

NT Public Cyclone Shelters

Design Brief



Document title	NT Public Cyclone Shelters Design Brief
Contact details	DIPL
Approved by	
Date approved	
Document review	
TRM number	To be confirmed

Version	Date	Author	Changes made
0.1	20 August 2021	Simon Scally	Issued for review by TEMC
0.2	20 October 2021	Simon Scally	Updated following TEMC review

Document Review and Development
Terry Franklin, Project Director Design, DIPL
Simon Scally, Director Infrastructure Planning, DIPL
Peter Wastle, Senior Manager Infrastructure Planning, DIPL
Jorge Mu, Manager Projects Structural, DIPL
Anthony Berrill, Project Manager Electrical
Lloyd Marquez, Senior Project Manager Mechanical Engineer
Kevin Tole, Project Manager Hydraulic

Related Documents
Northern Territory Cyclone Shelter Framework (Department of the Chief Minister, November 2019)
Queensland Government Department of Public Works Design Guidelines for Queensland Public Cyclone Shelters (September 2006)

Contents

1. Introduction and Purpose	5
2. Supporting Guidelines and Order of Precedence	6
3. Functional Requirements	7
3.1. Dual Purpose Function.....	7
3.2. Design Principles	7
3.3. Master Planning.....	7
3.4. Design Occupancy Level	7
3.5. Occupancy Duration.....	8
3.5.1. Functional Relationship Diagrams.....	8
3.5.2. Accommodation Schedule Summary	9
3.5.3. Functional Areas Requirements.....	9
3.5.3.1. Shelter Area(s).....	9
3.5.3.2. Office, Communications and First Aid Space	9
3.5.3.3. Shelter Registration Space	9
3.5.3.4. Toilets	9
3.5.3.5. Drinking Water Point(s)	10
3.5.3.6. Plant Room(s).....	10
3.5.3.7. Shelter Store	10
3.6. Technical Brief	11
3.6.1. Certification and Statutory Requirements.....	11
3.6.1.1. Building Certification Requirements	11
3.6.1.2. Accessibility.....	11
3.6.2. Design Life	11
3.6.3. Structural.....	11
3.6.4. Architectural	11
3.6.5. Landscape.....	11
3.6.6. ESD	11
3.6.7. Mechanical	12
3.6.8. Electrical	13
3.6.8.1. Essential Power	13
3.6.8.2. Lighting.....	14
3.6.9. Communications	14
3.6.10. Hydraulic.....	14
3.6.11. Fire Engineering.....	15
3.6.12. Lightning Protection	15
3.6.13. Civil and Stormwater	15
3.6.14. Car Parking and Vehicle	15
4. Site Selection Requirements	17
4.1. Location and Community Access.....	17

4.2. Storm Tide	17
4.3. Flood	17
4.4. Land Slip	17
4.5. Land Tenure	17
4.6. Site Services Infrastructure	17
4.7. Statutory Planning Requirements	18
Appendix A – NT Public Cyclone Shelters Structural Requirements	19

1. Introduction and Purpose

This Design Brief describes the functional, spatial, site selection, design criteria and technical requirements for NT Public Cyclone Shelters. It is intended for use for Public Cyclone Shelters located in urban, regional and remote areas of the NT.

It is expected that the Public Cyclone Shelter will be used for other activities, when not in use as a shelter. This Primary Use may vary from location to location dependant on the community needs. Typically cyclone shelters are normally used as community halls or school multipurpose halls. However NT cyclone shelters are also located in teaching areas of schools, libraries and other municipal buildings.

This Design Brief is not suitable for facilities that are intended to function as Evacuation Centres. The scope and functional requirements described in this Design Brief do not provide for shower, meal preparation or food storage facilities and may not provide sufficient emergency power, water or sewer services to accommodate people for a prolonged period following a cyclone event.

This Design Brief is not suitable for Carpark Cyclone Shelters. As these facilities enable people to shelter within their vehicles and may be located below ground level, requirements including occupancy level, ventilation and flood protection will be different to those defined in this Brief.

2. Supporting Guidelines and Order of Precedence

There are two other documents that, along with this Design Brief, may be referred to during the design and development of NT Public Cyclone Shelters:

- Northern Territory Cyclone Shelter Framework (Department of the Chief Minister, November 2019); and
- Queensland Government Department of Public Works Design Guidelines for Queensland Public Cyclone Shelters (September 2006).

In the event of a conflict between this Design Brief (including Appendices) and the above documents, the requirements of this Design Brief must apply.

In the event of a conflict between this Design Brief (including Appendices), the National Construction Code (NCC), other statutory requirement or Australian Standard, the more onerous requirement must apply, that being the requirement which calls for the highest standard.

3. Functional Requirements

3.1. Dual Purpose Function

It is expected that the Public Cyclone Shelter will be used for other activities, when not in use as a shelter. The 'Primary Use' use may vary from location to location depending on the community needs. Typically cyclone shelters are normally used as community halls or school multipurpose halls. However NT cyclone shelters are also located in teaching areas of schools, libraries and other municipal buildings.

The functionality of the Primary Use must not compromise the facility's ability to operate as a Public Cyclone Shelter.

This Design Brief does not describe functional or technical requirements for the Primary Use. The brief for the Primary Use will be developed on a project-specific basis.

3.2. Design Principles

The following design principles apply to all aspects of the design of Public Cyclone Shelters:

- Community use and access: The facility must enable and encourage community access and use both during and outside of emergencies scenarios.
- Durability and ease of maintenance: All aspects of the design must be highly durable to minimise ongoing maintenance requirements. Ease of maintenance must be enabled through safe and ready access to all areas of the facility, and through use of readily available materials, finishes and fittings.
- Safety: The design must consider and respond to user safety during all usage scenarios.
- Dual purpose: The facility must maximise community benefit through the Primary Use function. Multipurpose, flexible spaces should be provided. The functionality of the Primary Use function must not compromise the facility's ability to operate as a Public Cyclone Shelter.

Additional design principles for the Primary Use function of the facility, such as indoor environment or landscape quality, should be developed separately and on a project-specific basis.

3.3. Master Planning

Master planning should be considered on a project and site-specific basis. Reference existing master plans if possible, e.g. school or community master plans. Area plans should also be referred to.

Planning for future expansion related to projected population growth must be considered when planning and designing Public Cyclone Shelters.

3.4. Design Occupancy Level

The Design Occupancy Level will reflect the anticipated number of persons who may attend the Public Cyclone Shelter during a cyclone event and will be determined on a project-specific basis based on the population of a community and the number of existing Compliant to Building Code Structures¹ in a community.

¹ As defined in the Northern Territory Cyclone Shelter Framework

The Design Occupancy Level should factor in future population growth which may be addressed through future expansion capability.

The NT Government will lead analysis and confirmation of the Design Occupancy Level for each project.

The design must provide 1.2sqm of shelter floor space per Occupant. Floor space that may be counted towards the Design Occupancy Level excludes the following:

- Wet areas including toilets, laundry or kitchen;
- Plant room;
- Store rooms and storage space associated with the Primary Use function of the building, noting that the Shelter Store may be counted towards the floor space as this space will be empty during cyclone events.
- Areas with a dedicated Public Cyclone Shelter function described in the functional brief below, including the Shelter Registration space and the Office, Communications and First Aid Space.

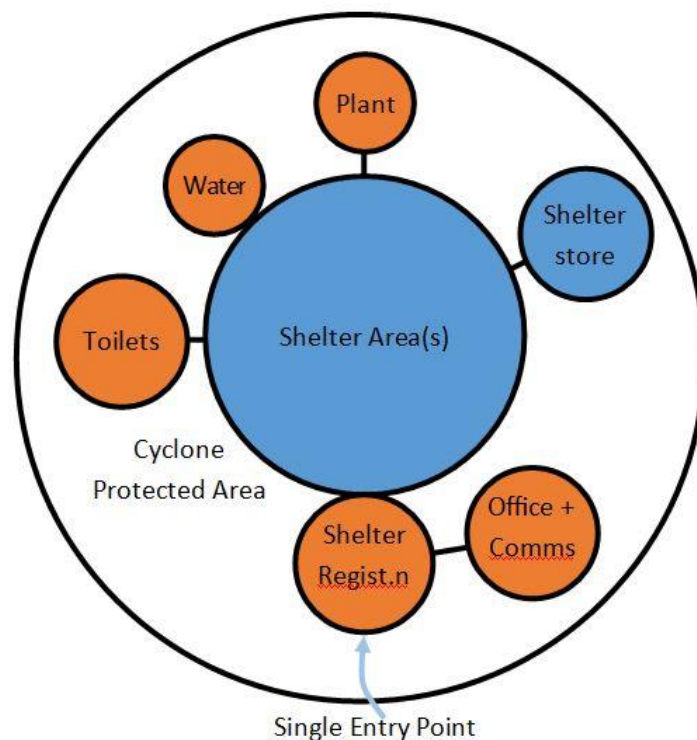
3.5. Occupancy Duration

Public Cyclone Shelters must be designed to meet a Design Total Occupancy Period of 36 hours including a Design Lock-Down Period of 18 hours.

The Design Total Occupancy Period includes: a period prior to the wind reaching a gust wind speed of 100km/hr, the Design Lock-Down Period when the winds are greater than 100km/hr, and a period after the winds have abated but prior to people departing the shelter.

During the Design Lock-Down Period, all windows and doors are closed to provide protection from winds, rain and debris.

3.5.1. Functional Relationship Diagrams



Note: Blue areas show spaces that may count towards the Design Occupancy Level area calculation. Areas are not proportionately sized in the above diagram.

3.5.2. Accommodation Schedule Summary

Functional Unit Name	Minimum Requirements
Shelter Area(s)	1.2sqm per Occupant
Office, Communications and First Aid Space	12sqm
Shelter Registration Space	as reqd.
Toilets	1:40 toilets per Occupant 1:100 washbasins per Occupant
Drinking Water Point(s)	as reqd.
Plant Room(s)	as reqd.
Shelter Store	as reqd.

3.5.3. Functional Areas Requirements

3.5.3.1. Shelter Area(s)

Shelter occupants will remain seated (80% of occupants) or lying down (up to 20% of occupants) during a cyclone events in the Shelter Area(s). Loose seating will be set up in the Shelter Area by the Shelter Management Team prior to occupants' arrival.

3.5.3.2. Office, Communications and First Aid Space

The Office, Communications and First Aid Space will function as a space for the Shelter Manager to coordinate management of shelter operations and communications within the Shelter and to external parties.

The Office, Communications and First Aid Space may be used to provide basic first aid to Occupants if required. Space for specialist medical equipment, such as examination table, is not required.

The Office and Communications Space must have direct line of sight visibility to the Shelter Area(s) and to the Shelter Registration space.

The Office and Communications Space must include a space for a desk with PC and phone.

3.5.3.3. Shelter Registration Space

The primary function of the Shelter Registration Space is to enable the Shelter Management Team to monitor and record people's movements in and out of the Shelter. The Shelter Registration Space will be the single entry point during cyclone events.

The Shelter Registration Space may be a separate room, such as a foyer or reception space, to enable monitoring of people's movements in and out of the Shelter. However, depending on the scale, the Design Occupancy Level and the Primary Use function of the centre, the Shelter Registration Space may be a temporary space set up with loose furniture and/or partitions.

3.5.3.4. Toilets

The minimum number of toilets for the Public Cyclone Shelter Function must be calculated as follows:

$$\text{Design Occupancy Level} \div 40 = \text{Minimum Required Number of Toilets}$$

The minimum number of washbasins for the Public Cyclone Shelter Function must be calculated as follows:

$$\text{Design Occupancy Level} \div 100 = \text{Minimum Required Number of Washbasins}$$

Safe access to the Toilets must be provided at all times during cyclone events. Access via external areas is not acceptable.

Where the NCC requires a greater number of toilets or washbasins for the building's Primary Use, these must be provided in accordance with the Code. Accessible sanitary facilities must be provided in accordance with the NCC for the Primary Use and to comply with AS1428.1.

For the purpose of calculating the minimum required number of toilets for the Public Cyclone Shelter function:

- Both closet pans and urinals are counted as toilets; and
- Closet pans in unisex accessible sanitary facilities may be counted as two toilets.

Portable and/or temporary amenities are not acceptable due to logistical issues associated with cyclones particularly in remote locations.

3.5.3.5. Drinking Water Point(s)

The Drinking Water Point(s) will provide access to drinking water for occupants and the Shelter Management Team.

The Drinking Water Point(s) is not required to be a separate room and may be located within the Shelter Area. Circulation to the Drinking Water Points must be considered. The Drinking Water Point(s) should not be located in or near the Shelter Registration Space to avoid queueing clashes.

Safe access to the Drinking Water Point must be provided at all times during cyclone events. The potential for slip and other hazards must be addressed.

3.5.3.6. Plant Room(s)

The Plant Room(s) must contain all plant and equipment that the Shelter Management Team may need to have access to during a cyclone event, including emergency battery, generator and switchboard and any associated plant and equipment control panels such as generator fuel shut-off.

Safe staff access to the Plant Room(s) must be provided at all times during cyclone events. Access via external areas is not acceptable.

3.5.3.7. Shelter Store

Will store all loose furniture and equipment required during the facility's operation as a Public Cyclone Shelter, such as chairs, tables, communications equipment, first aid items etc. The Shelter Store will not be used to store items associated with the Primary Use function of the facility. As the Shelter Store will be empty during cyclone events, usable floor area in the Shelter Store may count towards the Design Occupancy Level area calculation.

3.6. Technical Brief

3.6.1. Certification and Statutory Requirements

3.6.1.1. Building Certification Requirements

The NCC will apply to all Public Cyclone Shelters. Building Certification must be carried out for both the Primary Use and use as a Public Cyclone Shelter. A building certifier must provide full certification for all Public Cyclone Shelters, including Building Permit and Certificate of Occupancy (or Letter of Compliance when outside a Building Control Area).

3.6.1.2. Accessibility

The Shelter, and access to the Shelter, must comply with AS1428.1, the Disability Discrimination Act and the Disability (Access to Premises – Buildings) Standards.

3.6.2. Design Life

Refer to NT Public Cyclone Shelters Structural Requirements at Appendix A.

3.6.3. Structural

Refer to NT Public Cyclone Shelters Structural Requirements at Appendix A.

3.6.4. Architectural

All architectural elements must be highly durable to minimise wear and tear and ongoing maintenance requirements.

Debris screens must comply with NT Public Cyclone Shelters Structural Requirements at Appendix A. Operable debris screens and/or roller shutters are acceptable, however should be minimised. Fixed screening is preferred so that building preparation time prior to a cyclone event is minimised.

The exterior building fabric must be resistant to water penetration. The fabric must not permit penetration of uncontrolled water when tested in accordance with AS2047 under a water penetration resistance test pressure of 630 Pa.

Consideration should be given to the provision of non-slip flooring to high traffic areas.

3.6.5. Landscape

The landscape design must provide safe access to and from the Public Cyclone Shelter during all usage scenarios.

Where planting is included in the project use only cyclone resilient species. Do not use large shade trees that could cause risks to the Shelter or people during weather events.

3.6.6. ESD

In accordance with DIPL ESD Policy and Minimum Design Standards for the Primary Use of the building only.

3.6.7. Mechanical

Sufficient ventilation must be provided so that the shelter complies with the performance requirement of the NCC and the DIPL Minimum Design Standard – Mechanical services, which requires the shelter to be ventilated with outside air to maintain air quality. The ventilation system must ensure that people of varying ages including children, the aged and handicapped are safely accommodated in the shelter.

The Shelter must be conventionally (mechanical and/or natural) ventilated when the Shelter is not in Lock-Down (Section 3.5) and must be naturally ventilated during the Lock-Down Period.

The ventilation system operating both during and outside of the Lock-Down Period must:

- maintain fresh air volumes per person in accordance with the deemed to comply provisions of the NCC;
- must not use the natural ventilation system as the means to satisfy the provisions of the NCC where a mechanical ventilation system is the primary means of ventilation when the shelter is not in Lock-Down;
- include essential power to mechanical ventilation systems including toilet exhaust systems, if applicable;
- be protected from damage by debris in accordance with the NT Public Cyclone Shelters Structural Requirements at Appendix A;
- use system controls where only authorised persons can manually deactivate the supply air ventilation during the Lock Down Period, and reactivate on completion of the Lock Down Period;
- consider the potential for blockage of the inlet to the ventilation system by debris;
- consider the likelihood that people occupying the shelter may be in wet clothes and that water may be entering the shelter during the event; and
- assume that no smoking, cooking or heating will occur at any time in the Shelter.

The natural ventilation system designed for the Lock-Down Period must:

- maintain fresh air volumes per person in accordance with the deemed to comply provisions of the NCC;
- be designed correspond to a minimum average external wind speed of 70km/hr (noting this speed is an average over 10 minutes and is less than the minimum wind gust speed during Lock-Down);
- be fitted with dampers with manual override to enable adjustment of the level of ventilation during the Lock-Down Period;
- locate natural ventilation openings to maximize cross flow ventilation, particularly for large shelters;
- provide natural ventilation damper openings on a minimum of two external faces of the shelter, evenly distributed over the area of the shelter as far as the structure allows, and in accordance with the following minimum sizes:
 - Shelter volume < 100m³: 2 openings at 0.1m², or 4 openings at 0.05m²;
 - Shelter volume 100m³ to 200m³: 4 openings at 0.1m², or 8 openings at 0.05m²;
 - Shelter volume 200m³ to 1000m³: multiple openings 1m² in total; and
 - Shelter volume > 1,000m³: multiple openings 1m² in total for each 1,000m³ volume;

- consider options to provide improved natural ventilation by way of wind scoop or venturi grilled openings fitted with adjustable manual dampers; and
- Consider the potential for the natural ventilation system to be used as the primary ventilation method in the event that the mechanical ventilation is not available due to damage or loss of power supply.

Where air conditioning systems are provided as part of the Primary Use of the building, it is desirable for the air conditioning system to remain operational outside of the Lock-Down Period. Air conditioning (cooling) must not be provided with essential power.

3.6.8. Electrical

3.6.8.1. Essential Power

An essential power system must be provided to deliver power in the event of a mains power outage. The capacity of the emergency power system must be sized to provide essential power for 72 hours. Details of the systems that are supplied by essential power must be developed and confirmed on a project-specific basis, however must include:

- emergency lighting;
- designated general lighting;
- fire detection and warning system;
- designated power outlets;
- hydraulic services (e.g. pumps) if required to maintain water supply;
- emergency communications systems (if applicable); and
- mechanical ventilation systems (if applicable).

Air conditioning (cooling) systems are not required to be on essential power.

The essential power system:

- must be fully enclosed within the cyclone protected area of the building. The NT Public Cyclone Shelters Structural Minimum Design Standard applies to any stand-alone enclosure or plant space;
- must not rely on an external generator inlet socket. A mobile generator is not acceptable due to the potential for damage to the generator during cyclone events, the lead time to source a generator and the potential remote locations of Shelters;
- may provide power supply through a battery, generator, or a combination of both;
- must include an automatic changeover switch; and
- must, where a generator is used:
 - locate generator exhaust away from shelter air intakes so that exhaust fumes do not enter the shelter ventilation system;
 - utilise a cyclonic rated muffler and/or exhaust system;
 - include baffled louvres, or equivalent solution, to meet generator airflow requirements;
 - be weatherproofed in accordance with section 3.6.4 of this Brief to maintain operations and safety during cyclone events;

- provide fuel shut-off systems and locate fuel tanks so that the Shelter is not at risk from a fire associated with the generator fuel storage; and
- address acoustic and fire isolation requirements.
- External generator inlet socket for mobile generator is not acceptable due to logistical challenges in remote locations and IL4 protection of generator.

3.6.8.2. Lighting

Emergency Lighting must be compliant with the NCC for a class 9b building, with battery backup for 24hours.

The minimum lighting level is 40 lux throughout Shelter Area(s).

Lighting must provide a minimum of 320 lux in the Office, Communications and First Aid Space, Shelter Registration Space and Drinking Water Point(s).

Toilet lighting must meet relevant Australian Standards for minimum lux levels.

The design must specify only low energy usage fittings and must use LED lightning only.

3.6.9. Communications

Consideration is to be given to provision of communication systems within the shelter and external to the shelter. A battery powered hand held megaphone and a battery-powered radio receiver or television are considered the minimum provisions for internal and external communications.

A communication system is to be provided between the shelter and the designated disaster coordination centre.

3.6.10. Hydraulic

Water supply must be maintained for the Design Total Occupancy Period. The local supply may be utilized where it is assessed as meeting the IL4 rating. Where this is not the case an independent supply must be provided.

Where an on-site water supply tank(s) is used, the enclosure for the tank(s) and associated services must meet wind and debris loads specified in the NT Public Cyclone Shelters Structural Requirements. Emergency water supply capacity must be calculated as 20L per person based on the Design Occupancy Level.

The water supply may be via a gravity-fed header tank(s) or a pressure pump(s) serviced via essential power.

Safe staff access to the hydraulic pump(s) and associated systems must be provided at all times during cyclone events. Access via external areas is not acceptable.

To avoid water quality health risks associated with water tanks, options include:

- tanks to be filled from empty from mains supply only once the community is placed on cyclone watch;
- separate tanks for drinking water and toilet flushing to minimise tank filling time (i.e. toilet flushing tank could remain full as water quality may not be an issue); and

- continuous top-up of water tank only, when operating under the Primary Use.

The above options must be considered during the design of Public Cyclone Shelters and must consider project-specific needs, including mains water supply capacity, expected time required to fill tanks and water usage under the Primary Use.

The Shelter Management Sub-Plan will define any procedures for tank filling and/or water quality testing.

Use only low water usage fittings and equipment with a 6 star WELS rating.

3.6.11. Fire Engineering

Fire engineering systems must comply with the NCC. A fire engineered solution must be developed for the buildings function as a Public Cyclone Shelter and approved by a building certifier. The solution must include;

- fire detection and warning system;
- additional fire extinguishers to provide a backup to fire hose reels in the event of loss of mains water supply; and
- Appropriate fire separation to plant rooms containing generator and/or fuel storage.

In the event of a false alarm the shelter manager should have the ability to disable the audible fire alarm speakers from within the shelter. This may require an engineered solution with appropriate protocols to ensure safety.

3.6.12. Lightning Protection

Lightning protection must be provided to protect the shelter structure and provide protection from lightning induced surges in power and telecommunications cables entering the shelter.

3.6.13. Civil and Stormwater

Stormwater drainage must be provided in the form of piped systems, overland flow or levies. Flooding within the shelter must be prevented in the event that a piped system becomes blocked or levies overtopped by the storm tide or flood events.

Public Cyclone Shelters located below ground level are not acceptable, noting Carpark Cyclone Shelters, which may be below ground level, are not defined as Public Cyclone Shelters in the Northern Territory Cyclone Shelter Framework.

Where the proposed shelter site has the potential to be flooded an assessment must be made of the scour potential of the predicted inundation depths and flow velocities. This assessment must be made by a competent geotechnical professional and must take into consideration flow depth, flow conditions, soil characteristics and foundation type.

3.6.14. Car Parking and Vehicle

Requirements for parking and bus set down design are as follows:

- An area for bus set-down must be located near the Shelter entrance;
- Parking numbers must meet NT Planning Scheme requirements for the Primary Use function;
- Disabled car parking must be provided to NCC requirements; and

- Access between the bus set down area, the car parking area and the Shelter must comply with AS1428.1, Disability Discrimination Act and the Disability (Access to Premises – Buildings) Standards.

4. Site Selection Requirements

4.1. Location and Community Access

The shelter must be located so that access to the Shelter is maintained prior to and after the cyclonic event, including the flood and storm tide design criteria defined below. A bus set-down area must be located near the Shelter entrance. In addition, the selected site must respond to the project's Design Principles, including:

- to encourage community access and use both during and outside of emergencies scenarios; and
- to maximise community benefit through the Primary Use function.

4.2. Storm Tide

The building floor level must be at or above the 2,000 year Average Recurrence Interval (ARI) Storm Tide level (as mapped by the Department of Environment, Parks and Water Security (DEPWS), if available), plus 0.3m freeboard, plus 0.5m allowance for wave run-up.

The storm surge inundation maps published by DEPWS have factored in a 0.8m sea level rise to the year 2100). Where a location is not mapped by DPEWS, a 0.8m sea level rise must be factored into storm tide inundation calculations.

4.3. Flood

The building floor level must be at or above the 1 in 500 annual probability of exceedance flood level, plus 0.3m freeboard. The backwater effect on flood levels due to the design storm tide must be considered in determining the design river or creek flood heights.

DEPWS publishes flood maps with a 1 in 100 annual exceedance probability, but not many communities are mapped. Flood modelling consultant may need to be engaged where flood modelling is not available.

4.4. Hazards

The shelter shall not be located near significant hazards such as hazardous materials, high voltage power lines etc.

4.5. Land Slip

Land slip risks and design requirements must be considered on a case-by-case basis.

4.6. Land Tenure

It is strongly preferred that the selected site is NTG owned or leased to ensure management and maintenance of the infrastructure is controlled by the NTG.

4.7. Site Services Infrastructure

Existing sites services infrastructure and capacity, including power, water, sewer and communications, must be investigated prior to site selection to confirm the site's suitability and associated costs.

Site investigations may include site options analysis and/or feasibility studies to determine likely costs.

4.8. Statutory Planning Requirements

Town Planning, AAPA, EPA, NLC, TLC, ALC and Heritage requirements and restraints should be considered before a site is selected.

Appendix A – NT Public Cyclone Shelters Structural Requirements