Queensland Reconstruction Authority

CURRENT BUILDING AND ENGINEERING STANDARDS FRAMEWORK

February 2013

Contents

1. Fundamentals of 'Current Engineering Standards' REPA - (as applicable to 2013 National Partnership Agreement)

Introduction

The Queensland and Commonwealth Governments have signed a National Partnership Agreement (NPA) to facilitate Queensland's recovery from ex-tropical cyclone Oswald. The agreement strengthens and complements the existing Natural Disaster Relief and Recovery Arrangements (NDRRA) scheme.

A key component of the agreement is the development of a framework that seeks to ensure flood-prone public infrastructure is rebuilt to pre-disaster functionality utilising current engineering standards. This paper outlines how the Authority will recognise and apply the appropriate current engineering standards.

> *'What is clear is that design is a complex task. Design can never be merely the application of numbers from a set of tables developed from various theoretical constructs used for that purpose. There is a need to apply judgement and experience in arriving at the appropriate design. In the past, the complexity of design gave rise to the development and use of standard values for various elements to be used in various sets of defined circumstances in order to simplify the process. This approach is not always appropriate, although it allows people of limited experience to achieve acceptable design in many circumstances. Where more complex combinations of circumstances occur, however, designers require considerable skills and experience to enable them to choose the optimum solution.'*
>
> **DTMR Road Planning and Design Manual – 2005 p2-2**

National Partnership Agreement (NPA)

As specified in paragraph 46 of the National Partnership Agreement (NPA), and as required under the NDRRA, all restoration or reconstruction of essential public assets must be undertaken in accordance with recognised current building and engineering standards. This is subject to cases where betterment projects are agreed under the NPA. The appropriate standards to be applied to the restoration or replacement of assets damaged in the 2013 flooding, including transport infrastructure, will be delivered as agreed between the Parties within the framework of this document.

NDDRA Determination

In the context of this framework there are two key references in the NDRRA Determination that should be referenced in determining a proposed reconstruction or restoration.

Section 3.6.6 The requirements for restoration or replacement of an asset are:

a) the asset is an essential public asset; and

b) the restoration or replacement results in the asset being restored or replaced to its pre-disaster standard, in accordance with current building and engineering standards

Section 3.6.7 In this Determination betterment, in relation to an asset, means the restoration or replacement of the asset to a more disaster-resilient standard than its pre-disaster standard.

2. Application of Engineering Standards

All engineering must be delivered to a defined, measurable and appropriate standard.

What is a Standard?

A standard can be defined as a set of technical definitions and guidelines, 'how to' instructions for designers, builders, and users. Standards promote safety, reliability, productivity, and efficiency in almost every industry that relies on engineering.

> *'Standards are published documents setting out specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they were intended to. They establish a common language which defines quality and safety criteria. Standards can be guidance documents including:*
>
> - *Australian Standards;*
> - *International Standards and Joint Standards;*
> - *Codes;*
> - *Specifications;*
> - *Handbooks; and*
> - *Guidelines.*
>
> *These documents are practical and don't set impossible goals. They are based on sound industrial, scientific and consumer experience and are constantly reviewed to ensure they keep pace with new technologies. They cover everything from consumer products and services, construction, engineering, business, information technology, human services to energy and water utilities, the environment and much more.'*
>
> ***Standards Australia Webpage 13 Feb 13***

Standards are a vehicle of communication for producers and users. They aid a common language, defining quality and establishing safety criteria. Costs are lower and value for money outcomes more achievable if design and construction procedures are standardised.

When do Engineering Standards Apply?

Current engineering standards apply in the development of engineering solutions for the development of new infrastructure or reconstruction of existing. The application of engineering standards represents one of a number of key inputs into the scope definition, design development, and implementation of an infrastructure solution.

Current Engineering Standards

This Framework identifies 'Current engineering standard' as the application of the most recent sound engineering based on the currently available civil engineering body of knowledge as defined by current Australian Legislation, Standards, Codes and Guidelines and as applied through established mechanisms such as in place planning schemes, design and construction manuals and guidelines.

Current engineering standards seek to incorporate the principles of Value for Money by applying fitness for purpose, safety in design, and whole of life costings. Their application in any specific

situation will vary to suit the environment, existing service levels tempered by sound engineering judgement.

Design and Construction Standards.

Engineering solutions must be implemented in accordance with the prevailing laws and Acts. Examples of this include the *Transport Infrastructure Act* which provides a regime that allows for and encourages effective integrated planning and efficient management of a system of transport infrastructure and the *Integrated Planning Act (IPA)* which seeks to achieve ecologically sustainable development through coordination, integration, and streamlining of a number of land use planning processes. For example, engineers will use a set of standards and guides during road and bridge construction:

- Manual of Uniform Traffic Control Devices (MUTCD) – to ensure safe and consistent road signage practices across all regions in Australia for the safety of the road user community.
- QDTMR Standard Specification Roads – to ensure that works are carried out by all road construction parties to a consistent standard across the State Roads network in Queensland.
- QDTMR Road Planning and Design Manual (RPDM) – to provide a uniform set of design rules for State Roads network in Queensland.
- IPWEA Standard Drawings – to provide a consistent and reliable set of typical details for community infrastructure across Queensland.

> *'Design has to be developed with sound, professional judgement and guidelines assist the designer in making those judgements'*
>
> **Guide to Road Design (Austroads)**

> *'The volume of traffic on a day can exceed the AADT by a considerable amount so design on the AADT alone can be misleading. A road designed on the basis of the average volume will have to carry much larger volumes for a considerable portion of the year.'*
>
> ***Road Planning and Design Model (DTMR)***

There is an expectation that REPA reconstruction work must conform to Design and Construction Standards. In many cases the asset owner requires their infrastructure to conform to prescribed standards (e.g. Austroads). The expectation is that design and engineering solutions must conform to recommended service levels and must be informed by Current Engineering and Building Code Standards.

Standard Drawings and Designs

Standard drawings and designs are developed taking into consideration current engineering standards as specified by the applicable standards and the relevant regulating authorities and guiding organisations including:

- Austroads
- Department of Transport and Main Roads
- Institute of Public Works Engineering Australia (IPWEA)
- Australian Road Research Board (ARRB)
- Local Government Authorities (LGA)

'The standard drawings show construction layouts and details of infrastructure assets that are acceptable to Brisbane City Council.

Brisbane City Council – Webpage, Feb 13

Standard drawings show typical construction layouts and detail the acceptable level of service and quality acceptable to industry. Current standard designs incorporate appropriate engineering standards into the delivery of new works as required by legislation. For example IPWEA design standards and their suite of standard drawings are universally considered to be the baseline for Local Government Authorities (LGA) capital works. The majority of LGA have adopted IPWEA standards as their own and some have modified these standards to satisfy local requirements and/or expectations.

3. Transport and Civil Infrastructure Design and Specifications Framework

Under current NDRRA, REPA will fund the repair or reconstruction of eligible assets such as transport infrastructure, water and sewer main, buildings, structures, levees, drains, recreational infrastructure, marine infrastructure and gauging stations. If destroyed or damaged beyond repair these assets will need to be reconstructed in accordance with the standards specified in Appendices 1 and 2.

Initial 2013 damage assessments have identified the majority of work will require the repair of damaged roads and the reconstruction key transport infrastructure assets such as bridges, culverts and floodways destroyed or damaged beyond repair by high velocity flooding requiring asset owners to reconstruct.

Definition of Reconstruction

Reconstruction is defined as the 'act of rebuilding'. Within the context of REPA it seeks to rebuild NDRRA eligible assets to 'current engineering standards' in accordance with the applicable design and construction standards .

Design and Specifications Framework

The availability of design engineers able to apply current engineering standards is a key component of the successful delivery of NDRRA. It is expected designers understand the Authority's expectations with regard to design objectives and are able apply the factors affecting and basic considerations for design.

> *The main objects of this Act (Engineering Act) are—to protect the public by ensuring professional engineering services are provided by a registered professional engineer in a professional and competent way; and to maintain public confidence in the standard of services provided by registered professional engineers; and to uphold the standards of practice of registered professional engineers.*
>
> ***Professional Engineers Act Queensland 2002***

> *'Engineers occupy positions of trust and responsibility within the community, with industry and across government. An engineer plays a critical role in the design and construction of major infrastructure as well as providing critical engineering services to the mining and growing resources sector in Queensland.'*
>
> ***Board of Professional Engineers – Queensland Government***

Design objectives as applicable to REPA

In the context of providing pre-disaster functionality, the following design objectives are applicable to the delivery of REPA reconstruction works:

- Strategic fit - As well as satisfying local requirements, design objectives should support transportation outcomes required by governments (federal, state and local).
- Transport demand – Road design should accommodate the designated volume and composition of traffic in a safe and efficient manner.
- Safety – Safety in Design is a legislative requirement.

- Community expectations - The involvement of stakeholders throughout the planning process helps to ensure that all final design meets community expectations.
- Road characteristics and use – Design should consider the current functionality and capacity of the asset.

Factors affecting design decisions

A range of factors influence design choices for road projects. The design characteristics and values adopted must provide a satisfactory service to roads users and be economically viable within the financial, topographical and environmental constraints that may exist.

Basic Considerations for a Typical Infrastructure Design Development Process

Basic considerations for a typical infrastructure design development process for public road, bridge and community infrastructure, and the role of the selection and application of engineering standards within this process are provided in flow chart form at Appendix 3 and are summarised below:

- **Required Functionality and Level of Service**
  - Establish the regional planning context, and required operating requirements
  - Identify and validate community expectation
  - Identify the needs of the user
  - Consolidate inputs and establish minimum conditions (level)of service required
  - Consideration of asset's pre-disaster functionality

- **Existing Site Conditions**
  - Undertake site investigation, and relevant required field works and testing
  - Review the condition of existing and related adjacent infrastructure
  - Evaluate the current condition of exiting asset, and document

- **Key Performance Criteria**
  - Identify key outcomes required by which success will be measured against, and hence drive the basis for design development
  - Establish measureable targets that reflect required outcome criteria

- **Site Constraints ad Inputs**
  - Identify access to required construction materials, including available locally supplied resources and materials
  - Identify local environmental sensitivities / constraints
  - Identify other relevant site specific inputs to the design and construction solution

- **Applicable Design Standards (refer to Appendix 1 and 2)**
  - Identify & review the identified standards available
  - Identify & review relevant regulatory requirements, agency specific policies and standards, and industry guidelines
  - Identify those standards of relevance to the specific infrastructure scope, and hierarchy of precedence

- **Gap analysis**
    - Assess the level of service offered by the asset in its pre-disaster functionality, as compared with that necessary to meet required current engineering standards
    - Assess the gap between standards achieved by the existing asset pre-disaster functionality and relevant, required and applicable standards
    - Develop a framework of options based on requirements to overcome gaps / deficiencies in pre-disaster functionality /utility provided.

- **Design Development**
    - Critical review of options identified & shortlist based on required functionality, engineering standards, and key performance criteria
    - Develop concept designs for shortlisted options, and evaluate. Select preferred concept on basis of minimum likely cost to achieve required level of service and functionality / criteria.
    - Develop detailed design and complete risk assessment for final review

- **Design Challenge and Value for Money (VfM) Optimisation**
    - Critically review developed design and benchmark against key market indicators
    - Undertake peer review to ensure efficiency and adequacy of solution (i.e. fit for purpose)
    - Undertake cost analysis & challenge the solution with respect to value for money outcomes
    - Incorporation of innovation and value engineering into design and consideration of the Extended Design Domain Concepts as defined by Austroads Design Objectives.

- **Risk Assessment**
    - Undertake final risk review with respect to design compliance, legal, commercial & technical content
    - Identify required mitigation measures & implement to achieve acceptable residual risk profile

- **Design finalisation and Implementation**
    - Implement identified VFM measures identified from review processes
    - Implement risk mitigation measures generated from final review

4. QRA Application of 'Current Engineering Standards' within 2013 REPA Framework

The Authority operates in the extraordinary context of a disaster that covers all of Queensland where speed of reconstruction is paramount. This objective must be balanced with the Authority's role in assuring that the monies managed by it result in optimal Value for Money (VfM) outcomes and that this can be demonstrated to key stakeholders.

There are a range of proven VfM strategies and processes in use by existing funding administrators and recipients, which the Authority will utilise and leverage in carrying out its task. Given the scale of the program expected to be managed by the Authority, it is critical that the resources of the Authority are applied to those activities that are at most risk with regard to delivering value for money outcomes. The Authority's existing VfM Strategy addresses these key risks that have been identified through:

- Drawing on the experience of key funding recipients and project delivery organisations (such as Department of Transport and Main Roads (DTMR) and Local Government Authorities (LGAs))
- Drawing on the experience and expertise of the private sector through advisors to the Authority
- Leveraging learnings from other programs of similar scale and complexity e.g. Building the Education Revolution.

The Value for Money and Current Engineering Standards Framework

Value for money is considered to have been achieved by a submission when it is deemed fit for purpose in the context of locality, road hierarchy and functionality of the proposed reconstruction. Engineering judgement is used in balancing the fit for purpose, whole of life and safety considerations of the design against expenditure whilst maintaining an acceptable level of service for the asset.

The Authority's established VfM Strategy applies seven treatment strategies as part of its whole of State delivery model. They are:

1. Centralised reporting and common reporting structure
2. Risk-based assurance of existing local VfM strategies and processes
3. Local prioritisation balanced with whole-of-state considerations
4. Devolution of procurement and delivery to the responsible entities best positioned to address the risks identified
5. Transparent accountabilities across the program for VfM outcomes
6. Collaborative engagement with delivery organisations to optimise probability of achieving VfM outcomes
7. Establishment of external scope and cost references, including through price benchmarking, and review.

The current engineering standard framework for delivery of 2013 works, will incorporate into the Authority's seven treatment strategies the following:

- Application of current engineering standards consistently across Applicants and projects.

- Achieving balance in VfM and engineering standards by appraising the proposed technical solutions within the context of prescribed engineering standards, such as those included in Appendix 1.
- Utilisation of engineering and technical judgement to come to a reasonable view on how to best achieve a fit for purpose engineering standard, taking into consideration pre-disaster functionality.

Eligibility and Applicability of Works

The eligibility and applicability of works to current engineering standards within the 2013 REPA Framework must meet the following criteria:

- Must be eligible NDRRA works
- Must be approved by the Authority as works requiring reconstruction
- The proposed design solution and engineering outcome must be consistent with standard design and construction standards and existing engineering practices
- The final treatment must achieve desired VfM outcomes, as agreed between the Authority and the Applicant, by:
    - Advancing Government priorities,
    - Considering whole-of-life and transaction costs, and
    - Achieving a fit for purpose outcome.

The Framework also recognises the concept of betterment as defined in NDRRA Determination 2012 section 3.6.7. The rebuilding of the asset above recognised current engineering and building standards should be treated in line with the determination as betterment.

5. Conclusion

The Queensland and Commonwealth Governments have signed a National Partnership Agreement (NPA) to facilitate Queensland's recovery from ex-tropical cyclone Oswald. A key component of the agreement is the development of a framework that seeks to ensure flood-prone public infrastructure is rebuilt to pre-disaster functionality utilising current engineering standards.

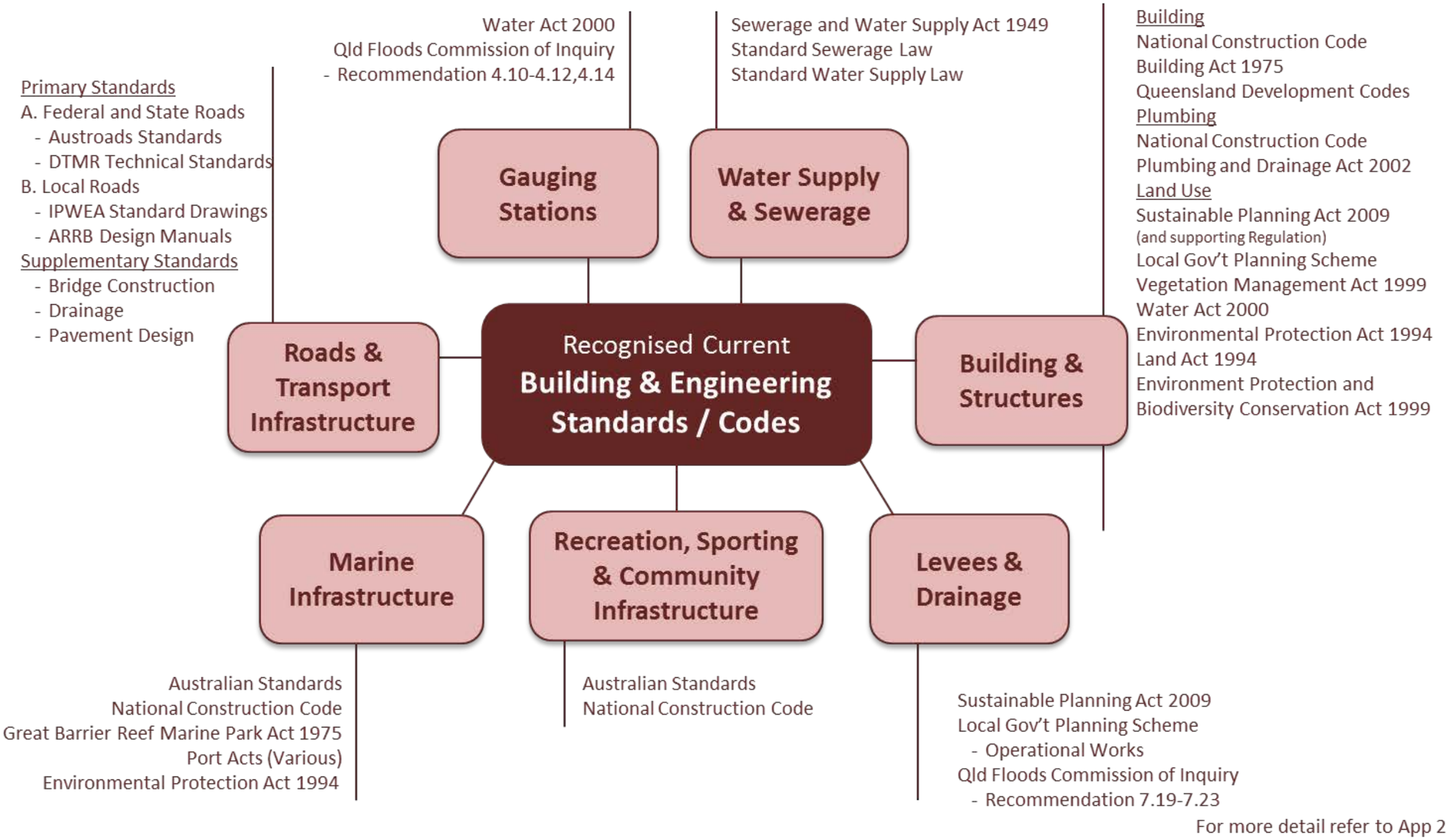
Current engineering standards apply in the development of engineering solutions for the development of new infrastructure or reconstruction of existing. The application of engineering standards represents one of a number of key inputs into the scope definition, design development, and implementation of an infrastructure solution.

This Framework identifies 'Current engineering standard' as the application of the most recent sound engineering based on the currently available civil engineering body of knowledge as defined by current Australian Legislation, Standards, Codes and Guidelines and as applied through established mechanisms such as in place planning schemes, design and construction manuals and guidelines.

By applying current engineering standards the Authority is seeking to incorporate the principles of Value for Money by applying fitness for purpose, safety in design, and whole of life costings.

For 2013 works the Authority will execute the delivery of works in line with agreed treatment strategies ensuring that the key eligibility criteria, defined in this document, can continue to be met.

Appendix 1 - Current Building and Engineering Standards for 2013 REPA



Appendix 2 - Example Current Building and Engineering Standards, Codes and Guidelines

Example Australian Standards

- Building and Construction - 124 Standards
- Water and Waste Services – 39 Standards
- Transport and Logistics – 40 Standards

Example Australian Transport Infrastructure Standards and Codes

- Australian Standard 5100 'Bridge Design Code'
- Austroads Guide to Pavement Technology
- Austroads Guide to Road Design
- Austroads Guide to Road Safety

Example State Government Acts

- Queensland Workplace Health and Safety Act 1995
- Queensland Fisheries Act
- Environmental Protection Act

Example State Government Transport Infrastructure Standards

Key DTMR documents include:

- Bridge Drafting Manual
- Conduct of Road Safety Audits
- Design Criteria for Bridge and Other Structures in Scope of Works and Technical Criteria (SWTC)
- Drafting and Design Presentation Standards Manual (DDPSM)
- Interim Guide to Road Planning and Design Practice
- Manual of Uniform Traffic Control Devices (MUTCD)
- Pavement Design Manual (PDM)
- Pavement Rehabilitation Manual (PRM)
- Planners and Designers Instructions
- Queensland Transport and Main Roads Investment Program (QTRIP)
- Road Drainage Manual (RDM)
- Road Maintenance Performance Contract (RMPC) Manual
- Road Planning and Design Manual (RPDM)
- Road Safety Audit Policy
- Standard Drawings Roads
- Standard Specifications Roads
- State-controlled Priority Road Network Investment Guidelines

Specific TNRP documents of relevance to these Guidelines include:

- Transport Network Reconstruction Program - Strategic Plan
- Program Management Plan – TNRP-SPO-PL-PM-001
- Risk Management Plan - TNRP-SPO-PL-PM-0006
- Safety Management Plan - TNRP-SPO-PL-PM-0008
- Environmental Management Plan – TNRP-SPO-PL-PM-0010
- Funding and Development Guideline – TNRP-SPO-PL-0017

- Submission Guideline – TNRP-SPO-PL-PM-0020

Example Local Government Transport Infrastructure Engineering Standards

Sewer and water

- Standards of the water and sewerage service provider (e.g. Queensland Urban Utilities)

Stormwater quality

- *State Planning Policy 4/10: Healthy Waters* and associated Guideline
- South East Queensland - Regional Plan 2009-2031 *Implementation Guideline No. 7 Water sensitive urban design: Design objectives for urban stormwater management*
- *Environmental Protection (Water) Policy 2009*
- *Water Sensitive Urban Design Technical Design Guidelines in SEQ*
- *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*
- *DERM Urban Stormwater Quality Planning Guidelines*
- Healthy Waterways Framework for the Integration of Flood and Stormwater Management into
- Open Space
- *Gold Coast City Council Planning Scheme Policy No.11: Land Development Guidelines Section13.1.3 Alteration or Creation of a Waterbody*

Stormwater Quantity

- *Queensland Urban Drainage Manual* (QUDM)
- Australian Rainfall and Runoff (ARR) - where referenced by QUDM
- Relevant local government design and construction standards

Major roads

- DTMRs' Road Planning and Design Manual
- DTMR *Pavement Design Manual*
- DTMR *Bridge Design Drafting Manual*
- *Queensland Urban Drainage Manual* (QUDM)
- DTMR *Road Drainage Manual*
- DTMR *Manual of Uniform Traffic Control Devices*
- DTMR Guide to Pavement Markings (print only)
- Australian Standard AS1158 (Street Lighting)

Minor roads

- See ULDA *Guideline No 6 Street and Movement Network*
- Queensland Complete Streets - Guidelines for Urban Street Design
- Relevant local government construction standards
- DTMR *Planning for Safe Transport Infrastructure at Schools*

Vehicle parking

- Australian Standard AS2890 - Parking Facilities (Parts 1 to 6)
- Site access
- Relevant local government design and construction standards
- Footpaths, cycle paths and end of trip facilities
- Local government standards for construction
- Austroads - Guide to Traffic Management Part 6A: Pedestrian and Cyclist Paths
- Refer also to ULDA *Guideline No 6 Street and Movement Network*

Public transport

- *Translink Public Transport Infrastructure Manual*
- DTMR *Planning for Safe Transport Infrastructure at Schools*
- DTMR's *Interim Guide to Road Planning and Design Practice*

Soil erosion

- International Erosion Control Association (IECA) - *Best Practice Erosion and Sediment Control*

Filling

- Australian Standard AS3798 -Guidelines on Earthworks for Commercial and Residential Developments

Example Water and Waste National Codes

- The Water Services Association of Australia has developed a suite of Code of Practices for the design and installation of water supply and sewerage assets.
- The National Codes for the urban water industry have been widely adopted by WSAA members and associates. Adopting utilities are required to close out options within each Code to accommodate utility needs and preferences as well as local construction practices and products. The Codes are supported by the activities of other WSAA committees and networks that focus on broader issues such as sustainability, environmental management, asset management, water quality, quality assurance, water reuse and conservation, pressure and leakage management, OH&S, critical infrastructure protection, strategic products and construction materials.
- National Water Services Association of Australia Codes include:
    - WSA 01-2004 Polyethylene Pipeline Code Version 3.1
    - WSA 02-2002 Sewerage Code of Australia Version 2.3
    - WSA 03-2002 Water Supply Code of Australia Version 2.3
    - WSA 03-2011 Water Supply Code of Australia Version 3.1
    - WSA 04-2005 Sewage Pumping Station Code Of Australia Version 2.1
    - WSA 05-2008 Conduit Inspection Reporting Code of Australia Version 2.2
    - WSA 06-2008 Vacuum Sewerage Code Version 1.2
    - WSA 07-2007 Pressure Sewerage Code of Australia Version 1.1
    - Australian Sewage Quality Management Guidelines
    - H2S Hydrogen Sulphide Control Manual Volume 1 & 2
- However, because of differences in regional business practices it is common for regional water and waste asset owners to modify these codes by way of Supplementary Manuals to address circumstances particular to their own water supply and sewerage reticulation standards
- Examples of other key source documents include:
    - DERM Planning Guidelines for Water Supply and Sewerage
    - AS/NZS 3500.2 Plumbing and drainage - Part 2: Sanitary plumbing and drainage
    - Water Supply (Safety and Reliability) Act 2008
    - Quality, National Water Quality Management Strategy, agriculture and Resource Management
    - ARMCANZ/ANZECC/NHMRC, 2000, Guidelines for Sewerage Systems – Use of Reclaimed
    - Water, National Water Quality Management Strategy, Agriculture and Resource Management
    - AS/NZS 3500: 2003 Plumbing and Drainage
    - AS/NZS 4020:2002 Testing of Products for Use in Contact With Drinking Water.

Example Building & Structures Standards

- Building
    - National Construction Code
    - Building Act 1975
    - Queensland Development Codes
- Plumbing
    - National Construction Code
    - Plumbing and Drainage Act 2002
- Land Use
    - Sustainable Planning Act 2009 (and supporting Regulation)
    - Local Gov't Planning Scheme
    - Vegetation Management Act 1999
    - Water Act 2000

- Environmental Protection Act 1994
- Land Act 1994
- Environment Protection and Biodiversity Conservation Act 1999

Example Gauging Stations Standards

- Water Act 2000
- Qld Floods Commission of Inquiry
- Recommendation 4.10-4.12,4.14

Example Marine Infrastructure Standards

- Australian Standards
- National Construction Code
- Great Barrier Reef Marine Park Act 1975
- Port Acts (Various)
- Environmental Protection Act 1994

Example Marine Infrastructure

- Australian Standards
- National Construction Code

Example Recreation, Sporting & Community Infrastructure

- Australian Standards
- National Construction Code

Example Levees & Drainage

- Sustainable Planning Act 2009
- Local Gov't Planning Scheme - Operational Works
- Qld Floods Commission of Inquiry- Recommendation 7.19-7.23

Appendix 3 – Design Application Flow Chart

Queensland Reconstruction Authority

Design Application Flow Chart