CITY PLAN POLICY 1

SUPPORTING INFORMATION

TABLE OF CONTENTS

1. SUPPORTING INFORMATION GENERALLY

1.1 Without limiting its discretion under Section 3.3.6 of the Integrated Planning Act (IPA), Council may request an applicant to provide the information identified in this Policy to assist in the assessment of a development proposal. Council will seek information of sufficient detail to enable it to adequately assess compliance with applicable codes and, in the case of impact assessable development, the likely impacts of the proposal and whether the impacts can be managed within acceptable levels.

1.2 JURISDICTION OF CITY PLAN POLICIES

Unless otherwise specified in a section of any Policy 1, 2 or 3, information and jurisdiction of any City Plan Policy lies with Council's Planning and Development Services Department.

1.3 AIMS AND OBJECTIVES OF CITY PLAN POLICES

City Plan Policies have been separated into three components, that being:

- Policy 1 – Supporting Information
- Policy 2 – Development Standards
- Policy 3 – Contributions

In some cases, separating policy issues into these components has not been achieved therefore policy concepts may cross boundaries across the three policies. Wherever possible, the name of the policy section identifies the subject of that policy section and should be referred to in all circumstances and applications relevant to the subject matter not just the title of the Policy, eg. Supporting Information.

2. ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

2.1 CIRCUMSTANCES IN WHICH AN ENVIRONMENTAL IMPACT STUDY OR ENVIRONMENTAL MANAGEMENT PLAN MAY BE REQUESTED

Council may request the preparation of an environmental impact study (EIS) and/or environmental management plan (EMP) where development proposals –

(a) are located:

  (i) within an overlay area; or

  (ii) on land which is on the Contaminated Land or Environmental Management Registers; or

(b) involve a material change of use for any of the following purposes:

  (i) level 2 environmentally relevant activities;

  (ii) extractive industry;

  (iii) intensive animal husbandry;

  (iv) commercial animal keeping;

  (v) major utility having state, regional or City-wide significance;

  (vi) major telecommunications facility;

  (vi) major tourist facility; or

  (vii) a shopping complex having a gross floor area of more than 4,000m^2; or

(c) involve a material change of use or reconfiguring of lots for residential purposes, if on land:

  (i) within one kilometre of an existing or approved intensive animal husbandry;

  (ii) within 500 metres of a Core Industry Precinct or a site used or approved for extractive industry, commercial animal keeping or a major utility having State, regional or City-wide significance,

  (iii) within 100 metres of a site used or approved for general industry; or

  (iv) adjoining the Rural Precinct.

(d) are considered by Council to otherwise warrant such a request.

2.2 INFORMATION REQUIREMENTS

Reports associated with an EIS or an EMP are to contain details of –

- the educational qualifications and experience of the person/s that prepared the report;
- background and scope of the proposal;
- existing environment details;
- potential impacts of the proposal;
- compliance with relevant codes;
- compliance with relevant standards, which may be expressed in the relevant code or policy;
- impact monitoring and management procedures; and
- consultation and sources.

An EMP is to also demonstrate commitments made to environmental management by –

- identifying all aspects of the project that require environmental management;
- establishing practical and achievable measures for the containment of environmental impacts to acceptable levels;
- allocating authority and responsibility for implementing management measures;
- nominating criteria for measuring impact levels and any sources from which criteria may be derived;
- describing a course of action and responsibilities for responding to incidents of non-compliance and emergency events that may arise; and
- establishing procedures for monitoring and reporting.

In addition to the overall and specific outcomes set out in relevant codes, the range of issues that may be required to be addressed in an EIS or EMP include –

- air quality;
- biting insects;
- buffer area management;
- consultation;
- erosion and sediment control;
- hazard and risk assessment;

- management of the impacts of land uses on surrounding areas;
- noise control;
- rehabilitation/landscaping;
- resource and waste management;
- stormwater management;
- vegetation management;
- visual amenity;
- water quality; and
- weed control.

3. SOCIAL IMPACT ASSESSMENT

3.1 CIRCUMSTANCES IN WHICH A SOCIAL IMPACT ASSESSMENT MAY BE REQUESTED

A specific outcome in each of the District Codes relates to ensuring that development does not have any significant adverse social impacts. Social impacts (both positive and negative) must be identified early in the planning process to ensure development is suitable for the site and locality proposed in the development application.

This Policy is the jurisdiction of Council's Community and Cultural Services Department[1].

To assist in assessing whether a proposal meets this outcome, Council may request the preparation of a social impact assessment (SIA) where the proposed development is likely to –

(a) give rise to a significant increase or reduction in the number of persons on the site;

(b) significantly benefit or disadvantage any particular social group;

(c) give rise to an increase or decrease in employment opportunities in the locality compared with the previous use of the land;

(d) have a significant impact (such as tenure, type, style, cost etc.) on existing housing stock in the locality, particularly low-rental housing;

(e) impact upon existing community meeting places;

(f) give rise to increased demand for community services or facilities in the locality;

(g) create a need for on-site support services;

(h) generate conflict in the community or adversely impact upon community identity;

(i) enhance or detract from the cultural characteristics of the community;

(j) create areas of insecurity or risk for occupants or pedestrians within or adjacent to the development; or

(k) give rise to increased public concern regarding public safety.

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[1] For further technical assistance, contact the stated section of Council. However, as a City Plan Policy, all information is to be lodged with the Planning and Development Services Department as part of the development application process.

Where one or more of the above circumstances are applicable to a development proposal, the applicant is encouraged to contact relevant Council officers as early as possible to discuss potential terms of reference for an independant SIA and to develop a stakeholder list.

3.2 INFORMATION REQUIREMENTS

The SIA should describe the potential positive and negative social impacts associated with a development proposal in the short, medium or long terms. It should also identify mitigation measures for any potential negative social impacts.

The SIA should be prepared by a qualified social impact practioner. Suitable persons may include social planners, sociologists, anthropologists and town planners with social impact assessment experience. Additionally, persons with skills and/or qualifications in the social sciences may also be suitable.

3.2.1 REPORTS ASSOCIATED WITH A SIA SHOULD ADDRESS THE FOLLOWING THEMES –

(a) Economic vitality

Economic vitality, in a social sense, relates to the extent to which development contributes to economic development and employment opportunities within the local community. The local economy may undergo dramatic changes as a result of new development, such as increased opportunities and changes to consumption levels and standards of living.

(b) *Ease of access*

Ease of access relates to the extent to which development impacts on the community's capacity to gain access to the services and facilities in areas that are essential to achieving and maintaining an equitable standard of living. This includes impacts on physical, geographic, administrative, policy or financial access. Fair and equitable access is essential to the maintenance of community wellbeing. Applicants should show how proposed new development enhances or does not hinder equitable access to services and facilities.

(c) *Community harmony*

Community harmony is the 'ties that bind' a community together. The concept relates to community pride, sense of place, community identity, participation in community life and the capacity of a community to accept and accommodate difference between people. Applicants

should show how proposed new development contributes to community harmony and does not disrupt the existing physical and social cohesion.

(d) *Community Safety*

The absence of anti-social behaviour such as crime, injury and harm, the prevention of potentially unsafe practices and the community's sense and perception of safety and security define community safety. New development should contribute to community safety and not in any way create an environment that threatens the community or individual's way of life.

(e) *Cultural Development*

Cultural development is defined as the expression of the life and character of a community through elements of tradition, historical and significant property and monuments, records, products and cultural events.

3.2.2 REPORTS SHOULD CONTAIN –

- the qualifications and experience of the person(s) who has undertaken the assessment.
- background and scope of the proposal;
- study process and study area;
- community/stakeholder consultation;
- assessment of likely social impacts;
- evaluation of significance and probability of occurence (risk assessment);
- consideration of possible measures for mitigating identified negative social impacts;
- monitoring program; and
- conclusions/recommendations.

3.2.3 IN ADDITION TO THE GENERAL THEMES OUTLINED ABOVE, THE RANGE OF ISSUES THAT MAY BE REQUIRED TO BE ADDRESSED IN THE SIA INCLUDE –

- access and mobility;
- community infrastructure, services and facilities (increased demand / likely future requirements / future provision);
- community structure (severance, cohesion and identity);
- population impacts (significant change resulting from land uses and structures);

- needs of particular social groups (women, aged, disabled, ethnic groups, Indigenous, young people);
- health;
- crime and safety (including Crime Prevention through Environmental Design principles);
- culture and community values;
- employment;
- economic effects;
- interface between old and new land uses and structures (friction / conflicting land uses);
- cumulative effects; and
- intergenerational equity issues.

3.3 CONSULTATION

The SIA should involve a comprehensive community consultation component which should aim to involve all interested and affected parties. At a minimum, consultation should include a facilitated focus session in which key stakeholders have the opportunity to personally discuss their issues regarding the development proposal. Stakeholders invited to the meeting may include –

- representatives of a local resident group;
- staff from community service organisations;
- officers from relevant state agencies;
- relevant Council representatives (officers and/or elected members); and
- other relvant persons.

The size of the meeting should be kept to a minimum, although the scale, nature and intensity of the development proposal will determine how many people should be present.

3.4 DICTIONARY

Significant – a significant impact is one where anticipated future social conditions resulting from a proposed action differ from those otherwise expected from normal change, and where this anticipation raises serious concerns among a professional or lay section of the public.

Any exercise in judging the significance of a social impact should consider –

- the importance of the attribute in question to decision makers;
- the distribution of change in time and space;
- the magnitude of change; and
- the reliability with which change has been predicted or measured.[2]

In determining the nature and magnitude of an impact, the following matters need to be considered –

- on-site and off-site impacts;
- all direct and indirect impacts;
- the frequency and duration of the action;
- the total impact which can be attributed to that action over the entire area to be affected and over time;
- the sensitivity of the receiving environment; and
- the degree of confidence with which the impacts of the action are known and understood.[3]

Community services – community services may be defined as a system for providing support to sustain and nurture the functioning of individuals, families and groups, to maximise their potential for development and to enhance community well being. (Townsville City Council & North Queensland Community Services Coalition).

Community identity – community identity reflects the perceptions, associations, memories and feelings of people in relation to the community in which they live, including its built environment, natural landscape and the relationships between people, both formal and informal. It is the way in which a community defines or understands itself and is influenced by cultural values, beliefs, customs, symbols, aspirations, expectations and shared experiences over time.

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

2 Dunker & Beanlands, Environmental Management Vol. 10, No. 1, 1986.

3 Environment Protection and Biodiversity Conservation Action 1999 – Administrative Guidelines on Significance.

4. ACID SULPHATE SOIL MANAGEMENT

4.1 CIRCUMSTANCES IN WHICH AN ACID SULPHATE SOIL STUDY MAY BE REQUESTED

Where a development is subject to the Acid Sulphate Soils Overlay Code, an applicant may be requested to provide additional information.

This Policy is the jurisdiction of Council's Environmental Management Services[4].

4.2 INFORMATION REQUIREMENTS

- the lowest point in metres AHD of the proposed excavation and the volume of excavation below 5m AHD;
- the height in metres AHD of land to be filled, and the volume and thickness of the fill to be placed below 5m AHD;
- a detailed acid sulphate soils (ASS) investigation report to determine whether ASS are present in the area to be disturbed, and if so, the location, depth and existing/potential acidity of ASS relative to the proposed disturbance. The methodology used for sampling and analysis (both field and laboratory) should also be provided;
- if ASS is to be disturbed, a comprehensive ASS management strategy outlining how the development will achieve compliance with the Code and with SPP2/02. The strategy should include (but not necessarily be limited to):
  - (a) details of any pilot project or field trial to be undertaken to prove the effectiveness of any new technology or innovative management practice being proposed,
  - (b) the monitoring and reporting procedures to be established and implemented; and
  - (c) a contingency plan and accident/ emergency response procedures, and performance criteria to be used to assess the effectiveness of the ASS management and monitoring measures.

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[4] For further technical assistance, contact the stated section of Council. However, as a City Plan Policy, all information is to be lodged with the Planning and Development Services Department as part of the development application process.

5. CULTURAL HERITAGE ASSESSMENT

5.1 CIRCUMSTANCES IN WHICH A CULTURAL HERITAGE ASSESSMENT MAY BE REQUESTED

Known places of cultural heritage value in the City are identified in Schedule 5 of City Plan, and are subject to the Cultural Heritage Features Overlay Code. These places include –

(i) those having **historic cultural heritage** significance generally associated with human activities since the beginning of non-Aboriginal settlement of the area, as well as natural places which have meaning for people of the current day. Such places include buildings, other structures and items, parks, cemeteries, trees, landscapes, localities, relics, submerged relics, archaeological sites, and other places and items, which contribute in an important or otherwise notable way to an understanding of the historical land uses and structures of the City and/or a particular locality; and

(ii) those having **townscape significance** because their particular townscape, character or streetscape qualities are valued by people of the current day. While such areas may not otherwise qualify as places of cultural heritage significance, they contribute to an appreciation of the particular qualities that make one place different to another and provide a meaningful link with the historical land uses and structures of those qualities. Such qualities may be the result of the types of buildings, the street pattern, plantings, fence types, the distribution of buildings along streets, and architectural features such as shop-fronts with leadlight transoms.

Places having Aboriginal or Torres Strait Islander cultural heritage significance are generally not included in Schedule 5 and therefore would not be subject to the Cultural Heritage Features Overlay Code. However, a specific outcome in each of the district codes seeks to ensure that there are no adverse impacts on such places. This outcome may be relevant to places that –

(i) have been previously identified (such as bora rings, artefact scatters, middens, and scarred trees) as having particular cultural heritage significance to Aboriginal or Torres Strait Islander people;

(ii) have been entered on the Site Database for the *Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987*, the Queensland Heritage Register of the *Queensland Heritage Act 1992*; included on the Commonwealth Register of the National Estate as a place of Indigenous cultural significance; or listed under any other relevant State or Commonwealth legislation;

(iii) potentially have Aboriginal or Torres Strait Islander cultural heritage significance, including cultural landscapes containing notable natural physical features such as waterways, the coastal zone, areas of high natural scenic amenity or conservation integrity, escarpments, peaks, rock formations, ridgelines or other elements which may be important to the local community and/or integral to local Aboriginal or Torres Strait Islander tradition or spiritual beliefs or otherwise of scientific interest.

5.2 INFORMATION REQUIREMENTS

Where a development is subject to the Cultural Heritage Features Overlay Code, or the relevant specific outcome in the District Codes, an applicant may be requested to provide the information outlined below, in the form of a conservation plan. Applicants should note that particular assessment requirements, beyond those outlined in the City Plan and this section of the City Plan Policy may exist for places having cultural heritage significance, including cultural relics and areas of archaeological interest, where they have been identified, listed or declared under relevant State or Commonwealth legislation.

A conservation plan should be prepared by a suitably qualified person and which provides as a minimum –

(a) a description of the place and its setting including a location plan showing the premises, adjoining premises and the surrounding locality, as well as photographs accompanied by an annotated location map;

(b) plans and elevations of the proposed land uses and structures in the context of the place of significance;

(c) an assessment of the cultural heritage values of the existing place which demonstrates an understanding of the significance of the place;

(d) an assessment of how the development proposal will affect this significance, having particular regard to whether the place:

- displays historical, economic or social themes that are of importance to the region, City or locality;
- represents customs or ways of life that are characteristic of the region, City or locality;
- has played an important part in the lives of residents of the region, City or locality;
- displays aesthetic merit, design characteristics or construction techniques of significance to the region, City or locality;
- is associated with a notable regional, City or local personality or event;

- is a notable regional, City or local landmark;
- is important to the heritage character of the local townscape and its removal or demolition would significantly diminish that character;
- is in a locality where little redevelopment has occurred such that the visual heritage character and amenity of the local townscape has remained largely unaffected over time; or
- has cultural significance to a particular group within the community;

(e) strategies for conservation and management, with timing costs and other resources required, and the conservation principles and processes that will be relied upon (refer to the Burra Charter);

(f) a list of people responsible for carrying out actions of the plan;

(g) the measures proposed for the conservation and management of the place; and

(h) ongoing maintenance and monitoring plan and who is responsible for this; and any other issues or actions that may affect the place or its cultural heritage significance.

6. NOISE ASSESSMENT

6.1 CIRCUMSTANCES IN WHICH A NOISE ASSESSMENT STUDY MAY BE REQUESTED

Consideration of the potential impacts of noise at the planning stage is more effective than noise mitigation following development. Where warranted by the level of traffic on the road or railway to which the site has frontage or is in proximity, Council may request the preparation of a noise assessment by a suitably qualified person, estimating the traffic volume and noise from the transport corridor to a 10 year planning horizon.

The noise assessment should have regard to –

- Australian Standards AS1055.2 and AS2107; or
- *Environmental Protection Act 1994* and *Environmental Protection (Noise) Policy 1977* (EPP Noise); or
- Department of Main Roads *Road Traffic Management – Code of Practice.*

6.2 INFORMATION REQUIREMENTS

Documentation should include –

(i) identification of:

- noise sources;
- nature of the noise;
- times of operation of the noise source and use/development on site;
- the use categories from AS2107 that may apply;
- type and proximity of adjacent land uses;
- details of any prescribed planning levels in the EPP (Noise) that may apply to the adjacent land uses; and
- whether any noise data exists for those adjacent land uses;

(ii) justification of the appropriate noise planning assessment methodology to determine the noise impacts on and from the land uses and structures both on the subject site and adjacent sites; and

(iii) assessment of whether noise emission complies with the calculated limiting criteria. If noise may be unacceptable describe the control measures that will be used to ensure compliance.

7. GEOTECHNICAL ASSESSMENT

7.1 CIRCUMSTANCES IN WHICH A GEOTECHNICAL STUDY MAY BE REQUESTED

Where a development is subject to the Steep or Unstable Land Overlay Code, an applicant may be requested to undertake an assessment of the likely geotechnical impacts of the proposal and determine ways to avoid or mitigate unacceptable risks and other impacts. Such an investigation should be carried out by a suitably qualified geologist or geotechnical engineer.

Such investigations should cover the matters set out below, and may include, but need not be limited to –

- desktop studies of geological, slope instability and topographical maps and study reports, this should include analysis and commentary on matters addressed in the Coffey Report (Landslide Hazard Zoning Study, Townsville City Area: January 2001);
- appraisal of slope instability indicators (including such factors as seepage, soil creep, vegetation and building distress);
- collection of geological and topographical measurements from the site;
- consideration of stability and affects to/from land above and below the proposed development site;
- identification of landslip/subsidence risk areas; and
- recommendations for building design and construction, earthworks, retaining walls, drainage, effluent disposal, vegetation retention and site maintenance.

7.2 INFORMATION REQUIREMENTS

Reports associated with the geotechnical investigations should include the following components –

(a) site description –

- location, size, access;
- regional geology;
- mapping of local geology, natural slope and landforms;
- drainage;
- vegetation;
- existing site usage/development; and

- existing cuts and fills;

(b) sub-surface conditions –

- how and where observed;
- profile and Interpretation; and
- groundwater;

(c) evidence of slope instability;

(d) stability assessment;

(e) proposed development –

- type of structure and footing types;
- area for development; and
- AS2870 classification, foundation depth, materials; and

(f) geotechnical constraints on development –

- steepened areas and steep-sided gullies;
- unsupported cuts and fills;
- retaining walls;
- rock outcrops, boulders on or above the site;
- surface/sub-surface drainage;
- septic and sullage disposal; and
- erosion controls, vegetation.

8. ENGINEERING DRAWINGS

8.1 CIRCUMSTANCES IN WHICH ENGINEERING DRAWINGS MAY BE REQUESTED

Engineering design documentation required in respect of assessable operational works or operational works associated with a material change of use or reconfiguration of lots is to be prepared by a qualified person in engineering drafting or design. The plans should be presented in both graphic and written form and contain sufficient information to enable Council to assess compliance with the applicable codes.

Documents submitted to Council for the approval of operational works must be able to be read as "stand alone" documents.

8.2 INFORMATION REQUIREMENTS

Plan information should include some or all of the following –

- locality plan showing location in relation to adjacent properties;
- scales, legend, north point and date;
- title block to include reference numbers, version number, amendment details, property description and contact details;
- surveyed site boundaries;
- description and location of all existing built elements and footprints of proposed built elements, including floor levels;
- locations of all existing and proposed drainage lines and structures;
- longitudinal sections along road centre lines;
- cross sections at relevant and regular chainages;
- kerb or shoulder levels;
- intersection details;
- finished surface contours;
- existing services to be shown on both plans and longitudinal sections;
- structural details where required;
- vegetation to be retained;
- original and finished contours and/or spot levels;

- cross-hatching to show cut and fill areas;
- cut and fill volumes;
- cross-sections where additional detail is required;
- original and altered drainage paths;
- existing services;
- structural details for retaining structures;
- locations of all existing and proposed drainage lines and structures;
- longitudinal sections through drainage lines;
- catchment plan;
- tabulated hydrological and hydraulic calculations for all internal and external catchments, and for each drainage line;
- original and finished contours and/or spot levels;
- enlargements where additional detail is required;
- existing services;
- structural details;
- soil erosion and sediment control measures; and
- refer also to *Aus-spec Development Design Specifications*.

"As constructed" plans shall be provided after completion of works either as an annotated set of the original plans (where variations to the original design are minor) or otherwise as a new site survey.

9. LANDSCAPING PLANS

9.1 CIRCUMSTANCES IN WHICH LANDSCAPING PLANS MAY BE REQUESTED

Landscaping documentation submitted to Council is to be prepared by a suitably qualified person. The plan must be presented in graphic and written form, containing the information identified in this section of the Policy and provide sufficient detail to enable Council to assess its compliance with the applicable codes or relevant approval.

Documents submitted to Council for the approval of landscape works must be able to be read as 'stand alone' documents.

This Policy is the jurisdiction of Council's Park Services[5].

9.2 INFORMATION REQUIREMENTS

A landscaping plan should consist of a number of detailed plan/s presented in written and graphic form illustrating –

(a) standard requirements –

- locality map (illustrating surrounding reserves/natural areas, roads and local features);
- scale and scale bar;
- legend and north point;
- street name/s; and
- drawing number (for reference) plus date, version and amendment record;

(b) site conditions and base information –

- site boundaries (surveyed) and levels;
- description and location of built elements, including "off street car parking";
- site analysis identifying opportunities and constraints;

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[5] For further technical assistance, contact the stated section of Council. However, as a City Plan Policy, all information is to be lodged with the Planning and Development Services Department as part of the development application process.

- description of all native vegetation present and any landforms (for example dunes, gullies);
- identified vegetation to be retained and/or removed (ie. height > 3m);
- driveways, paths (identify finished surface/s), existing footpaths, adjoining driveways;
- significant features pertaining to the application e.g. the location of refuse collection areas;
- grading and drainage in relation to the landscaping (overland flows to be identified) with inlet and discharge points clearly shown; and
- site services – water, power, telecom and gas;

(c) landscape details and schedules –

- hard surface treatment eg. unit pavers, concrete stepping stones, boardwalks;
- fence height, material and finish, to boundaries and pool area (if applicable);
- outline of mulched garden beds;
- lawn areas to include method of establishment;
- existing levels and design levels of building slab, hard surfaces, drainage grates and landscaped areas, especially adjacent to trees to be retained;
- surface and subsurface drainage and collection points;
- position of external elements;
- details and soil depth of planter boxes and podiums;
- dimensions and construction section details of the proposed works, ie: garden beds, fencing, screening, retaining walls, paths and mounded height of garden;
- plant list to contain plant code, plant species, location, quantity and spacing and size of container (and approximate size of the plant if requested as part of a condition). For example:

PLANT CODE	PLANT NAME	LOCATION	QTY	SPACING	CONTAINER SIZE
1	Rhoeo spathacea	Garden 1	30	500mm centres	140mm
2	Carpentaria acuminata	Garden 2	3	As per plan	25 Litre
3	Callistemon Capt Cook	Garden 1 & 2	10	1 metre centres	150mm

- materials and depth of topsoil and mulch;
- responsibility for plant replacement and maintenance;
- planting bed preparation details/notes including excavation, cultivation, imported topsoil depths, fertiliser or soil additive type and application rate;
- method of erosion control for slopes steeper than 1:4;
- subgrade treatment and construction of paved areas;
- accurate location, dimension and construction notes/details of concrete footpath/paving;
- calculation of the square metre area of landscape and recreation area; and
- calculation of the square metre area of landscaping actually planted, broken down into turfed and mulched and planted areas.
- details and method of vegetation to be transplanted.

(d) irrigation details –

- project name / location;
- reference number / drawing number / sheet number (2 of 4);
- date of issue;
- drawn scale;
- IAA certification;
- designers name and / or company;
- drafters name and / or company;
- surveyors name and or company;
- standard plan legend, valve key and sprinkler key;
- design notes, nominating descriptions etc, sprinkler types, valves, etc;
- details of irrigation system and connection (town supply or bore water);
- location of water meter, backflow device, automatic controller, valve boxes.

10. RECONFIGURING A LOT WHERE INVOLVING OVERALL CONCEPT PLANNING

10.1 OVERALL CONCEPT PLAN

Where a proposed development potentially involves the creation of more than twenty (20) lots Council may request the preparation of an overall concept plan. If the land involved is in more than one ownership, Council may prepare the plan in consultation with the owners and cost shall be apportioned to the land owners.

This plan is to be approved prior to approval of further stages of the subdivision.

10.1.1 This plan should identify –

(a) the nature and intensity of proposed land uses (which may include such requirements as set out in Policy 1, Section 11);

(b) the location and types of roads;

(c) the location and type of open space;

(d) the location of community facilities;

(e) the location of infrastructure, ie. water, sewer, stormwater, carparking. transport nodes/interchange;

(f) pedestrian and bikeway paths;

(g) provision of access and manoeuvring areas for service vehicles onto and within the site[6]; and

(h) crime prevention through environmental design (CPTED) principles utilised on site, especially in public areas, ie landscaping, landscape design, cycle paths, etc[7].

10.2 LANDSCAPE VEGETATION MANAGEMENT PLAN

A landscape vegetation management plan (LVMP) should also accompany the overall concept plan. The LVMP is to take the form of a detailed plan(s) illustrating the proposed intent for, and design and treatment of areas to be dedicated for public open space purposes and should be accompanied by a written report. Conditions of approval will require the approval of the LVMP prior to any works being commenced on site for any stage.

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[6] For further technical assistance, applicants should contact Council's Citiwaste on telephone number (07) 4727 9003 and the Department of Emergency Services on telephone number (07) 4799 7666.

[7] For further technical assistance, applicants should contact Council's City Safe Unit on telephone number (07) 4727 9700.

This policy is the jurisdiction of Council's Parks Services[8].

The detail to be included in the LVMP will vary depending on the scale of the project. The LVMP may address (but is not limited to) the following matters, having regard to the provisions of relevant codes and the standards for public open space set out in Section 13 of this Policy:

- the overall extent of the open space network;
- the uses and functions of major and minor open space areas;
- pedestrian and cyclist movement systems;
- location of sealed parking areas;
- proposed recreational equipment – including location, compliance with Australian Standards, proprietary products to be nominated if known;
- a flora study to identify the variety of plant species growing within and immediately adjacent the development site, and form the basis of a plant list for use within the development, including any transitional[9] and revegetation zones; and
- a management plan for any transitional areas, vegetation to be retained, revegetation areas and other environmentally sensitive areas;
- landscape details (having regard to requirements for landscaping plans – refer to the Landscaping Code in the City Plan and Section 9 of this Policy) including:
    - turfed areas – type of turf, hydromulching or drill seeding to be nominated;
    - garden areas – shape, edging materials, ground treatment eg. mulch to be nominated;
    - treatment of other open spaces such as streetscapes and pedestrian links which are a significant component of the open space network;
    - irrigation system – full details required in accordance with Council's irrigation specifications;
    - paths and bikeways – details of width and materials to be nominated;
    - park furniture facilities and structures – location, style, proprietary products to be nominated if known (eg. seats tables, fences, lighting, drinking fountain, etc.);
    - entry statements;
    - landform changes;
    - water features; and

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[8] For further technical assistance, contact the stated section of Council. However, as a City Plan Policy, all information is to be lodged with the Planning and Development Services department as part of the development application process.

[9] Refer Sub section 10.3 of this Section.

- interpretive facilities and materials; and

- hand-over procedures, maintenance/lifecycle costs and requirement.

10.2.1 Both the overall concept plan and the LVMP should include –

- a location map;
- scale and scale bar (the scale for such plans shall be in the range of 1:100 and 1:500);
- north point;
- street names;
- name and contact information for applicant and designer;
- drawing number (for reference), plus date, version and amendment record;
- key/legend; and
- an aerial photo of the site.

The LVMP is to be submitted in CAD form.

10.3 TRANSITIONAL AREAS

Public open space may include "transitional areas" where a lesser standard of development and long term maintenance will be acceptable. A transitional area will be considered to be an unirrigated area planted with drought tolerant grasses, trees or shrubs and may include revegetation areas where native vegetation is to be retained or re-established.

11. RECONFIGURING A LOT FOR RESIDENTIAL PURPOSES

Where a proposal for reconfiguring a lot includes residential lots of less than 600m^2, or lots intended to accommodate dual occupancies or multiple dwellings, Council may request the preparation of a plan or plans which include the following –

- lot area;
- lot dimensions;
- existing contours, structures, drainage, vegetation and services (sewer, water, sanitary drainage, telephone and electricity);
- a building plan for each lot less than 300m^2 including floor plans and elevations for all buildings and other structures;
- a building envelope plan for each lot less than 600m^2 indicating minimum front, side and rear setbacks and the maximum height of buildings in accord with Dwelling House and relevant District Codes in City Plan;
- a building envelope plan for each lot intended to accommodate a dual occupancy or multiple dwelling, indicating minimum front, side and rear setbacks and the maximum height of buildings, and which demonstrates the ability to comply with other relevant provisions of the Dual Occupancy Code or the Multiple Dwelling Code (including an indication of the number of dwelling units achievable on the lot where a multiple dwelling is proposed);
- location of driveways (including ingress and egress) and car parking provisions;
- location of private open space areas;
- location of communal open space (if land is to be subdivided in accordance with the *Body Corporate and Community Management Act*);
- finished site and floor levels;
- landscaping provisions for street reserves, as well as allotments;
- other proposed site works;
- privacy screening to openings on all levels, ie. windows, etc;
- fencing to side and rear boundaries in accordance with Policy 2, Section 4 – Screen Fencing; and;
- provision of access and manoeuvring areas for service vehicles onto and within the site[10].

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[10] For further technical assistance, applicants should contact Council's Citiwaste on telephone number (07) 4727 9003 and the Department of Emergency Services on telephone number (07) 4799 7666.

12. SOIL EROSION & SEDIMENT CONTROL

12.1 DEVELOPMENT TO WHICH THIS POLICY APPLIES

This policy applies to all development applications for:

(a) Building work;

(b) Operational work;

(c) Plumbing work; and

(d) Drainage work.

12.2 POLICY

12.2.1 OPERATIONAL WORKS

(a) Council requires any application for the approval of operational works involving the disturbance of land to be accompanied by an Erosion and Sediment Control Plan (ESCP).

(b) Pursuant to the provisions of this policy, ESCPs are to be prepared in accordance with the content and process requirements outlined under Appendix A - Guideline Part 1: Content and Process for Preparing Erosion and Sediment Control Plans.

(c) All ESCPs prepared to accompany applications for operational works must nominate a suitably qualified person[11] who is to be responsible for ensuring that the requirements of the ESCP and any conditions imposed by Council are implemented.

(d) ESCPs prepared pursuant to this policy must nominate:

- *Standards* to be maintained during the period that the ESCP remains active;
- *Hold Points*, being points at which works cannot proceed further without independent confirmation that requirements of the ESCP have been met;
- *End Points*, being outcomes that will be achieved before the ESCP is declared inactive (ie completed).

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[11] For the purposes of this policy a "suitably qualified person" is a person having the experience and qualifications prescribed by Section 3 of this policy.

With respect to the requirements of this clause, the ESCP must nominate how hold points and end points are to be verified.[12]

As a condition of approval of any application for operational works, Council will generally require all works under the ESCP to be completed and verified by a 'suitably qualified person[13], prior to the signing of the plan of survey or, where a plan of survey is not required, prior to the commencement of any site works. Council may however, at its discretion, require the lodgment of a performance bond (eg. for larger developments). Where a performance bond is required, the value of the bond is to be equivalent to 120% of the cost of implementing the ESCP.

Where a performance bond is required, no site works are to commence until the ESCP and the performance bond is submitted to and approved by Council.

Following approval of an ESCP by Council, it will become active and remain active until nominated End Points are achieved and verified. Upon verification, by a "suitably qualified person" that End Points have been achieved, Council will refund any unused portion of the performance bond.

During the period that an ESCP remains active, Council may monitor the performance of the applicant in relation to the requirements of the ESCP. Failure to meet the nominated standards or procedures of the approved ESCP may necessitate the implementation of remedial measures or result in the requirement to cease work and submit a revised ESCP for Council consideration and approval. Failure to maintain approved standards or procedures may result in the forfeiture of the performance bond (where applicable) and/or action under the *Environmental Protection Act 1994* or both.

12.2.2 BUILDING WORK, DRAINAGE WORK AND PLUMBING WORK

Any applications for Building, Plumbing or Drainage Work are required to be accompanied by an Erosion Risk Self-Assessment Form (Appendix D). This form is designed to ensure that the Applicant has considered the erosion risk of their site. Based on the outcome of the assessment, the Applicant is directed to a number of sources of information that will assist them to plan and implement appropriate erosion and sediment control. These are as follows:

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[12] By independent audit or Council inspection.

[13] For the purposes of this policy a 'suitably qualified person' is a person having the experience and qualification prescribed by Section 3 of this policy.

Low Risk Sites:

- General guidelines provided in *Erosion and Sediment Control on Residential Building Sites* (Townsville City Council).

High Risk Sites:

Techniques and guidelines described in:

- *Erosion and Sediment Control on Residential Building Sites* (Townsville City Council);
- *Building Operations Fact Sheet* (Townsville City Council);
- *Drainage Control Fact Sheet* (Townsville City Council);
- *Erosion Control Fact Sheet* (Townsville City Council);
- *Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites* (IE Aust 1996).

It is intended that the above process be self-administered to ensure that applicants are aware of their obligation under the *Environmental Protection Act 1994* to take all reasonable and practicable measures to prevent or minimise environmental harm. Further, that failure to adequately prevent discharge of sediment or building waste to stormwater may result in the enforcement provisions of the Act being used by Council to secure compliance with the provisions of this policy.

12.3 CERTIFICATION

Council require that Erosion and Sediment Control Plans (ESCPs) be prepared by practitioners with experience and training in soil and water management.

From 1 January 2001, and for the purposes of this policy, a "suitably qualified person" is a person who satisfies one of the following criteria:

1. holds a Statement of Attainment from a Townsville City Council 5 Day Course (Erosion and Sediment Control Planning for North Queensland); or
2. is a Certified Professional in Erosion and Sediment Control (CPESC); or
3. holds a qualification which is equivalent to either of the above and is accepted by Council.

12.4 NON-COMPLIANCE

The *Environmental Protection Act 1994* requires that development proponents avoid carrying out activities that cause, or are likely to cause, environmental harm. This is an enforceable legal obligation under the Act with penalties for non-compliance.

With respect to non-compliance, Townsville City Council has the authority to act on certain offences under powers devolved from the Environmental Protection Agency (S31 and S32 of the EPP for Water).

The Responsible Person as defined in the ESCP produced for the site, or the site foreman (in the case of Building Works, Plumbing Work and Drainage Work) will be notified of any environmental incident. They will be asked to take immediate steps to cease causing environmental harm and to take corrective action to the satisfaction of the Manager Environmental Management Services. Council may require any site works to cease pending the implementation of remedial measures or the preparation and approval (by Council) of a revised ESCP.

In accordance with Section 31(11) of the *Environmental Protection (Water) Policy 1997* Council will at the same time notify by letter the Environmental Protection Agency of any infringements against the requirements of the Act.

Council reserves the right to inspect the site at any time to ensure that effective erosion and sediment controls are in place.

Council may order works to cease if site inspections indicate that the works may damage Council infrastructure (*Sewage and Water Supply Act 1949*) and/or expose Council to liability under the *Environmental Protection Act 1994*. If agreed corrective action is not undertaken following an order to cease works, any performance bond held by Council pursuant to this policy may be forfeited.

12.5 DEFINITIONS

For the purposes of this Policy and the Policy Guideline the following terms have the meaning assigned hereunder:

Design Storm: A fictitious, isolated storm event, of varying frequency and duration, used in the estimation of both design discharge and design flood hydrographs. Design storms are based on the

statistical analysis of locally recorded rainfall data. They may be determined from the Institution of Engineers "Australian Rainfall and Runoff" (ARR) publication.

Erosion: The process whereby water or wind detaches soil particles and carries them from a site. On-site management can prevent erosion and is preferable to sediment control.

Erosion Control: The control/management of the processes causing erosion via various management techniques e.g. hydromulching of bare areas; drainage control. ie. directing water away from bare ground.

Sediment control: Trapping and containing soil particles (silt and sediment) that have been eroded before they leave the development site.

Wet season: 1 December to 31 March (inclusive).

Responsible Person: A person who is responsible for ensuring that the implementation of the approved Erosion and Sediment Control Plan (applicant/developer/owner) and is directly accountable for compliance with this Policy.

Applicant: The person(s), body or company proposing to carry out, or carrying out, development works pursuant to this Policy.

Clearing works: Any disturbance to existing vegetation which exposes the soil surface to wind and water erosion.

Legal Parameters: *Environmental Protection Act (1994), Integrated Planning Act (1997)*, City of Townsville Planning Scheme, The Town Planning Scheme for the City of Thuringowa, as administered by Townsville City Council.

APPENDIX A - GUIDELINE PART 1

CONTENT AND PROCESS FOR PREPARING EROSION AND SEDIMENT CONTROL PLANS (ESCP)

1. CONTENT

The proponent shall take all reasonable precautions to prevent soil erosion from any lands used, occupied or affected by the proposed development, erosion of the bed or banks of any stream or river and the deposition of excavated or eroded materials in any water course, stream, dam, lake or reservoir that may result from the execution of the works.

The proponent shall incorporate design measures and techniques to control erosion and sedimentation to guard against adverse impacts during all phases of the project.

ESCP documentation shall comprise a report and accompanying mapping, illustrations and engineering drawings:

The Report should provide:

- Introduction;
- Scope (including design parameters adopted, nominated standards to be maintained, End Points to be achieved and assumptions made);
- Background information (including soils, vegetation, drainage, climate etc);
- Methodology (detailing field work carried out and data sources);
- ESCP;
    - a description of each structure or treatment,
    - implementation and maintenance details,
    - illustrations, design details or engineering drawings as appropriate,
    - nominate who is responsible for implementation of the ESCP (the Responsible Person),
    - nominate how decisions regarding any modifications to the ESCP will be managed,
    - nominate how any Hold Points and End Points are to be verified (for example independent audit or Council inspection).

- A costing for implementation of the ESCP based on third party costs. This will be used as a basis for determining the bond amount;
- Appendices (providing laboratory reports and other raw data).

Mapping will typically include:

- a soils map;
- a vegetation map;
- existing contours;
- ESCP (showing property boundaries, the extent of the ESCP, contours, location of structures and techniques to be used, a north direction, scale and date of submission, name, qualifications and signature of the person who prepared the plan).

2. STEPS IN PREPARING AN EROSION AND SEDIMENT CONTROL PLAN

2.1 SITE SPECIFIC ASSESSMENT

Soil erosion susceptibility, vegetation and acid sulphate soils maps prepared by Council (Appendix B) provide a coarse assessment of the constraints to soil and sediment management at a specific site. These data must be supplemented with site specific assessment of the physical constraints of the development-site including soil, water and landscape limitations. Some laboratory-based tests may be required to identify these constraints. Specifically, the following tasks need to be completed:

- Prepare a contour plan. The contour interval needs to be consistent with the scale of the plan but in general should be 0.5m to 1m. Slope (gradient and length) and catchment boundaries can be determined from this plan.
- Collate rainfall data for the area. This will include monthly rainfall (to assist in scheduling of earthworks and revegetation works) and IFD curves (refer to Section 2.1 of Appendix B).
- Prepare a soils map to identify soil series present on site (suitable scale 1:5,000 with reference to Section 2.2 of Appendix B).

- Assess and map remnant vegetation with reference to Section 2.4 (of Appendix B). The degree of investigation necessary is dependent on the type and condition of the vegetation on-site. It should however be sufficient to determine the significance of the existing vegetation communities in terms of:
  - their role in stabilising the site;
  - their integrity (ie. level of disturbance, connectivity to larger areas of intact vegetation, and/or nature reserve such as National Park or Environmental Park);
  - their role in controlling salinity,
  - the habitat values provided,
  - weeds present.
- Prepare a description of existing land use on-site and that of the adjoining areas to determine if works on-site could impact on adjoining features such as water bodies, vegetation and infrastructure.
- It is helpful to determine baseline surface water quality. Through a description of the existing situation it is possible to define site values and constraints which are important with respect to protecting downstream water quality, for example:
  - drainage lines with intact riparian vegetation,
  - steep sloping areas,
  - highly erodible soils or presence of acid sulphate soils.
- If risk of acid sulphate soils is present (refer to Section 2.5 of Appendix B) carry out an assessment and mapping.
- Check compliance with State Planning Policy 1/00: Planning and management of coastal development involving acid sulphate soils.

2.2 SELECTION OF DESIGN PARAMETERS

Design parameters to be adopted for the project need to be determined and justified. These can be determined by consideration of local information (Appendix B), regulator requirements and industry standards. Design parameters should include:

- particle size to be retained on-site (based on industry standards and/or soil types present on-site)
- design event for drainage structures (based on an assessment of the consequences of failure).

2.3 EVALUATION AND MODIFICATION OF THE DEVELOPMENT

Reference to design drawings, site information collected and ESCP design parameters adopted are used to identify:

- how surface water flow will be affected by the development;
- areas that will need to be disturbed;
- possible amendment to the development which will avoid or reduce erosion risk;
- areas that can be retained in their natural state.

2.4 IDENTIFICATION OF ESCP PRACTICES

Council recommends the following design manuals:

- *Soil Erosion and Sediment Control – Engineering Guidelines for Queensland Construction Sites* 1996, Institution of Engineers, Queensland,
- *Stormwater Design Manual*, 1992. Townsville City Council,
- *Erosion Treatment for Urban Creeks – Guidelines for Selecting Remedial Works*, 1997. Brisbane City Council.

As with the information on design parameters supplied with this Policy, the guidelines referenced above are not intended to replace site-specific evaluation, testing and design. They are however the basis for achievement of the goals outlined in this Policy document.

2.5 NOMINATE STANDARDS, HOLD POINTS AND END POINTS

Nominate standards to be maintained throughout the period that the ESCP remains active with respect to:

- water quality (refer to the *Environmental Protection (Water) Policy 1997*);
- weed control;
- sediment loss;
- land contamination;
- acid sulphate soil management.

Standards must be designed to ensure compliance with the *Environmental Protection Act 1997* is maintained at all times. Nominate Hold Points beyond which work cannot proceed until it has been confirmed that the key works have been carried out. Examples of typical key works are:

- area to be cleared marked out;
- drainage structures in place;
- surface stabilisation treatment completed;
- Nominate End Points to be achieved at the end of the ESCP. Examples of typical End Points are:
  - percentage ground cover to be achieved,
  - permanent erosion control structures stable.

2.6 PRODUCTION OF IMPLEMENTATION PLAN

Prepare a works schedule which details the following for each section of the site to be disturbed:

- when the area will be cleared;
- when erosion controls will be in place (possible Hold Points);
- when permanent drainage/erosion controls will be in place;
- when surface treatment will be completed;
- estimated maintenance period and estimated time until End Points will be achieved.

USEFUL REFERENCES

Commonwealth Australia, Bureau of Meteorology (1988) *Climatic Averages Australia.* AGPS.

Crossley, R. (1996) *Review of the Existing Soils Information to Identify Constraints to Development – 1. New Townsville Area (Townsville coastal Plain – Southern Section) and 2. Townsville Coastal Plain – Northern Section.* Report to the Planning and Development Services Department, Townsville City Council.

Hunt, J.S. (1992) *Urban Erosion and Sediment Control*. NSW Department of Conservation and Land Management.

Institute of Engineers - Australia, Queensland Division (1996) *Soil Erosion and Sediment Control - Engineering Guidelines for Queensland Construction Sites.*

Lukacs, G. (1996) *Wetlands of the Townsville Area*. Australian Centre for Tropical Freshwater Research – Report No. 96/28.

Murtha, G.G. and Reid, R. (1992) *Soils of the Townsville Area in Relation to Urban Development*. CSIRO – Division of Soils DN Report No. 11.

Murtha, G.G. (1975) *Soils and Land Use on the Northern Section of the Townsville Coastal Plain, North Qld.* CSIRO Soils and Land use Series No. 55.

Murtha, G.G. (1982) *Soils and Land Use on the Southern Section of the Townsville Coastal Plain, North Qld.* CSIRO Soils and Land Use Series No. 59.

NSW Department of Conservation and Land Management (1992) *Urban Erosion and Sediment Control Field Guide.* Lake Macquarie City Council.

Sammut, J. Lines-Kelly, I. (1996). *An Introduction to Acid Sulphate Soils.* Dept. Sport and Territories and Australian Seafood Industry Council.

Skull, S. (1996) *Townsville City Council Region: Vegetation Communities and Conservation Priorities*. Australian Centre for Tropical Freshwater Research. Report No. 96/26.

Townsville City Council (1992) *Stormwater Drainage Manual.*

Witheridge, G. and Walker, R. (1994) *Soil Erosion and Sediment Control*. An Engineering Guide for Queensland. Australian Institute of Agricultural Science and the Institution of Engineers.

APPENDIX B – GUIDELINE PART 2

PRINCIPLES AND DESIGN PARAMETERS FOR PREPARATION OF AN EROSION AND SEDIMENT CONTROL PLAN

1. PRINCIPLES

The key principles to be considered in achieving the objectives of an Erosion and Sediment Control Plan (ESCP) are as follows:

1.1 REDUCE THE RISK OF SOIL EROSION

To achieve this objective, the following principles need to be applied:

- stage works to minimise area of disturbance at any given time;
- remove vegetation and strip the topsoil only in specific construction areas (ie. retain undisturbed areas where construction works are not required – construction vehicles should not enter these same areas);
- designate appropriate entry / exit points for vehicles;
- stage works to consider provision of services: power, drainage, water. Consider installation of conduit for telecommunications services;
- avoid clearing work in the wet season where possible. Additional protective works will be required where works are performed during the wet season;
- retain leaf litter and mulch, and shred plants removed to use as mulch around tree plantings;
- revegetate disturbed areas using quick growing local native species that are known to grow well given local soil and seasonal conditions;
- locate and protect stockpile areas to minimise risk of erosion and resulting sediment runoff;
- ensure temporary control structures are in place at the end of each days work;
- stabilise vulnerable areas (cut and fill batters, dispersive soils) within seven days of completion of works (vegetation, soil-cement).

1.2 CONTROL STORMWATER AND RUN-OFF

To control stormwater crossing the site and run-off from the site, the following principles need to be applied:

- separate run-off from undisturbed and disturbed areas, divert stormwater around disturbed areas, convey roof drainage off-site;
- stabilise channels carrying water;
- reduce the velocity of run-off water by surface roughening, use of contour banks, check dams or other appropriate methods;
- maintain existing natural drainage lines in good condition;
- no changes to catchment hydrology without consideration of the need to upgrade the downstream drainage system;
- use natural reinforcing or armouring techniques (stone or Geoweb and grass) in preference to concrete or rock, except in locations requiring protection from higher velocities (refer to *Stormwater Drainage Manual*, Townsville City Council, 1992);
- stabilise site drainage works with particular attention to the use of a number of materials or techniques to convey water between impermeable and natural surfaces (to prevent scouring along structure margins);
- make provision for handling of waste: skips, paint washing stations, litter bins;
- all run-off contaminated by pollutants such as fuel oils, paint washings and herbicides, as well as organic matter (seeds, grass clippings), to be retained and treated on-site.

1.3 REDUCE SEDIMENT TRANSPORT OFF THE SITE

Transport of sediments may be controlled through control of on-site flows before the water is discharged off-site. The following principles need to be applied:

- reduce water velocities;
- disperse run-off as sheet flow across well vegetated areas;
- direct run-off water to sediment traps;
- all sediment contaminated by pollutants such as fuel oils, paint washings and herbicides, as well as organic matter (seeds, grass clippings), to be retained and treated on-site;
- stabilise site entry and exit points;
- maintain grass or sediment fences along appropriate boundaries.

1.4 MAINTAIN OR IMPROVE THE ECOLOGICAL, LANDSCAPE AND RECREATIONAL VALUES OF THE SITE

The following principles need to be applied:

- retain areas of natural vegetation communities, particularly where they are components of larger contiguous areas and especially where they include nature reserves (National Parks, Environmental Parks);
- optimise opportunities to develop control structures as landscape or recreational features.

2. DESIGN PARAMETERS FOR TOWNSVILLE

The extent of soil erosion losses from any parcel of land are controlled by variations in the following parameters:

- Climate: rainfall amount, rainfall variability, and rainfall intensity
- Soils: erosion susceptibility, constraints to plant growth
- Topography: slope, drainage
- Vegetation cover: vegetation type, extent of ground cover

The following information is provided to assist the Applicant in preparing a ESCP under the headings: Climate, Soils, Topography, Vegetation, Acid Sulphate Soils.

2.1 CLIMATE

2.1.1 RAINFALL

The official weather station for Townsville is located at the Townsville Airport, Garbutt. The long-term average annual rainfall is 1161 mm (Comm. Aust., Bur. Met., 1988).

The rainfall in the Townsville-Thuringowa area is strongly seasonal with 925mm, or some 80% of the annual total, falling on average in the summer wet season of December to March inclusive.

The rainfall is also of variable reliability. Figure 1 shows the monthly rainfall probabilities for Townsville.

80% of rainfall falls between December and March inclusive

2.1.2 RAINFALL EROSIVITY

The erosivity of the rainfall is a measure of the ability of the rain to cause erosion. It involves two variables, the amount of rain that falls within a storm event and the intensity of the rainfall. Of these, the intensity factor is the more important in that it controls the energy of the raindrops and therefore the force they can impart to soil particles.

Figure 2 provides rainfall intensity figures for Townsville in the form of Intensity - Frequency - Duration curves.

The design storm event for a particular development or structure needs to be determined and justified based on consideration of:

- local and state government requirements;
- industry standards or guidelines;
- practical achievement;
- values to be protected and the consequences of failure of the structure.

Table 1 provides suggested design storm recurrence intervals for various temporary drainage structures on building and construction sites.

Permanent drainage structures should be designed in accordance with the normal local government drainage design guidelines, or guidelines prepared or endorsed for particular industries for example:

(i) *Erosion and Sediment Control Manual,* Department of Main Roads (1998);

(ii) *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland,* QDME (1995).

Table 1.

Recommended design storm recurrence interval for temporary drainage structures

Drainage structure	Design storm	
	Design life 0 – 6 months	**Design life > 6 months**
Drainage structures not draining to a sediment basin: (catch drains, diversion channels, level spreaders, chutes, drop pipes).	Q1	Q2
Drainage structures in areas that drain to a suitability designed and operated sediment basin.	Non erosive hydraulic capacity = 0.25 times Q1[1] Total hydraulic capacity (including freeboard) Q1	Non erosive hydraulic capacity = Q1[2] Total hydraulic capacity (including freeboard) Q2
Sediment basin primary outlet	Q1	Q1
Sediment basin emergency spillway	Q10	Q20 to PMF[3]

Notes:

[1] For simplicity, in most cases it is better to design for Q1. A design flow rate of 0.25 Q1 should only be used when designing for Q1 capacity is considered hydraulically impractical or financially unreasonable for the given site conditions.

[2] For simplicity, in most cases it is better to design for Q2. A design flow rate of Q1 should only be used when designing for Q2 capacity is considered hydraulically impractical or financially unreasonable for the given site conditions.

[3] If the design life is greater than 12 months, then design for 1 in 100 year; if failure of the structure is likely to result in a significant risk to life, then design for the Probable Maximum Flood (PMF).

2.2 SOILS

2.2.1 SOILS OF THE TOWNSVILLE - THURINGOWA AREA

The soils[14] have formed in four major geological units:

- bedrock which outcrops in the higher and steeper sloping parts of the region,
- stream sediments deposited as alluvial fans at the base of the steeper slopes,
- stream sediments on generally flat-lying alluvial plains and alluvial terraces formed by current and ancient river systems,
- marine sediments (active and ancient tidal mudflats, mangrove muds, stranded beach ridges).

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[14] The soils of the Townsville - Thuringowa area have been described by Murtha (1975, 1982). Their properties and use in agronomic and urban development have been discussed by Murtha and Reid (1992) and Crossley (1996).

<u>FIGURE 1</u> - Monthly rainfall probabilities for Townsville, based on long-term monthly rainfall data (1871 - 1994)

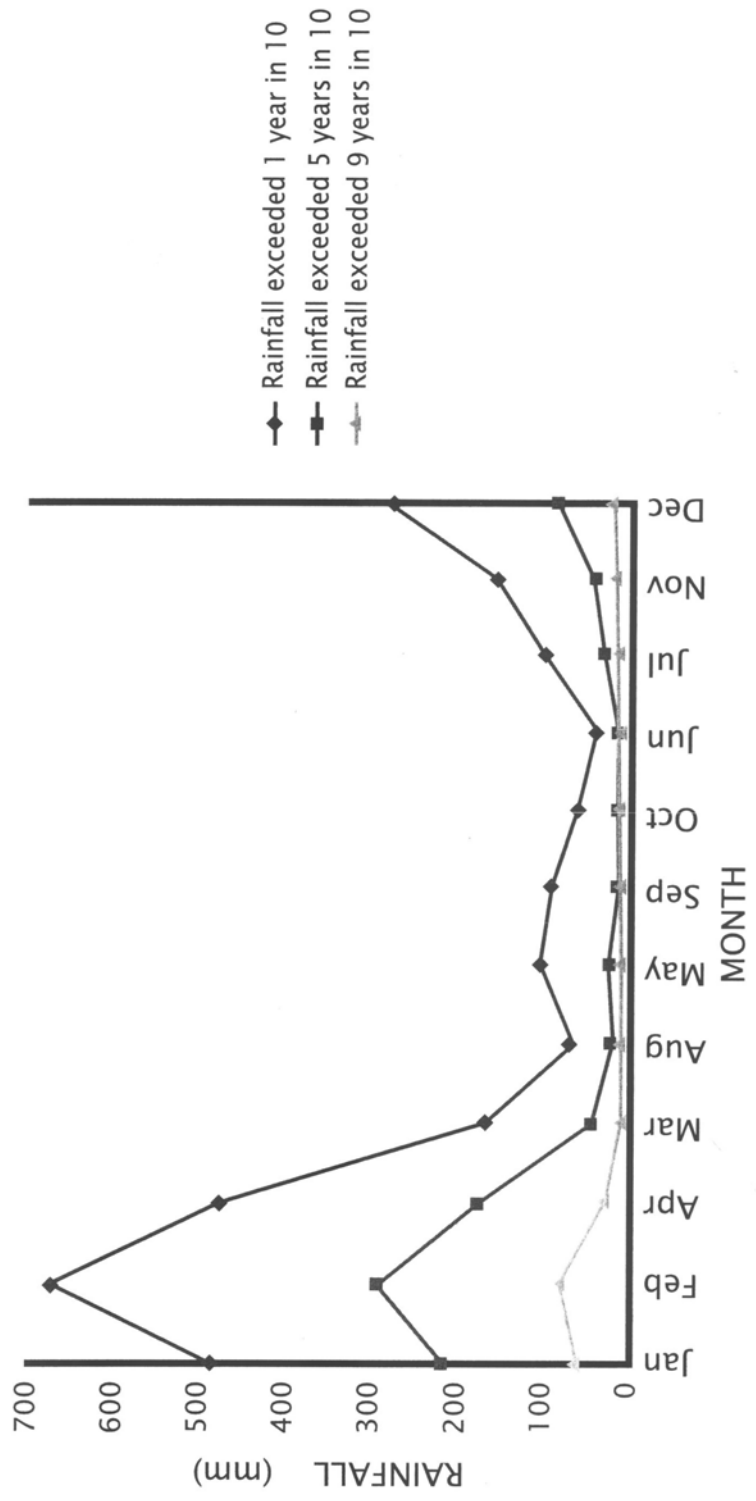


Figure 1 Monthly rainfall probabilities for Townsville, based on long-term monthly rainfall data (1871 - 1994)

<u>FIGURE 2</u> - Monthly rainfall probabilities for Townsville, based on long-term monthly rainfall data (1871 - 1994)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area
from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series	Expected Slope Range* Average (Min-Max)

Figure 2 Intensity-Frequency-Duration curves for Townsville

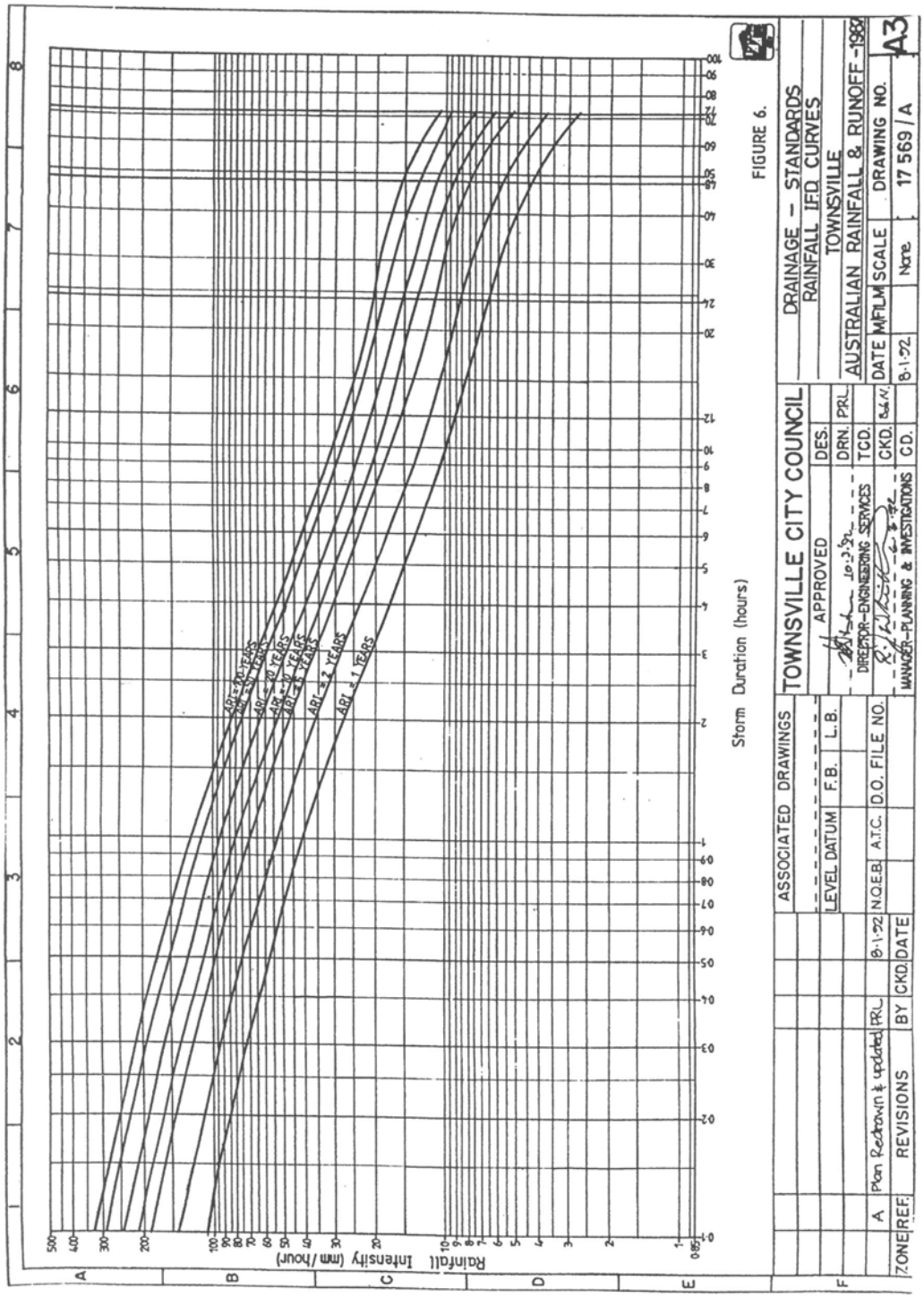


TABLE OF DESIGN AVERAGE RECURRENCE INTERNVALS AND RUNOFF COEFFICIENTS - TOWNSVILLE

DEVELOPMENT CATEGORY	Primary System		Secondary System	
	D.A.R.I	Cy	D.A.R.I	Cy
Central Business Buildings to boundaries, sealed footpaths, max. parking, min. landscaping	10	0.90	50	1.00
Commercial / Industrial Shopping centres, hospitals, vehicle repairs, workshops, warehouses, off-street parking, landscaping	5	0.84	20	0.92
Residential 'D' 3 High density >20 Dwells./Hd multi-unit cluster housing allots. <500 sqm, includes roads	5	0.80	20	0.88
Residential 'C' 2 Medium density 13-19 Dwells./Hd allots. 600-800 sqm, includes roads	5	0.77	20	0.85
Residential 'A' 1 Low density 5-12 Dwells./Hd allots. 800-2000 sqm, includes roads	2	0.66	20	0.82
Rural Residential 2-5 Dwells./Hd allots. 2000-5000 sqm, includes roads	2	0.63	20	0.78
Open Space and Parks Playing fields, golf courses	1	0.56	10	0.70
Major Road Gutter Flow	10	1.00	50	1.00
Major Road Cross Drainage (Culverts)	50	1.00	50	1.00
Minor Road Gutter Flow	*	1.00	*	1.00
Minor Road Cross Drainage (Culverts)	*	1.00	*	1.00

* Refer relevant development category.

Rainfall Intensity (mm/h) for Townsville

1 hour,	2 years:	55.00
12 hour,	2 years:	12.40
72 hour,	2 years:	4.20
1 hour,	50 years:	110.00
12 hour,	50 years:	26.25
72 hour,	50 years:	9.60
	Skewness:	0.05

Geographical factor	F2:	3.92
Geographical factor	F50:	17.00

\DUR ARI	**5m**	**6m**	**10m**	**20m**	**30m**	**1h**	**2h**	**3h**	**6h**	**12h**	**24h**	**48h**	**72h**	**User**
1	118	111	94	71	59	42.3	28.1	22.0	14.4	9.46	6.34	4.16	3.17	0.00
2	152	144	121	92	77	55	36.4	28.5	18.8	12.4	8.32	5.48	4.18	0.00
5	197	186	157	119	99	71	47.7	37.5	24.8	16.5	11.2	7.47	5.75	0.00
10	223	211	178	135	113	81	54	42.9	28.5	19.0	13.0	8.71	6.74	0.00
20	258	244	206	156	131	94	63	50.0	33.3	22.2	15.3	10.3	8.00	0.00
50	305	288	243	185	155	111	75	59	39.6	26.5	18.4	12.5	9.72	0.00
100	340	322	271	206	173	124	84	67	44.6	29.9	20.8	14.2	11.1	0.00
User	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated Rainfall Factor ®: 8780
Estimated 1:10 Storm (S10): 6340

(Department of Conservation and Land Management
Date: 09/05/2001)

As a result, the soils for plant growth occur on the alluvial fans that form fringes around the bases of the hills and mountains, and in narrow strips on the younger alluvial terraces and levees adjacent to the major streams that cross the coastal plain.

2.2.2 *SOIL EROSION SUSCEPTIBILITY CLASSES*

The characteristics of a soil that determine its erosion susceptibility are:

- its propensity to break down and disperse, or to form aggregates, and the stability of any such aggregates;
- its capacity to accept water (infiltration capacity of the surface soil);
- its capacity to store water (soil porosity, soil permeability);
- its capacity to transmit water through the soil profile (soil hydraulic conductivity);
- slope.

Information on the above factors, in the form of topography, hydrology, and soil properties such as texture of surface soil and dispersiveness of subsoil, has been used to define three soil erosion susceptibility classes. The distribution of these classes in the Townsville area has been mapped, according to unique mapping areas, in Figure 3 at a scale of 1:100,000. This scale is sufficient to indicate which erosion susceptibility classes occur in an area but is not a substitute for site specific assessment. The likely erosion susceptibility class for an area can be determined by identifying the Unique Mapping Area (UMA) from Figure 3. Appendix C provides information on Soils Series and notes on erosion susceptibility.

While standard management practices are required for development anywhere, the level of management required will be higher on land that is more prone to erosion (the higher erosion susceptibility classes). Soils that are more prone to erosion will require additional, or more specialised, treatment to prevent adverse impacts during development or Council costs in repairing erosion damage to infrastructure.

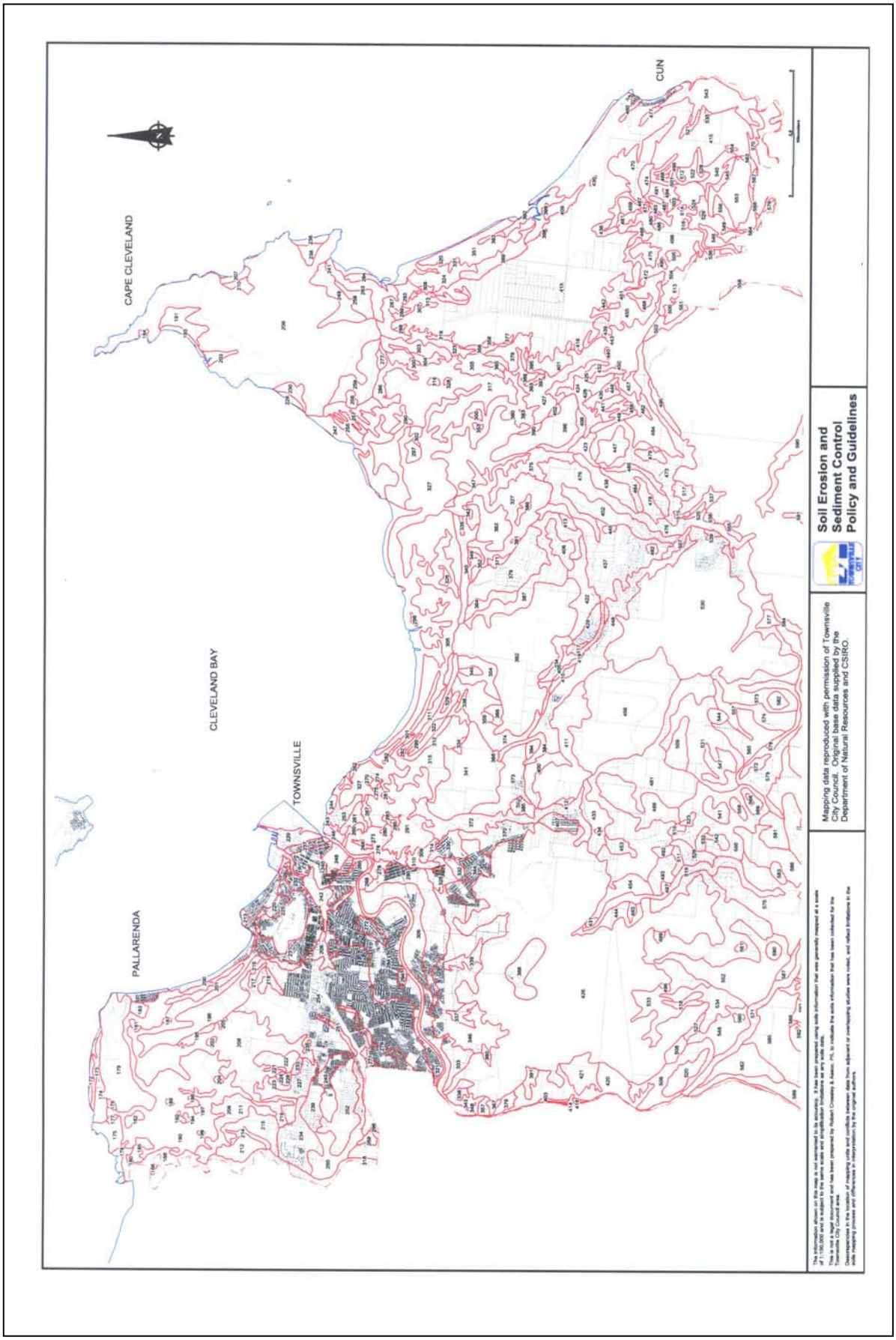
Class 1: Land requiring normal management practices as part of a ESCP. Typically these areas are relatively flat (slopes < 2%). Soils are non-dispersive but may be weakly reactive (shrink-swell).

ESCPs for these lands will need to pay particular attention to:

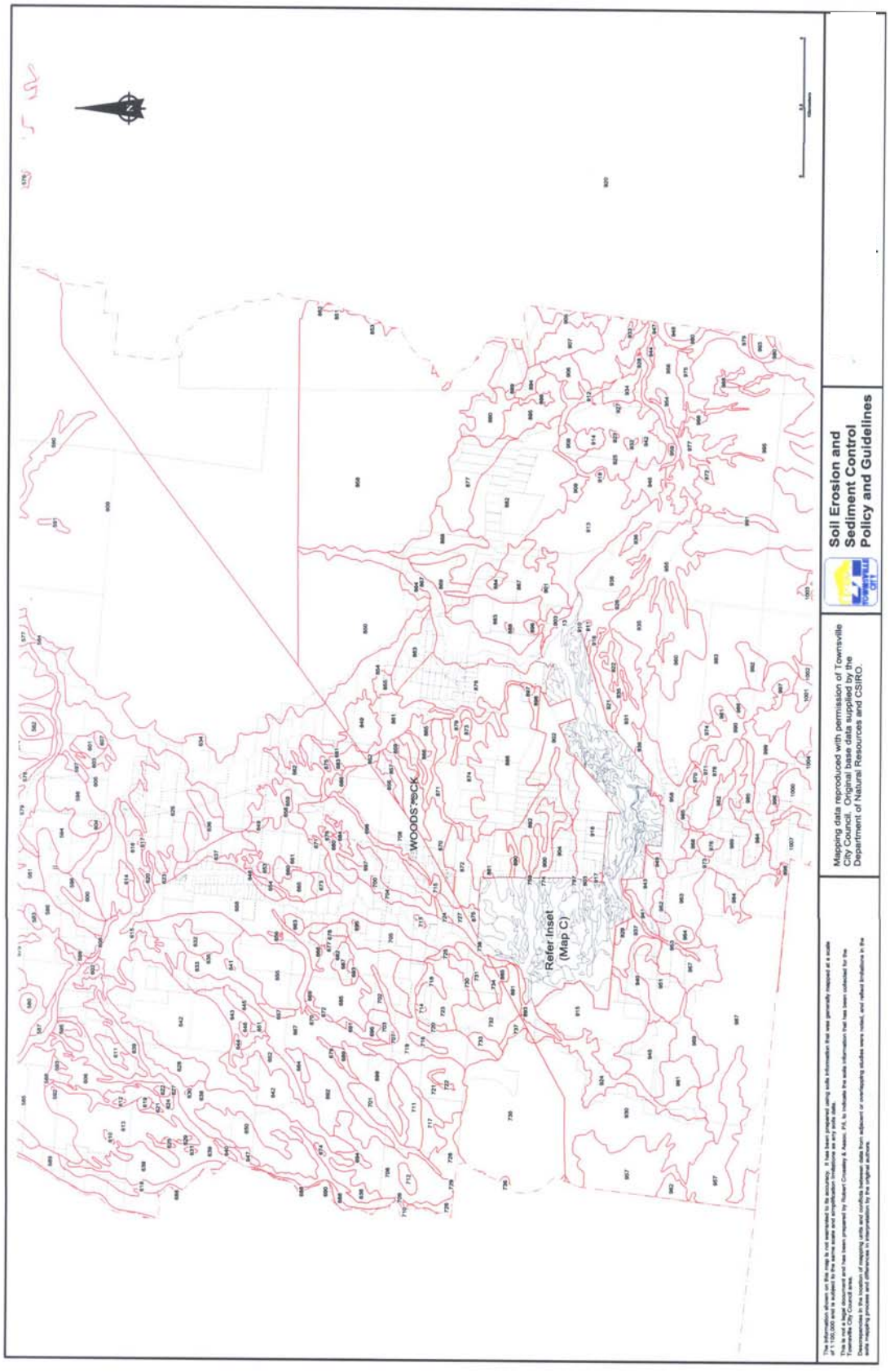
- minimising erosion from disturbed topsoil or exposed subsoil;
- containing wind-blown dust in the dry season;

- retaining sediment in the wet season;
- containing contaminated run-off and treating it on-site;
- preventing stream bank erosion;
- vegetation management;
- specific site management issues.

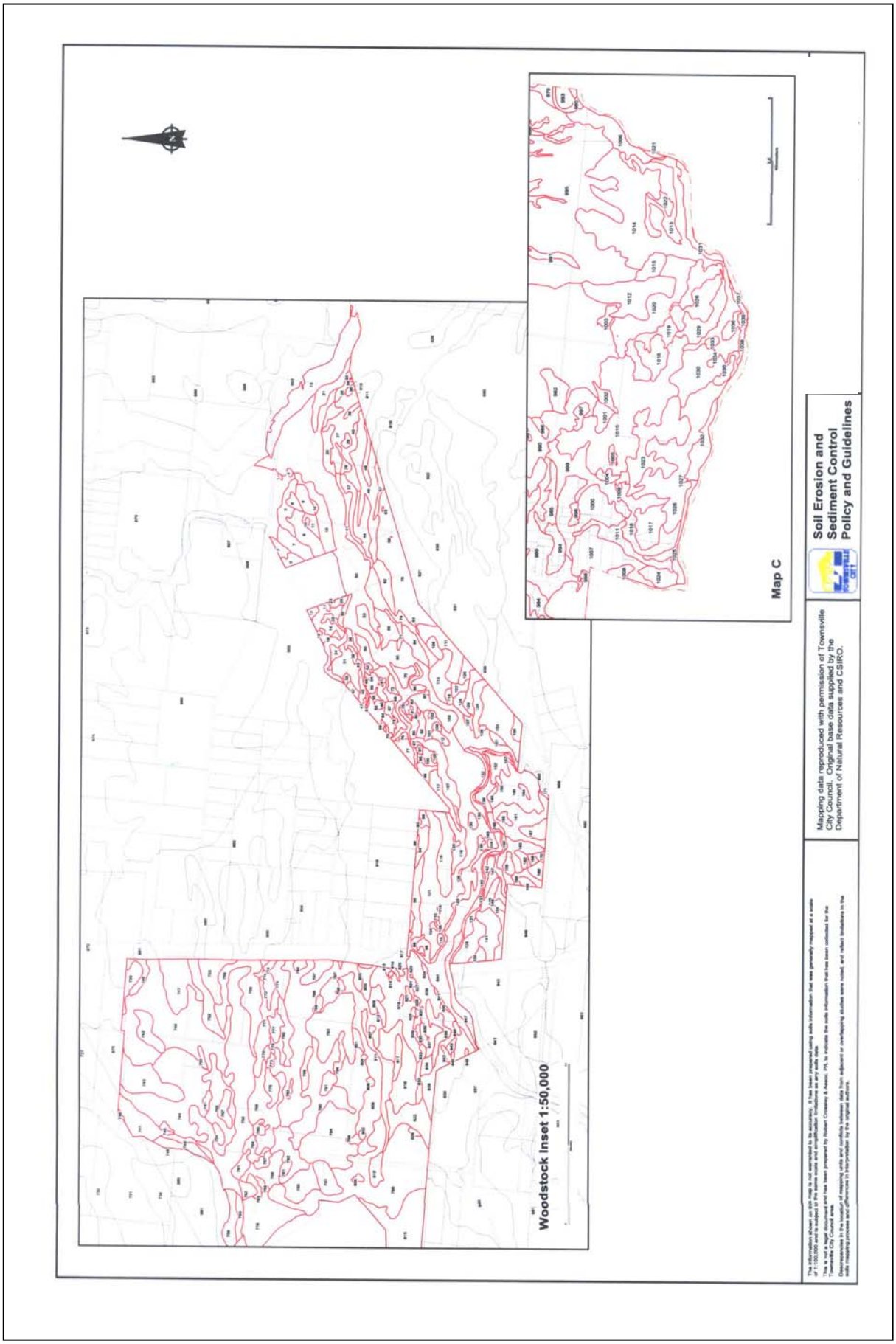
Figure 3 – Soil Erosion Susceptibility Classes Based on Unique Mapping Areas
Map A



<u>Figure 3</u> - Soil Erosion Susceptibility Classes Based on Unique Mapping Areas Map B



<u>Figure 3</u> - Soil Erosion Susceptibility Classes Based on Unique Mapping Areas - Map C and Inset (1:50,000)



Class 2: Land requiring erosion control measures to prevent degradation during construction, and immediate revegetation to stabilise disturbed areas. These areas are either steeper than Class 1, and/or have soils with a moderate tendency to disperse or shrink-swell.

The Erosion Susceptibility Class for Class 2 land may be further refined using the following subscripts (see Appendix C):

s: soils susceptible to sheet erosion;

w: soils susceptible to sheet and wind erosion;

b: soils susceptible to beach front erosion.

Erosion and Sediment Control Plans for Class 2 land will need to pay particular attention to:

- erosion control measures and revegetation to prevent erosion from disturbed topsoil or exposed subsoil;
- diversion of run-off around the site;
- containing wind blown dust in the dry season and, where wind erosion is noted to be a problem, particular attention to methods of wind erosion control;
- beach protection measures if appropriate;
- retaining sediment in the wet season;
- containing contaminated run-off and treating it on-site;
- preventing stream bank erosion if appropriate;
- vegetation management;
- specific site management issues.

Class 3: Land requiring substantial erosion control measures to prevent degradation during construction. This land may be particularly prone to gully erosion. Remediation of areas where gully erosion has commenced is expensive and the success rate is very low. Such land is typically steep, with bedrock outcrops and shallow soils, or is dominated by dispersive and/or reactive soils.

The Erosion Susceptibility for Class 3 land may be further refined using the following subscripts (see Appendix C):

g: soils susceptible to sheet and gully erosion;

e: existing gullied areas, in most cases these are part of the natural landscape evolution and gully slopes are rounded and stabilised. In other cases active gully erosion has occurred since settlement.

Erosion and Sediment Control Plans for these lands will need to pay particular attention to:

- ensuring disturbance of the site is not permitted between December to March inclusive;
- erosion control measures and revegetation to prevent erosion from disturbed topsoil or exposed subsoil;
- in the case of soils that have dispersive subsoil: specifying the period that any subsoil may be exposed, the depth of topsoil to be replaced over dispersive subsoil if exposed, and a revegetation schedule;
- measures to control run-off within the site and to divert run-off from other areas away from the site;
- containing wind blown dust in the dry season;
- retaining sediment in the wet season;
- containing contaminated runoff and treating it on-site;
- preventing stream bank erosion if appropriate;
- vegetation management;
- specific site management issues.

The soil series of a particular site must be determined and the associated erosion characteristics addressed.

2.2.3 LOCAL SOIL CONSTRAINTS TO PLANT GROWTH

A good "arable" soil is one which is capable of being tilled, cultivated, cropped, or managed in an urban landscape. The better the soil for these purposes, the more of the following characteristics it will display:

- 1 - 2m deep to provide adequate volume of soil for roots to exploit for water and plant nutrients;
- an adequate plant nutrient supply derived from the breakdown of soil organic matter and inorganic mineral matter in the soil;
- about equal proportions of clay, silt, and sand to ensure good physical properties:

clay: (<0.002 mm)

silt: (0.002 - 0.02 mm)

sand: (0.02 - 2 mm)

- adequate surface soil structure to allow water entry and plant shoot emergence - breaking down to fine aggregates, not hard setting, not crusting, providing a good seed bed;
- enough large pores to allow water entry and drainage of excess water;
- enough fine pores to hold water for plant use.

The older alluvial sediments form the most extensive geological units of the coastal plain and underlie much of the land currently used for agriculture and urban development, and also underlie the land likely to support potential urban expansion. The soils of these lands have a number of significant limitations to urban development including:

- either a strong texture contrast down the soil profile (lighter textured, sandy or silty surface soils showing a sharp change at about 15 - 20 cm depth to heavier textured, clayey subsoils), or uniform-textured clay-rich profiles that are prone to swelling and shrinking on wetting and drying;
- poor to very poor soil profile drainage;
- sodium dominated cation exchange complexes in the subsoil (sodic subsoils) which have a strong tendency to disperse and are therefore highly erodible.

The sodic subsoils promote extensive rill and gully erosion on exposed land surfaces - particularly along stream and gully banks and along man-made drains. This undermines civil engineering structures such as concrete aprons in drains, and water flow and erosion control structures in stream beds. Poor plant growth on the exposed sodic subsoils fails to protect these soils from erosion.

Plant growth can be enhanced in sodic soils by:

- ripping the soil;
- applying gypsum (calcium sulphate) at rates of 10 - 20 tonnes per ha;
- selecting appropriate grasses and legumes to grow at the site;
- using appropriate establishment techniques (irrigation and fertiliser) and might include hydromulching in particular areas.

New methods for growing plants on sodic soils in the Townsville - Thuringowa area are currently being developed by staff of CSIRO and James Cook University.

The greatest impact of soil erosion is on the uppermost layers of the soil profile where the plant nutrients are concentrated. This is particularly important in the soils of the Townsville - Thuringowa area where the naturally occurring soil nutrient content is generally low. The loss of any nutrient will have a strongly detrimental effect on plant growth, and escaped nutrients are likely to pollute the downstream waterways.

Research in a variety of landscapes has shown that sediment concentrations in run-off water are reduced to low and acceptable levels when at least 40% of the ground surface is covered by herbage. The ground cover acts a protective barrier for the soil, effectively dissipating the kinetic energy of the raindrops in the foliage.

Stoloniferous grasses (*ie* grasses with adventitious roots that send runners out over the soil surface) rather than tussock grasses are more effective for surface stabilisation. The velocity of run-off waters is reduced as a result of increased surface roughness under stoloniferous grasses. Grass tussocks tend to enhance the concentration of run-off waters into rills and channels and thereby accelerate the erosion process.

To ensure successful establishment of a groundcover a maintenance period is required. The length of the maintenance period must be sufficient to ensure grass cover is in place prior to the first storms of the subsequent wet season. A 12 month maintenance period is generally required and, during the dry season, irrigation is required to maintain plant growth and development, as is regular slashing or mowing (frequent cutting 75-100 mm above the ground encourages lateral stems to develop).

Ground cover of 40% away from waterways (60% in vegetated water dispersal area and in vegetated drains) is the minimum acceptable level of vegetative cover.

Rapid establishment of vegetation on bare or poorly covered soil surfaces (eg by irrigation and soil amendments such as gypsum and fertiliser) is essential.

Ongoing maintenance of the vegetation until an acceptable level of ground cover is achieved is necessary.

2.3 *TOPOGRAPHY*

Erosion and sedimentation processes are strongly influenced by the slope of the land which exercises primary control over the velocity of the run-off water. The length of the slope controls the quantity and depth of the run-off water and to a lesser extent its velocity. The shape of the slope controls the time taken for water to concentrate into channels and this affects the flooding potential along creeks.

Three kinds of erosion by flowing water can be related to increasing depth and velocity of run-off waters, and each should be addressed in the ESCP.

- *Sheet erosion* - characterised by the loss of a thin layer of soil from the land surface. It occurs when shallow, unconcentrated flows of water ("sheetflow") move over the soil surface. Soil particles are carried, in part, by turbulence created by raindrop impacts in the thin flows of water.
- *Rill erosion* - occurs when run-off water accumulates and concentrates into small channels just a few centimetres wide and deep. Often the rills erode to the depth of cultivation (5 -10 cm) in cropped lands. Soil losses can be high.
- *Gully erosion* - occurs where rills coalesce and the run-off waters are concentrated into channels. The larger gullies cannot be readily removed by cultivation, cannot be easily crossed by vehicles and machinery, and are difficult and expensive to repair.

Specific treatments are required to treat the different types of erosion that the on-site soils are susceptible to.

2.4 VEGETATION

Figure 4, which has been adapted from data supplied by Townsville City Council, shows the extent of the remnant vegetation communities in the Townsville area[15]. These remnant areas provide; important habitats for a diverse suite of plant and animal communities, important ecosystem services (such as air and water quality filters), and many aesthetic and recreational values to the region. The loss of natural vegetation cover and subsequent habitat fragmentation in the region has largely resulted from rapid changes in land use and increased urban expansion.

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[15] The most comprehensive appraisals of Townsville's broad scale vegetation communities (including wetlands), and their associated conservation values, have been provided in recent reports by Skull (1996) and Lukacs (1996).

In assessing the significance of remnant vegetation in a particular area, the Applicant should also consider the site in a regional context. This approach will help reduce the impact on natural systems by reducing fragmentation. The Applicant should aim to not only maintain existing values but enhance these by strategic rehabilitation by, for example, using native species suited to the area being developed.

Areas of existing natural vegetation are valuable in erosion control. The canopy, shrub and ground layers dissipate the erosive energy of raindrops and the ground layer spreads and slows surface flows.

Areas of remnant vegetation need to be assessed in terms of:

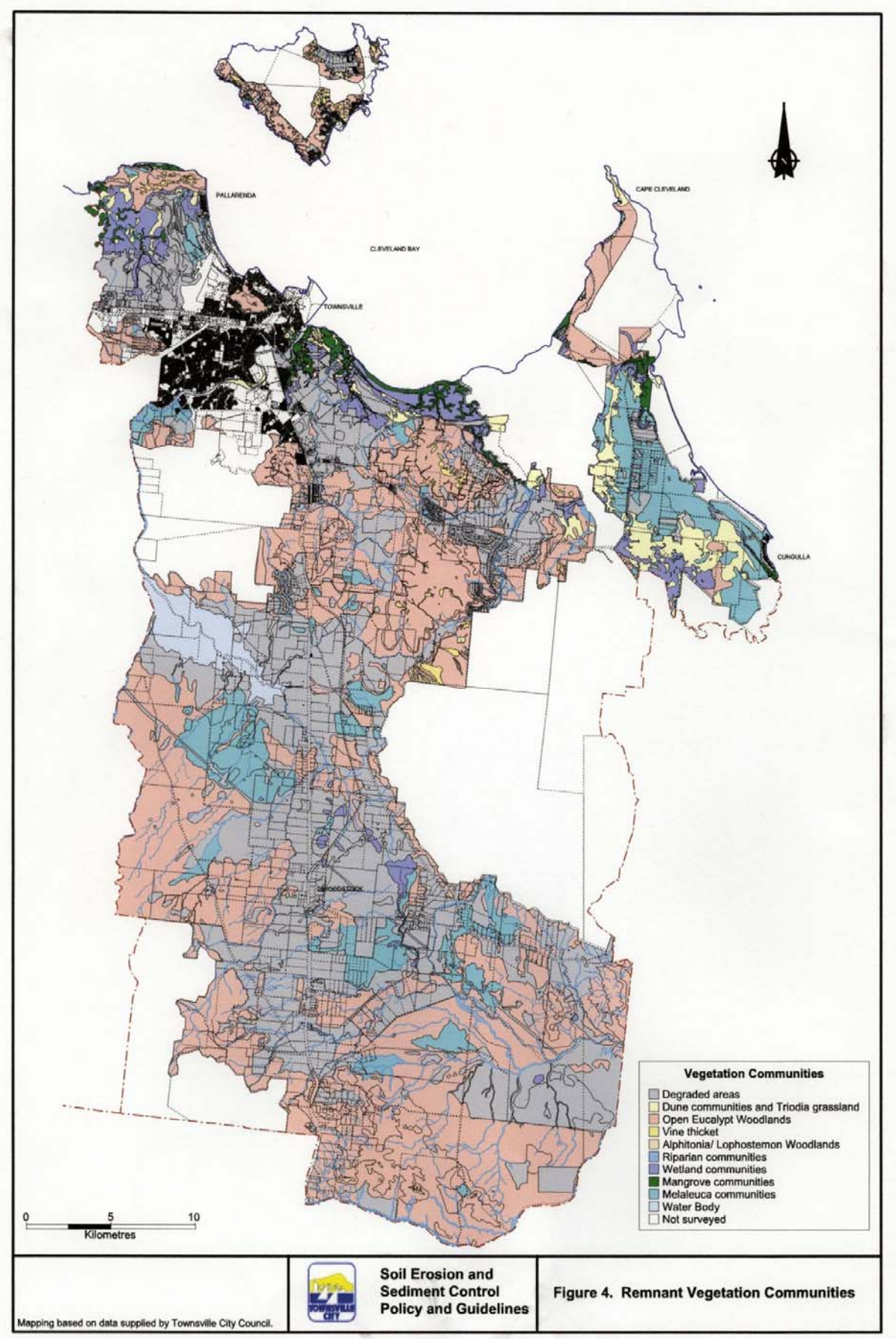
- their role in resisting erosion and protecting water quality;
- their significance - plant species or community rarity (with reference to the *Nature Conservation Act 1992);*
- their role in controlling salinity hazard;
- provision of livestock shade and shelter (in rural areas);
- scenic quality;
- their role in reducing flood hazard;
- integrity - level of disturbance, degree of connectivity, is it part of a larger contiguous area of vegetation, does this include areas of nature reserve (National Park, Environmental Park).

The regional significance of an area[16] should be identified and appropriately managed.

Assess existing areas of natural vegetation particularly in terms of erosion control, significance and integrity

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[16] Regional significance of areas in Townsville and associated recommendations can be determined by referring to Skull (1996) and Lukacs (1996).


PALLARENDA
CLEVELAND BAY
TOWNSVILLE
CAPE CLEVELAND
CUNGULLA
WOODSTOCK
Vegetation Communities
Degraded areas
Dune communities and Triodia grassland
Open Eucalypt Woodlands
Vine thicket
Alphitonia/ Lophostemon Woodlands
Riparian communities
Wetland communities
Mangrove communities
Melaleuca communities
Water Body
Not surveyed
0
5
10
Kilometres
Mapping based on data supplied by Townsville City Council.
Soil Erosion and Sediment Control Policy and Guidelines
Figure 4. Remnant Vegetation Communities

2.5 ACID SULPHATE SOILS

Acid sulphate soils[17] are those containing appreciable levels of iron sulphides contained in a layer of water-logged soils. The water prevents the iron sulphides being exposed to oxygen and thus maintains their stability. This layer is termed Potential Acid Sulphate Soil (PASS). When iron sulphides are exposed by natural processes (drought) or human activities (draining water-logged soils, excavation) they react and produce sulfuric acid. The soil itself can neutralise some of the sulfuric acid, but the remainder moves through the soil, acidifying the soil water, groundwater and eventually surface waters.

The short term effects of this process are:

- prevention of plant growth;
- corrosion of concrete, iron, steel and certain aluminium infrastructure;
- downstream environmental impacts; fish kills, fish disease, mortalities of microscopic organisms, increased light penetration, loss of acid sensitive crustaceans, destruction of fish eggs.

Long term downstream impacts (particularly in estuarine areas) are:

- loss of habitat;
- persistent iron coatings;
- alterations to plant communities;
- invasion by acid-tolerant water plants and plankton;
- reduced fish spawning success;
- chemical migration barriers;
- reduced food sources;
- growth abnormalities;
- increased availability of toxic elements.

Techniques for managing acid sulphate soils are:

- avoid disturbing or draining the iron sulphide layer;

The following are non-statutory inclusions for information purposes only and do not form part of the City Plan Policy.

[17] The following description of acid sulphate soils is summarised from Sammut and Lines-Kelly (1996).

- early recognition and quantification of the extent of the problem (prior to any earthworks). Indicators of the presence of acid sulphate soils are cloudy green-blue water, excessively clear water, iron stains, poor pasture, scalded soils and presence of yellow jarosite in the profile;
- liming the soil surface or water to neutralise the acid;
- resubmerge the affected area and maintain the water cover;
- use of shallow surface drainage (wide shallow drains that allow surface water to drain without disturbing the iron sulfide layer).

Figure 5 shows the possible extent of Acid Sulphate and Possible Acid Sulphate Soils in the Townsville area.

A series of initiatives have been instigated in Australia to deal with the problems presented by acid sulphate soils. In Queensland the Queensland Acid Sulphate Soils Investigation Team (QASSIT) has been established. For development of areas which have been identified as acid sulphate soil risk areas consultation with QASSIT regarding current best practice in quantification and management of acid sulphate soils is needed. QASSIT is located at:

The Resources Sciences Centre

Department of Natural Resources

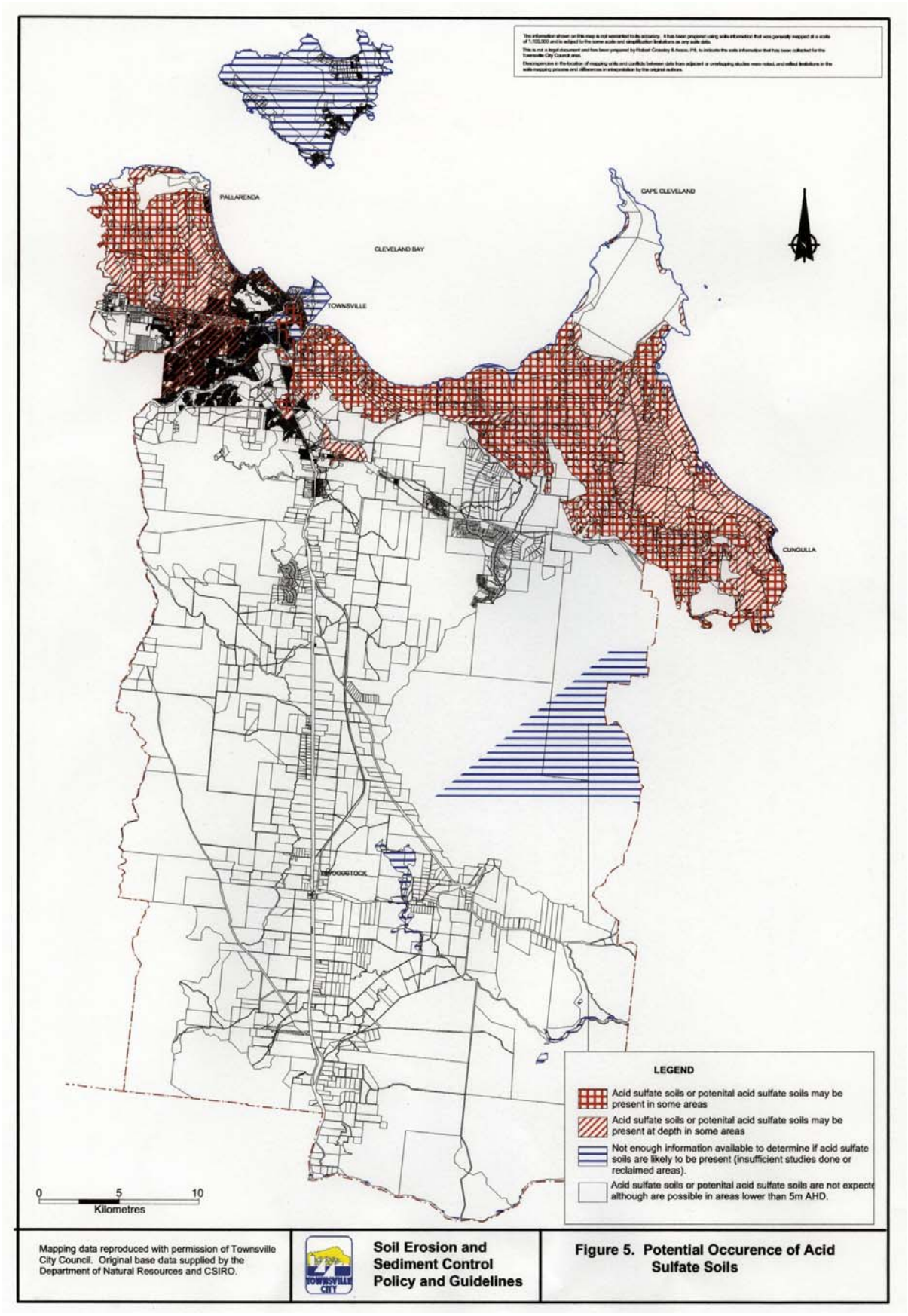
80 Meiers Road

INDOOROOPILLY QLD 4068.

Ph: 07 3896 9819

Fax: 07 3896 9782

For development of areas which have been identified as acid sulphate soil risk areas consultation with QASSIT regarding current best practice in quantification and management of acid sulphate soils is needed.


PALLARENDA
CAPE CLEVELAND
CLEVELAND BAY
TOWNSVILLE
CUNGULLA
LEGEND
Acid sulfate soils or potenital acid sulfate soils may be present in some areas
Acid sulfate soils or potenital acid sulfate soils may be present at depth in some areas
Not enough information available to determine if acid sulfate soils are likely to be present (insufficient studies done or reclaimed areas).
Acid sulfate soils or potenital acid sulfate soils are not expecte although are possible in areas lower than 5m AHD.
0
5
10
Kilometres
Mapping data reproduced with permission of Townsville City Council. Original base data supplied by the Department of Natural Resources and CSIRO.
Soil Erosion and Sediment Control Policy and Guidelines
Figure 5. Potential Occurence of Acid Sulfate Soils

APPENDIX C

SOIL EROSION SUSCEPTIBILITY TABLE

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source		Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
1	CSIRO (Unpublished)	Calman-(1)-90%			0.5% (0.5-0.5%)
2	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0-0.5%)
3	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
4	CSIRO (Unpublished)	Calman-(1)-90%			0.5% (0.5-0.5%)
5	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
6	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
7	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
8	CSIRO (Unpublished)	Manton-(3g)-80%	Gilligan-(3g)-10%		0.5% (0.5-0.5%)
9	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
10	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
11	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
12	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
13	CSIRO (Unpublished)	Magenta-(2s)-90%			0% (0-0.5%)
14	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
15	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-0.5%)
16	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0% (0-0%)
17	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
18	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
19	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
20	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
21	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0% (0-0%)
22	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
23	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
24	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
25	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
26	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
27	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
28	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
29	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-0.5%)
30	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-0.5%)
31	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
32	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
33	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
34	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
35	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0.5%)
36	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
37	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
38	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0-0.5%)

*Soils Data contained in the Appendix is based on mapping that was generally presented at 1 100,000 and is subject to the same scale and simplification limitations as any soils data. Slope information was derived from digital terrain models based on 1:25,000 and 1:50,000 topographic data supplied buy the Department of Natural Resources. The information presented should be sued as a general indication of the soils and slopes but is not necessarily site specific.

** Refer Section 2.21

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source		Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
39	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-0.5%)
40	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		1.5% (1-2%)
41	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
42	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
43	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
44	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
45	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
46	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
47	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
48	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0-0.5%)
49	CSIRO (Unpublished)	Stockyard-(3e)-90%			0% (0-0%)
50	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
51	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
52	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
53	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0-0.5%)
54	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
55	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
56	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
57	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0.5%)
58	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
59	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
60	CSIRO (Unpublished)	Woodridge-(1h)-90%			0% (0-0%)
61	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
62	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
63	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
64	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0.5-0.5%)
65	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0-1%)
66	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0% (0-0.5%)
67	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
68	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
69	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
70	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
71	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
72	CSIRO (Unpublished)	Magenta-(2s)-90%			0.5% (0.5-0.5%)
73	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
74	CSIRO (Unpublished)	Stockyard-(3e)-90%			0% (0-0%)
75	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-0.5%)
76	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
77	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
78	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		1.5% (0.5-2%)
79	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
80	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
81	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
82	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0-1%)
83	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0-0.5%)
84	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0-0.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source		Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
85	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-0.5%)
86	CSIRO (Unpublished)	Magenta-(2s)-90%			0.5% (0-0.5%)
87	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
88	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
89	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0.5-1%)
90	CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (1-1%)
91	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
92	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
93	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
94	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-1%)
95	CSIRO (Unpublished)	Lansdown-(3g)-90%			1% (0.5-1%)
96	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
97	CSIRO (Unpublished)	Magenta-(2s)-90%			0% (0-0%)
98	CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (1-1%)
99	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-1.5%)
100	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	1% (1-1%)
101	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
102	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
103	CSIRO (Unpublished)	Double Barrel-(2s)-90%			0% (0-0%)
104	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1%)
105	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
106	CSIRO (Unpublished)	Woodridge-(1h)-90%			0% (0-0%)
107	CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (0.5-2.5%)
108	CSIRO (Unpublished)	Manton-(3g)-90%			1% (1-1%)
109	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0% (0-0%)
110	CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (1-1%)
111	CSIRO (Unpublished)	Manton-(3g)-40%	Gilligan-(3g)-40%	Woodridge-(1h)-10%	0% (0-0%)
112	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	0.5% (0-1%)
113	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
114	CSIRO (Unpublished)	Woodridge-(1h)-90%			0% (0-0%)
115	CSIRO (Unpublished)	Woodridge-(1h)-90%			1% (1-1%)
116	CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0-1.5%)
117	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-1%)
118	CSIRO (Unpublished)	Lansdown-(3g)-90%			0% (0-0%)
119	CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-1%)
120	CSIRO (Unpublished)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	1% (1-1%)
121	CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
122	CSIRO (Unpublished)	Glenoming-(2s)-90%			0.5% (0-1%)
123	CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
124	CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (0.5-1%)
125	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-0.5%)
126	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0-1%)
127	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-0.5%)
128	CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-0.5%)
129	CSIRO (Unpublished)	Manton-(3g)-90%			0.5% (0.5-1%)
130	CSIRO (Unpublished)	Sandalwood-(3g)-90%			1% (1-1%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
131 CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-0.5%)
132 CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-1.5%)
133 CSIRO (Unpublished)	Woodridge-(1h)-90%			1% (0.5-1%)
134 CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
135 CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0-1%)
136 CSIRO (Unpublished)	Lansdown-(3g)-90%			1% (0.5-2%)
137 CSIRO (Unpublished)	Stockyard-(3e)-90%			0% (0-0%)
138 CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0% (0-0%)
139 CSIRO (Unpublished)	Double Barrel-(2s)-90%			1.5% (1.5-1.5%)
140 CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0-0.5%)
141 CSIRO (Unpublished)	Lansdown-(3g)-90%			1% (1-1%)
142 CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-1%)
143 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
144 CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
145 CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (1-1%)
146 CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-1%)
147 CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-0.5%)
148 CSIRO (Unpublished)	Stockyard-(3e)-90%			0.5% (0.5-1%)
149 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
150 CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-1%)
151 CSIRO (Unpublished)	Lansdown-(3g)-90%			1% (0.5-1%)
152 CSIRO (Unpublished)	Stockyard-(3e)-90%			1.5% (1-1.5%)
153 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
154 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
155 CSIRO (Unpublished)	Sandalwood-(3g)-90%			1% (1-1%)
156 CSIRO (Unpublished)	Double Barrel-(2s)-90%			0.5% (0.5-1%)
157 CSIRO (Unpublished)	Double Barrel-(2s)-90%			1% (1-1.5%)
158 CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
159 CSIRO (Unpublished)	Stockyard-(3e)-90%			1% (0.5-1.5%)
160 CSIRO (Unpublished)	Sandalwood-(3g)-90%			1% (1-1%)
161 CSIRO (Unpublished)	Woodridge-(1h)-90%			1% (1-1%)
162 CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-0.5%)
163 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
164 CSIRO (Unpublished)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0.5-1%)
165 CSIRO (Unpublished)	Woodridge-(1h)-90%			0.5% (0.5-1%)
166 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-1%)
167 CSIRO (Unpublished)	Lansdown-(3g)-90%			1% (0.5-1%)
168 CSIRO (Unpublished)	Sandalwood-(3g)-90%			0.5% (0.5-0.5%)
169 CSIRO (Unpublished)	Lansdown-(3g)-90%			0.5% (0.5-0.5%)
170 CSIRO (Unpublished)	Woodridge-(1h)-90%			1% (0.5-1%)
171 CSIRO (Unpublished)	Double Barrel-(2s)-90%			1% (1-1%)
172 Murtha (1982)	Toolakea-(2wb)-100%			2% (0.5-3%)
173 Murtha (1982)	Mangroves-(1)-100%			1% (0.5-3%)
174 Murtha (1982)	Toolakea-(2wb)-60%	Jalloonda-(2wb)-30%	Pallerenda-(2w)-10%	6.5% (0.5-31%)
175 Murtha (1982)	Mountainous area-(3g)-100%			4% (0-61.5%)
176 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-63.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
177 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-4.5%)
178 Murtha (1982)	Toolakea-(2wb)-90%	Jalloonda-(2wb)-10%		5% (0-31.5%)
179 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-1.5%)
180 Murtha (1982)	Jalloonda-(2wb)-100%			17% (3.5-38%)
181 Murtha (1982)	Jalloonda-(2wb)-100%			1% (0-4%)
182 Murtha (1982)	Coonambelah-(1)-90%	Salt Pans-(2w)-10%		0% (0-12%)
183 Murtha (1982)	Coonambelah-(1)-90%	Salt Pans-(2w)-10%		0% (0-0%)
184 Murtha (1982)	Hillview-(2s)-100%			40.5% (0-184%)
185 Murtha (1982)	Coonambelah-(1)-90%	Salt Pans-(2w)-10%		6% (0-61%)
186 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-17%)
187 Murtha (1982)	Jalloonda-(2wb)-100%			0.5% (0-9%)
188 Murtha (1982)	Mangroves-(1)-90%	Salt Pans-(2w)-10%		0.5% (0-15%)
189 Murtha (1982)	Coonambelah-(1)-100%			1% (0-4.5%)
190 Murtha (1982)	Salt Pans-(2w)-80%	Coonambelah-(1)-10%	Mangroves-(1)-10%	5% (0-24%)
191 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-20%		6.5% (1-42.5%)
192 Murtha (1982)	Mangroves-(1)-100%			0.5% (0-2%)
193 Murtha (1982)	Jalloonda-(2wb)-80%	Toolakea-(2wb)-20%		4% (0-51.5%)
194 Murtha (1982)	Coonambelah-(1)-100%			1% (0-12%)
195 Murtha (1982)	Brolga-(1)-100%			7% (0-53%)
196 Murtha (1982)	Mangroves-(1)-90%	Salt Pans-(2w)-10%		4.5% (0-62.5%)
197 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
198 Murtha (1982)	Jalloonda-(2wb)-50%	Pallerenda-(2w)-50%		0.5% (0-1.5%)
199 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-1.5%)
200 Murtha (1982)	Toolakea-(2wb)-80%	Jalloonda-(2wb)-20%		1% (0-5%)
201 Murtha (1982)	Toolakea-(2wb)-50%	Jalloonda-(2wb)-50%		0% (0-0%)
202 Murtha (1982)	Brolga-(1)-100%			0.5% (0.5-1%)
203 Murtha (1982)	Hillview-(2s)-100%			2.5% (0-7%)
204 Murtha (1982)	Coonambelah-(1)-100%			24% (0.5-68.5%)
205 Murtha (1982)	Brolga-(1)-100%			0.5% (0-3%)
206 Murtha (1982)	Water Body-(NA)-			0.5% (0-2%)
207 Murtha (1982)	Jalloonda-(2wb)-80%	Toolakea-(2wb)-20%		6% (0.5-42.5%)
208 Murtha (1982)	Coonambelah-(1)-80%	Salt Pans-(2w)-10%	Brolga-(1)-10%	0% (0-0%)
209 Murtha (1982)	Mountainous area-(3g)-100%			5.5% (0-49%)
210 Murtha (1982)	Hillview-(2s)-100%			9% (0-55%)
211 Murtha (1982)	Coonambelah-(1)-80%	Brolga-(1)-10%	Salt Pans-(2w)-10%	11.5% (0-60.5%)
212 Murtha (1982)	Nightjar-(3g)-80%	Alick-(1)-10%	Purono-(3g)-10%	0.5% (0-3%)
213 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-1.5%)
214 Murtha (1982)	Morngi-(3g)-100%			2.5% (0-10%)
215 Murtha (1982)	Nightjar-(3g)-80%	Alick-(1)-10%	Purono-(3g)-10%	0.5% (0-3%)
216 Murtha (1982)	Mountainous area-(3g)-100%			4% (0-35%)
217 Murtha (1982)	Jalloonda-(2wb)-80%	Pallerenda-(2w)-20%		0.5% (0-3%)
218 Murtha (1982)	Brolga-(1)-90%	Gulliver-(3g)-10%		0.5% (0.5-1%)
219 Murtha (1982)	Brolga-(1)-90%	Coonambelah-(1)-10%		0.5% (0-7.5%)
220 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		5% (0-35%)
221 Murtha (1982)	Brolga-(1)-100%			1.5% (0-10.5%)
222 Murtha (1982)	Nightjar-(3g)-80%	Alick-(1)-10%	Purono-(3g)-10%	1% (0-9%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
223 Murtha (1982)	Water Body-(NA)-			0.5% (0-1%)
224 Murtha (1982)	Nightjar-(3g)-80%	Alick-(1)-10%	Purono-(3g)-10%	2% (0-6.5%)
225 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0.5-1%)
226 Murtha (1982)	Jalloonda-(2wb)-80%	Toolakea-(2wb)-20%		13.5% (1-54%)
227 Murtha (1982)	Nightjar-(3g)-80%	Alick-(1)-10%	Purono-(3g)-10%	0.5% (0-1%)
228 Murtha (1982)	Mountainous area-(3g)-100%			3% (0-19.5%)
229 Murtha (1982)	Reclaimed land-()-100%			0% (0-1.5%)
230 Murtha (1982)	Hillview-(2s)-100%			0.5% (0-13.5%)
231 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-10%	Stag-(2s)-10%	30.5% (1-156.5%)
232 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		25.5% (3.5-53%)
233 Murtha (1982)	Oolgar-(2w)-100%			0% (0-0%)
234 Murtha (1982)	Pattel-(3g)-80%	Kulburn-(3g)-20%		0% (0-1%)
235 Murtha (1982)	Oolgar-(2w)-100%			0.5% (0-3%)
236 Murtha (1982)	Jalloonda-(2wb)-80%	Toolakea-(2wb)-20%		8.5% (0-53.5%)
237 Murtha (1982)	Toolakea-(2wb)-50%	Jalloonda-(2wb)-50%		3.5% (0-30.5%)
238 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-20%		4.5% (0-29.5%)
239 Murtha (1982)	Healy-(3g)-80%	Hervey-(3g)-20%		3% (0-10%)
240 Murtha (1982)	Coonambelah-(1)-80%	Brolga-(1)-10%	Salt Pans-(2w)-10%	2% (0-11%)
241 Murtha (1982)	Cungulla-(2w)-100%			2% (0-29.5%)
242 Murtha (1982)	Reclaimed land-()-100%			1.5% (0-2.5%)
243 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-3.5%)
244 Murtha (1982)	Mangroves-(1)-100%			1% (0-37.5%)
245 Murtha (1982)	Hervey-(3g)-80%	Hillview-(2s)-10%	Clemant-(2s)-10%	4% (0-50.5%)
246 Murtha (1982)	Mangroves-(1)-100%			7.5% (0-43.5%)
247 Murtha (1982)	Mangroves-(1)-100%			1% (0-11%)
248 Murtha (1982)	Reclaimed land-()-100%			0.5% (0-3%)
249 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-20%		5% (0-24.5%)
250 Murtha (1982)	Hervey-(3g)-80%	Hillview-(2s)-10%	Clemant-(2s)-10%	0.5% (0-1%)
251 Murtha (1982)	Bluewater-(1)-50%	Yileena-(1)-50%		31% (1-87%)
252 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-2%)
253 Murtha (1982)	Jalloonda-(2wb)-50%	Toolakea-(2wb)-50%		0.5% (0-4.5%)
254 Murtha (1982)	Gulliver-(3g)-50%	Purono-(3g)-40%	Garbutt-(3g)-10%	0% (0-0%)
255 Murtha (1982)	Salt Pans-(2w)-100%			8% (0-73.5%)
256 Murtha (1982)	Mountainous area-(3g)-100%			1.5% (0-5.5%)
257 Murtha (1982)	Jalloonda-(2wb)-80%	Cungulla-(2w)-20%		1% (0-4.5%)
258 Murtha (1982)	Mangroves-(1)-100%			0% (0-1%)
259 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-20%		0.5% (0-4%)
260 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-1.5%)
261 Murtha (1982)	Coonambelah-(1)-100%			0% (0-1.5%)
262 Murtha (1982)	Jalloonda-(2wb)-50%	Toolakea-(2wb)-50%		0% (0-10%)
263 Murtha (1982)	Mangroves-(1)-100%			3% (0.5-20.5%)
264 Murtha (1982)	Jalloonda-(2wb)-80%	Toolakea-(2wb)-20%		0% (0-1%)
265 Murtha (1982)	Mangroves-(1)-100%			1% (0-13.5%)
266 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-1%)
267 Murtha (1982)	Salt Pans-(2w)-100%			1.5% (0-12.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
268 Murtha (1982)	Mangroves-(1)-100%			0% (0-0%)
269 Murtha (1982)	Manton-(3g)-60%	Alick-(1)-40%		0.5% (0-4%)
270 Murtha (1982)	Jalloonda-(2wb)-100%			0.5% (0-4.5%)
271 Murtha (1982)	Manton-(3g)-60%	Alick-(1)-40%		3.5% (0-17%)
272 Murtha (1982)	Gulliver-(3g)-50%	Purono-(3g)-50%		2.5% (0-20%)
273 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
274 Murtha (1982)	Coonambelah-(1)-100%			0% (0-1%)
275 Murtha (1982)	Jalloonda-(2wb)-100%			0.5% (0-20.5%)
276 Murtha (1982)	Mangroves-(1)-100%			23% (2-68.5%)
277 Murtha (1982)	Salt Pans-(2w)-100%			2% (0-52%)
278 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-1%)
279 Murtha (1982)	Bluewater-(1)-50%	Yileena-(1)-50%		27.5% (5-49%)
280 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-17.5%)
281 Murtha (1982)	Jalloonda-(2wb)-100%			0% (0-0%)
282 Murtha (1982)	Jalloonda-(2wb)-100%			0% (0-0%)
283 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
284 Murtha (1982)	Black-(1)-70%	Central-(2s)-20%	Bluewater-(1)-10%	2.5% (0-11%)
285 Murtha (1982)	Coonambelah-(1)-100%			0% (0-2%)
286 Murtha (1982)	Mangroves-(1)-100%			0% (0-0%)
287 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
288 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
289 Murtha (1982)	Cungulla-(2w)-100%			0% (0-1.5%)
290 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-2%)
291 Murtha (1982)	Coonambelah-(1)-80%	Salt Pans-(2w)-10%	Black-(1)-10%	0% (0-0.5%)
292 Murtha (1982)	Coonambelah-(1)-100%			1.5% (0-12%)
293 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0%)
294 Murtha (1982)	Gulliver-(3g)-50%	Purono-(3g)-50%		5% (0-21.5%)
295 Murtha (1982)	Toonpan-(1)-70%	Black-(1)-20%	Sachs-(3g)-10%	0% (0-0.5%)
296 Murtha (1982)	Morngi-(3g)-80%	Purono-(3g)-10%	Kulburn-(3g)-10%	0.5% (0-7%)
297 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-4.5%)
298 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
299 Murtha (1982)	Coonambelah-(1)-100%			0% (0-1.5%)
300 Murtha (1982)	Cungulla-(2w)-100%			0.5% (0-4%)
301 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0.5%)
302 Murtha (1982)	Coonambelah-(1)-100%			2.5% (0-43.5%)
303 Murtha (1982)	Cungulla-(2w)-80%	Pallerenda-(2w)-20%		0% (0-2.5%)
304 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
305 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-2.5%)
306 Murtha (1982)	Black-(1)-70%	Central-(2s)-20%	Toonpan-(1)-10%	0% (0-0%)
307 Murtha (1982)	Cungulla-(2w)-100%			0.5% (0-9%)
308 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0.5%)
309 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
310 Murtha (1982)	Salt Pans-(2w)-100%			2% (0-4.5%)
311 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-2%)
312 Murtha (1982)	Jalloonda-(2wb)-90%	Cungulla-(2w)-10%		0% (0-1%)
313 Murtha (1982)	Coonambelah-(1)-80%	Brolga-(1)-20%		0% (0-2%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
314 Murtha (1982)	Jalloonda-(2wb)-50%	Pallerenda-(2w)-50%		0% (0-1%)
315 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-32.5%)
316 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-5%)
317 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-1%)
318 Murtha (1982)	Bluewater-(1)-60%	Central-(2s)-30%	Windsor-(1)-10%	0% (0-0%)
319 Murtha (1982)	Brolga-(1)-100%			1% (0-6.5%)
320 Murtha (1982)	Salt Pans-(2w)-100%			3.5% (0-46%)
321 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-1%)
322 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
323 Murtha (1982)	Coonambelah-(1)-90%	Brolga-(1)-10%		0% (0-0%)
324 Murtha (1982)	Mangroves-(1)-100%			0% (0-1%)
325 Murtha (1982)	Coonambelah-(1)-80%	Salt Pans-(2w)-10%	Gilligan-(3g)-10%	0% (0-0.5%)
326 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
327 Murtha (1982)	Mangroves-(1)-100%			1.5% (0-19%)
328 Murtha (1982)	Coonambelah-(1)-100%			7.5% (0-37.5%)
329 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
330 Murtha (1982)	Gilligan-(3g)-60%	Manton-(3g)-40%		0% (0-0%)
331 Murtha (1982)	Salt Pans-(2w)-100%			5% (0-59.5%)
332 Murtha (1982)	Gulliver-(3g)-50%	Purono-(3g)-50%		31% (0-174%)
333 Murtha (1982)	Gullied lands-(3e)-	Healy-(3g)-Minor	Hillview-(2s)-Minor	0.5% (0-4.5%)
334 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
335 Murtha (1982)	Jalloonda-(2wb)-80%	Cungulla-(2w)-20%		4.5% (2-10.5%)
336 Murtha (1982)	Jalloonda-(2wb)-100%			0.5% (0-1%)
337 Murtha (1982)	Gullied lands-(3e)-	Healy-(3g)-Minor	Hillview-(2s)-Minor	0% (0-0%)
338 Murtha (1982)	Hillview-(2s)-100%			0% (0-0.5%)
339 Murtha (1982)	Gullied lands-(3e)-	Healy-(3g)-Minor	Hillview-(2s)-Minor	0% (0-0%)
340 Murtha (1982)	Jalloonda-(2wb)-80%	Cungulla-(2w)-20%		3.5% (0-36%)
341 Murtha (1982)	Gilligan-(3g)-60%	Manton-(3g)-40%		0.5% (0-2%)
342 Murtha (1982)	Salt Pans-(2w)-100%			4% (0-44.5%)
343 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	3.5% (0-20%)
344 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-10%	Healy-(3g)-10%	1% (0-2.5%)
345 Murtha (1982)	Stanley-(2s)-80%	Hillview-(2s)-20%		0% (0-1%)
346 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	0.5% (0-43.5%)
347 Murtha (1982)	Coonambelah-(1)-90%	Salt Pans-(2w)-10%		3.5% (0-21%)
348 Murtha (1982)	Hillview-(2s)-100%			0% (0-0%)
349 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
350 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0.5%)
351 Murtha (1982)	Jalloonda-(2wb)-50%	Toolakea-(2wb)-30%	Cungulla-(2w)-20%	0% (0-0%)
352 Murtha (1982)	Salt Pans-(2w)-100%			1.5% (0-7%)
353 Murtha (1982)	Salt Pans-(2w)-100%			1% (0-6.5%)
354 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-10%	Healy-(3g)-10%	0.5% (0-2%)
355 Murtha (1982)	Cungulla-(2w)-80%	Pallerenda-(2w)-20%		31% (0-100.5%)
356 Murtha (1982)	Brolga-(1)-100%			0.5% (0-0.5%)
357 Murtha (1982)	Hillview-(2s)-100%			0% (0-0.5%)
358 Murtha (1982)	Coonambelah-(1)-100%			3% (0-7%)
359 Murtha (1982)	Stanley-(2s)-80%	Healy-(3g)-20%		0% (0-0.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
360 Murtha (1982)	Gullied lands-(3e)-	Healy-(3g)-Minor	Hillview-(2s)-Minor	5.5% (1.5-20%)
361 Murtha (1982)	Purono-(3g)-80%	Alick-(1)-10%	Bohle-(3g)-10%	0.5% (0-2%)
362 Murtha (1982)	Salt Pans-(2w)-100%			2.5% (0.5-7%)
363 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
364 Murtha (1982)	Flagstone-(2s)-60%	Granite-(2s)-20%	Pepperpot-(1)-20%	7% (0-46.5%)
365 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
366 Murtha (1982)	Gullied lands-(3e)-	Healy-(3g)-Minor	Hillview-(2s)-Minor	0% (0-0.5%)
367 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	0% (0-1%)
368 Murtha (1982)	Stanley-(2s)-80%	Healy-(3g)-20%		29% (0.5-73%)
369 Murtha (1982)	Jalloonda-(2wb)-50%	Toolakea-(2wb)-30%	Cungulla-(2w)-20%	0% (0-0%)
370 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	2.5% (0.5-7%)
371 Murtha (1982)	Salt Pans-(2w)-100%			6% (0-21%)
372 Murtha (1982)	Black-(1)-70%	Central-(2s)-20%	Bluewater-(1)-10%	0% (0-1%)
373 Murtha (1982)	Gulliver-(3g)-50%	Purono-(3g)-50%		2.5% (0-6.5%)
374 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	4% (0-35%)
375 Murtha (1982)	Salt Pans-(2w)-100%			1% (0-5.5%)
376 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	4.5% (1-19%)
377 Murtha (1982)	Coonambelah-(1)-100%			0% (0-3%)
378 Murtha (1982)	Coonambelah-(1)-70%	Brolga-(1)-20%	Salt Pans-(2w)-10%	8% (1.5-33.5%)
379 Murtha (1982)	Frederick-(3g)-100%			0% (0-0.5%)
380 Murtha (1982)	Salt Pans-(2w)-100%			29% (2-142%)
381 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-38.5%)
382 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	1% (0-10%)
383 Murtha (1982)	Salt Pans-(2w)-100%			9.5% (0.5-41.5%)
384 Murtha (1982)	Toonpan-(1)-80%	Black-(1)-20%		4% (0-10%)
385 Murtha (1982)	Alice-(1)-40%	Carinya-(1)-40%	Black-(1)-20%	0% (0-0%)
386 Murtha (1982)	Salt Pans-(2w)-100%			1% (0-5.5%)
387 Murtha (1982)	Hillview-(2s)-80%	Clemant-(2s)-10%	Healy-(3g)-10%	0% (0-0.5%)
388 Murtha (1982)	Strongly Undulating Area-(3g)-100%			4% (0-24.5%)
389 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0.5-0.5%)
390 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	0% (0-0%)
391 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	0% (0-0.5%)
392 Murtha (1982)	Mangroves-(1)-100%			4% (0-29%)
393 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0.5%)
394 Murtha (1982)	Mountainous area-(3g)-100%			3.5% (0-24%)
395 Murtha (1982)	Brolga-(1)-100%			0% (0-0.5%)
396 Murtha (1982)	Mountainous area-(3g)-100%			4.5% (0.5-11%)
397 Murtha (1982)	Coonambelah-(1)-100%			4.5% (0-41%)
398 Murtha (1982)	Salt Pans-(2w)-100%			2% (0-29%)
399 Murtha (1982)	Jalloonda-(2wb)-100%			3.5% (0-9%)
400 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	3.5% (1-9%)
401 Murtha (1982)	Coonambelah-(1)-70%	Brolga-(1)-20%	Salt Pans-(2w)-10%	17% (1-42%)
402 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	27.5% (2-55%)
403 Murtha (1982)	Ross-(1)-80%	Bluewater-(1)-20%		2.5% (0-8.5%)
404 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		0% (0-0%)
405 Murtha (1982)	Kulburn-(3g)-90%	Hillview-(2s)-10%		4% (0-33.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
406 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-24%)
407 Murtha (1982)	Kulburn-(3g)-80%	Bluewater-(1)-10%	Central-(2s)-10%	6% (0-40.5%)
408 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	23.5% (2-61.5%)
409 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-1%)
410 Murtha (1982)	Kulburn-(3g)-100%			8% (0-39%)
411 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-0%)
412 Murtha (1982)	Kulburn-(3g)-80%	Bluewater-(1)-10%	Central-(2s)-10%	1% (0-23%)
413 Murtha (1982)	Healy-(3g)-80%	Hillview-(2s)-10%	Sachs-(3g)-10%	11.5% (0-39%)
414 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		0% (0-1%)
415 Murtha (1982)	Cungulla-(2w)-80%	Jalloonda-(2wb)-20%		0.5% (0-2%)
416 Murtha (1982)	Coonambelah-(1)-100%			10.5% (0-41.5%)
417 Murtha (1982)	Gullied lands-(3e) -	Kulburn-(3g)-Minor	Hillview-(2s)-Minor	1% (0-11%)
418 Murtha (1982)	Ross-(1)-80%	Bluewater-(1)-20%		0% (0-0.5%)
419 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		2.5% (0-6.5%)
420 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	0% (0-0%)
421 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	2.5% (0.5-4%)
422 Murtha (1982)	Healy-(3g)-70%	Kulburn-(3g)-20%	Hillview-(2s)-10%	1.5% (0-22%)
423 Murtha (1982)	Sachs-(3g)-70%	Manton-(3g)-30%		2% (0-6.5%)
424 Murtha (1982)	Salt Pans-(2w)-100%			1.5% (0-8%)
425 Murtha (1982)	Mangroves-(1)-100%			4% (0-10%)
426 Murtha (1982)	Mountainous area-(3g)-100%			3.5% (0-15.5%)
427 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
428 Murtha (1982)	Coonambelah-(1)-100%			0% (0-1.5%)
429 Murtha (1982)	Kulburn-(3g)-90%	Hillview-(2s)-10%		0.5% (0-3%)
430 Murtha (1982)	Doughboy-(1)-100%			14% (4-33%)
431 Murtha (1982)	Mountainous area-(3g)-100%			6% (0-52.5%)
432 Murtha (1982)	Coonambelah-(1)-100%			35.5% (6.5-73%)
433 Murtha (1982)	Kulburn-(3g)-80%	Bluewater-(1)-10%	Central-(2s)-10%	4% (1.5-8.5%)
434 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	0% (0-0.5%)
435 Murtha (1982)	Oolgar-(2w)-100%			4% (0-24%)
436 Murtha (1982)	Doughboy-(1)-80%	Coonambelah-(1)-10%	Brolga-(1)-10%	1% (0-4%)
437 Murtha (1982)	Stanley-(2s)-40%	Julago-(1)-40%	Ettrick-(3g)-20%	4% (0-25.5%)
438 Murtha (1982)	Purono-(3g)-90%	Bently-(1)-10%		6.5% (0-43%)
439 Murtha (1982)	Cungulla-(2w)-100%			0.5% (0-3.5%)
440 Murtha (1982)	Coonambelah-(1)-100%			1% (0-3%)
441 Murtha (1982)	Coonambelah-(1)-80%	Brolga-(1)-10%	Salt Pans-(2w)-10%	0.5% (0-5%)
442 Murtha (1982)	Brolga-(1)-100%			7% (2.5-16.5%)
443 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
444 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	1.5% (0-10%)
445 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-20%)
446 Murtha (1982)	Coonambelah-(1)-100%			26.5% (0-121.5%)
447 Murtha (1982)	Mountainous area-(3g)-100%			3% (0-20%)
448 Murtha (1982)	Stanley-(2s)-40%	Julago-(1)-40%	Ettrick-(3g)-20%	0% (0-0.5%)
449 Murtha (1982)	Oolgar-(2w)-100%			5.5% (0-47.5%)
450 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
451 Murtha (1982)	Brolga-(1)-100%			0.5% (0-5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
452 Murtha (1982)	Bently-(1)-70%	Black-(1)-20%	Sachs-(3g)-10%	3.5% (0-15%)
453 Murtha (1982)	Gullied lands-(3e) -	Stanley-(2s)-Minor		0% (0-1%)
454 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	0.5% (0-3.5%)
455 Murtha (1982)	Coonambelah-(1)-70%	Brolga-(1)-20%	Salt Pans-(2w)-10%	0.5% (0-2.5%)
456 Murtha (1982)	Stuart-(2s)-80%	Sachs-(3g)-10%	Stanley-(2s)-10%	3.5% (0-22%)
457 Murtha (1982)	Coonambelah-(1)-80%	Brolga-(1)-10%	Salt Pans-(2w)-10%	0.5% (0-12.5%)
458 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
459 Murtha (1982)	Doughboy-(1)-80%	Brolga-(1)-20%		0% (0-0%)
460 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0.5%)
461 Murtha (1982)	Coonambelah-(1)-90%	Doughboy-(1)-10%		0% (0-0.5%)
462 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		0% (0-0.5%)
463 Murtha (1982)	Sachs-(3g)-100%			0% (0-0.5%)
464 Murtha (1982)	Bently-(1)-70%	Purono-(3g)-20%	Sachs-(3g)-10%	24% (0-82.5%)
465 Murtha (1982)	Sachs-(3g)-80%	Manton-(3g)-20%		4% (1.5-11.5%)
466 Murtha (1982)	Coonambelah-(1)-90%	Brolga-(1)-10%		1% (0-7%)
467 Murtha (1982)	Cungulla-(2w)-100%			22.5% (0-61%)
468 Murtha (1982)	Brolga-(1)-90%	Coonambelah-(1)-10%		0% (0-0.5%)
469 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-0.5%)
470 Murtha (1982)	Doughboy-(1)-80%	Coonambelah-(1)-10%	Brolga-(1)-10%	8% (0-40.5%)
471 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0%)
472 Murtha (1982)	Cungulla-(2w)-100%			0.5% (0-3.5%)
473 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	0.5% (0-1.5%)
474 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-0%)
475 Murtha (1982)	Coonambelah-(1)-90%	Brolga-(1)-10%		0% (0-0%)
476 Murtha (1982)	Black-(1)-80%	Central-(2s)-10%	Bluewater-(1)-10%	1% (0-10.5%)
477 Murtha (1982)	Coonambelah-(1)-100%			30% (0-61%)
478 Murtha (1982)	Purono-(3g)-90%	Bently-(1)-10%		4.5% (0-64.5%)
479 Murtha (1982)	Stuart-(2s)-90%	Julago-(1)-10%		0.5% (0-2.5%)
480 Murtha (1982)	Coonambelah-(1)-100%			6% (0.5-13%)
481 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	2.5% (0-31%)
482 Murtha (1982)	Stuart-(2s)-100%			0% (0-0%)
483 Murtha (1982)	Cungulla-(2w)-100%			0.5% (0-36.5%)
484 Murtha (1982)	Pattel-(3g)-80%	Beefwood-(3g)-10%	Sandalwood-(3g)-10%	0.5% (0.5-1%)
485 Murtha (1982)	Ross-(1)-80%	Central-(2s)-10%	Kulburn-(3g)-10%	1% (0-8.5%)
486 Murtha (1982)	Coonambelah-(1)-100%			26.5% (0-64%)
487 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0%)
488 Murtha (1982)	Cungulla-(2w)-100%			10% (1.5-37%)
489 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	4.5% (0-10%)
490 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
491 Murtha (1982)	Coonambelah-(1)-90%	Doughboy-(1)-10%		1.5% (0-39.5%)
492 Murtha (1982)	Gullied lands-(3e) -	Stanley-(2s)-Minor	Hillview-(2s)-Minor	0% (0-0%)
493 Murtha (1982)	Mountainous area-(3g)-100%			5% (0-38%)
494 Murtha (1982)	Cungulla-(2w)-100%			6% (2.5-34%)
495 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		0% (0-0%)
496 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	2% (0-20%)
497 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	1.5% (0-6.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
498 Murtha (1982)	Brolga-(1)-70%	Coonambelah-(1)-20%	Salt Pans-(2w)-10%	0% (0-0.5%)
499 Murtha (1982)	Mountainous area-(3g)-100%			9% (0.5-29.5%)
500 Murtha (1982)	Brolga-(1)-100%			4% (0.5-18%)
501 Murtha (1982)	Coonambelah-(1)-100%			2% (0.5-26%)
502 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		39% (0-238.5%)
503 Murtha (1982)	Cungulla-(2w)-100%			0% (0-0%)
504 Murtha (1982)	Cungulla-(2w)-100%			19.5% (6.5-32%)
505 Murtha (1982)	Coonambelah-(1)-90%	Brolga-(1)-10%		2% (0-9.5%)
506 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	3.5% (1.5-24%)
507 Murtha (1982)	Purono-(3g)-90%	Sachs-(3g)-10%		1.5% (0-10.5%)
508 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	0.5% (0-2%)
509 Murtha (1982)	Woodridge-(1h)-80%	Sachs-(3g)-20%		26.5% (0-70%)
510 Murtha (1982)	Gullied lands-(3e) -	Healy-(3g)-Minor	Hillview-(2s)-Minor	7% (0-35.5%)
511 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	8.5% (1-47.5%)
512 Murtha (1982)	Mountainous area-(3g)-100%			16.5% (1-35%)
513 Murtha (1982)	Coonambelah-(1)-90%	Brolga-(1)-10%		0.5% (0-11%)
514 Murtha (1982)	Coonambelah-(1)-100%			28.5% (3-55.5%)
515 Murtha (1982)	Gullied lands-(3e) -	Stanley-(2s)-Minor	Hillview-(2s)-Minor	3% (0-39.5%)
516 Murtha (1982)	Coonambelah-(1)-100%			0% (0-2%)
517 Murtha (1982)	Gullied lands-(3e) -	Stanley-(2s)-Minor	Hillview-(2s)-Minor	1.5% (0-4%)
518 Murtha (1982)	Black-(1)-90%	Central- (2s)-10%		1% (0-26.5%)
519 Murtha (1982)	Black-(1)-90%	Central- (2s)-10%		0.5% (0-1.5%)
520 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-0%)
521 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
522 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		0% (0-0%)
523 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	0% (0-0.5%)
524 Murtha (1982)	Coonambelah-(1)-100%			8% (0.5-37%)
525 Murtha (1982)	Purono-(3g)-100%			4% (0-20.5%)
526 Murtha (1982)	Kulburn-(3g)-80%	Bluewater-(1)-10%	Sandalwood-(3g)-10%	4% (0.5-9%)
527 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	0.5% (0-27.5%)
528 Murtha (1982)	Mountainous area-(3g)-100%			1.5% (0-39.5%)
529 Murtha (1982)	Coonambelah-(1)-100%			0% (0-0%)
530 Murtha (1982)	Stuart-(2s)-100%			0% (0-0.5%)
531 Murtha (1982)	Sachs-(3g)-60%	Manton-(3g)-40%		0% (0-0%)
532 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	0% (0-4%)
533 Murtha (1982)	Healy-(3g)-70%	Hervey-(3g)-20%	Hillview-(2s)-10%	8.5% (0-79.5%)
534 Murtha (1982)	Five Head-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0% (0-0.5%)
535 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-14%)
536 Murtha (1982)	Coonambelah-(1)-100%			0.5% (0-0.5%)
537 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	1% (0-12.5%)
538 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	4% (0-28.5%)
539 Murtha (1982)	Stuart-(2s)-100%			3.5% (0-41.5%)
540 Murtha (1982)	Doughboy-(1)-80%	Brolga-(1)-20%		10% (0-37%)
541 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	5.5% (1-34%)
542 Murtha (1982)	Mountainous area-(3g)-100%			8% (0-23%)
543 Murtha (1982)	Mangroves-(1)-100%			3.5% (1.5-20.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
544 Murtha (1982)	Stuart-(2s)-80%	Stanley-(2s)-10%	Julago-(1)-10%	37% (0-94.5%)
545 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		0.5% (0-1%)
546 Murtha (1982)	Coonambelah-(1)-90%	Salt Pans-(2w)-10%		4% (1-13%)
547 Murtha (1982)	Woodridge-(1h)-80%	Sachs-(3g)-20%		0% (0-0%)
548 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-30%		0% (0-0%)
549 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-28%)
550 Murtha (1982)	Healy-(3g)-80%	Hervey-(3g)-20%		4.5% (0.5-18.5%)
551 Murtha (1982)	Althaus-(3g)-80%	Stanley-(2s)-10%	Hillview-(2s)-10%	0% (0-0%)
552 Murtha (1982)	Sachs-(3g)-60%	Manton-(3g)-40%		0% (0-1.5%)
553 Murtha (1982)	Mountainous area-(3g)-100%			18.5% (4-36.5%)
554 Murtha (1982)	Doughboy-(1)-80%	Brolga-(1)-20%		1% (0-21%)
555 Murtha (1982)	Ettrick-(3g)-40%	Stanley-(2s)-40%	Julago-(1)-20%	0% (0-0%)
556 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		8.5% (0-44.5%)
557 Murtha (1982)	Beefwood-(3g)-80%	Sachs-(3g)-10%	Stuart-(2s)-10%	1% (0-3.5%)
558 Murtha (1982)	Hillview-(2s)-80%	Elliot-(2s)-10%	Clemant-(2s)-10%	1.5% (0-3.5%)
559 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	3% (0-16%)
560 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		1% (0-20%)
561 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-2.5%)
562 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-30%		1% (0-3.5%)
563 Murtha (1982)	Hillview-(2s)-90%	Clemant-(2s)-10%		2.5% (1.5-3.5%)
564 Murtha (1982)	Mangroves-(1)-100%			0.5% (0-7%)
565 Murtha (1982)	Sachs-(3g)-100%			8.5% (0-62.5%)
566 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0-3.5%)
567 Murtha (1982)	Mangroves-(1)-100%			18.5% (8.5-31.5%)
568 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-0%)
569 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	0.5% (0-1%)
570 Murtha (1982)	Salt Pans-(2w)-100%			0% (0-1%)
571 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		3.5% (0-29%)
572 Murtha (1982)	Sachs-(3g)-100%			2% (0-9%)
573 Murtha (1982)	Stuart-(2s)-80%	Stanley-(2s)-10%	Julago-(1)-10%	12% (0-39%)
574 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	13% (0-29.5%)
575 Murtha (1982)	Kulburn-(3g)-80%	Bluewater-(1)-10%	Sandalwood-(3g)-10%	6.5% (0-39.5%)
576 Murtha (1982)	Salt Pans-(2w)-100%			0.5% (0-2%)
577 Murtha (1982)	Toonpan-(1)-50%	Double Barrel-(2s)-30%	Magenta-(2s)-20%	10% (0-50%)
578 Murtha (1982)	Beefwood-(3g)-90%	Stuart-(2s)-10%		0.5% (0-4.5%)
579 Murtha (1982)	Black-(1)-90%	Central-(2s)-10%		7.5% (3.5-15%)
580 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	19.5% (2-52%)
581 Murtha (1982)	Beefwood-(3g)-70%	Stockyard-(3e)-20%	Sandalwood-(3g)-10%	3.5% (0-21.5%)
582 Murtha (1982)	Stuart-(2s)-100%			1% (0-5%)
583 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	25% (6.5-46.5%)
584 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	0% (0-0%)
585 Murtha (1982)	Sachs-(3g)-60%	Manton-(3g)-40%		7% (0-30.5%)
586 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	0% (0-0%)
587 Murtha (1982)	Purono-(3g)-50%	Carinya-(1)-30%	Yileena-(1)-20%	3.5% (0-10.5%)
588 Murtha (1982)	Sandalwood-(3g)-100%			4.5% (0-27%)
589 Murtha (1982)	Ross-(1)-80%	Bluewater-(1)-10%	Central-(2s)-10%	0% (0-4%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
590 Murtha (1982)	Black-(1)-70%	Central-(2s)-30%		0% (0-0%)
591 Murtha (1982)	Black-(1)-70%	Central-(2s)-30%		0.5% (0-2%)
592 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-3%)
593 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	0.5% (0-3.5%)
594 Murtha (1982)	Beefwood-(3g)-70%	Stockyard-(3e)-20%	Sandalwood-(3g)-10%	1.5% (0-3%)
595 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	0% (0-0%)
596 Murtha (1982)	Sachs-(3g)-70%	Manton-(3g)-30%		13.5% (0-35%)
597 Murtha (1982)	Beefwood-(3g)-80%	Stockyard-(3e)-20%		0.5% (0-3.5%)
598 Murtha (1982)	Stanley-(2s)-50%	Ettrick-(3g)-30%	Julago-(1)-20%	0.5% (0-2.5%)
599 Murtha (1982)	Kulburn-(3g)-80%	Sandalwood-(3g)-10%	Bluewater-(1)-10%	0.5% (0-1.5%)
600 Murtha (1982)	Stockyard-(3e)-70%	Beefwood-(3g)-30%		0.5% (0-7.5%)
601 Murtha (1982)	Antill-(1)-80%	Stag-(2s)-10%	Flagstone-(2s)-10%	2% (0.5-15.5%)
602 Murtha (1982)	Sachs-(3g)-70%	Manton-(3g)-30%		3.5% (1-12%)
603 Murtha (1982)	Beefwood-(3g)-80%	Stockyard-(3e)-20%		0% (0-1%)
604 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-1%)
605 Murtha (1982)	Beefwood-(3g)-50%	Stockyard-(3e)-30%	Carinya-(1)-20%	1% (0.5-1.5%)
606 Murtha (1982)	Sandalwood-(3g)-90%	Purono-(3g)-10%		0% (0-0.5%)
607 Murtha (1982)	Mountainous area-(3g)-100%			11% (3.5-29%)
608 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		0.5% (0-1%)
609 Murtha (1982)	Mountainous area-(3g)-100%			0% (0-0%)
610 Murtha (1982)	Sandalwood-(3g)-100%			0% (0-0.5%)
611 Murtha (1982)	Pepperpot-(1)-70%	Wallaroo-(1)-20%	Flagstone-(2s)-10%	14% (1-51%)
612 Murtha (1982)	Purono-(3g)-100%			0.5% (0-2.5%)
613 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	0% (0-0%)
614 Murtha (1982)	Beefwood-(3g)-80%	Stockyard-(3e)-20%		1% (0-2%)
615 Murtha (1982)	Sachs-(3g)-70%	Manton-(3g)-30%		0.5% (0-1.5%)
616 Murtha (1982)	Beefwood-(3g)-80%	Stockyard-(3e)-20%		1% (0-4%)
617 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-3.5%)
618 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	0.5% (0-3.5%)
619 Murtha (1982)	Granite-(2s)-100%			1% (0.5-2.5%)
620 Murtha (1982)	Stockyard-(3e)-70%	Beefwood-(3g)-20%	Elliot-(2s)-10%	0.5% (0-3.5%)
621 Murtha (1982)	Purono-(3g)-100%			0.5% (0-1.5%)
622 Murtha (1982)	Granite-(2s)-100%			0.5% (0-1%)
623 Murtha (1982)	Beefwood-(3g)-80%	Stockyard-(3e)-20%		0.5% (0-0.5%)
624 Murtha (1982)	Purono-(3g)-100%			1.5% (0-10.5%)
625 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0 -1%)
626 Murtha (1982)	Stockyard-(3e)-70%	Beefwood-(3g)-20%	Elliot-(2s)-10%	0.5% (0-0.5%)
627 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-5%)
628 Murtha (1982)	Pepperpot-(1)-70%	Wallaroo-(1)-20%	Flagstone-(2s)-10%	0.5% (0-1.5%)
629 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-0.5%)
630 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0.5-0.5%)
631 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0.5-1%)
632 Murtha (1982)	Five Head-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0% (0-0.5%)
633 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	0.5% (0-4.5%)
634 Murtha (1982)	Elliot-(2s)-60%	Hillview-(2s)-40%		0.5% (0-0.5%)
635 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0.5% (0-2%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
636 Murtha (1982)	Stockyard-(3e)-70%	Beefwood-(3g)-20%	Elliot-(2s)-10%	0.5% (0.5-0.5%)
637 Murtha (1982)	Sachs-(3g)-100%			0.5% (0.5-0.5%)
638 Murtha (1982)	Purono-(3g)-70%	Woodlands-(3g)-20%	Sandalwood-(3g)-10%	6% (0-60.5%)
639 Murtha (1982)	Alice-(1)-40%	Carinya-(1)-40%	Bluewater-(1)-20%	0% (0-0%)
640 Murtha (1982)	Purono-(3g)-100%			0.5% (0.5-0.5%)
641 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-1.5%)
642 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	0.5% (0.5-1%)
643 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0.5% (0-2%)
644 Murtha (1982)	Pepperpot-(1)-100%			1% (0-2.5%)
645 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1% (0-1.5%)
646 Murtha (1982)	Pepperpot-(1)-100%			1% (0.5-1%)
647 Murtha (1982)	Granite-(2s)-60%	Pepperpot-(1)-40%		0% (0-0.5%)
648 Murtha (1982)	Beefwood-(3g)-90%	Sandalwood-(3g)-10%		1% (1-1%)
649 Murtha (1982)	Sachs-(3g)-100%			0.5% (0-0.5%)
650 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0.5% (0.5-0.5%)
651 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-1%)
652 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0% (0-0.5%)
653 Murtha (1982)	Beefwood-(3g)-100%			0% (0-0%)
654 Murtha (1982)	Sandalwood-(3g)-100%			0% (0-0.5%)
655 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	0.5% (0.5-0.5%)
656 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-1.5%)
657 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0% (0-0%)
658 Murtha (1982)	Elliot-(2s)-60%	Hillview-(2s)-40%		0% (0-0%)
659 Murtha (1982)	Stockyard-(3e)-100%			0.5% (0-0.5%)
660 Murtha (1982)	Beefwood-(3g)-90%	Sandalwood-(3g)-10%		0.5% (0-2%)
661 Murtha (1982)	Beefwood-(3g)-60%	Carinya-(1)-30%	Yileena-(1)-10%	0% (0-0%)
662 Murtha (1982)	Elliot-(2s)-60%	Hillview-(2s)-40%		0.5% (0-0.5%)
663 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	0.5% (0-0.5%)
664 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	0.5% (0.5-0.5%)
665 Murtha (1982)	Sandalwood-(3g)-80%	Beefwood-(3g)-10%	Stockyard-(3e)-10%	0% (0-0.5%)
666 Murtha (1982)	Sandalwood-(3g)-100%			1% (0.5-1.5%)
667 Murtha (1982)	Woodlands-(3g)-60%	Carinya-(1)-30%	Yileena-(1)-10%	0.5% (0-1%)
668 Murtha (1982)	Toonpan-(1)-50%	Double Barrel-(2s)-30%	Magenta-(2s)-20%	1% (0-3%)
669 Murtha (1982)	Granite-(2s)-100%			1% (0-2%)
670 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-1%)
671 Murtha (1982)	Alick-(1)-30%	Vantasell-(1)-30%	Manton-(3g)-40%	1% (0-2.5%)
672 Murtha (1982)	Sandalwood-(3g)-100%			0% (0-0%)
673 Murtha (1982)	Beefwood-(3g)-90%	Sandalwood-(3g)-10%		0.5% (0.5-0.5%)
674 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-0.5%)
675 Murtha (1982)	Stockyard-(3e)-70%	Carinya-(1)-30%		0% (0-0.5%)
676 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0.5-1%)
677 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-0.5%)
678 Murtha (1982)	Alick-(1)-60%	Manton-(3g)-40%		0% (0-0%)
679 Murtha (1982)	Sandalwood-(3g)-100%			0% (0-0%)
680 Murtha (1982)	Alick-(1)-30%	Vantasell-(1)-30%	Manton-(3g)-40%	0.5% (0.5-0.5%)
681 Murtha (1982)	Stockyard-(3e)-70%	Carinya-(1)-30%		0.5% (0.5-0.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
682 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1% (0.5-1%)
683 Murtha (1982)	Stockyard-(3e)-100%			0.5% (0-0.5%)
684 Murtha (1982)	Beefwood-(3g)-90%	Stockyard-(3e)-10%		0.5% (0.5-0.5%)
685 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0.5% (0-0.5%)
686 Murtha (1982)	Beefwood-(3g)-90%	Stockyard-(3e)-10%		0.5% (0.5-0.5%)
687 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	1% (0-5%)
688 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		0.5% (0-2.5%)
689 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0.5% (0.5-1.5%)
690 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		2.5% (0-12%)
691 Murtha (1982)	Sandalwood-(3g)-100%			1% (0.5-2%)
692 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0.5% (0-1%)
693 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1% (1- 1%)
694 Murtha (1982)	Woodridge-(1h)-100%			0.5% (0.5-0.5%)
695 Murtha (1982)	Alick-(1)-60%	Manton-(3g)-40%		1% (0-2.5%)
696 Murtha (1982)	Purono-(3g)-70%	Kulburn-(3g)-20%	Sandalwood-(3g)-10%	1.5% (1-2.5%)
697 Murtha (1982)	Alick-(1)-30%	Vantasell-(1)-30%	Manton-(3g)-40%	1% (0.5-1.5%)
698 Murtha (1982)	Stockyard-(3e)-70%	Carinya-(1)-30%		0.5% (0-1%)
699 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0.5% (0-1.5%)
700 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-1.5%)
701 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	0.5% (0.5-1.5%)
702 Murtha (1982)	Purono-(3g)-70%	Kulburn-(3g)-20%	Sandalwood-(3g)-10%	1% (0-2%)
703 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1.5% (0-29.5%)
704 Murtha (1982)	Beefwood-(3g)-60%	Carinya-(1)-30%	Yileena-(1)-10%	0.5% (0.5-0.5%)
705 Murtha (1982)	Barringha-(1)-100%			0.5% (0-1%)
706 Murtha (1982)	Pepperpot-(1)-60%	Wallaroo-(1)-20%	Flagstone-(2s)-20%	0.5% (0.5-0.5%)
707 Murtha (1982)	Mountainous area-(3g)-100%			0.5% (0.5-0.5%)
708 Murtha (1982)	Alick-(1)-30%	Vantasell-(1)-30%	Manton-(3g)-40%	1% (0.5-1%)
709 Murtha (1982)	Black-(1)-80%	Central-(2s)-20%		1% (0-3.5%)
710 Murtha (1982)	Alice-(1)-40%	Carinya-(1)-40%	Bluewater-(1)-20%	0.5% (0.5-0.5%)
711 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1% (0.5-1%)
712 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	3.5% (0-30.5%)
713 Murtha (1982)	Granite-(2s)-100%			2% (0-7.5%)
714 Murtha (1982)	Purono-(3g)-80%	Woodlands-(3g)-10%	Kulburn-(3g)-10%	2% (0-6.5%)
715 Murtha (1982)	Sandalwood-(3g)-100%			0.5% (0-2%)
716 Murtha (1982)	Purono-(3g)-80%	Kulburn-(3g)-10%	Lansdown-(3g)-10%	0.5% (0-1.5%)
717 Murtha (1982)	Woodlands-(3g)-60%	Purono-(3g)-20%	Kulburn-(3g)-20%	1% (0.5-1%)
718 Murtha (1982)	Purono-(3g)-80%	Kulburn-(3g)-10%	Lansdown-(3g)-10%	2.5% (0-5.5%)
719 Murtha (1982)	Alice-(1)-40%	Carinya-(1)-40%	Yileena-(1)-20%	0.5% (0-0.5%)
720 Murtha (1982)	Purono-(3g)-80%	Woodlands-(3g)-10%	Kulburn-(3g)-10%	1.5% (1.5-1.5%)
721 Murtha (1982)	Elliot-(2s)-50%	Hillview-(2s)-30%	Clemant-(2s)-20%	0% (0-0.5%)
722 Murtha (1982)	Gullied lands-(3e) -	Elliot-(2s)-Minor	Hillview-(2s)-Minor	0.5% (0-1%)
723 Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	1% (0-4.5%)
724 Murtha (1982)	Alick-(1)-30%	Vantasell-(1)-30%	Manton-(3g)-40%	6.5% (0-24.5%)
725 Murtha (1982)	Purono-(3g)-80%	Kulburn-(3g)-10%	Lansdown-(3g)-10%	1.5% (1-2%)
726 Murtha (1982)	Alice-(1)-40%	Carinya-(1)-40%	Bluewater-(1)-20%	0.5% (0.5-1%)
727 Murtha (1982)	Woodridge-(1h)-100%			0.5% (0-3.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source		Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
728	Murtha (1982)	Gullied lands-(3e)-	Elliot-(2s)-Minor	Woodlands-(3g)-Minor	2% (0.5-3.5%)
729	Murtha (1982)	Frederick-(3g)-100%			2% (2-2.5%)
730	Murtha (1982)	Pall Mal-(3g)-100%			0.5% (0-1%)
731	Murtha (1982)	Granite-(2s)-50%	Pepperpot-(1)-30%	Wallaroo-(1)-20%	3% (0-9.5%)
732	Murtha (1982)	Flagstone-(2s)-60%	Granite-(2s)-20%	Pepperpot-(1)-20%	2% (0-6%)
733	Murtha (1982)	Pall Mal-(3g)-100%			4% (0.5-9.5%)
734	Murtha (1982)	Pall Mal-(3g)-100%			1.5% (0-3.5%)
735	Murtha (1982)	Mountainous area-(3g)-100%			2.5% (1.5-4.5%)
736	Murtha (1982)	Gullied lands-(3e)-	Elliot-(2s)-Minor	Hillview-(2s)-Minor	4% (1.5-22%)
737	Murtha (1982)	Healy-(3g)-80%	Hillview-(2s)-10%	Clemant-(2s)-10%	7% (0.5-16%)
738	Murtha and Crack (1966)	Sandalwood-(3g)-90%			0% (0-0%)
739	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (0.5-1%)
740	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0-1.5%)
741	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
742	Murtha and Crack (1966)	Woodridge-(1h)-90%			0% (0-0%)
743	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
744	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (0.5-1%)
745	Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (0-2.5%)
746	Murtha and Crack (1966)	Woodridge-(1h)-70%	Gilligan-(3g)-20%		28.5% (0-75.5%)
747	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0.5-1%)
748	Murtha and Crack (1966)	Magenta-(2s)-90%			0.5% (0-1%)
749	Murtha and Crack (1966)	Double Barrel-(2s)-90%			1% (1-1%)
750	Murtha and Crack (1966)	Stockyard-(3e)-90%			1% (0-1.5%)
751	Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (1-2%)
752	Murtha and Crack (1966)	Stockyard-(3e)-90%			1% (0.5-1.5%)
753	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0.5-1%)
754	Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (0.5-1%)
755	Murtha and Crack (1966)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
756	Murtha and Crack (1966)	Wyoming-(2s)-90%			1% (0.5-2%)
757	Murtha and Crack (1966)	Glenoming-(2s)-60%	Magenta-(2s)-30%		1% (0.5-2%)
758	Murtha and Crack (1966)	Magenta-(2s)-90%			0.5% (0-2%)
759	Murtha and Crack (1966)	Glenoming-(2s)-90%			0.5% (0.5-1%)
760	Murtha and Crack (1966)	Double Barrel-(2s)-90%			1% (0.5-2.5%)
761	Murtha and Crack (1966)	Glenoming-(2s)-90%			1% (1-1.5%)
762	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1%)
763	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1.5%)
764	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1.5%)
765	Murtha and Crack (1966)	Lansdown-(3g)-90%			1% (1-1.5%)
766	Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (1-1.5%)
767	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
768	Murtha and Crack (1966)	Lansdown-(3g)-90%			1% (0.5-1.5%)
769	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (0-2.5%)
770	Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (0-2.5%)
771	Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		0.5% (0-1%)
772	Murtha and Crack (1966)	Woodridge-(1h)-90%			0.5% (0-1%)
773	Murtha and Crack (1966)	Sandalwood-(3g)-90%			0% (0-0.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
774 Murtha and Crack (1966)	Sandalwood-(3g)-90%			0.5% (0-1.5%)
775 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	0% (0-0%)
776 Murtha and Crack (1966)	Lansdown-(3g)-90%			0.5% (0-1%)
777 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (1-1%)
778 Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
779 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (0.5-1%)
780 Murtha and Crack (1966)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	1% (1-1%)
781 Murtha and Crack (1966)	Woodridge-(1h)-90%			3% (1-6%)
782 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	0% (0-0%)
783 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (0.5-1%)
784 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0-3%)
785 Murtha and Crack (1966)	Lansdown-(3g)-90%			5% (1-28%)
786 Murtha and Crack (1966)	Sandalwood-(3g)-90%			2.5% (2.5-2.5%)
787 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1%)
788 Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (0.5-1.5%)
789 Murtha and Crack (1966)	Sandalwood-(3g)-70%	Gilligan-(3g)-10%	Calman-(1)-10%	1% (0.5-1.5%)
790 Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
791 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		3% (2.5-3.5%)
792 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1.5% (0.5-5%)
793 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1.5% (0.5-2%)
794 Murtha and Crack (1966)	Woodridge-(1h)-90%			3% (1-5.5%)
795 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1.5% (1.5-1.5%)
796 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (1.5-1.5%)
797 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (1-1%)
798 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1-1.5%)
799 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1.5-1.5%)
800 Murtha and Crack (1966)	Stockyard-(3e)-90%			2.5% (2-3%)
801 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (0.5-3%)
802 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1-2%)
803 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (1-1%)
804 Murtha and Crack (1966)	Sandalwood-(3g)-90%			0.5% (0.5-1%)
805 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1.5% (1.5-1.5%)
806 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1.5-1.5%)
807 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (0.5-2.5%)
808 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (1-1%)
809 Murtha and Crack (1966)	Manton-(3g)-90%			1.5% (1.5-1.5%)
810 Murtha and Crack (1966)	Wyoming-(2s)-90%			1.5% (1-1.5%)
811 Murtha and Crack (1966)	Magenta-(2s)-90%			1.5% (1.5-1.5%)
812 Murtha and Crack (1966)	Calman-(1)-90%			1% (1-1%)
813 Murtha and Crack (1966)	Calman-(1)-90%			1% (1-1%)
814 Murtha and Crack (1966)	Sandalwood-(3g)-90%			0.5% (0.5-1%)
815 Murtha and Crack (1966)	Ewan-(2s)-40%	Dalrymple-(2s)-30%	Conolly-(2s)-10%	2% (1.5-3%)
816 Murtha and Crack (1966)	Calman-(1)-90%			1% (1-1%)
817 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (1-1%)
818 Murtha and Crack (1966)	Stockyard-(3e)-90%			0.5% (0.5-0.5%)
819 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (1.5-1.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
820 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (1-1%)
821 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (1-1%)
822 Murtha and Crack (1966)	Double Barrel-(2s)-90%			1% (1-1%)
823 Murtha and Crack (1966)	Double Barrel-(2s)-90%			0% (0-0%)
824 Murtha and Crack (1966)	Manton-(3g)-90%			1% (1-1%)
825 Murtha and Crack (1966)	Lansdown-(3g)-90%			1.5% (0.5-2%)
826 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (1-1.5%)
827 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1%)
828 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (1-1%)
829 Murtha and Crack (1966)	Double Barrel-(2s)-90%			1% (1-1.5%)
830 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	1% (1-1.5%)
831 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		1% (0.5-1%)
832 Murtha and Crack (1966)	Double Barrel-(2s)-90%			1.5% (1-2%)
833 Murtha and Crack (1966)	Double Barrel-(2s)-90%			1% (1-1%)
834 Murtha and Crack (1966)	Stockyard-(3e)-90%			1% (1-1%)
835 Murtha and Crack (1966)	Woodridge-(1h)-90%			1% (1-1%)
836 Murtha and Crack (1966)	Manton-(3g)-90%			1.5% (1.5-1.5%)
837 Murtha and Crack (1966)	Manton-(3g)-50%	Gilligan-(3g)-40%		0% (0-0%)
838 Murtha and Crack (1966)	Wyoming-(2s)-90%			1.5% (1-1.5%)
839 Murtha and Crack (1966)	Lansdown-(3g)-60%	Manton-(3g)-10%	Stockyard-(3e)-10%	0.5% (0.5-0.5%)
840 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1% (1-1%)
841 Murtha and Crack (1966)	Stockyard-(3e)-90%			1% (0.5-1.5%)
842 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1.5-2%)
843 Murtha and Crack (1966)	Manton-(3g)-90%			1% (1-1.5%)
844 Murtha and Crack (1966)	Double Barrel-(2s)-90%			23.5% (2.5-50.5%)
845 Murtha and Crack (1966)	Sandalwood-(3g)-90%			1.5% (1-2.5%)
846 Murtha and Crack (1966)	Woodridge-(1h)-90%			1.5% (1.5-1.5%)
847 Murtha and Crack (1966)	Magenta-(2s)-90%			1.5% (1.5-1.5%)
848 Murtha and Crack (1966)	Sandalwood-(3g)-90%			0% (0-0%)
849 Rogers & Musameci (1977)	Scrubby-(1)-70%	Elliot-(2s)-Minor	Purono-(3g)-Minor	0.5% (0-1%)
850 Rogers & Musameci (1977)	Stuart-(2s)-50%	Conolly-(2s)-30%	Dalrymple-(2s)-0%	5.5% (0.5-28%)
851 Rogers & Musameci (1977)	Clement-red subsoil-(2s)-70%	Black-(1)-Minor	Dalrymple-(2s)-Minor	2% (0-12%)
852 Rogers & Musameci (1977)	Serpentine-(1)-40%	Sachs-(3g)-40%	Purono-(3g)-0%	0.5% (0-1%)
853 Rogers & Musameci (1977)	Dalrymple-(2s)-90%	Walker-(3g)-Minor		6.5% (0-35%)
854 Rogers & Musameci (1977)	Elliot-(2s)-50%	Scrubby-(1)-40%		4.5% (1-21.5%)
855 Rogers & Musameci (1977)	Scrubby-(1)-80%	Stockyard-(3e)-Minor		1.5% (0-39.5%)
856 Rogers & Musameci (1977)	Purono-(3g)-80%	Sachs-(3g)-Minor		25% (0-55.5%)
857 Rogers & Musameci (1977)	Purono-(3g)-80%	Moosie-(3g)-Minor		3% (0-19.5%)
858 Rogers & Musameci (1977)	Stuart-(2s)-50%	Conolly-(2s)-30%	Dalrymple-(2s)-0%	5% (0-37%)
859 Rogers & Musameci (1977)	Purono-(3g)-80%	Moosie-(3g)-Minor		0.5% (0-0.5%)
860 Rogers & Musameci (1977)	Sachs-alkaline subsoil-(1)-80%	Purono-(3g)-Minor	Moosie-(3g)-Minor	0.5% (0.5-0.5%)
861 Rogers & Musameci (1977)	Serpentine-(1)-90%	Sachs-(3g)-Minor		1% (0.5-1%)
862 Rogers & Musameci (1977)	Black-(1)-60%	Goodbye-(3g)-20%	Magenta-(2s)-10%	0.5% (0.5-0.5%)
863 Rogers & Musameci (1977)	Black-(1)-80%	Elliot-(2s)-Minor	Ross-(1)-Minor	6% (0-20.5%)
864 Rogers & Musameci (1977)	Scrubby-(1)-70%	Elliot-(2s)-Minor	Walker-(3g)-Minor	0.5% (0-0.5%)
865 Rogers & Musameci (1977)	Purono-(3g)-80%	Moosie-(3g)-Minor		2.5% (0-16.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
866 Rogers & Musameci (1977)	Sachs-alkaline subsoil-(1)-80%	Purono-(3g)-Minor	Moosie-(3g)-Minor	0.5% (0-1%)
867 Rogers & Musameci (1977)	Black-(1)-70%	Walker-(3g)-Minor	Magenta-(2s)-Minor	0.5% (0-0.5%)
868 Rogers & Musameci (1977)	Elliot-(2s)-80%	Clemant-(2s)-Minor		0.5% (0.5-1%)
869 Rogers & Musameci (1977)	Black-(1)-80%	Ross-(1)-Minor		0.5% (0-0.5%)
870 Rogers & Musameci (1977)	Julago-(1)-70%	Gilligan-(3g)-Minor	Purono-(3g)-Minor	0.5% (0-3.5%)
871 Rogers & Musameci (1977)	Sachs-alkaline subsoil-(1)-80%	Purono-(3g)-Minor	Moosie-(3g)-Minor	0.5% (0-0.5%)
872 Rogers & Musameci (1977)	Julago-(1)-70%	Gilligan-(3g)-Minor	Purono-(3g)-Minor	1.5% (0.5-6%)
873 Rogers & Musameci (1977)	Elliot-(2s)-90%	Scrubby-(1)-Minor		10% (2-35%)
874 Rogers & Musameci (1977)	Purono-(3g)-70%	Stockyard-(3e)-Minor	Moosie-(3g)-Minor	0.5% (0-1%)
875 Rogers & Musameci (1977)	Julago-(1)-90%			2.5% (0-7%)
876 Rogers & Musameci (1977)	Black-(1)-70%	Ross-(1)-Minor	Goodbye-(3g)-Minor	1.5% (1-3%)
877 Rogers & Musameci (1977)	Walker-grey subsoil-(3g)-60%	Clemant-(2s)-20%	Artillery-(3g)-0%	2.5% (0-15.5%)
878 Rogers & Musameci (1977)	Walker-(3g)-70%	Julago-(1)-Minor	Stuart-(2s)-Minor	6% (1.5-15.5%)
879 Rogers & Musameci (1977)	Serpentine-(1)-60%	Althaus-(3g)-20%	Purono-(3g)-10%	1.5% (0-23%)
880 Rogers & Musameci (1977)	Julago-(1)-80%	Walker-(3g)-Minor	Elliot-(2s)-Minor	37% (0-110.5%)
881 Rogers & Musameci (1977)	Pennsfield-(3g)-60%	Julago-(1)-Minor	Althaus-(3g)-Minor	1% (0.5-2%)
882 Rogers & Musameci (1977)	Stockyard-(3e)-50%	Clemant-(2s)-30%	Scrubby-(1)-10%	3% (0-37.5%)
883 Rogers & Musameci (1977)	Scrubby-(1)-60%	Clemant-red subsoil -(2s)-Minor	Althaus-(3g)-Minor	6% (0-54.5%)
884 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Clemant-(2s)-Minor		0.5% (0-1%)
885 Rogers & Musameci (1977)	Pall Mal-(3g)-90%			5% (0.5-25.5%)
886 Rogers & Musameci (1977)	Elliot-(2s)-90%	Scrubby-(1)-Minor		0.5% (0.5-0.5%)
887 Rogers & Musameci (1977)	Clemant-(2s)-80%	Clemant-red subsoil-(2s)-Minor		0.5% (0.5-0.5%)
888 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Purono-(3g)-Minor		0.5% (0-2%)
889 Rogers & Musameci (1977)	Artillery-(3g)-80%	Elliot-(2s)-Minor		1% (0-13.5%)
890 Rogers & Musameci (1977)	Pennsfield-(3g)-60%	Julago-(1)-Minor	Althaus-(3g)-Minor	0.5% (0-1%)
891 Rogers & Musameci (1977)	Clemant-(2s)-80%	Pall Mal-(3g)-Minor	Elliot-(2s)-Minor	1% (0.5-1.5%)
892 Rogers & Musameci (1977)	Julago-(1)-50%	Stockyard-(3e)-30%	Gilligan-(3g)-0%	0.5% (0.5-0.5%)
893 Rogers & Musameci (1977)	Magenta-(2s)-60%	Ross-(1)-30%		32% (0-88%)
894 Rogers & Musameci (1977)	Artillery-(3g)-60%	Walker-(3g)-20%	Stockyard-(3e)-10%	2% (0.5-13.5%)
895 Rogers & Musameci (1977)	Stockyard-(3e)-70%	Stockyard-(3e)-Minor	Sachs-(3g)-Minor	0.5% (0-1.5%)
896 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Purono-(3g)-Minor		0.5% (0.5-0.5%)
897 Rogers & Musameci (1977)	Serpentine-(1)-60%	Althaus-(3g)-20%	Purono-(3g)-10%	0.5% (0-0.5%)
898 Rogers & Musameci (1977)	Purono-(3g)-70%	Julago-(1)-Minor	Moosie-(3g)-Minor	0.5% (0-11.5%)
899 Rogers & Musameci (1977)	Sachs-brown subsoil-(1)-90%	Stockyard-(3e)-Minor		6% (1-10.5%)
900 Rogers & Musameci (1977)	Pennsfield-(3g)-60%	Julago-(1)-Minor	Althaus-(3g)-Minor	1% (0.5-1%)
901 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Purono-(3g)-Minor		0.5% (0-1%)
902 Rogers & Musameci (1977)	Purono-(3g)-70%	Julago-(1)-Minor	Moosie-(3g)-Minor	0.5% (0.5-0.5%)
903 Rogers & Musameci (1977)	Goodbye-(3g)-70%	Walker-(3g)-Minor	Althaus-(3g)-Minor	0% (0-0.5%)
904 Rogers & Musameci (1977)	Black-red subsoils-(1)-70%	Black-(1)-20%	Scrubby-(1)-0%	2% (1-5%)
905 Rogers & Musameci (1977)	Elliot-(2s)-70%	Stockyard-(3e)-Minor	Artillery-(3g)-Minor	2.5% (0-15.5%)
906 Rogers & Musameci (1977)	Elliot-(2s)-80%	Stockyard-(3e)-Minor		5.5% (0-23.5%)
907 Rogers & Musameci (1977)	Artillery-(3g)-40%	Conolly-(2s)-30%		8.5% (0-40%)
908 Rogers & Musameci (1977)	Artillery-(3g)-70%	Elliot-(2s)-20%		40.5% (0-106.5%)
909 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Artillery-bleached A2-(3g)-Minor		0.5% (0.5-0.5%)
910 Rogers & Musameci (1977)	Stockyard-(3e)-70%	Goodbye-(3g)-Minor		0% (0-0.5%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source		Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
911	Rogers & Musameci (1977)	Moosie-(3g)-50%	Goodbye-(3g)-30%	Gilligan-(3g)-10%	0.5% (0-1.5%)
912	Rogers & Musameci (1977)	Stockyard-(3e)-80%	Magenta-(2s)-Minor		2.5% (0-17%)
913	Rogers & Musameci (1977)	Purono-(3g)-40%	Stockyard-(3e)-20%	Goodbye-(3g)-10%	0.5% (0-1%)
914	Rogers & Musameci (1977)	Stuart-(2s)-70%	Artillery-(3g)-Minor	Clemant-(2s)-Minor	7.5% (4.5-14.5%)
915	Rogers & Musameci (1977)	Ewan-(2s)-40%	Dalrymple-(2s)-30%	Stanley-(2s)-0%	5% (0-37%)
916	Rogers & Musameci (1977)	Moosie-(3g)-50%	Goodbye-(3g)-30%	Gilligan-(3g)-10%	0% (0-0.5%)
917	Rogers & Musameci (1977)	Scrubby-(1)-70%	Althaus-(3g)-Minor	Gilligan-(3g)-Minor	1.5% (1-2%)
918	Rogers & Musameci (1977)	Purono-(3g)-70%	Goodbye-(3g)-Minor	Stockyard-(3e)-Minor	0.5% (0.5-1%)
919	Rogers & Musameci (1977)	Elliot-(2s)-80%	Stockyard-(3e)-Minor		0.5% (0-1.5%)
920	Rogers & Musameci (1977)	Scrubby-(1)-50%	Miscellaneous flooded -(NA)-(30%)	Walker-(3g)-0%	0.5% (0-0.5%)
921	Rogers & Musameci (1977)	Stockyard-(3e)-70%	Goodbye-(3g)-Minor		0% (0-0%)
922	Rogers & Musameci (1977)	Stockyard-(3e)-70%	Goodbye-(3g)-Minor	Purono-(3g)-Minor	0% (0-0.5%)
923	Rogers & Musameci (1977)	Artillery-(3g)-70%	Stuart-(2s)-Minor	Clemant-(2s)-Minor	9% (4-16%)
924	Rogers & Musameci (1977)	Althaus-(3g)-80%	Magenta-(2s)-Minor		27% (1-63.5%)
925	Rogers & Musameci (1977)	Elliot-(2s)-70%	Clemant-red subsoil -(2s)-Minor	Purono-(3g)-Minor	0.5% (0.5-0.5%)
926	Rogers & Musameci (1977)	Gilligan-(3g)-70%	Sachs-(3g)-Minor	Purono-(3g)-Minor	0% (0-0.5%)
927	Rogers & Musameci (1977)	Miscellaneous flooded-(NA) -			17.5% (0-41%)
928	Rogers & Musameci (1977)	Pall Mal-(3g)-70%	Purono-(3g)-Minor	Elliot-(2s)-Minor	0% (0-0%)
929	Rogers & Musameci (1977)	Scrubby-(1)-70%	Althaus-(3g)-Minor	Gilligan-(3g)-Minor	1% (0.5-1%)
930	Rogers & Musameci (1977)	Ewan-(2s)-90%			20% (0-90%)
931	Rogers & Musameci (1977)	Stockyard-(3e)-70%	Goodbye-(3g)-Minor		0.5% (0-0.5%)
932	Rogers & Musameci (1977)	Artillery-(3g)-70%	Stuart-(2s)-Minor	Clemant-(2s)-Minor	8% (2.5-13%)
933	Rogers & Musameci (1977)	Artillery-(3g)-80%	Althaus-(3g)-Minor		0.5% (0-1%)
934	Rogers & Musameci (1977)	Stockyard-(3e)-80%	Purono-(3g)-Minor		0.5% (0.5-0.5%)
935	Rogers & Musameci (1977)	Gilligan-(3g)-70%	Purono-(3g)-Minor	Sachs-(3g)-Minor	0.5% (0-1%)
936	Rogers & Musameci (1977)	Sachs-(3g)-70%	Purono-(3g)-20%		0.5% (0-0.5%)
937	Rogers & Musameci (1977)	Black-red subsoils-(1)-70%	Black-(1)-20%	Scrubby-(1)-0%	1% (0.5-1.5%)
938	Rogers & Musameci (1977)	Purono-(3g)-70%	Goodbye-(3g)-Minor	Walker-(3g)-Minor	7% (0-39%)
939	Rogers & Musameci (1977)	Black-(1)-70%	Goodbye-(3g)-Minor	Magenta-(2s)-Minor	0.5% (0.5-1%)
940	Rogers & Musameci (1977)	Limeview-(2s)-60%	Stanley-(2s)-Minor	Elliot-(2s)-Minor	0.5% (0-0.5%)
941	Rogers & Musameci (1977)	Black-red phase-(1)-20%	Pennsfield-(3g)-Minor		0.5% (0.5-0.5%)
942	Rogers & Musameci (1977)	Artillery-(3g)-70%	Stuart-(2s)-Minor	Clemant-(2s)-Minor	0.5% (0.5-0.5%)
943	Rogers & Musameci (1977)	Black-(1)-70%	Stockyard-(3e)-Minor		0.5% (0.5-0.5%)
944	Rogers & Musameci (1977)	Stockyard-(3e)-90%			0.5% (0-16%)
945	Rogers & Musameci (1977)	Althaus-(3g)-80%	Dalrymple-(2s)-Minor		23.5% (3-45.5%)
946	Rogers & Musameci (1977)	Purono-(3g)-50%	Gilligan-(3g)-40%		0% (0-0%)
947	Rogers & Musameci (1977)	Pall Mal-(3g)-80%	Purono-(3g)-Minor		0.5% (0-0.5%)
948	Rogers & Musameci (1977)	Scrubby-(1)-50%	Stockyard-(3e)-30%	Pennsfield-(3g)-0%	1% (0.5-2.5%)
949	Rogers & Musameci (1977)	Black-(1)-70%	Goodbye-(3g)-Minor	Magenta-(2s)-Minor	1% (0-1.5%)
950	Rogers & Musameci (1977)	Moosie-(3g)-60%	Althaus-(3g)-20%	Goodbye-(3g)-0%	1% (0.5-1.5%)
951	Rogers & Musameci (1977)	Limeview-(2s)-70%	Flagstone-(2s)-20%		3.5% (2.5-3.5%)
952	Rogers & Musameci (1977)	Limeview-(2s)-80%	Stanley-(2s)-Minor		1% (0-2.5%)
953	Rogers & Musameci (1977)	Black-(1)-70%	Goodbye-(3g)-Minor	Magenta-(2s)-Minor	0.5% (0-0.5%)
954	Rogers & Musameci (1977)	Gilligan-(3g)-70%	Sachs-(3g)-Minor	Purono-(3g)-Minor	0.5% (0.5-1%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
955 Rogers & Musameci (1977)	Sachs-(3g)-70%	Gilligan-(3g)-Minor	Purono-(3g)-Minor	0.5% (0-1%)
956 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Black-(1)-Minor		0.5% (0-0.5%)
957 Rogers & Musameci (1977)	Rangeview-(3g)-40%	Thorpe-(2s)-20%	Pinnacle-(2s)-10%	6.5% (0-45%)
958 Rogers & Musameci (1977)	Moosie-(3g)-60%	Althaus-(3g)-20%	Goodbye-(3g)-0%	2% (0.5-5%)
959 Rogers & Musameci (1977)	Artillery-(3g)-70%	Stuart-(2s)-Minor	Clemant-(2s)-Minor	11% (0-21.5%)
960 Rogers & Musameci (1977)	Purono-(3g)-70%	Julago-(1)-Minor	Gilligan-(3g)-Minor	24% (3-93%)
961 Rogers & Musameci (1977)	Conolly-(2s)-80%	Dalrymple-(2s)-Minor		7% (0-57.5%)
962 Rogers & Musameci (1977)	Pinnacle-(2s)-80%	Hillview-(2s)-Minor		30% (0-84%)
963 Rogers & Musameci (1977)	Stanley-(2s)-60%	Limeview-(2s)-Minor	Clemant-(2s)-Minor	1% (0-10.5%)
964 Rogers & Musameci (1977)	Limeview-(2s)-60%	Dalrymple-(2s)-30%		5% (0-15.5%)
965 Rogers & Musameci (1977)	Clemant-(2s)-60%	Scrubby-(1)-Minor	Elliot-(2s)-Minor	4% (0-27.5%)
966 Rogers & Musameci (1977)	Sachs-(3g)-80%	Gilligan-(3g)-Minor	Purono-(3g)-Minor	0% (0-0.5%)
967 Rogers & Musameci (1977)	Stockyard-(3e)-70%	Elliot-(2s)-Minor		2% (0-11.5%)
968 Rogers & Musameci (1977)	Moosie-(3g)-60%	Althaus-(3g)-20%	Goodbye-(3g)-0%	0% (0-0.5%)
969 Rogers & Musameci (1977)	Conolly-(2s)-50%	Dalrymple-(2s)-30%		30.5% (0.5-69.5%)
970 Rogers & Musameci (1977)	Ewan-(2s)-70%	Scrubby-(1)-Minor	Clemant-(2s)-Minor	4% (1.5-15%)
971 Rogers & Musameci (1977)	Clemant-(2s)-80%	Elliot-(2s)-Minor		2% (1.5-2.5%)
972 Rogers & Musameci (1977)	Miscellaneous flooded-(NA)-			0% (0-0.5%)
973 Rogers & Musameci (1977)	Limeview-(2s)-80%	Stanley-(2s)-Minor		30% (9.5-48.5%)
974 Rogers & Musameci (1977)	Clemant-(2s)-80%	Scrubby-(1)-Minor		2% (0-3.5%)
975 Rogers & Musameci (1977)	Gilligan-(3g)-70%	Sachs-(3g)-Minor	Purono-(3g)-Minor	0.5% (0-1%)
976 Rogers & Musameci (1977)	Limeview-(2s)-90%			19% (0-72.5%)
977 Rogers & Musameci (1977)	Sachs-(3g)-80%	Purono-(3g)-Minor		0.5% (0-1%)
978 Rogers & Musameci (1977)	Flagstone-(2s)-70%	Elliot-(2s)-Minor		2.5% (1.5-3%)
979 Rogers & Musameci (1977)	Julago-(1)-90%	Gilligan-(3g)-Minor		0.5% (0.5-0.5%)
980 Rogers & Musameci (1977)	Black-(1)-80%	Scrubby-(1)-Minor		1% (0-2.5%)
981 Rogers & Musameci (1977)	Scrubby-(1)-90%			0.5% (0.5-0.5%)
982 Rogers & Musameci (1977)	Clemant-(2s)-70%	Scrubby-(1)-Minor	Stanley-(2s)-Minor	0.5% (0-9.5%)
983 Rogers & Musameci (1977)	Moosie-(3g)-60%	Scrubby-(1)-Minor	Julago-(1)-Minor	2% (0-6.5%)
984 Rogers & Musameci (1977)	Limeview-(2s)-60%	Stanley-(2s)-30%	Black-(1)-0%	12.5% (0-19.5%)
985 Rogers & Musameci (1977)	Stanley-(2s)-50%	Limeview-(2s)-20%	Elliot-(2s)-0%	0% (0-0.5%)
986 Rogers & Musameci (1977)	Scrubby-(1)-60%	Clemant-(2s)-30%		4.5% (0.5-23.5%)
987 Rogers & Musameci (1977)	Conolly-(2s)-80%	Dalrymple-(2s)-Minor	Hillview-(2s)-Minor	0.5% (0-1.5%)
988 Rogers & Musameci (1977)	Gilligan-(3g)-70%	Purono-(3g)-Minor	Sachs-(3g)-Minor	0% (0-1%)
989 Rogers & Musameci (1977)	Limeview-(2s)-80%	Stanley-(2s)-Minor		18.5% (0-58%)
990 Rogers & Musameci (1977)	Althaus-(3g)-70%	Stanley-(2s)-Minor	Limeview-(2s)-Minor	2% (0-8%)
991 Rogers & Musameci (1977)	Gilligan-(3g)-50%	Purono-(3g)-30%	Sachs-(3g)-10%	0% (0-0%)
992 Rogers & Musameci (1977)	Scrubby-(1)-70%	Clemant-(2s)-Minor		1.5% (0-13%)
993 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Julago-struct. surf.-(1)-Minor		0.5% (0-0.5%)
994 Rogers & Musameci (1977)	Limeview-(2s)-80%	Artillery-(3g)-Minor	Conolly-(2s)-Minor	5.5% (0-21.5%)
995 Rogers & Musameci (1977)	Stockyard-(3e)-40%	Purono-(3g)-30%	Goodbye-(3g)-20%	1% (0-6.5%)
996 Rogers & Musameci (1977)	Limeview-(2s)-80%	Stanley-(2s)-Minor		2% (2-2%)
997 Rogers & Musameci (1977)	Elliot-(2s)-80%	Artillery-(3g)-Minor		16.5% (3.5-31.5%)
998 Rogers & Musameci (1977)	Miscellaneous disturbed-(NA)-			10.5% (0-62%)
999 Rogers & Musameci (1977)	Limeview-(2s)-40%	Stanley-(2s)-10%	Carse O'Gowrie-(2s)-10%	2.5% (0-3.5%)
1000 Rogers & Musameci (1977)	Stanley-(2s)-80%	Limeview-(2s)-Minor		32% (4-69%)

Erosion Susceptibility Class for Soil Series described in each Unique Mapping Area from various soils studies in the Townsville City Area

UMA No and Soils Data Source	Soil Series Present (Indication Only)* Soil Series - (Erosion Susceptibility Class**) - Percent UMA Covered by Soil Series			Expected Slope Range* Average (Min-Max)
1001 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Althaus-(3g)-Minor		17% (1-36.5%)
1002 Rogers & Musameci (1977)	Bullock-(1)-80%	Bullock-(1)-Minor		2.5% (1-3%)
1003 Rogers & Musameci (1977)	Clemant-(2s)-70%	Elliot-(2s)-Minor	Pall Mal-(3g)-Minor	25% (3.5-56%)
1004 Rogers & Musameci (1977)	Limeview-(2s)-20%			27.5% (0-82%)
1005 Rogers & Musameci (1977)	Limeview-(2s)-40%			6.5% (0-53.5%)
1006 Rogers & Musameci (1977)	Stockyard-(3e)-80%	Pennsfield-(3g)-Minor	Gilligan-(3g)-Minor	0.5% (0-2%)
1007 Rogers & Musameci (1977)	Ross-(1)-60%	Stockyard-(3e)-Minor	Elliot-(2s)-Minor	1.5% (0.5-7%)
1008 Rogers & Musameci (1977)	Clemant-(2s)-70%	Elliot-(2s)-Minor		1.5% (0-7.5%)
1009 Rogers & Musameci (1977)	Limeview-(2s)-20%			6.5% (0-44.5%)
1010 Rogers & Musameci (1977)	Limeview-(2s)-50%	Stanley-(2s)-30%	Althaus-(3g)-0%	27% (3-41%)
1011 Rogers & Musameci (1977)	Althaus-(3g)-90%	Stanley-(2s)-Minor		2% (0-12.5%)
1012 Rogers & Musameci (1977)	Gilligan-(3g)-70%	Purono-(3g)-30%		0.5% (0.5-0.5%)
1013 Rogers & Musameci (1977)	Gilligan-(3g)-70%	Sachs-(3g)-Minor	Goodbye-(3g)-Minor	0.5% (0-9%)
1014 Rogers & Musameci (1977)	Goodbye-(3g)-70%	Gilligan-(3g)-Minor	Purono-(3g)-Minor	0.5% (0-2%)
1015 Rogers & Musameci (1977)	Clemant-(2s)-60%	Elliot-(2s)-30%		1% (0.5-1%)
1016 Rogers & Musameci (1977)	Artillery-(3g)-40%	Ewan-(2s)-40%	Pinnacle-(2s)-0%	24.5% (0-65.5%)
1017 Rogers & Musameci (1977)	Artillery-(3g)-70%	Conolly-(2s)-20%		2% (0-19.5%)
1018 Rogers & Musameci (1977)	Limeview-(2s)-60%	Stanley-(2s)-30%		31% (0-80.5%)
1019 Rogers & Musameci (1977)	Scrubby-(1)-60%	Stockyard-(3e)-Minor	Artillery-(3g)-Minor	0% (0-0.5%)
1020 Rogers & Musameci (1977)	Julago-(1)-70%	Moosie-(3g)-Minor	Purono-(3g)-Minor	0.5% (0-1.5%)
1021 Rogers & Musameci (1977)	Pennsfield-(3g)-90%			0% (0-3.5%)
1022 Rogers & Musameci (1977)	Purono-(3g)-70%	Gilligan-(3g)-Minor	Goodbye-(3g)-Minor	5% (0-43%)
1023 Rogers & Musameci (1977)	Artillery-(3g)-40%	Flagstone-(2s)-40%	Pinnacle-(2s)-0%	8.5% (0-22.5%)
1024 Rogers & Musameci (1977)	Stockyard-(3e)-60%	Julago-(1)-Minor	Pennsfield-(3g)-Minor	2.5% (0-13.5%)
1025 Rogers & Musameci (1977)	Julago-(1)-50%	Althaus-(3g)-30%	Pennsfield-(3g)-0%	0.5% (0-6%)
1026 Rogers & Musameci (1977)	Stockyard-(3e)-70%	Julago-(1)-Minor		8.5% (1-21%)
1027 Rogers & Musameci (1977)	Bullock-(1)-10%			1.5% (0-3.5%)
1028 Rogers & Musameci (1977)	Artillery-(3g)-40%	Ewan-(2s)-40%	Pinnacle-(2s)-0%	2% (0.5-11.5%)
1029 Rogers & Musameci (1977)	Althaus-(3g)-50%	Artillery-(3g)-20%	Julago-(1)-10%	0.5% (0.5-0.5%)
1030 Rogers & Musameci (1977)	Purono-(3g)-60%	Stanley-(2s)-30%	Julago-(1)-0%	0.5% (0-1%)
1031 Rogers & Musameci (1977)	Stockyard-(3e)-70%	Althaus-(3g)-Minor	Pennsfield-(3g)-Minor	2% (0-4.5%)
1032 Rogers & Musameci (1977)	Pennsfield-(3g)-60%	Julago-(1)-Minor	Althaus-(3g)-Minor	5.5% (0-48%)
1033 Rogers & Musameci (1977)	Althaus-(3g)-90%	Elliot-(2s)-Minor		5% (2-11.5%)
1034 Rogers & Musameci (1977)	Julago-(1)-60%	Althaus-(3g)-Minor	Pennsfield-(3g)-Minor	31.5% (0-59.5%)
1035 Rogers & Musameci (1977)	Artillery-(3g)-90%			5.5% (0-17.5%)
1036 Rogers & Musameci (1977)	Elliot-heavy text. surf.-(2s)-70%	Artillery-(3g)-Minor	Althaus-(3g)-Minor	13.5% (5-21%)
1037 Rogers & Musameci (1977)	Althaus-(3g)-80%	Pennsfield-(3g)-Minor		2.5% (0-18.5%)
1038 Rogers & Musameci (1977)	Althaus-(3g)-50%	Pennsfield-(3g)-40%		1% (0.5-1.5%)
1039 Rogers & Musameci (1977)	Artillery-(3g)-90%			4.5% (1-11%)

Erosion Susceptibility Class for Soil Series described in Soils Mapping for the Townsville Coastal Plain

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Alice	As	Dark brown or reddish brown sandy loam A horizons overlying dark red fine blocky structured sandy clay loam to light clay B horizons.	1
Alick	Ak	Dark grey, weakly self-mulching heavy clay over a dark grey to grey brown heavy clay with a coarse blocky structure.	1
Althaus	Al	Strongly bleached loamy sand or sandy loam A horizons 25 - 60cm thick overlying mottled light brownish grey and yellowish brown heavy clay B horizons.	3g
Antill	At	Thin grey-brown loamy sand A1 over thick strongly bleached A2 horizon, abrupt change at 45 - 60cm to strongly cemented siliceous pan.	1
Argea	Ar	Coarse sands with pale A2 horizon overlying pale brown or yellowish subsoils.	1
Artillery	Ay	Massive reddish brown sands grading to structured reddish brown clay loams.	3g
Artillery - bleached A2	Aye1	Massive reddish brown sands grading to structured reddish brown clay loams - bleached A2 horizon variant.	3g
Barra	Ba	Dark grey-brown or reddish brown loam A horizons overlying dark red or yellowish red clay loam B horizons.	2s
Barringha	Bg	Dark grey-brown loam A1 and strongly bleached A2 horizon, clear change at 30 - 35cm to brown or dark yellowish brown medium or heavy clay B horizons.	1
Beefwood	Be	Light grey-brown sandy loam A1, very strongly bleached A2 horizon, abrupt change at 15 - 20cm to dark grey-brown or olive-brown sandy clay B horizons.	3g
Bently	By	Very dark grey-brown fine sandy loam A1 and bleached A2 horizon, clear change at 25 - 35cm to mottled brownish grey and yellowish brown medium to heavy clay B horizon.	1
Black	Bl	Dark grey-brown sandy loam A horizons overlying brown sandy clay loam to sandy clay B horizons which grade to coarse water-worn gravels from 1 - 1.5 m.	1
Black - red phase	Blr	Dark grey-brown sandy loam A horizons overlying brown sandy clay loam to sandy clay B horizons which grade to coarse water-worn gravels from 1 - 1.5m - red phase.	1
Black - red subsoils	Blr2	Dark grey-brown sandy loam A horizons overlying brown sandy clay loam to sandy clay B horizons which grade to coarse water-worn gravels from 1 - 1.5 m - red subsoil phase.	1
Bluewater	Bw	Brown or grey-brown sandy loam A horizons overlying red sandy clay loam earthy B horizons.	1
Bobawillie	Bo	Coarse sands with pale A2 horizon overlying yellowish brown subsoils. Water-worn gravels from 1.5 - 2 m.	1

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Bohle	Bh	Thin dark grey-brown sporadically bleached loam to clay loam A horizons overlying dark grey-brown heavy clay B horizons.	3g
Brolga	Br	Strongly gleyed grey cracking clay overlying mottled subsoils.	1
Bullock	Bu	Uniform dark clay with much calcareous material in subsoil.	1
Bullock	Bul1	Uniform dark clay with much calcareous material in subsoil - light textured phase.	1
Calman	Cm	Uniform dark heavy clays overlaying highly calcareous grey and yellowish grey heavy clay.	1
Carinya	Cn	Thin light grey-brown sandy loam A1, sporadically bleached A2 horizon, gradual change at 40 - 50cm to mottled pale brown, yellow, or yellowish brown sandy loam B horizon.	1
Carse O'Gowrie	Cr	Dark brown over yellowish brown sands.	2s
Central	Ce	Grey brown fine sandy loams grading to coarse gravels with little profile development.	2s
Clemant	Cl	Grey-brown loamy sand or sandy loam A horizons overlying reddish yellow sandy loam B horizons which grade to coarse gravels from 1 - 1.5 m.	2s
Clemant - heavy text.	Clh12	Grey-brown loamy sand or sandy loam A horizons overlying reddish yellow sandy loam B horizons which grade to coarse gravels from 1 - 1.5 m - heavy textured phase.	2s
Clemant - red subsoil	Clr2	Grey-brown loamy sand or sandy loam A horizons overlying reddish yellow sandy loam B horizons which grade to coarse gravels from 1 - 1.5 m - red phase.	2s
Conolly	Cy	Grey brown and yellowish brown sands on granite.	2s
Coonambelah	Co	Strongly bleached fine sandy loam or loam A horizons to 10cm thick overlying faintly mottled very dark greyish brown and olive heavy clay B horizons.	1
Cungulla	Cg	Deep coarse sands with dark brown or dark yellowish brown weakly coherent B horizons.	2w
Dalrymple	Dp	Sandy loam topsoils over red clay subsoils.	2s
Danishman	Da	Strongly bleached silty loam A horizons 15 - 25cm thick overlying dark yellowish brown coarse blocky structured heavy clay B horizons.	3g
Double Barrel	Db	Brown or grey-brown sandy loam A horizons overlying red-brown or brown sandy clay B horizons.	2s
Doughboy	Dy	Thin very dark or black sandy loam A1 horizon, abrupt change to very dark grey or black medium or heavy clay B horizons.	1
Elliot	El	Grey-brown loamy sand to sandy loam A horizons overlying reddish brown or yellowish red sand to sandy loam B horizons.	2s
Elliot - heavy text. surf.	Elh1	Grey-brown loamy sand to sandy loam A horizons overlying reddish brown or yellowish red sand to sandy loam B horizons - heavy textured phase.	2s

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Ettrick	Et	Very dark grey brown sandy loam to loam A horizon, with a clear change to a mottled yellowish brown, light grey, pale brown, and yellowish red medium to heavy clay B horizons.	3g
Ewan	Ew	Shallow massive brown sandy loams over metamorphic rock.	2s
Five Head	Fh	Grey-brown fine sandy loam A1 and strongly bleached A2 horizon, clear change at 30 - 55cm to mottled pale brown and yellowish brown medium clay B horizons.	3g
Flagstone	Fs	Strongly bleached loamy sand A horizons overlying mottled yellow-brown and yellowish red sandy clay loam B horizons.	2s
Frederick	Fr	Very strongly bleached loamy sand A horizons 40 - 60cm thick overlying cemented pan. Mottled massive sandy clays occur below the pan.	3g
Garbutt	Ga	Thin light grey-brown loamy A1, strongly bleached A2 horizon, abrupt change to yellowish-brown sandy clay B horizons.	3g
Gilligan	Gi	Strong fine self-mulching light to medium clay over an olive brown heavy clay.	3g
Glenoming	Gn	Grey-brown sandy loam A1 overlaying a moderately bleached A2 over a mottled yellow or red, structured medium clay B horizon.	2s
Goodbye	Gb	Dark greyish brown clay loam topsoils grading to dark clay subsoils.	3g
Granite	Gr	Strongly leached coarse sands with whole coloured or mottled yellowish red, yellow, or yellow-grey B horizons.	2s
Gulliver	Gv	Thin light grey-brown sandy loam A1, sporadically bleached A2 horizon, abrupt change at 15 - 20cm to dark grey or dark brownish grey coarse blocky heavy clay B horizons.	3g
Gumlow	Gu	Coarse leached sands overlying coarse gravel from 10 - 60cm depth.	2s
Halifax	Ha	Dark grey brown silt loam A horizon over a weakly developed brown silt loam B horizon.	1
Healy	He	Strongly bleached sandy loam A horizons, abrupt change at 20 - 40cm to mottled brownish grey and yellowish brown heavy clay b horizons.	3g
Hervey	Hy	Strongly bleached sandy loam A horizons 20 - 24cm thick overlying mottled yellowish brown and red coarse medium or heavy clay B horizons.	3g
Hillview	Hv	Grey-brown loamy sand to sandy loam A horizons overlying red or yellowish red sandy clay loam to sandy clay B horizons.	2s
Jalloonda	Ja	Deep coarse sands, weakly developed A2 horizon overlying pale brown or yellowish brown subsoils.	2wb
Julago	Ju	Very thin dark grey-brown loam to clay loam over a dark brown medium to heavy clay B horizons.	1
Julago - struct. surf.	Jup1	Very thin dark grey-brown loam to clay loam over a dark brown medium to heavy clay B horizons - structured phase.	1

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Julago - struct. surf.	Ju1	Very thin dark grey-brown loam to clay loam over a dark brown medium to heavy clay B horizons - structured phase.	1
Kulburn	Ku	Very strongly bleached, sandy loam to silty loam A horizons 15 - 25cm thick overlying mottled grey-brown and yellowish brown heavy clay B horizons.	3g
Lagoon	La	Deep strongly bleached fine sandy loam A horizons overlying light brownish grey medium clay B horizons.	3g
Langai	Lg	Grey-brown sandy loam A horizons overlying dark red sandy loam massive B horizons.	2s
Lansdown	Ls	Thin light grey-brown sandy loam A1, strongly bleached A2 horizon, abrupt change at 25 - 45cm to mottled brownish yellow or yellowish brown heavy clay B horizons.	3g
Limeview	Li	Dark brown sandy clay loams grading to red clay subsoils.	2s
Magenta	Ma	Grey brown loamy sands with rounded gravels at depth. Little profile development.	2s
Mangroves	Mg	Undescribed saline muds or sands.	1
Manton	Mt	Complex of solodic soils in the depressions and grey cracking clay soils on puffs.	3g
Miscellaneous disturbed	MD		NA
Miscellaneous flooded	MF		NA
Moosie	Ms	Loamy top soil grading to structured brown clayey subsoil.	3g
Morngi	Mo	Strongly bleached fine sandy loam A horizons 15 - 20cm thick overlying mottled light brownish grey and yellowish brown heavy clay B horizons.	3g
Mountainous area	M3	Varies, but mainly red duplex soils (Dr 2-22) similar to those of Stuart association.	3g
Mountainous area	M1	Shallow to deep uniform sands (Uc 1-21, Uc 4-21, Uc 4-22), coarse massive earths (Gn 2-14, Gn 2-24) and red duplex soils (Dr 2-21, Dr 2-61).	3g
Nightjar	Nj	Grey-brown sporadically bleached fine sandy loam A horizons 18 - 25cm thick overlying dark grey-brown or olive-grey heavy clay B horizons.	3g
Noholme	No	Dark grey-brown silty loam A1 horizon overlying mottled light brownish grey and yellowish brown medium clay B horizons.	3g
Ocke	Oc	Light grey-brown sandy loam A horizons overlying pale reddish brown sandy loam B horizons. Abrupt change at 50 - 60cm to coarse ironstone gravels.	2s
Oolgar	Oo	Leached, deep coarse sands with deep A2 horizons overlying pale brown subsoils.	2w
Pall Mal	Pm	Dark grey sandy loam A1, slightly paler A2 horizon, clear change to mottled yellowish brown on yellowish coarse blocky structured heavy clay B horizons.	3g
Pallerenda	Pl	Deep coarse sands, weakly developed A2 horizon overlying reddish brown or yellowish red subsoils.	2w

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Pattel	Pa	Strongly bleached fine sandy loam or silty loam A horizons 25 - 35cm thick overlying mottled light brownish grey and yellowish brown medium to heavy clay B horizons.	3g
Pennsfield	Pf	Sandy, loam topsoils over structured red medium clay.	3g
Pepperpot	Pp	Light grey-brown sandy loam A horizons overlying yellowish brown sand clay loam B horizons.	1
Pinnacle	Pi	Strongly bleached sandy loam A horizons overlying mottled light brownish yellow sandy clay loam B horizons.	2s
Purono	Pu	Strongly bleached silty loam or fine sandy loam A horizons, abrupt change at 12 - 20cm to olive grey coarse blocky heavy clay B horizons.	3g
Quinda	Qu	Strongly bleached loamy sand to sandy loam A horizons to 10cm thick overlying strong columnar structured grey-brown and yellowish brown heavy clay B horizons.	3g
Rangeview	Ra	Dark reddish brown loams over structured red to yellowish red clay.	3g
Ross	Ro	Grey-brown sandy loam A horizons overlying brown or yellowish brown sandy clay loam B horizons. Abrupt change at 40 - 70cm to pedal heavy clay D horizon.	1
Sachs	Sh	Very dark grey or black strong blocky structured heavy clay, gradual change at 60cm to brown or dark greyish brown heavy clay, carbonate nodules from 80cm.	3g
Sachs - alkaline subsoil	Sha3	Very dark grey or black strong blocky structured heavy clay, gradual change at 60cm to brown or dark greyish brown heavy clay, carbonate nodules from 80cm - alkaline lower subsoils.	1
Sachs - brown subsoil	Shb2	Very dark grey or black strong blocky structured heavy clay, gradual change at 60cm to brown or dark greyish brown heavy clay, carbonate nodules from 80cm - brown subsoils.	1
Salt Pans	Sp	Saline clays to saline duplex soils. Not described.	2w
Sandalwood	Sa	Very thin light brownish grey sandy loam A horizons overlying mottled dark greyish brown and yellowish brown heavy clay B horizons.	3g
Scrubby	Sc	Thin light grey-brown sandy loamy A1, bleached A2 horizon, abrupt to change to mottled greyish brown or dark grey sandy clay B horizons.	1
Serpentine	Se	Uniform and gradational black clays typically saturated for several months a year.	1
Stag	St	Dark grey-brown loamy sand A1 horizon and bleached A2 horizon overlying mottled yellow-brown and yellowish red sandy clay loam B horizons.	2s
Stanley	Sy	Grey-brown silty or sandy clay loam A1 over slightly paler A2 horizon, clear change at 12 - 20cm to yellowish brown sandy clay or medium clay B horizons.	2s
Stockyard	Sd	Light grey-brown sandy loam or loamy sand A1, strongly bleached A2 and pale yellow light sandy clay loam A3 horizon, abrupt change at 40 - 60cm to mottled light grey and yellowish brown sandy or gritty medium to heavy clay B horizons.	3e

Soil Series and Code Used		Characteristics*	Erosion Susceptibility Class
Stockyard - red subsoil	Sdr2	Light grey-brown sandy loam or loamy sand A1, strongly bleached A2 and pale yellow light sandy clay loam A3 horizon, abrupt change at 40 - 60cm to mottled light grey and yellowish brown sandy or gritty medium to heavy clay B horizons - red subsoil.	3e
Strongly Undulating Area	M2	Shallow to moderately deep soils, acid duplex soils (Dy 3-41) dominate but there is a wide range of other duplex and gradational textured soils.	3g
Stuart	Su	Very dark grey or grey-brown loam A1 over a weakly developed clay loam A2 horizons, clear change at 15-30cm to dark red medium to heavy clay B horizons.	2s
Tambouki	Tb	Grey-brown loamy sand to sandy loam A horizons becoming a dark red sandy loam to sandy clay at depth.	2s
Thorpe	Th	Dark grey sandy loam grading to brown clayey subsoils.	2s
Toolakea	Ta	Deep coarse sands, light brown or yellowish brown in colour.	2wb
Toonpan	To	Dark grey-brown loam A1 and sporadically bleached A2 horizon, clear change at 12 - 30cm to very dark grey or black blocky structured heavy clay B horizons.	1
Vantasell	Va	Dark grey self mulching heavy clay over a greyish brown or grey heavy clay.	1
Walker	Wk	Dark clay loam topsoils grading to brown clayey subsoils.	3g
Walker - grey subsoil	Wkf2	Dark clay loam topsoils grading to brown clayey subsoils - grey subsoils.	3g
Wallaroo	Wr	Light grey-brown loamy sand to sandy loam A horizon over an earthy yellowish brown sandy loam to light sandy clay B horizon.	1
Warbooga	Wa	Very dark grey-brown sandy loam A horizons to 12cm thick overlying dark red strong fine blocky structured medium clay B horizons.	2s
Water Body	W	No Information.	NA
Windsor	Wi	Brown or grey-brown sandy loam A horizons overlying brown or yellow brown sandy clay loam earthy B horizons.	1
Woodlands	Wl	Thin light grey-brown loamy sand A1, strongly bleached A2 horizon, abrupt change at 25 - 45cm to grey-brown or dark grey-brown weak coarse blocky sandy clay B horizons.	3g
Woodridge	Wo	Dark grey-brown loam A horizons overlying mottled yellow-brown and red clay loam to light clay B horizons. Abrupt change to pedal clay D horizons from about 80cm.	1h
Wyoming	Wy	Dark reddish brown sandy loam grading to red sandy clay loam - sandy clay.	2s
Yabulu	Ya	Very dark grey-brown sandy loam A1 horizon and slightly paler A2 horizon overlying dark red blocky structured light-medium clay B horizons.	1
Yileena	Yi	Grey-brown loam A horizons with slightly paler A2 overlying yellow-brown sandy clay loam subsoils.	1

APPENDIX D

EROSION RISK SELF-ASSESSMENT FORM

This self assessment form is designed to assist householders and builders to gain an appreciation of the erosion and sedimentation risk which may exist on their building site. It is anticipated that owners and builders will take note of the results of the assessment, consult the list of information sources provided, and implement 'reasonable and practical' erosion and sediment controls as required to comply with the *Environmental Protection Act 1994*.

Project Name:	
Site Address:	

Controlling Factors	Points	Score
Average slope of the whole site prior to building work.		
• Slope < 2%	0	
• 2% Slope < 5%	1	
• 5% ≤ Slope < 10%	2	
• 10% ≤ Slope < 15%	4	
• Slope ≥ 15%	5	
Soil Type[1].		
• Coastal sands	1	
• Sands, sandy loams and gravels on slopes above 5%	2	
• Sands and gravels on slopes less than 5%	3	
• Grey clays on the flood plains	3	
• Shallow soils on slopes	4	
• Grey clays on slopes above 5%	5	
Anticipated duration of site disturbance[2].		
• Duration < 2 weeks	0	
• 2 weeks ≤ duration < 3 months	2	
• 3 months ≤ duration < 6 months	4	
• Duration ≥ 6 months	5	

Controlling Factors	Points	Score
Anticipated time of year during which the site will be vulnerable to erosion[3]. • May, June, July, August, September, October (NB storms may still occur during this period) • April, November • December, January, February, March	0 2 5	
Off-site sediment control (*ie* downstream from the building site). • Score 1 point if there is no purpose-built, operational and well-maintained sediment 'trap' (*eg* sediment basin, gross pollutant trap or purpose-built wetland) to catch sediment before it enters a water body with environmental values (*eg* creek, natural wetland, river or bay)[4].	1	
Runoff entering the site. • Score 1 point if runoff entering the site is not or cannot be diverted away from the building area.	1	
Extent of site disturbance. • Score 2 points if building involves reshaping the ground surface (*eg* 'cut and fill' works)[5].	2	
	Total Score:	

Risk Rating Scores

1 Where there is more than 1 type of soil on the site, select the category with the *highest* point value.

2 The time from when the building site will first become vulnerable to erosion (ie when the surface is disturbed) to the time the soil will be fully stabilised (*eg* grassed).

3 If this time span covers more than one category, select only the category with the *highest* point value. Note that if there is no grass/vegetation cover on the site before building work has started (*eg* a bare slab), the time span starts from the time this form is completed.

4 If you are not sure score 1 point.

5 For the purpose of this form, 'cut and fill' works are those works that will result in a steep batter or retaining wall above and/or below the building slab greater than 1 metre in height. If the slab has already been fully cut and stabilised (*eg* grassed) during the subdivision stage, score 0 points.

Category	Sources of Information on Control Measures	Assessment
High Risk Site (Total Score: ≥ 10 points or scored a 5 for any factor). **Significant Erosion and Sediment Control measures will need to be implemented on-site**.	Guidelines: • *Erosion and Sediment Control on Residential Building Sites* (Townsville City Council). • *Erosion and Sediment Control on Building Sites Fact Sheets:* Building Operations Fact Sheet Drainage Control Fact Sheet Erosion Control Fact Sheet (Townsville City Council). • *Soil E&SC Engineering Guidelines for Queensland Construction Sites* (IEAust, 1996) or later version.	This site is a high risk site ☐
Low Risk Site (Total Score: < 10 points). Building under these conditions represents a low risk. However, 'reasonable and practicable' erosion and sediment controls (*eg* sediment fences, a stabilised entry/exit, turf filter strips) are still required to comply with *Environmental Protection Act 1994* (see supporting materials).	Pamphlet: • *Erosion and Sediment Control on Residential Building Sites.*	This site is a low risk site ☐

Note: Persons responsible for poor erosion and sediment control that leads to sediment leaving the site and contaminating stormwater or waterways are liable to a $240 on-the-spot fine under the *Environmental Protection (Water) Policy 1997*. One site may receive several of these fines if offences continue.

Name of Builder (if known):

Name:	**Ph:**
Company/Business:	

Person completing this form:

Name:	**Ph:**
Company/Business:	
Signature:	**Date:**

For more information contact Townsville City Council Planning & Development Services.

13. PUBLIC OPEN SPACE

13.1 DEVELOPMENT TO WHICH THIS SECTION APPLIES

This section of the policy sets out the basis for calculation of public open space which Council may request detail of, through applications for the reconfiguration of a lot for residential, commercial or industrial purposes, and to applications for material change of use for such purposes where subsequent reconfiguration of lots is a likely consequence. The provisions of this section are to be read in conjunction with Section 10 of this Policy and Policy 3, Section 3 where relevant.

Council may require either –

- the dedication of land for use as public open space;
- works be provided for the improvement of land for use as open space; or
- any combination of land, monetary contribution or works, provided that the total value of the combination does not exceed the equivalent value of either the land or money component assessed individually under this policy.

13.2 STANDARDS FOR LAND TO BE DEDICATED AS PUBLIC OPEN SPACE

Prior to considering any land for dedication as open space, Council must be satisfied that the proposed open space must be appropriate for its intended purpose. In determining the suitability of areas intended for public open space, regard will be given to the factors set out below, in addition to any overall concept plan and landscape vegetation management plan (refer City Plan Policy 1 – Supporting Information, Section 10).

(i) Compliance with the "Townsville-Thuringowa Strategy Plan" (TTSP).

Land dedications for open space which facilitate the achievement of the regions identified Recreation and Amenity Network (RAN) will be preferred and encouraged where applicable.

(ii) Site specific considerations

Land should be selected for public open space purposes having regard to –

- recreation opportunity (high priority will be given to those settings that have the potential to accommodate the broadest use and participation, ie. unstructured recreation, without excluding the interests of more specialist activities and settings);

- scenic, environmental or historical sensitivity (where culturally significant sites are potentially available, a high priority will be given to incorporating the recorded sites within the open space system);
- flexibility (Council will give priority to those areas that have a high potential for a multiple use function. For example, highly managed settings such as sports grounds which can be integrated with or adjacent to areas of natural vegetation or linear parks to fulfil a range of functions);
- value as a link or consolidation mechanism;
- access (including barriers to access); and
- safety (areas should be designed with regard to CPTED (Crime Prevention through Environmental Design) criteria including consideration of visual surveillance and uses on the edges of, or adjacent to, the site).

(iii) Land unsuitable for residential, commercial or industrial subdivision

Certain areas are unsuitable for further subdivision for residential, commercial or industrial purposes due to their physical characteristics or environmental and habitat value. Such areas may be incorporated within the open space system but for calculation purposes will not be accepted as part of the land required to be dedicated for public open space purposes pursuant to this policy. These areas may include –

- Foreshore areas, riparian corridors, waterways and wetlands identified under the Townsville City Urban Stormwater Quality Management Plan (1998).

(iv) Linear and Waterside open space

In all lot reconfigurations adjoining the City's rivers, creeks and foreshores, it is intended that that linear waterside open space be secured. These areas may be used to facilitate –

- the preservation of natural areas, vegetation and landscape features;
- the provision of wildlife corridors and habitat opportunities;
- the provision of opportunities for bicycle and pedestrian links;
- esplanade and waterfront access;
- the provision of buffers to preserve the residential amenity or define neighbourhoods; and
- protection of riparian zones.

While the land for linear waterside open space may be susceptible to occasional inundation, it should be stable and useable for recreation and pedestrian and cycle movement, within the broader functions of drainage, conservation and visual amenity.

Linear open space (whether to be developed or left undeveloped) should connect with other parks or reserves.

Wherever practical, the minimum extent of waterside open space shall be 15 metres in width along each side of the watercourse or from the water's edge, measured from –

- the centreline of the creek, or other smaller watercourse, as determined by survey;
- the banks of the watercourse where the watercourse is a river or other larger watercourse;
- the standing natural highwater mark of a wetland area; or
- the level of the Highest Astronomical Tide where along a sandy or estuarine part of the coastline; or the cliff edge where at a rocky coast.

To maximise access (both physical and visual) to the waterside open space, it is desirable that a minor collector road or higher adjoins at least one side of the open space.

(v) Freedom from encumbrances

In general terms, land provided for public open space should not be constrained by encumbrances from providing a potentially wide range of public recreation uses. Such encumbrances may relate to heritage, cultural, conservation or infrastructure, except where these can be incorporated to supplement or enhance the uses intended for the land.

(vi) Transitional areas

Public open space may include "transitional areas" where a lesser standard of development and long term maintenance will be acceptable. A transitional area will be considered to be an unirrigated area planted with drought tolerant grasses, trees or shrubs and may include revegetation areas where native vegetation is to be retained or re-established.

13.3 WORKS FOR PUBLIC OPEN SPACE

Prior to accepting land dedications for open space, Council may require certain works to be undertaken in open space areas to ensure that the land is useable for its intended purpose. Such works may include:

- earthworks or other works necessary to ensure each area is of dimensions and have a topography suitable for its intended use;
- selective clearing and turfing, with declared and environmental weeds removed, together with any rubbish and dangerous trees as determined by the Council, and such other works as may be reasonably necessary to protect each area from erosion and other environmental;
- provision of direct physical access to a constructed road appropriate to the relevant recreational setting; and
- any other works outlined in a development approval.

Council may, at its discretion, require other works for open space facilities including the development of recreational equipment.

Where works are undertaken, those works are to be –

- equal to or lesser in value than the amount which would ordinarily apply in the case of a monetary contribution; and
- constructed to the requirements of the Council's Planning and Development Services Department.

Where open space works or embellishments are provided voluntarily in addition to land, monetary or works contributions made pursuant to this section, such works are to be in accordance with an open space plan approved by Council.

13.4 LAND TENURE

As a condition of any development approval, land for open space will be required to be transferred to Council in freehold title. All costs of the transfer, including the valuation of the land, is to be at the developer's expense.

The time in which such land is to be dedicated will be nominated in the conditions of approval.

However, for staged subdivisions, land for open space to be dedicated in later stages may be required to be transferred to Council (to be held in trust) at the time Council endorses stage 1 of the plan of subdivision. The transfer shall include the provision of any access easements to the proposed open space. In general, the lands held in trust should be prepared in accordance with the minimum required works outlined above as the adjacent development stages proceed.

The desired outcome is to ensure that the required amount of public open space is being developed systematically and in accordance with the overall public open space contribution required for the entire development.

13.5 MAINTENANCE PERIOD

For the purpose of this section, **"maintenance period"** is defined as –

> *"The period of time between when Council accepts open space works on maintenance until handover to Council. This is to be a minimum of twelve (12) calendar months and must take in at least one (1) full wet season (December – March inclusive)."*

At the conclusion of the maintenance period, Council will conduct an inspection of the site and ask the developer to rectify any works that are not to Council's satisfaction. Such rectification works are to be completed and re-inspected prior to handover to Council.

14. INSPECTION AND TESTING PLANS

14.1 CIRCUMSTANCES IN WHICH INSPECTION AND TESTING PLANS MAY BE REQUESTED

Inspection and testing plans may be required in respect of projects involving assessable operational works of a 'major' nature, being works of significant value, co-ordination, controversy or complexity, have potential to affect public infrastructure, lands, uses, etc., where documented and certified project quality assurance assists with monitoring and demonstration of construction standards.

14.2 INFORMATION REQUIREMENTS

Inspection and testing plans are to be prepared and implemented by personnel with qualifications and experience in quality assurance processes, are competent in all aspects of the works, are conversant with all relevant Australian Standards, are capable of accurately interpreting engineering and/or landscaping drawings and specifications and identifying compliance of construction with such standards.

Quality assurance (QA) personnel should be:

Engineering works A Registered Professional Engineer of Queensland (RPEQ), or professional with extensive experience in the construction or supervision of civil works.

Landscaping works An Arborist with formal qualifications (Level 3 Australian Qualification Framework) or at least 5 years recognised experience in arboriculture.

Irrigation works A person with current Queensland Plumbers Registration or Queensland Building Services Association (QBSA) Irrigation Installers Registration, competent in all aspects of irrigation work, with at least 5 years demonstrated experience in the installation of commercial irrigation systems, conversant with all relevant Australian Standards.

Soil Erosion and Sediment Control A person who is accredited from a Townsville City Council 5 day course (Erosion and sediment control planning for North Queensland) or is a Certified Professional in Erosion and Sediment Control (CPESC) or equivalent.

The Inspection and Testing Plans are to show how the works are monitored and recorded for assurance of quality relative to the approved design and specifications. In particular, the inspection and testing plans should include –

- Method statement, demonstrating how the inspection and testing plan facilitates monitoring and recording of the works quality assurance.
- Qualifications, experience and contact details of the person who prepared the Inspection and Testing Plans
- Qualifications, experience and contact details of the person nominated as the Quality Assurance Officer for carrying out the inspection and testing plan
- Details concerning the items to be inspected and/or tested :
    - Description of activity
    - Description of key quality criteria to be inspected/tested
    - Methods of inspection and testing
    - Spatial and temporal frequency of inspection and testing
    - Reference of standard required to be achieved
    - Recording, reporting and notification requirements
- Sample inspection and testing logsheets to be used, clearly identifying:
    - activity being inspected/tested
    - precise physical location of items
    - standard to be achieved
    - actual standard observed
    - resultant action/recommendation.

Note

1. The results of the inspection and testing may form part of a future submission to demonstrate the quality assurance of the works (Refer to City Plan Policy 1, Section 15 – Compliance Monitoring) – from which efficient recording can be achieved by extending the Inspection and Test Plan to include a schedule documenting the actual Inspection Logsheets associated with each item.
2. Refer to the User Guide – City Plan Policy 1, Section 14, Inspection and Test Plans for examples.

15. COMPLIANCE MONITORING

15.1 CIRCUMSTANCES IN WHICH COMPLIANCE MONITORING MAY BE CONDUCTED

Compliance monitoring may be required for any assessable development to accommodate the recovery of infrastructure charges, to secure timely and definitive confirmation of the development activity against the permit and facilitate registration of infrastructure being handed over to Council as a public asset.

15.2 DEFINITIONS

This policy includes references to operational works type development in categories being 'major' or 'minor' in nature. These are defined more specifically:

'Major' works works of significant value, co-ordination, controversy or complexity, or have potential to affect public infrastructure, lands, uses, etc.

'Minor' works works of no significant value, no co-ordination, no controversy nor complexity, or which have little potential to affect public infrastructure, lands, uses, etc.

15.3 INFORMATION REQUIREMENTS

Persons conducting assessable operational works, reconfiguring a lot and/or initiating a material change of use should provide all relevant documentation, access to site and reasonable support to allow the Assessment Manager (or authorised delegate) to check the works/premises for the following:

15.3.1 'PRESTART' COMPLIANCE MONITORING

Prior to the commencement of assessable operational works:

(i) the development approval is current and valid.

(ii) insurance and indemnity is provided where conditioned.

(iii) the design drawings are approved and certified.

(iv) the limits of works are identified and within the subject land.

(v) significant environmental areas are protected and soil erosion and sediment control measures are in place or programmed appropriately.

(vi) a traffic management plan is provided and operational where works will interfere with public right of way.

(vii) a quality assurance person has been nominated, is available, and any inspection and testing plan is approved and understood by all parties.

(viii) other conditions of approval relevant to start of works have been satisfied.

(ix) infrastructure charges have been paid, satisfied/secured (where required by an Infrastructure Charges Notice to be paid before commencement of work).

15.3.2 'ON MAINTENANCE' COMPLIANCE MONITORING

Where assessable operational works of a 'major nature' have been constructed:-

(i) The scope of works is in accordance with the development permit.

(ii) the works are assured of quality by records of complete and satisfactory inspections and testing, conducted in accordance with the approved inspection and testing plans and certified by the quality assurance personnel.

(iii) a registered surveyor has certified the position of infrastructure etc.

(iv) A licensed surveyor has certified the location of features of a cadastral nature.

(v) Approval conditions relative to the 'On Maintenance' stage of works have been satisfied (e.g. Maintenance Bond is lodged, etc).

(v) 'As constructed drawings':

- show the works are constructed to the approved design and specifications,
- are prepared by a Registered Professional Engineer of Queensland for works of engineering nature,
- are prepared by a landscaping professional for works of landscaping nature,
- should be three dimensional, DWG or DXF format electronic plans, oriented to the MGA94 meridian, to the layering conventions specified herein, including some or all of the following –

  <u>General</u>

  - locality plan showing location in relation to adjacent properties;
  - scales, legend, north point and date;
  - title block to include reference numbers, version number, amendment details, property description and contact details;
  - surveyed site boundaries;
  - existing services to be shown on both plans and longitudinal sections;

- description and location of all existing built elements and footprints of proposed built elements, including floor levels.

Earthworks

- existing and finished contours;
- original and finished contours and/or spot levels;
- location of toe and top of batters;
- cut and fill volumes;
- cross-hatching to show cut and fill areas;
- structural details for retaining structures;
- vegetation to be retained;
- cross-sections where additional detail is required.

Roads

- longitudinal sections along road centre lines;
- cross sections at relevant and regular chainages;
- kerb or shoulder levels;
- intersection details;
- finished surface contours;
- pavement design details
- surfacing design details
- linemarking and signage

Drains

- existing services; locations of all existing and proposed drainage lines and structures;
- longitudinal sections through drainage lines;
- catchment plan;
- tabulated hydrological and hydraulic calculations for all internal and external catchments, and
- for each drainage line;

- original and finished contours and/or spot levels;
- original and altered drainage paths;
- structural details where required;
- enlargements where additional detail is required.

Sewer

- existing services;
- sewer line, manhole and pumpstation identification numbers;
- locations of sewer lines, manholes, pump stations, property service connections;
- materials, sizes, grades, lengths, upstream pipe invert levels, downstream pipe invert levels, type of property service connections, distance of property service connections from downstream manhole;
- top of manhole levels;
- tabulated data of design sewer loading and capacity calculations.

Water Supply

- existing services;
- water main alignment, stop valves, junctions, fire hydrants, property service connections;
- materials, sizes, depth below finished surface level, grades, lengths;
- tabulated data of design water supply loading and pressure calculations.

Streetlighting

- alignment, height, depth, size and type of poles, lamps, cabling and controllers;
- endorsement from electrical engineer confirming design category of lighting.

Electrical and Telecommunications

- alignment, height, depth, size and type of poles, cabling, cabinets, junctions and property services;
- details of any trenching arrangements;
- endorsement from Electrical and Telecommunications service provider.

Landscaping and irrigation

- project name / location;
- reference number / drawing number / sheet number;
- revision no / date of issue;
- drawn scale;
- designers name and / or company;
- drafters name and / or company;
- surveyors name and / or company;
- location and finished levels of all hard landscape elements such as kerbs, pathways, garden edges, walls, structures, light poles etc;
- manufactured item detail (code no/warranties);
- location of all grass and garden areas;
- as constructed finished levels at all design level locations;
- complete planting plan;
- planting schedule detailing size, number and species;
- calculated areas of garden, turf and paths/paved areas;
- measured lengths and heights of kerbs, walls etc;
- location of all controllers, water meter assembly, main lines, lateral lines, sprinklers, drip tube, valves, electrical inspection pits, water taps, drinking fountains;
- irrigation controller assignment table.

Townsville Digital As-Constructed (TDAC) Layering Conventions

Controlled Layers

INFRASTRUCTURE THEME	CONTROLLED LAYER NAME	DESCRIPTION
Cadastre:	AC_Cadastre	Lot boundary linework
	AC_Cadastre_Labels	Lot text
	AC_Cadastre_Stlayers	Lot text for road reserves
Roads:	AC_Kerb_Island	Kerb linework for islands
	AC_Kerb_Island_Labels	Island text
	AC_Road_Cen	Road centreline
	AC_Road_Cen_Labels	Road centreline text
	AC_Road_Edge	Road edge linework including kerb or edge of bitumen
	AC_Road_Edge_Labels	Text for road edge
	AC_Road_Flush_Point	Subsoil drainage flush point
	AC_Road_Parking	Parking linework
	AC_Road_Parking_Labels	Parking text
	AC_Road_Path	Pathways linework
	AC_Road_Path_Labels	Pathways text
	AC_Road_Pramramp	Pram ramp linework
	AC_Road_Ssd	Roads subsoil drainage
	AC_Road_Ssd_Labels	Roads subsoil text
Sewer:	AC_Sewer_Fittings	Sewer fittings
	AC_Sewer_Housecon	Sewer house connections
	AC_Sewer_Labels	Sewer text
	AC_Sewer_Nonpressure	Non pressurised sewer linework
	AC_Sewer_Pit	Sewer manhole
	AC_Sewer_Pressure	Pressurised sewer linework
	AC_Sewer_Valve	Sewer valve
Stormwater:	AC_Storm_Labels	Stormwater text

INFRASTRUCTURE THEME	CONTROLLED LAYER NAME	DESCRIPTION
	AC_Storm_Pipe	Pipe linework - edges
	AC_Storm_Pipe_Cen	Pipe linework - centreline
	AC_Storm_Pit	Stormwater pits and manholes
	AC_Storm_Structure	Stormwater end structure including end walls, wing walls and aprons
	AC_Storm_Surface	Surface stormwater drainage
Water:	AC_Water_Fittings	Water fittings
	AC_Water_Hydrant	Hydrants
	AC_Water_Labels	Text for water
	AC_Water_Meter	Water meters
	AC_Water_Pipe	Water linework
	AC_Water_Pit	Water maintenance holes
	AC_Water_Valve	Valves

Standard Layers

INFRASTRUCTURE THEME	STANDARD LAYER NAME	DESCRIPTION
Cadastre:	Cadastre_Cancelled_Lotplan	All cancelled lots that are replaced by new cadastral fabric.
	Cadastre_Exist	All existing cadastral fabric required for association of new cadastral fabric.
Contours	Contour_Exist	All existing contours for the development site.
	Contour_Proposed	All proposed/new contours for the development site.
Parks:	Park_Furniture	Location of all items of new park furniture (i.e swings, climbing frames, tables etc)
	Park_Notes	Any additional "notes" information required for park layout (i.e. labels for park equipment)
Roads:	Road_Signs	Location of any new road signs
	Road_Crash Barrier	Location of any new road crash barriers (ie. guard rails etc.)
	Road_Notes	Any additional "notes" information required for road layout (i.e. guard rail or sign name labels)
Sewer	Sewer_MH_Ties	Linework and annotation for TIE location information for sewer maintenance holes. Either TIE or OFFSET information is acceptable
	Sewer_MH_Offsets	Linework and annotation for OFFSET location information for Sewer Maintenance Holes. Either TIE or OFFSET information is acceptable
	Sewer_HC_Ties	Linework and annotation for TIE location information for Sewer house/property connections. Either TIE or OFFSET information is acceptable

INFRASTRUCTURE THEME	STANDARD LAYER NAME	DESCRIPTION
	Sewer_HC_Offsets	Linework and annotation for OFFSET location information for sewer house/property connections. Either TIE or OFFSET information is acceptable
	Sewer_Notes	Any additional "notes" information required for sewer infrastructure layout
	Sewer_Abandon	All existing sewer infrastructure that is abandoned due to the construction of the new sewer infrastructure
	Sewer_Exist	All existing sewer infrastructure required for connectivity of new sewer network.
Spot Heights	Spot_Heights	All proposed/new spot heights or levels for the development site
Stormwater:	Storm_Notes	Any additional "notes" information required for stormwater infrastructure layout
	Storm_Abandon	All existing stormwater infrastructure that is abandoned due to the construction of the new stormwater infrastructure.
	Storm_Exist	All existing stormwater infrastructure required for connectivity of new stormwater network.
Water	Water_Notes	Any additional "notes" information required for water infrastructure layout
	Water_Abandon	All existing water infrastructure that is abandoned due to the construction of the new Water Infrastructure.
	Water_Exist	All existing water infrastructure required for connectivity of new water network.

15.3.3 'OFF MAINTENANCE' COMPLIANCE MONITORING

Where assessable operational works of a 'major nature' have been constructed:–

(i) all conditions of the development permit for operational works are satisfied.

(ii) all defects identified at the 'On Maintenance' stage and during the Maintenance Period have been remedied.

15.3.4 'FINAL COMPLETION' COMPLIANCE MONITORING

Where assessable operational works of a 'minor nature' have been constructed:–

(i) 'as constructed drawings' show the works are constructed in accordance with the approved design and specifications.

'as constructed drawings' should be prepared by a professional draftsperson (A1 and A3 size), showing accurate locations, surface and invert levels, materials and sizes of all works and infrastructure constructed.

(ii) test results of all materials etc conditioned in the development permit are submitted and show the works achieve the development standards and specifications.

(iii) the scope of works is in accordance with the development approval.

(iv) approval conditions relative to the 'Final Completion' stage of works have been satisfied.

15.3.5 'RECONFIGURATION OF LOT' COMPLIANCE MONITORING

Where a plan of reconfiguration is submitted for approval and dating further to assessable reconfiguration of a lot:–

(i) all conditions of the development permit for reconfiguration of lot are satisfied/secured.

(ii) infrastructure charges have been paid, satisfied/secured.

15.3.6 'Commencement of Use' Compliance Monitoring

Where an assessable material change of use is about to/has commenced use as authorised by a development permit:–

(i) all conditions of the development permit for material change of use are satisfied/secured.

(ii) infrastructure charges have been paid, satisfied/secured.

15.3.7 'UNSCHEDULED' COMPLIANCE MONITORING

The scope and performance of works and activities is in accordance with the development approval.

16 ON-SITE SEWERAGE DISPOSAL REPORT

16.1 CIRCUMSTANCES IN WHICH ONSITE SEWERAGE DISPOSAL REPORTING MAY BE REQUIRED

Development which is not connected to Council's sewerage system and not within the Declared Service Area (Sewer) may require an On-site Sewerage Disposal Report to demonstrate the effective and safe disposal of sewerage on-site. In particular, subdivisions to create allotments of less than 2,000m^2 area, operational works adjacent existing on-site disposal facilities, and material change of use development in sites of known hydro-geologic, environmental, public health or otherwise constrained concerns should provide an On-site Sewerage Disposal Report.

16.2 INFORMATION REQUIREMENTS

The report should be prepared by a professional engineer or hydraulic consultant to document a site and soil evaluation, and design of disposal facility (in the least case, of a hypothetical but realistic scenario) as per procedures outlined in sections 4.1.3.4 and 4.2.3.2 of *AS1547 – 2000, On-site Domestic Wastewater Management.* The report should include (all section references are to *AS1547-2000*):

(a) Site and Soil Evaluation Report

(i) Details of the site and soil evaluation personnel confirming:

- o past experience of site and soil evaluation assessments,
- o successful completion of an accredited training program,
- o knowledge of the regulatory assessment requirements,
- o professional liability for the interpretation of, conclusions drawn from and recommendations made as a result of the site evaluation.

(ii) Desk top study as per section 4.1A2,

(iii) Site and soil check as per section 4.1A3,

(iv) Soil assessment items as per section 4.1A4,

(v) Evaluation of results as per section 4.1.4.

(b) Design Report

(i) Details of land application facility designer confirming:

- o past experience designing on-site sewerage disposal facilities,
- o successful completion of an accredited training program,
- o knowledge of the regulatory design requirements,
- o professional liability for the interpretation of, conclusions drawn from and recommendations made as a result of the design.

(ii) Documentation of the design process:

- o System selection as per section 4.2A4,
- o Soils and LTAR/DLR values as per section 4.2A5,
- o Design Flows as per section 4.2A6.

(iii) Siting considerations as per section 4.2.3.3,

(iv) Reserve area as per section 4.2.3.4,

(v) Distribution system as per section 4.2.3.5,

(vi) Nutrients as per section 4.2.3.6,

(vii) Rainfall surface flow control as per section 4.2.3.7,

(viii) Land use activity as per section 4.2.3.8.

(c) Site plan

- North point,
- Full property description,
- Name of person who evaluated the site,
- Scales of 1:200 or 1:500,
- Predominant wind direction,
- Location, height, density and type of vegetation,
- Access roads, tracks, vehicle manoeuvring areas, storage areas,
- Test boreholes/pits,
- Fall of land,
- Setbacks.

- Water supply bores, top banks of water courses, lakes, ponds, unlined stormwater drainage channels, dams
- Buildings, fences, property boundaries, pedestrian paths, walkways, recreation areas, retaining walls, in-ground swimming pools, in-ground potable water tanks
- Primary and reserve land application areas

17. TRAFFIC IMPACT ASSESSMENT

17.1 CIRCUMSTANCES IN WHICH TRAFFIC IMPACT ASSESSMENT MAY BE REQUIRED

Development which proposes a significant impact to pedestrian, cyclist and vehicular traffic may require a Traffic Impact Assessment to demonstrate the level of service, capacity, amenity, etc resulting from the proposed development. For example, road layouts for subdivisions that do not follow the relevant code provisions may attract a Traffic Impact Assessment to show that design speed environment is maintained, or that on-street parking availability is adequate, etc.

17.2 INFORMATION REQUIREMENTS

Traffic Impact Assessments should be prepared by professionals with qualifications and experience in road and/or carpark design, road safety, and are conversant with *Queensland Streets* and all relevant Australian Standards.

Traffic Impact Assessments should include a report identifying:

- Qualifications, experience and contact details of personnel conducting the assessment,
- current characteristics of pedestrian, cyclist and vehicular traffic (volumes, capacities, demographics, delay, queueing, parking, time of use, etc),
- contributions of the proposed development to the characteristics of pedestrian, cyclist and vehicular traffic (e.g. additional traffic, loss of parking, diversion of cyclists, etc),
- expected characteristics of pedestrian, cyclist and vehicular traffic resulting from the development and any mitigation measures proposed to bring those characteristics within reasonable levels of service and safety,
- Road Safety audit conducted in accordance with Australian Standand, HB43 : 2002 – Road Safety Audit.

Traffic Impact Assessments for Operational Works development may also require a Traffic Management Plan to accompany the report to demonstrate how traffic is managed safely and without undue loss of amenity during the proposed construction activity.

Traffic Management Plans should include:

- Details for any temporary roadways and detours showing pavement, wearing surface and drainage details, details of arrangements for construction under traffic and a signpost layout plan showing:
    - location, size and legend of all temporary signs,
    - temporary regulatory signs and temporary speed zones, and
    - all traffic control devices such as temporary traffic signals, linemarking, pavement reflectors, guideposts, guardfence and barrier boards,
    - working times when traffic control measures are in place to minimise disruption to traffic during periods of peak flows.

18. GROUNDWATER RESOURCE REPORT

18.1 CIRCUMSTANCES IN WHICH GROUNDWATER RESOURCE REPORTS MAY BE REQUESTED

Development which is not connected to Council's water supply reticulation and not within the Declared Service Area (Water Supply) may require assessment of groundwater conditions where it is nominated as a supply of water and there is an unknown risk to the sustainability of supply to the development, the aquifer or other affected users of the groundwater. Development which has significant potential to affect aquifer recharge, storage, permeability or water quality may also require an assessment.

In particular, rural and rural residential subdivisions which create allotments without existing operating underground bores, or permanent water from dams, lagoons, creeks, etc, will require a Groundwater Resource Assessment.

18.2 INFORMATION REQUIREMENTS

A groundwater resource assessment study should be undertaken by a qualified hydro-geologist. Such a study should include, at a minimum –

- consideration of information available from previous studies and new information collected as part of the investigation;
- consideration of the maximum ground water extraction rate attainable, proposed pumping rates, land slope, flooding, drainage, geology, ground water recharge potential, local experience, proximity to and protection from potential contaminants, soil characteristics (colour, texture, structure, permeability and presence of rock), percolation testing, direction of ground water flow, seasonal fluctuation in ground water levels, and the current degree of district and local extraction;
- a comparison between the average annual ground water demand and the average annual ground water recharge, on a local and a district level;
- the results of drilling and testing of an adequate number of bores, supplemented with ground water modelling where necessary, to ensure a thorough and accurate investigation of the ground water resources available. Bores are required for two purposes, namely, for interference testing and for regional ground water level observation;
- results of independent and simultaneous pumping of test bores, and measurement of water levels to check for localised pumping interference with any existing and proposed neighbouring bores. Pumping tests should be undertaken for a minimum of 8 hours duration and pumped at the rate the pump is intended to be operated in the proposed development. The available draw down in neighbouring bores during the test must not be reduced by greater than 20% when compared to available draw down in these bores prior to pumping;

- if bore interference is found to be greater than 20% of the available draw down, supplementary pumping tests should be undertaken to measure the effect of reducing either the pumping rate, the duration of pumping, or both, until the resulting interference is within this level;
- water quality testing to determine whether extracted water will be of a potable quality, including where relevant, written advice from the Department of Natural Resources (Water Resources) on the ground water quality;
- investigation of previous land uses and the possibility of contamination of acquifers to determine the quality of ground water;
- details of the pump type, capacity and pumping curve for bores; and
- preparation of a report detailing all the studies and works undertaken, the resource assessment findings and assumptions made.

19. SEWER CONDITION REPORT

19.1 CIRCUMSTANCES IN WHICH SEWER CONDITION REPORTING IS REQUIRED

Development which proposes to construct a building or structure or undertake earthworks in the vicinity of, or within the 'zone of influence' (i.e. 45º vertical projection) of an existing sewer may be required to identify the condition of the sewer for assessment of serviceability and structural compatibility with the development.

The assessment may be preliminary to a Standard Building Regulation, Section 56 requirement for the local government to give consent for building over/adjacent a sewer.

19.2 INFORMATION REQUIREMENTS

A closed circuit television inspection of the affected reach of sewer should be conducted by a professional with qualifications and experience in the inspection and assessment of sewers.

The inspection should be recorded on video or DVD and be supported by a written report and 1:200 or 1:500 scaled drawing/sketch identifying:

(i) Description of subject property,

(ii) Name, qualifications, experience and contact details of personnel who conducted the assessment,

(iii) Date of inspection,

(iv) Buildings, fences, trees, property boundaries, other services,

(v) Sewer size, material and serviceability of condition,

(vi) Gradient and direction of sewer fall,

(vii) Depth to sewer invert,

(viii) Deformities, ponding, blockages, cracks, root intrusions, etc,

(ix) Property service connections, junctions, etc.,

(x) Manholes (including no. and top of cover RL's).

The inspection should be conducted from a convenient manhole/access chamber, and be coordinated both with Citiwater and the property owner for permission to carry out the activity.

The location of features should be recorded relative to the inspection manhole and/or the relevant property boundaries.

20. NOISE AND VIBRATION IMPACT ASSESSMENT

20.1 CIRCUMSTANCES IN WHICH NOISE AND VIBRATION IMPACT ASSESSMENTS MAY BE REQUESTED

Development which proposes to construct a building, structure or undertake extensive earthworks in areas of known or suspected rock formation may be required to assess the compatibility of noise and vibration impacts from the excavation/construction activity on adjoining development and land uses.

Development which proposes to locate a road, laneway, pathway or other substantial noise/vibration generation activity adjacent a sensitive area (e.g. wildlife refuge, residential neighbourhood, accommodation building, etc) may be required to assess the compatibility of noise and vibration impacts from the development on the noise sensitive land uses.

20.2 INFORMATION REQUIREMENTS

The noise impact assessment should be conducted by a professional with qualifications and experience in the modelling, monitoring and mitigation of noise and vibration (especially related to construction and traffic activity).

The assessment should be supported by a written report identifying:

(i) Description of subject property,

(ii) Name, qualifications, experience and contact details of personnel who conducted the assessment,

(iii) Date of assessment,

(iv) Background noise/vibration characteristics,

(v) Characteristics of, and risks exposed to, existing buildings, fences, trees, property boundaries, services (within at least 1km for blasting ops),

(vi) Relevant Australian Standards and safety constraints applicable to the noise/vibration activity,

(vii) Characteristics of the noise/vibration activity (e.g. days, hours, durations, sound pressure levels, particle velocities, etc), demonstrating how those activities comply with Australian Standards for noise and vibration and have regard to the risks of damage and nuisance to existing buildings, fences, trees, property boundaries, services.

(viii) Method of monitoring noise/vibration.

(ix) Contingency actions should the relevant noise/vibration limits be exceeded.

(x) Public consultation on time/methods.

21. WASTE MANAGEMENT PLAN

21.1 CIRCUMSTANCES IN WHICH A WASTE MANAGEMENT PLAN MAY BE REQUESTED

Development which proposes building works (demolition or construction) or operational works with potential to generate significant quantities, unusual or contentious types and considerable reusable/recyclable components of waste material may be required to provide a waste management plan to demonstrate the efficient and appropriate disposal of such waste.

In particular, all operational works associated with Material Change of Use or Reconfiguration development on Magnetic Island should have a waste management plan.

21.2 INFORMATION REQUIREMENTS

The waste management plan should:

(i) Identify the subject property and development activity.

(ii) Include name, qualifications, experience and contact details of personnel who prepared the waste management plan.

(iii) Describe the nature and quantities of waste generated in relation to the development, including categories of green-waste, recycleable waste, re-useable waste, regulated waste and general waste.

(iv) Demonstrate how the generation of waste is minimised by:

- use of alternate materials and or processes;
- recycling and reuse;
- treatment to render it less or non-hazardous;
- disposal as a last resort.

(v) Nominate authorised facilities for processing such wastes.

(vi) Describe the method, times (hours of day) and durations of storage, treatment and transport of waste from the site to the authorised waste facility, accounting for amenity, aesthetics, potential cyclone hazards, and breeding hazards for vermin and mosquitoes.