SCHEDULE E LAND MANAGEMENT

MINIMISING DISTURBANCE TO LAND AND SOIL MANAGEMENT

(E1) The holder of this authority must:

1. limit the right of way width to a maximum of 30 metres;
2. minimise disturbance to land in order to prevent land degradation;
3. ensure that for land that is to be significantly disturbed by petroleum activities (except in areas of highly erosive soils), the top layer of the soil profile is removed; and
   (a) stockpiled in a manner that will preserve its biological and chemical properties, and
   (b) used for rehabilitation purposes in accordance with condition (E30).

(E2) The holder of this authority must develop and implement a soils monitoring and management plan prior to commencement of petroleum activities. This plan must include but not be limited to:

1. ground truthing of soils mapping in every mapped unit or every 2 to 5 km in large units;
2. verification of the allocation of the Australian Soil Classification (ASC) for each mapping unit;
3. develop soil descriptions that are relevant to assessment for agricultural suitability, topsoil assessment, erodibility and rehabilitation, for example:
   (a) shallow cracking clay soils;
   (b) deep cracking clay soils;
   (c) deep saline and/or sodic cracking clay soils with melonholes;
   (d) thin surface, sodic duplex soils;
   (e) medium to thick surface (say >15 cm), sodic duplex soils; and
   (f) non-sodic duplex soils;
4. detail mitigation measures to manage adverse risks for the construction stage and for ongoing maintenance of the corridor during the operational stage; and
5. map areas of good quality agricultural land and detail methods to be undertaken to minimise potential impacts.

(E3) The holder of this authority must undertake an acid sulfate soils (ASS) investigation for the proposed linear disturbance (excavation, filling) on land areas that may potentially contain ASS (including all areas <5m AHD) according to the *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*.

(E4) The holder of this authority must provide detailed management measures in accordance with the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines 2002* to the administering authority at least 20 business days prior to commencement of excavation or filling activities within areas identified as potential for containing ASS in the investigation outlined in condition (E3).

(E5) The holder of this authority must have due regard to any comments provided by the administering authority when implementing ASS management measures.

EROSION AND SEDIMENT CONTROL PLANS

(E6) An Erosion and Sediment Control Plan must be developed and implemented for all stages of the petroleum activities and which has been certified by a Certified Professional in Sediment and Erosion Control, or a professional with appropriate experience and or qualifications accepted by the Administering Authority.

(E7) Appropriate measures to achieve compliance with condition (E6) for the petroleum activity must be described in the EM plan and include:

1. diverting uncontaminated stormwater run-off around areas disturbed by petroleum activities or where contaminants or wastes are stored or handled that may contribute to stormwater;
2. contaminated stormwater runoff and incident rainfall is collected; and treated, reused, or released in accordance with the conditions of this environmental authority;
3. roofing or minimising the size of areas where contaminants or wastes are stored or handled;
4. using alternate materials and or processes (such as dry absorbents) to clean up spills that will minimise the generation of contaminated waters;
5. erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent the contamination of any waters;
6. an inspection and maintenance program for the erosion and sediment control features; and
7. provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from December to March.
8. identification of remedial actions that would be required to ensure compliance with the conditions of this environmental authority.

(E8) Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment and contamination of stormwater.

(E9) The maintenance and cleaning of any vehicles, plant or equipment must not be carried out in areas from which contaminants can be released into any waters, roadside gutter or a stormwater drainage system.

(E10) Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable. Such spillages must be cleaned up using dry methods that minimise the release of wastes, contaminants or materials to any stormwater drainage system, roadside gutter or waters.

VEGETATION MANAGEMENT

(E11) The holder of this authority must:

1. prevent or minimise disturbance to vegetation by petroleum activities; and
2. manage the effects of clearing to prevent the loss of biodiversity, reduction of ecological processes and land degradation.

(E12) The holder of this authority must ensure that:

1. petroleum activities are not conducted within category A or B environmentally sensitive areas (ESA's);
2. petroleum activities do not cause a significant disturbance within 1km of a category A ESA or within 500m of a category B ESA;
3. petroleum activities are not conducted in a category C ESA without the written agreement from the relevant administering authority;
4. if the relevant administering authority gives written permission to conduct petroleum activities in a category C ESA with conditions that are in conflict with the conditions of this authority, the holder must as a minimum comply with the conditions of this authority; and
5. staff, contractors or agents carrying out petroleum activities on a petroleum authority are aware of the location of any relevant category A, B or C ESA's within the petroleum authority.

(E13) Despite conditions (E12)(1) and (2), where no reasonable alternative exists, petroleum activities may be undertaken within an endangered regional ecosystem (ERE) or the 500m buffer zone of an ERE, provided that those activities are located according to the following order of preference:

1. pre-existing areas of significant disturbance within the buffer zone;
2. undisturbed areas more than 100m from the ESA within the buffer zone;
3. undisturbed areas less than 100m from the ESA within the buffer zone;

4. pre-existing areas of significant disturbance within the ESA;
5. areas within the ESA of lower environmental value; then
6. areas where clearing of an endangered regional ecosystem is unavoidable.

(E14) The holder of this authority must ensure that any clearing in accordance with Condition (E13) complies with the following:

1. the clearing does not for the life of the project exceed 10% of the endangered regional ecosystem as ground truthed and mapped before any activity commences as per condition (E13) of this authority;
2. all reasonable and practical measures are made to minimize the area cleared and to avoid the clearing of mature trees;
3. when requested by the administering authority the environmental authority holder enters into an agreement with the administering authority to provide an environmental offset to counterbalance the impacts of the activity on the ERE in accordance with the *Queensland Government Environmental Offsets Policy*;
4. access tracks are not located in ERE;
5. the right of way is limited to 20m in width except between kilometer point 372 to kilometer point 401 and in approaches to watercourses where the banks are higher than 3m;
6. clearing of mature and hollow bearing trees is avoided where practicable; and
7. a qualified ecologist is present during clearing activities to ensure impacts on flora and fauna are minimized.

(E15) The condition and spatial extent of any remnant and regrowth "endangered" and "of concern" regional ecosystems must be assessed. This must include but not be limited to the carrying out of field surveys and observations and mapping, prior to carrying out of any petroleum activity within the regional ecosystems.

(E16) A record of the regional ecosystem assessment required by condition (E15) must be kept and made available to the administering authority on request.

(E17) The findings of the assessment must be used to implement minor route alignments to avoid disturbance to dense stands or large specimens of regionally significant species.

(E18) The environmental authority holder must comply with any agreement made in accordance with condition (E14 (3)) of this authority.

(E19) The holder of this authority must ensure that camps and lay down areas are located at least 20m from remnant regional ecosystems or high value regrowth regional ecosystems.

(E20) Fallen timber must be moved as little as practicable, and where necessary to be moved replaced once construction has been completed unless otherwise required by the land holder.

(E21) The clearing of native vegetation within road reserves or watercourses must not reduce the width of the vegetation community to less than 50m.

(E22) Despite condition (E14 (3)), an overall biodiversity offset strategy must be developed for the project that complies with the requirements all relevant legislation and as a minimum mitigates any impacts on remnant and regrowth endangered and of concern regional ecosystems in accordance with the *Queensland Government Environmental Offsets Policy*.

PROTECTION OF RIVERINE AREAS

(E23) The holder of this authority must not:

1. undertake activities within a wetland or spring;
2. excavate or place fill in a way that interferes with the flow of water in a watercourse, wetland, or spring, including: works that divert the course of flow of the water, or works that impound the water;
3. undertake activities that take water from a watercourse, wetland or spring; or

4. undertake activities that take overland flow water using works that are mentioned as assessable development in a water resource plan under the *Water Act 2000*.

(E24) Activities resulting in significant disturbance to the bed or banks of a watercourse must:

1. only be undertaken where necessary for the construction and/or maintenance of roads, tracks and pipelines that are essential for carrying out the authorised petroleum activities and no reasonable alternative location is feasible; and
2. be no greater than the minimum area necessary for the purpose of the significant disturbance; and
3. be designed and undertaken by a competent person; and
4. have rehabilitation commence immediately upon cessation of the authorised petroleum activities.

(E25) Sediment control measures must be implemented to minimise any increase in water turbidity due to carrying out petroleum activities in the bed or banks of a watercourse in accordance with condition (E7).

(E26) Routine visual monitoring must be undertaken while carrying out petroleum activities in a watercourse. If, due to the petroleum activities, water turbidity increases in the watercourse, outside contained areas, works must cease and the sediment control measures must be rectified before activities recommence.

REHABILITATION REQUIREMENTS

(E27) Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the authorised petroleum activities on the relevant petroleum authority.

(E28) For areas of native vegetation, revegetation must use seed sourced from local provenance native species.

(E29) As soon as practicable and within 3 months at the end of petroleum activities that cause any significant disturbance to land, the holder of this authority must investigate contaminated land status in accordance with *Environmental Protection Act 1994* requirements and the *National Environment Protection (Site Assessment) Measure 1999* where land has been subject to contamination caused by petroleum activities authorised under this authority.

(E30) All land significantly disturbed by petroleum activities must be rehabilitated to:

1. a stable landform with a self-sustaining vegetation cover with same species and density of cover to that of the surrounding undisturbed areas, except over the area that must be maintained free of large flora species for pipeline integrity and access, and in cases where approval is sought in accordance with Condition (E33);
2. ensure that all land is reinstated to the pre-disturbed land use and suitability class;
3. ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities.

(E31) Notwithstanding Condition (E30) any planned rehabilitation outcome that does not fulfil the rehabilitation requirements listed in Condition (E30) approval must be sought from the administering authority, prior to the rehabilitation being carried out.

(E32) Maintenance of rehabilitated areas must take place to ensure and demonstrate:

1. stability of landforms;
2. erosion control measures remain effective;
3. stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters;
4. plants show healthy growth and recruitment is occurring; and
5. declared pest plants are controlled on rehabilitated areas to a level consistent with the surrounding property and prevented from spreading to unaffected areas through authorised petroleum activities.

(E33) Rehabilitation can be considered successful when the site can be managed for its designated land-use (either similar to that of surrounding undisturbed areas or as otherwise agreed in a written document with the landowner/holder and administering authority) without any greater management input than for other land in the area being used for a similar purpose and there is evidence that the rehabilitation has been successful for at least 3 years.

PEST AND WEED MANAGEMENT

(E34) The holder of this authority must develop and implement a pest and weed control program that includes but is not limited to the following:

1. identification of areas requiring pest and weed control;
2. control measures to prevent the spread of pest and weed species; and
3. measures to eliminate infestations of noxious pest and weed species that may occur.

STORAGE AND HANDLING OF CHEMICALS, FLAMMABLE AND COMBUSTIBLE LIQUIDS

(E35) All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard.

(E36) Flammable and combustible liquids (including petroleum products and associated piping and infrastructure), must be stored, handled and maintained in accordance with the latest edition of Australian Standard 1940 – *The Storage and Handling of Flammable and Combustible Liquids.*

(E37) Any liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land. Where no relevant Australian Standard is available, the following must be applied:

1. storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and
2. drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.

(E38) All containment systems must be designed to minimise rainfall collection within the system.

SCHEDULE F FAUNA MANAGEMENT

(F1) The holder of this authority must develop and implement fauna management procedures in such a manner that petroleum activities are undertaken to prevent and/or minimise environmental harm.

(F2) The fauna management procedures must include but not be limited to:

1. training and awareness of staff and contractors;
2. conduct of a preconstruction ecological survey to identify the presence of any endangered, vulnerable or rare fauna species and identify and mark hollow-bearing trees;
3. the development of management strategies to minimise impact on any endangered, vulnerable or rare species;
4. minimising the clearing of mature and hollow-bearing trees;
5. minimising the length of time the trench is open through the staging of activities;
6. temporary exclusion fencing where practicable to restrict fauna access to the trench;
7. the use of "night caps" over open pipe string ends to prevent the ingress of wildlife;
8. pipes being strung with gaps to allow for fauna movement across the line of the pipe;
9. a suitably qualified person for fauna handling must be present during clear and grade activities to relocate fauna or recover any injured fauna and must check the entire trench for captured fauna at least daily, preferably in the morning;
10. installation of ramps and trench plugs with a slope less than 50% at least every 1000m to assist fauna to leave the trench; and
11. installation of shelter material to provide wet weather protection and reduction of heat stress, such as by placing sawdust filled Hessian bags in pairs every 250m.

(F3) A copy of the fauna management procedures must be made available to the administering authority on request

SCHEDULE G DECLARED WILD RIVER AREAS

(G1) If the petroleum authority is in or partly within a declared wild river area, or a moratorium is in place under the *Wild Rivers Act 2005*, the holder of this authority must ensure that petroleum activities within the (proposed) wild river area are conducted in accordance with the conditions in the wild river declaration for the area relevant to the petroleum activities.

SCHEDULE H PROJECT INFRASTRUCTURE

(H1) All petroleum infrastructure (including buildings, structures, plant and equipment erected and/or used for the petroleum activities) authorised under this authority must be located within the PPL144 Licence Area.

(H2) All petroleum infrastructure must be removed from the relevant petroleum authority prior to surrender of this authority, except where agreed in writing by the administering authority and the current landowner.

(H3) Prior to the commencement of decommissioning or abandonment activities the scope of work for decommissioning or abandonment of project infrastructure shall be developed and agreed to with the administering authority.

(H4) The holder of this authority must decommission the petroleum and gas pipeline to a situation where ongoing, or potential environmental harm is prevented or minimised. As a minimum, pipeline must be decommissioned such that:

1. it no longer contains hazardous contaminants;
2. it is left in stable condition;
3. all the above ground infrastructure is removed, and
4. all areas disturbed by above ground infrastructure are rehabilitated in accordance with the requirements of this authority.

SCHEDULE I DAMS

(I1) Conditions (I3) to (I10) apply to all dams installed as part of the petroleum activities, as defined in this authority.

(I2) Dams in the significant or high hazard category as defined in Appendix 4 are not permitted under this authority.

GENERAL CONDITIONS

(I3) The holder of this authority must ensure that all dams on the operational land are designed and constructed by a suitably qualified engineer and maintained in accordance with generally accepted engineering standards and practices.

(I4) In operating or decommissioning any dam, the holder of this authority must not interfere with any groundwater or surface water resource or watercourse so as to cause environmental harm, except where that interference and consequent harm has been authorised in this authority.

(I5) The holder of this authority must ensure that any activities conducted under this authority, or enabled by this authority, do not compromise the integrity of any dam, either on the operational land or adjacent to the operational land.

(I6) The holder of this authority must take advice from suitably qualified and experienced persons and, based on that advice, monitor the condition of all dams located on the operational land, for early signs of loss of structural or hydraulic integrity.

(I7) In the event of any early signs of loss of structural or hydraulic integrity, the holder of this authority must take action to prevent and/or to minimise any environmental harm, and report any findings and actions taken to the administering authority.

(I8) The holder of the authority must assess the hazard category of each dam using Table 1 of Appendix 3 - prior to construction of any new dam, and thereafter on an annual basis. The holder of the authority must act on that monitoring and assessment in accordance with Condition (I9).

(I9) Where the hazard category for any dam has been assessed as significant or high, the holder of this authority must:

1. notify the administering authority in writing;
2. implement measures to manage the potential for environmental harm; and
3. apply to the administering authority to amend this environmental authority to allow for the operation of a significant or high hazard dam.

(I10) The holder of this authority must not abandon any dam, but must decommission each dam to a situation where ongoing environmental harm will not occur, unless in accordance with condition (E30). Decommissioned dams must no longer be dams but become landforms on the operational land and must comply with any rehabilitation requirements of this authority.

SCHEDULE J MONITORING PROGRAMS

(J1) The holder of this authority must:

1. develop and implement a monitoring program that will demonstrate compliance with the conditions in this authority; and
2. document the monitoring and inspections carried out under the program and any actions taken.

(J2) The holder of this authority must ensure that a suitably qualified, experienced and competent person(s) conduct all monitoring required by this authority.

(J3) The holder of this authority must record, compile and keep for a minimum of five years all monitoring results required by this authority and make available for inspection all or any of these records upon request by the administering authority. Monitoring results relating to rehabilitation should be kept until the relevant petroleum tenure is surrendered.

(J4) An annual monitoring report must be prepared each year and submitted to the administering authority when requested. This report shall include but not be limited to:

1. a summary of the previous twelve (12) months monitoring results obtained under any monitoring programs required under this authority and, a comparison of the previous twelve (12) months monitoring results to both this authority limits and to relevant prior results; and
2. an evaluation/explanation of the data from any monitoring programs; and
3. a summary of any record of quantities of releases required to be kept under this authority; and
4. a summary of the record of equipment failures or events recorded for any site under this approval; and
5. an outline of actions taken or proposed to minimise the environmental risk from any deficiency identified by the monitoring or recording programs.

SCHEDULE K COMMUNITY ISSUES

MANAGING COMPLAINTS

(K1) When the administering authority advises the holder of a complaint alleging nuisance (e.g. caused by dust or noise), the holder must investigate the complaint and advise the administering authority of the action proposed or undertaken in relation to the complaint.

(K2) If the administering authority is not satisfied with the proposed or completed action, the holder must undertake monitoring or other action requested by the administering authority.

(K3) Maintain a record of complaints and incidents causing environmental harm, and actions taken in response to the complaint or incident.

(K4) Retain the record of complaints required by this condition for 5 years.

COMPLAINT RESPONSE

(K5) The holder of this authority must record the following details for all complaints received and provide this information to the administering authority on request:

1. time, date, name and contact details of the complainant;
2. reasons for the complaint;
3. any investigations undertaken;
4. conclusions formed; and
5. any actions taken.

TERM	MEANING
	Lands) Act 1982.
Petroleum project	A petroleum project is all activities carried out, or proposed to be carred out, under 1 or more of the following, in any combination, as a single integrated operation— (a) a 1923 Act petroleum tenure granted under the *Petroleum Act 1923*; (b) a petroleum authority granted under the *Petroleum and Gas (Production and Safety) Act 2004*; (c) a licence, permit, pipeline licence, primary licence, secondary licence or special prospecting authority granted under the *Petroleum (Submerged Lands) Act 1982*
Petroleum works site	A separate location on the area subject to a petroleum authority where petroleum activities are undertaken (e.g. a well site, seismic survey line, camp site, compressor site, evaporation pond etc).
Potential discharge area	Low lying parts of the landscape (relative to adjacent terrain) where groundwater movements are within 2-5m of the land surface and the landscape may be subject to upward movement of groundwater in the future.
Protected area	A protected area under the *Nature Conservation Act 1992*; or • a marine park under the *Marine Parks Act 1992*; or • a World Heritage Area.
Progressive rehabilitation	Rehabilitation (defined below) undertaken progressively or as a staged approach to rehabilitation as petroleum operations are ongoing.
Rehabilitation	The process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land.
Representative	A sample set which covers the variance in monitoring or other data either due to natural changes or operational phases of the petroleum activities.
Regulated dam	Means any dam in the significant or high hazard category as defined above.
Riverine area	Refers to the land confined to the flood flow channel of a watercourse.
Sedimentation pond	A bunded or excavated structure used to contain and settle waterborne sediment running off disturbed areas.
Self sustaining	An area of land that has been rehabilitated and has maintained the required acceptance criteria without human intervention for a period nominated by the administering authority.
Sensitive place	Sensitive place means any of the following places – (a) a dwelling; (b) a library, childcare centre, kindergarten, school, college, university or other educational institution; (c) a hospital, surgery or other medical institution; (d) a protected area or an area identified under a conservation plan as a critical habitat or an area of major interest, under the *Nature Conservation Act 1992*; (e) a marine park under the *Marine Parks Act 1982*; and (f) a park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment).
Sewage	Sewage is the effluent discharged from a sanitary appliance (i.e. sewage treatment works).

TERM	MEANING
Significantly disturbed land	Significantly disturbed land and significant disturbance means land if: (a) it is contaminated land caused by petroleum activities under this authority; or (b) it has been disturbed by petroleum activities under this authority and human intervention is needed to rehabilitate it: i. to a state required under the relevant environmental authority; or ii. if the environmental authority does not require the land to be rehabilitated to a particular state – to its state immediately before the disturbance. Examples of a disturbance to land caused by petroleum activities authorised under this authority include: (a) areas where soil has been compacted, removed, covered, exposed or stockpiled; (b) areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; (c) areas where land use suitability or capability has been diminished; (d) areas within a watercourse, waterway, wetland or lake where petroleum activities occur and human intervention is necessary to restore or stabilise the disturbed area; (e) areas submerged by hazardous waste storage and dam walls in all cases; (f) areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads etc) which is to be removed after petroleum activities have ceased; or (g) areas where land has become contaminated land and a suitability statement has not been issued. However, the following areas are not significantly disturbed: (a) areas off the petroleum authority (e.g. roads or tracks which provide access to the petroleum authority); (b) areas previously significantly disturbed which have been rehabilitated to the administering authority's satisfaction; (c) areas under permanent infrastructure (e.g. existing tracks and roads within the petroleum authority area); (d) areas that were significantly disturbed prior to the grant of the environmental authority, unless those areas are disturbed to a greater extent than their current condition by the holder of the environmental authority during the term of the authority; (e) minor disturbances such as drill sumps and minor respreading of soil on GPS located seismic lines.
Significant hazard category	In relation to a dam is one that, as a result of a hazard assessment using Table 1 Appendix 4, would be assessed as being in the significant hazard category.
Stable	Means land form dimensions are or will be stable within tolerable limits now and in the foreseeable future. Stability includes consideration of geotechnical stability, settlement and consolidation allowances, bearing capacity (trafficability), erosion resistance and geochemical stability with respect to seepage, leachate and related contaminant generation.
Suitably qualified and experienced person for dams	Means one who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 1988*, OR registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, OR holds equivalent professional qualifications to the satisfaction of the administering authority for the Act, in these 'relevant fields': (a) knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impact

TERM	MEANING
	of dams; and (b) at least a total of five years of suitable experience and demonstrated expertise in at least four of the following areas: • investigation, design or construction of dams; • operation and maintenance of dams; • geomechanics with particular emphasis stability, geology and geochemistry; • hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology; • hydraulics with particular reference to sediment transport and deposition, erosion control, beach processes; and • hydrogeology with particular reference to seepage, groundwater, • solute transport processes and monitoring thereof; and • dam safety
Suitably qualified and experienced person for pipelines	Means one who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 1988*, OR registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, OR holds equivalent professional qualifications to the satisfaction of the administering authority for the Act, in the 'relevant fields' of designing, constructing, operating and decommissioning high pressure petroleum pipelines.
Top layer	The surface layer of a soil profile, which is usually more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater than about 300mm in depth from natural surface.
Void	Means any man-made, open excavation in the ground.
Watercourse	Watercourse means a river, creek or stream in which water flows permanently or intermittently in a visibly defined channel (natural, artificial or artificially improved) with: (a) continuous bed and banks; (b) an extended period of flow for some months after rain ceases, and (c) an adequacy of flow that sustains basic ecological processes and maintains biodiversity.
Waters	Waters includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea) or any part-thereof, stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part thereof.
Waterway	A naturally occurring feature where surface water runoff normally collects, such as a clearly defined swale or gully, but only flows in response to a local rainfall event.
Wetland	An area of permanent or periodic/intermittent inundation, whether natural or artificial, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m. Wetlands typically include areas such as lakes, swamps, marshes, estuaries or mudflats.
Wild river areas	Wild river areas are defined in the *Wild Rivers Act 2005* and may include the following– (a) high preservation areas; (b) preservation areas; (c) floodplain management areas;

TERM	MEANING
	(d) subartesian management areas.

APPENDIX 2 Environmentally sensitive areas

Category A and Category B environmentally sensitive areas

Category A and Category B environmentally sensitive areas are listed in Section 25 and 26 respectively of the *Environmental Protection Regulation 2008.*

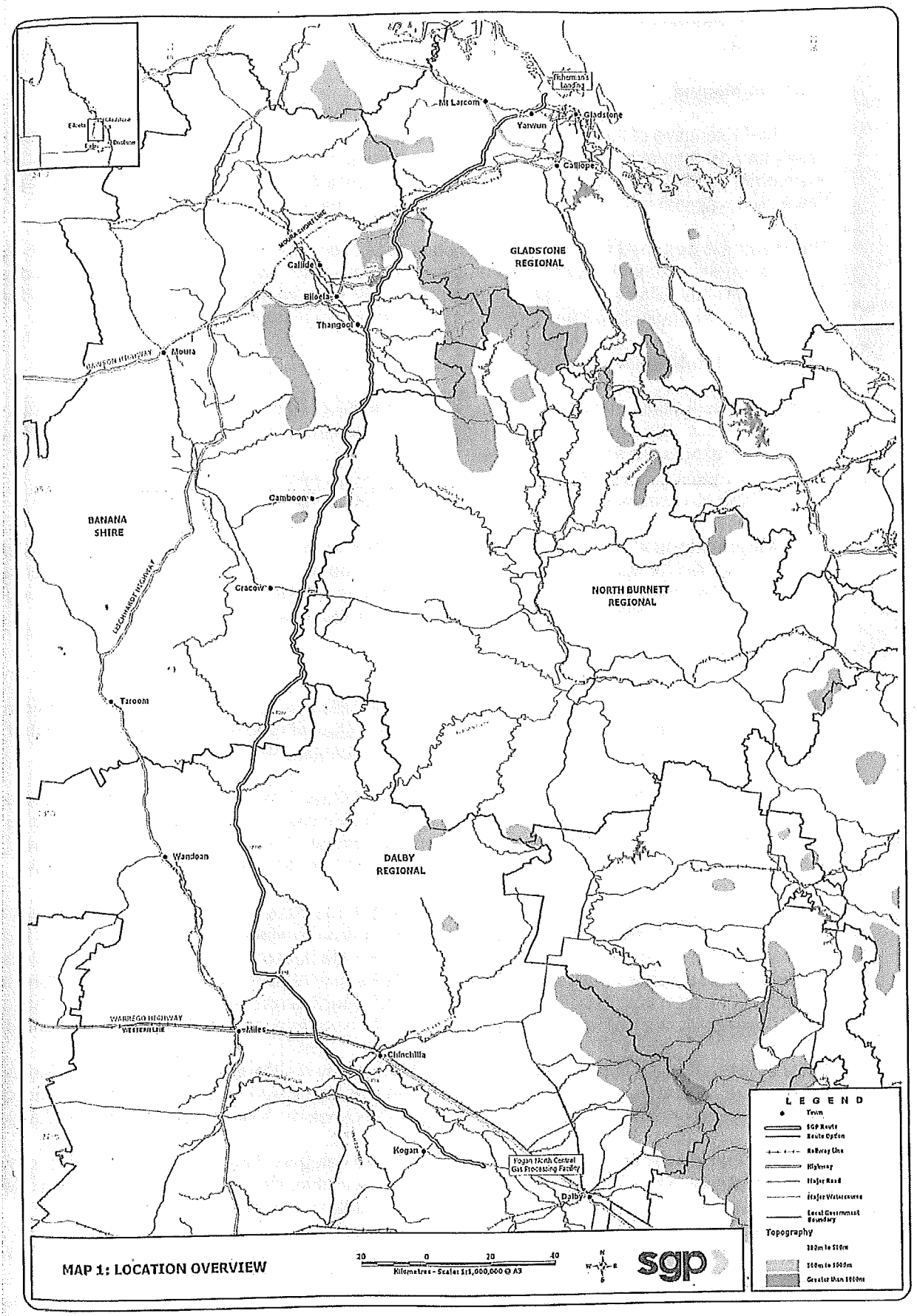
Category C environmentally sensitive areas

LAND AREA CLASSIFICATION	ADMINISTERING LEGISLATION	ADMINISTERING AUTHORITY
Nature Refuges and Resource Reserves	*Nature Conservation Act 1992*	Department of Environment and Resource Management
Koala Habitat Area	*Nature Conservation (Koala) Conservation Plan 2006*	Department of Environment and Resource Management
An area identified as essential habitat by the EPA for a species of wildlife listed as endangered, vulnerable, near threatened or rare under the Nature Conservation Act 1992	*Nature Conservation Act 1992*	Department of Environment and Resource Management
Declared Catchment Areas	*Water Act 2000*	Department of Environment and Resource Management and/or Relevant Storage Operator or Board
River Improvement Areas	*River Improvement Trust Act 1940*	Department of Environment and Resource Management and the Relevant River Trust
Former Designated Landscape Area - Stanbroke Pastoral Holding	*Aboriginal Cultural Heritage Act 2003*	Department of Environment and Resource Management
Areas under Part 5 Division 2 of the Aboriginal Cultural Heritage Act 2003 and Torres Strait Islander Cultural Heritage Act 2003	*Aboriginal Cultural Heritage Act 2003* *Torres Strait Islander Cultural Heritage Act 2003*	Department of Environment and Resource Management
State Forest or Timber Reserves	*Forestry Act 1959*	Department of Environment and Resource Management
DPI Research Sites	Nil	Department of Employment, Economic Development and Innovation
Areas of land occupied by the Bureau of Sugar Experiment Stations.	*Sugar Industry Act 1999*	Department of Employment, Economic Development and Innovation
Coastal Management Districts	*Coastal Protection and Management Act 1995*	Department of Environment and Resource Management

LAND AREA CLASSIFICATION	ADMINISTERING LEGISLATION	ADMINISTERING AUTHORITY
Declared Areas	*Sections 17, 18 and 19a of the Vegetation Management Act 1999*	Department of Environment and Resource Management
An area shown as a wetland on a 'map of referable wetlands'	*Environmental Protection Act 1994*	Department of Environment and Resource Management
Reserves under the Land Act 1994	*Land Act 1994*	Department of Environment and Resource Management
An 'of concern' regional ecosystem identified in the database maintained by the EPA called 'Regional ecosystem description database' containing regional ecosystem numbers and descriptions.	Nil	Department of Environment and Resource Management

Important Note: Regional ecosystem classification is determined according to the Queensland Herbarium *Biodiversity Status Classification.* Information on ERE's is maintained by the DERM on the Regional Ecosystem Description Database.

APPENDIX 3 MAP OF PPL144



APPENDIX 3 DETERMINING HAZARD CATEGORIES FOR REGULATED DAMS

Manual for Assessing Hazard Categories and Hydraulic Performance of Dams
Version 1.0

Scope of Manual

The Chief Executive of the Environmental Protection Agency, under the *Environmental Protection Act 1994* (the Act) regulates dams associated with environmentally relevant activities 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 the ecological processes on which life depends.

This manual is designed to ensure that the standards used for the design, construction, operation, modification and decommissioning of dams are appropriate for the hazards associated with each dam. This is consistent with the requirement under the Act to take all reasonable and practicable steps to protect the environmental values present, and to minimise environmental harm.

Background to Manual

Good practice requires that all dams must be assessed for "dam break" and "failure to contain" hazard potential. Those dams that could have significant or high impacts need to be carefully designed and operated. Hazards are situations where:

- Something exists that could cause environmental harm, and
- An environmental value is present which could be harmed.

The early identification of the hazard potential of a dam is important as this determines the standard of reliability required for construction and operation of the dam. In this manual, the hazard assessment will determine those dams that require documentation of basic design performance and monitoring. Detailed design of a dam may not need to be done prior to the issue of an authority or approval.

Purpose of Manual

This manual is a regulatory document designed to be called up by model conditions for environmental authorities and development approvals and any other relevant regulatory provisions. Together these provisions will regulate dams associated with environmentally relevant activities.

The purpose of this manual is to guide the assessment of the hazard category of all dams, and thereby determine those dams that require documentation of basic design performance and monitoring. This manual does *not* utilise risk (level) or risk (cost) assessment. Dams include levees, bunds and voids, but *not* any bunds designed for spill containment to an Australian Standard, for example AS1940.

Dams may be assessed using this manual into one of three hazard categories: low, significant or high. A suitably qualified and experienced person should review all available information on a dam, including a site inspection if necessary; and determine the appropriate hazard category for each dam. Lodgement of documentation of hazard assessments with the EPA is *only* required as set out in paragraphs below. Site inspection of a dam is at the discretion of the suitably qualified and experienced person conducting the hazard assessment, provided that all relevant aspects have been researched and documented.

While all dams subject to this manual must be assessed by a suitably qualified and experienced person for "dam break" and "failure to contain" hazard potential, dams with man-made embankments over a specified height or minimum volume and contaminant concentrations, cannot be assessed as low hazard.

For dams that are assessed as being in the low hazard category, basic conditions only are provided in model conditions, requiring dam owners to ensure that all their dams are designed and operated in accordance with accepted engineering standards and have an annual hazard assessment.

Dams that are assessed as being in the significant or high hazard category are referred to as 'regulated dams' because certification of design to performance standards by suitably qualified and experienced persons is normally required to be lodged, and certified annual inspections and reports must be provided.

This Manual replaces and supersedes the previously used information sheets 'Determining Dams Containing Hazardous Waste' and 'Managing Dams Containing Hazardous Waste'.

Background to Hazard Assessment based on Failure Event Scenarios

Failure to Contain Hazard

"Failure to contain" hazards are those potential dam failures that are non-flood producing, but the release of contaminants would endanger environmental values including human life. Examples of events include:
Release of contaminated waters from a spillway during stormwater inflow events,
Punctured membrane discharging contaminated process water or tailings,
Releases due to pipe bursts in tailings or process water circuits associated with the dam,
Piping (localised failure) of containment banks or bunds,
Excessive foundation seepage,
Overtopping of tailings dams by superelevation of tailings beaches or blockage of drainage,
Erosion of containment structures around mining waste (decommissioned tailings dams, waste heaps etc.), and
Dust and gas emissions.

Evaluation of the hazard potential on release requires information on the probable chemical nature of the stored material, including rates, volume and concentrations at the time of a possible release. Acidity and metal ions in solutions due to prolonged contact with ore bodies or stored material must also be considered.

Contaminant concentrations in an unplanned release must be estimated based on the contaminant concentration in the dam, basic design parameters such as storage volume, and resulting dilution in the stormwater. A range of less frequent rainfall events of short duration on contributing catchments must be checked. The hazard assessment must consider the interaction of any failure of a dam with all other dams, on project sites having multiple dams.

Dam Break Flood Hazard
The prerequisites for a dam break hazard are the existence, either permanently or temporarily, of a large body of water or other flowable substances (slimes, tailings etc); and environmental values, including stock, human life or property, that are susceptible to harm should a dam break occur.

A flood generally attenuates over time and ceases to be considered a flood once it is totally contained between the bed and banks of a stream. A high hazard for stock or animals on a flood plain or elsewhere is associated with water depths occurring in excess of 300 millimetres (0.3 metre). The estimated extent of the flood at a particular probability level is called the 'flood footprint'.

If the flood footprint is contaminated by the dam break flood, the environmental harm and potential for consequent harm from contaminants including access by stock or humans to the contaminants, must be fully considered. While environmental values include the ecology, if no significant environmental values exist within the flood footprint, then a conclusion of minimal consequent harm may be justified.

Where tailings or contaminated waters are associated with a dam break flood, environmental harm can also arise from the residual effects of the material deposited. The consequences of a clean up in the general environment can involve substantial costs that would fall within the meaning of 'environmental harm' in the Act.

Basic Hazard Evaluation Data
Applications that involve the construction and operation of any containment structure, must include relevant information on which an initial hazard assessment by the applicant has been undertaken.

Dam owners are likely to have much of the information already available. The minimum information is:

- specification by map/s of the location of the proposed project in relation to surrounding land use and watercourses – including the general topography and contours at a suitable scale,
- details of environmentally sensitive areas, rare and endangered species and human habitation and infrastructure developments in the near vicinity or general area and particularly downstream,
- details of watercourses and groundwater aquifers that are or might be used as water resources,

- engineering sketch drawings, in accordance with good professional practice and sufficient to fully define the layout, structure, volume and proposed means of construction of all aspects of operations associated with the proposal,
- details of quantities and concentrations of all raw materials, products, by-products and waste products produced in operations associated with the proposal, and
- details of all studies conducted to assess requirements for storage and strength of all structures associated with the project – such as hydrological and geotechnical data.

Inspection of Site or Desktop Analysis

Whether or not a site inspection is required for a particular dam as part of a hazard assessment is a matter for consideration by the suitably qualified and experienced person concerned. Relevant factors to consider might be previous assessments, known changes, dams that are located remote from the main project site, and the likely outcomes. However, that person must be satisfied that all relevant aspects have been otherwise researched and documented to enable a reliable hazard assessment in each case.

Any assessment must include areas in the potential failure path or downstream of the dam that could be impacted by collapse or failure of the dam. Relevant matters to be observed include (but are not limited to):

- environmentally significant sites and species located in potential impact areas
- infrastructure including human habitation, worker accommodation and site offices, road crossings
- recreation facilities (bush camping etc.) along watercourses
- raw (fresh water) storages on the same watercourse
- presence of stock, irrigation and domestic water supply pumps, and water holes
- downstream storage containments – such as tailings dams and process water dams
- mine adits (entrances to underground mining) and/or open cuts (voids) – current or proposed
- catchment modification works (diversion drains, bunds etc) – current or proposed

In the case of tailings dams and other waste disposal facilities, a site inspection should also note points of impact above the level of the dam. Typical impacts from such facilities include:

- dusting potential (eg. heavy metals, arsenic)
- gas emissions (eg. cyanide, hydrogen fluoride, hydrogen sulphide, sulphur dioxide)
- spray mist (acid evaporation ponds etc)
- offensive odours
- smoke and heat (including spontaneous combustion of stored material)
- visual amenity

Collation and Assessment of Data

A hazard category based on 'dam break' or 'failure to contain' scenarios, must be determined based on the most adverse environmental harm that can arise from the range of all possible scenarios. The hazard category is based on the consequences of failure, not on the perceived probability of the failure occurring.

The following aspects of possible adverse scenarios should be carefully considered:
Depending on its severity and duration, a rainfall event may give rise to a spill from a dam that does not result in collapse of the dam structure but nevertheless causes some harm.
Rainfall events may be of sufficient intensity and duration to lead to a collapse of the dam structure with consequent increase in harm.
Where potential harm is by release of a contaminant, account should be taken of the potential dilution by clean runoff entering the dam prior to release and potential dilution in receiving waters.
A suitable range of rainfall events will need to be considered in order to cover all potential harm scenarios and the range of performance contained in Tables 4 and 5.
For an earth dam or bund wall, a 'sunny day' failure can also occur due to loss of structural integrity of the wall, such as piping failure or weakness in zones of the wall due to various causes. The probability of such failure mechanisms occurring are reduced by good design and construction practices, and regular inspections by informed operators and qualified professionals.

Hazard Category Assessment Criteria for this Manual

This manual is a regulatory document designed to ensure that appropriate standards are applied to dams. In certain cases, it is reasonable to expect applicable standards to be documented (ie. a 'regulated dam').

All dams as defined must have their hazard category assessed based on the potential harm resulting from failure event scenarios as set out in Tables 1 and 2 as guided by this text. For dams with a volume in excess of 250 megalitres, specific guidance is provided on the following page for assessing the dam break hazard.

However, as set out in the subsequent sections 'Hazard Category based on Height' or 'Hazard Category based on Contaminant Concentration and Minimum Volume', dams that meet the criteria in those sections must be assessed as regulated dams – either in the significant or high hazard category.

Hazard Category - Based on Assessment of Hazard Potential (Failure Event Scenarios)

The two basic possible "failure" sets of scenarios to be applied in any assessment are:

1. **"Failure to contain"** – spills or unplanned releases from the dam due to any cause, and
2. **"Dam break"** - collapses of the dam structure due to any possible cause.

In assessing the hazard category of a dam based on possible failure event scenarios, it is to be assumed that a failure event of each type specified has occurred ie 'failure to contain' and 'dam break', and then the potential environmental harm (ie. the consequences) resulting from each such assumed failure event is to be assessed using Table 1. The hazard category for the dam overall, will be the highest hazard category produced in any category of harm, generated by any failure event scenario.

Failure to contain must consider potential adverse effects due to release to any groundwater systems.

Table 1 Failure to Contain Scenarios

ENVIRONMENTAL HARM	FAILURE TO CONTAIN HAZARD CATEGORY		
	High	Significant	Low
Categories of Harm			
General environmental	Location such that harm to a significant environmental value is likely, or serious environmental harm is possible. Such a value might include the presence of protected or endangered flora or fauna.	The environmental value is of lesser significance and harm is possible but not likely, or material environmental harm is possible.	No environmental values of significance, or only trivial environmental harm is possible.
Loss or harm to humans	Consumption of contaminated waters by humans with consequent loss or harm is likely.	Consumption of contaminated waters by humans with consequent loss or harm is possible.	No contamination of waters used for human consumption expected.
Loss of stock	Consumption of contaminated waters by stock with consequent loss or harm is likely.	Consumption of contaminated waters by stock with consequent loss or harm is possible.	Contaminated water not available to stock or no harm expected from consumption.
General economic loss	Serious harm to communities, industrial, commercial or agricultural facilities, important utilities, the dam itself or other water resources in the failure path.	Material harm to industry, secondary roads, minor railways, public utilities, the dam itself or other water resources in the failure path.	Trivial harm to environmental values such as environmental nuisance arising from minor spills.

The hazard category of a dam can be changed by redesigning the proposal to isolate the dam from the environmental value. However, a hazard category cannot be changed by reliance on another structure, man-made or otherwise (eg. bunds) to control the risk of a failure of the dam, where the bund/s could also be subject to failure under a possible scenario.

In relation to a dam break scenario, consideration must always be given to downstream consequences including failure of other storages that may be affected by the flood wave. The consequences of such sequential failure of other storages must be considered as part of the harm caused.

Where the contained volume of a dam at imminent failure is greater than 250 megalitres, the hazard assessment must fully address the hazard associated with consequent failure of other dams, containments or on-site infrastructure downstream of the dam being considered in the assessment.

Table 2 Dam Break Scenarios

ENVIRONMENTAL HARM	DAM BREAK HAZARD CATEGORY		
	High	Significant	Low
Categories of Harm			
General environmental	Location such that harm to a significant environmental value is likely, or serious environmental harm is possible. Such a value might include the presence of protected or endangered flora or fauna.	The environmental value is of lesser significance and harm is possible but not likely, or material environmental harm is possible.	No environmental values of significance, or only trivial environmental harm is possible.
Loss or harm to humans	Location such that people are routinely present in the failure path and if present loss or harm is likely. Consumption of contaminated waters by humans with consequent loss or harm is likely.	Location such that people are routinely present in the failure path and if present loss or harm is possible. Consumption of contaminated waters by humans with consequent loss or harm is possible.	Location such that people are not routinely present in the failure path. No contamination of waters used for human consumption expected.
Loss of stock	Location of stock such that loss of stock likely. Consumption of contaminated waters by stock with consequent loss or harm is likely.	Location of stock such that loss of stock possible. Consumption of contaminated waters by stock with consequent loss or harm is possible.	Stock not in path of dam break flood. Contaminated water not available to stock or no harm expected from consumption.
General economic loss	Serious harm to communities, industrial, commercial or agricultural facilities, important utilities, the dam itself or other water resources in the failure path.	Material harm to industry, secondary roads, minor railways, public utilities, the dam itself or other water resources in the failure path.	Trivial harm to environmental values such as environmental nuisance arising from minor spills.

For the purposes of assessing the aspect of potential environmental harm in Tables 1 or 2, the cost of potential environmental harm within the meaning of the *Environmental Protection Act 1994* may be taken to be the cost of rehabilitation or restoration of the environmental value harmed.

Hazard Category Based on Height of a Man-made Embankment

While all dams as defined are subject to assessment using Tables 1 and 2 of this document, a dam is a regulated dam if it incorporates a man-made embankment and the height of that embankment is greater than 8 metres as measured between the crest and the lowest point of the toe of that embankment.

That is, such a dam must be assessed as in the significant or high hazard category and not in the low hazard category, even though it could be argued that the dam is low hazard by merely applying Tables 1 and 2.

Hazard Category Based on Contaminant Concentrations and Minimum Volume

While all dams are subject to assessment using Tables 1 and 2 of this document, a dam is a regulated dam if that dam:

(a) is likely to contain contaminants at a greater concentration than that indicated in Table 3, or outside the range of pH indicated in Table 3, at any time when the volume contained within the dam is greater than 20% of the contained volume at imminent failure, AND
(b) has a contained volume at imminent failure that is greater than that indicated in Table 3.

That is, such a dam must be assessed as in the significant or high hazard category and not in the low hazard category, even though it could be argued that the dam is low hazard by merely applying Tables 1 and 2.

Table 3 - Contaminant Concentrations and Minimum Volumes

Contaminant [1]	Liquor [2]	Total Solids [3]	Dam Volume
Arsenic	1.0 mg/L	500 mg/kg	2.5 ML
Boron	5.0 mg/L	15,000 mg/kg	2.5 ML
Cadmium	10 µg/L	100 mg/kg	2.5 ML
Cobalt	1.0 mg/L	500 mg/kg	2.5 ML
Copper	1.0 mg/L	5,000 mg/kg	2.5 ML
Lead	0.5 mg/L	1,500 mg/kg	2.5 ML
Mercury	2 µg/L	75 mg/kg	2.5 ML
Nickel	1.0 mg/L	3,000 mg/kg	2.5 ML
Selenium	50 µg/L	150 mg/kg	2.5 ML
Zinc	20 mg/L	35,000 mg/kg	2.5 ML
Cyanide	10 mg/L	2,500 mg/kg	2.5 ML
pH	5 to 9 inclusive	Net acid generation pH < 4.5	2.5 ML
Chloride	2,500 mg/L	-	10 ML
Fluoride	2.0 mg/L	-	10 ML
Sulphate	1,000 mg/L	-	10 ML
Salinity (conductivity)	4,000 µs/cm	-	10 ML

1 Metals should be analysed in accordance with recognised test methods by a NATA certified laboratory.
2 These concentrations apply to contaminants in solution, and therefore all samples should be filtered using the techniques described in the Water Quality Sampling Manual (EPA 1994).
3 Applies to the solids in a dam. Total solids include suspended and colloidal solids.

Hydraulic Performance Criteria for Regulated Dams

Hydraulic performance criteria mean the capacity of a regulated dam (as defined) to divert, contain or safely pass flowable substances. The performance criteria addressed below are:

For regulated dams that are NOT 'levees' as defined

- Spillway capacities.
- Design Storage Allowance (DSA).
- Mandatory Reporting Level (MRL).

For regulated dams that are 'levees' as defined

- Design protection (or conveyance) rating.

Application of Performance Criteria

Estimates of quantities based on the performance criteria set out in Tables 4 and 5 of this manual for regulated dams, must be applied as set out below, and documented accordingly.

1. Except as specified below in the section 'Full Hydrologic Analysis for DSA or MRL', a runoff coefficient of 1.0 must be used for all watershed translation of rainfall into runoff and no deductions must be allowed for losses due to evaporation from the ponded area of a dam.

2. For each regulated dam that is not a levee, a spillway must be designed and maintained to pass the peak flow from a design storm of critical duration for the relevant contributing catchment, at the annual exceedance probability (AEP) specified in Table 4. In determining the spillway capacity, the assumption must be made that the dam commences full at the spillway crest level.

3. For each regulated dam that is not a levee, and at any time could contain contaminants whose release would cause material or serious environmental harm, a DSA and MRL must be estimated.

4. The DSA must be provided in the dam or in the flow path below the dam, and must be demonstrated or estimated from either:
   (a) a 'full hydrologic analysis' as specified below and in table 5, OR
   (b) the 'method of monthly deciles' as specified below using the AEP value in Table 5.

If a full hydrologic analysis cannot be conducted, then the 'method of monthly deciles' must be used.

5. For each regulated dam that is not a levee and requires an MRL, an MRL must be estimated as the lowest level (below spillway crest) that will allow either of the following to be retained within the dam:
   (a) the runoff from a 72 hour duration storm at the AEP specified in the Table 5; OR
   (b) a wave allowance at that AEP as estimated using a recognised engineering method.

6. Each levee must be designed and maintained to contain or divert the peak flow from either:
   (a) a design storm of critical duration for the contributing catchment relevant to the zone to be protected by the levee, at an AEP specified in Table 4, OR
   (b) the estimated volume and flow rate of a release of flowable materials resulting from a failure of relevant other works or infrastructure; AND such that
   (c) in at least one place in the levee crest, there is a restricted length of low crest, due to limiting the freeboard at that point or otherwise, such that the flood just exceeding the imminent failure flood of the levee will be directed to a planned area or areas within the zone to be protected.

Important NOTE

Whatever hydrologic techniques are used for estimating required design parameters for a dam, the hazard assessor and dam designer must take into account the effect on hazard category that arises from changes in design of the dam. In particular, the impact on estimated concentrations of contaminants in releases resulting from unexpected and infrequent rainfall events contributing to dams or systems of dams, must be fully considered by the person assessing or designing the dam.

Full Hydrologic Analysis for DSA, MRL or Levees

A 'full hydrologic analysis' for DSA or MRL must use a model with a maximum daily timestep, and a calibrated watershed component based on soil moisture balance accounting, as set out below. All modelling must be conducted such that it obeys the law of conservation of matter (mass balanced).

The calibration of the watershed component of the model must be conducted using local rainfall data and consequent flows recorded at intervals the same as, or less than, the intervals to be used in analysis. The calibration must be conducted such that all of the following criteria are satisfied:

- at least five events must be used in the calibration, with each event resulting in 100% of the contributing catchment producing runoff at some time during the rainfall event;

- at least one event is estimated to be less frequent than ARI 5 when the real rainfall event is compared against design rainfall events of the same duration from AR&R or CRCFORGE;
- the simulated peak flow must agree with the recorded peak flow to within 30%, and the simulated total volume must agree with the recorded flow volume to within 10%; AND
- calibrations must be reviewed annually based on any additional qualifying events that have been recorded during the interim.

All hydrologic analyses with the calibrated model must use historical rainfall sequences representative of the site and sourced from either the Bureau of Meteorology daily rainfall stations or the Silo Data Drill.

Evaporative losses may be allowed in respect of lake evaporation based on accepted methods - such as Morton's method for shallow lakes. Daily data for Morton's method is available on the Silo Data Drill. No evaporative losses must be allowed for model time steps when rainfall is being applied.

A regulated dam shall be deemed to have sufficient design storage allowance (AEP 0.01) if the system of which it forms a part, does not spill during the continuous water balance simulation. For this condition to be met, a continuous simulation using at least 100 years of data is required (eg. Silo Data Drill). A spill may be acceptable within the simulation only if an outlier event is justified as indicated below.

Where the contributing catchment is less than or equal to 100 square kilometres, the AEP of an event in a 'full hydrologic analysis' and suspected of being an outlier, shall be estimated by matching the total depth of that 'real' rainfall event suspected of being an outlier, with an equivalent total depth for a design rainfall event (of the same duration and catchment area) from AR&R or CRCFORGE.

Where the contributing catchment is greater than 100 square kilometres, the AEP of an event in a 'full hydrologic analysis' and suspected of being an outlier, shall be estimated using frequency analyses of surface water flows from the application of real rainfall to the calibrated model, together with rainfall analyses of contributing catchments (and sub-catchments as relevant) as indicated above.

These methods of AEP estimation for real rainfall events may also be used when estimating volumes for MRL using a full hydrological analysis, as opposed to the default volume estimate method set out below.

Estimating Volume for MRL (Default Method)

The default method for estimating the volume allowance for MRL is to apply a design rainfall event to the contributing catchment of the particular dam or sequence of dams, making conservative operational assumptions: eg. pumps are not operable during the event.

Method of Monthly Deciles for DSA (Default Method)

The 'method of monthly deciles' is the use of a rainfall record of sufficient length, recorded at a location in close proximity to the site physically and in terms of relevant rainfall characteristics, to be acceptable for conservative estimation of rainfall input to a dam.

A critical wet period is determined from Figure 1 based on the physical location of the site relative to catchments in Queensland. The maximum rainfall for the critical wet period each year is then determined and a probability distribution fitted to the data points.

Rainfall depths for relevant AEPs are interpolated or extrapolated as necessary, and 100% runoff is assumed from the relevant contributing catchments to generate run-off volumes for combination with estimated other inputs to the dam over the critical wet period.

Table 4 Performance Criteria - AEP – Spillway and Levee Design

Operational Life of Dam	Design Event Probability (AEP) by Hazard Category	
	High	Significant
1 year	0.0001	0.001
2 to 5 years	0.00002	0.0002

6 to 10 years	0.00001	0.0001
11 to 30 years	0.000004 (or PMP)	0.00004
More than 30 years	0.000001 (or PMP)	0.00001

Table 5 Performance Criteria - AEP – Design Storage Allowance and Mandatory Reporting Levels

Hazard Category	Design Event Probability AEP		
	DSA Full Hydrologic Analysis	**DSA Deciles Analysis**	**MRL 72 hour event**
High	0.01	0.01	0.01
Significant	0.01	0.05	0.01

Figure 1 – Critical Wet Periods for 'Method of Monthly Deciles'