REPORT

PALMERSTON NORTH CITY COUNCIL

Development of Land which is, or is likely to be, subject to Erosion or Slippage
Policy Document

Report prepared for:
PALMERSTON NORTH CITY COUNCIL

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Table of contents

1. Introduction

The main purpose of the Policy Document is to provide clear guidelines and practical solutions to questions relating to the issuing of building consents for buildings on land which is, or is likely to be, subject to erosion or slippage within the Palmerston North City boundary.

In addition, the Policy Document is to cover the matter of subdivision consent approvals on land which is, or is likely to be, subject to erosion or slippage.

Although the Policy Document will sit outside the District Plan, it is intended that this Policy Document will be an extension of the urban land use capability (ULUC) survey which covers part (Aokautere) of the City. The approach used within the District Plan to manage land in the Aokautere Development Area has been endorsed by the Council through its decisions on submissions to the District Plan which became fully operative in March 2005.

2. Statutory responsibilities in relation to land stability hazard

There are two primary pieces of legislation which define the responsibilities of Council for the management of land hazards including erosion and slippage. These are the Resource Management Act 1991 (RMAct) and the Building Act 2004 (BAct).

2.1 Resource Management Act 1991

The overall purpose of the RMAct is to promote the sustainable management of natural and physical resources and Council has responsibilities under the Act for the avoidance and mitigation of natural hazards.

The specific functions of Council are defined under Section 31 of the RMA, and include the avoidance and mitigation of natural hazards through the control of land use and subdivision.

> *Section 31(1)(b) of the RM Act states that every territorial authority has, as a function:*
>
> *The control of any actual or potential effects of the use, development, or protection of land, including for the purpose of the avoidance or mitigation of natural hazards.*

To carry out these functions, Council must produce a District Plan which describes how resource management issues will be managed to achieve the sustainable management of natural and physical resources. Section 73(4) of the Act requires a local authority to amend its District Plan to give effect to a regional policy statement if the statement contains a provision to which the plan does not give effect and the statement is reviewed under section 79, thereby ensuring the integrated management of the natural and physical resources of the region and district.

With respect to the subdivision and use of land, Council has requirements relevant to the avoidance or mitigation of natural hazards. Section 106 (1) specifies that a consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that -

"(a) *the land in respect of which a consent is sought, or any structure on the land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; or*

(b) *any subsequent use that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to that land, other land, or structure, by erosion, falling debris, subsidence, slippage, or inundation from any source."*

Conditions applied under section 106(1) must be for the purposes of avoiding, remedying or mitigating the effects referred to in section 106(1).

2.2 Building Act 2004

The purpose of the BAct is to provide the necessary controls over building works, use and safety. Under this Act the obligations for managing building works in relation to natural hazards are solely the responsibility of the District Council.

The BAct requires Council to refuse the granting of a building consent for construction of a building, or major alterations to a building, if:

Section 71(1)

(a) *the land on which the building work is to be carried out is subject or is likely to be subject to 1 or more natural hazards; or*

(b) *the building work is likely to accelerate, worsen, or result in a natural hazards on that land or any other property.*

Unless (2) *the building consent authority is satisfied that adequate provision has been or will be made to:*

(a) *protect the land, building work, or other property referred to in that subsection from the natural hazard or hazards; or*

(b) *restore any damage to that land or other property as a result of the building work.*

(3) *In this section and sections 72 to 74,* ***natural hazard*** *means any of the following:*

(a) *erosion (including coastal erosion, bank erosion, and sheet erosion)*

(b) *falling debris (including soil, rock, snow, and ice)*

(c) *subsidence*

(d) *inundation (including flooding, overland flow, storm surge, tidal effects, and ponding)*

(e) *slippage.*

72 ***Building consent for building on land subject to natural hazards must be granted in certain cases***

Despite section 71, a building consent authority must grant a building consent if the building consent authority considers that:

(a) *the building work to which an application for a building consent relates will not accelerate, worsen, or result in a natural hazard on the land on which the building work is to be carried out or any other property; and*

(b) *the land is subject or is likely to be subject to one or more natural hazards; and*

(c) *it is reasonable to grant a wavier or modification of the building code in respect of the natural hazard concerned.*

73 ***Conditions on building consents granted under section 72***

(1) *A building consent authority that grants a building consent under section 72 must include, as a condition of the consent, that the building consent authority will, on issuing the consent, notify the consent to:*

(a) *in the case of an application made by, or on behalf of, the Crown, the appropriate Minister and the Surveyor-General; and*

(b) *in the case of an application made by, or on behalf of, the owners of Maori land, the Registrar of the Maori Land Court; and*

(c) *in any other case, the Registrar-General of Land.*

(2) *The notification under subsection (1)(a) or (b) must be accompanied by a copy of the project information memorandum that relates to the building consent in question.*

(3) *The notification under subsection (1)(c) must identify the natural hazard concerned.*

2.3 Community expectations

Prior to the RMAct and the BAct, subdivision and building in potentially hazardous areas was controlled by the Town and Country Planning Act 1977 and the Local Government Act 1974.

The Abbotsford landslip disaster and subsequent commission of enquiry highlighted the very much greater expectation the public has of local authorities, and the demand for councils to put more effort into their land subdivision and building permit control. Parliament, anxious to protect property owners from the considerable loss that could result if land disappeared underneath them, obliged with Sections 274 and 641 of the Local Government Amendment Act in 1979. That Act made it difficult, if not impossible, for local authorities to allow subdivision or to issue building permits on land that was likely to be subject to, amongst other hazards, erosion and slippage.

With the advent of the Local Government Amendment Act (1979), councils found administering subdivisional and building permit applications in terms of Sections 274 and 641 a bitter pill to swallow. Local authorities were suddenly faced with refusing building permits on land where they had earlier allowed subdivision to proceed, and developers and land owners saw potential profits threatened and brought pressure to bear. The public who found themselves restricted in hazard prone areas resented the loss of land value and loss of "freedom" to do what they wanted.

Accordingly, despite the clear conclusions and recommendations of the Commission of Enquiry into the Abbotsford Landslip Disaster which reported in November 1980, less than a year later the Local Government Amendment Act was yet again amended with Section 641(a) (now Section 72 of the BAct) which allows a local authority to issue a building permit where the land is subject to erosion, subsidence, slippage or inundation and not be under any civil liability (Rogers and Taylor 1986).

No amount of controls on development can produce zero risk in the urban areas of Palmerston North City, and we do not believe that the community expects that to be achieved.

What the community can rightly expect, however, is that the actual and potential hazards are properly identified, and that the potential consequences are clearly explained.

3 Land subject to erosion or landslippage

3.1 Geology and geomorphology

The City area includes urban and rural land which encompasses steep greywacke hillslopes to the east (Tararua Range) and a series of terraces over the balance of the City (DSIR, 1967). These river cut terraces, made up of gravels, sands and silt (mainly marine sediments), are blanketed by variable thicknesses of loess (wind blown silt). The terraces are locally incised by streams draining toward the Manawatu River.

With respect to erosion or slippage, there are two basic landform types (Cowie, 1974) which present a hazard to urban development. These are:

3.1.1 Landform A - Moderate to steep slopes of the foothills and main range of the Tararua Range

Whilst the bedrock (greywacke) materials are inherently very strong, these ranges are up-hrust east of, and along, a major geological fault and the western side of the ranges are consequently oversteep. Accordingly, even under a full forest cover these slopes were probably adjusting to being oversteep by slippage to reduce the overall slope angles to achieve stability. With the forest cover removed (albeit in places now replaced by plantation forest) the slopes are even more susceptible to slippage in the form of shallow debris slides. Whilst on some of the steep slopes evidence of past instability is clearly seen by the landslip scars and debris lobes, all slopes steeper than about 20° should be considered to be susceptible (i.e. likely to be subject) to slippage under low frequency rainstorm or seismic events. Slopes steeper than 30° appear to be very susceptible to slippage under higher frequency (i.e. more common) rainstorm events.

3.1.2 Landform B - Moderate to precipitous slopes, being both old (relic) and present banks of the Manawatu River (and also, around the Ashurst area, the Pohangina River), and the banks and sides of tributary streams and gullies

The current riverbanks are generally oversteep due to currently active, or recent, downcutting and/or erosion at the toe of the banks. When the banks become no longer actively eroded at the toe, they become, over a long time period, progressively more gently sloping due to erosion and slippage of the slopes themselves. Generally these old (relic) river banks, as well as the gully and valley sides of the streams draining the alluvial terraces, become stable (with respect to landslip and gully erosion) at slopes of about 18° (1 vertical to 3 horizontal) to 20° (Jessen, 1989). Slopes steeper than 30° appear very susceptible to slippage.

3.2 Delineation of areas subject to, or likely to be subject to, erosion or slippage

Council has recognised, for a long time, that within the City boundary there exist areas of actual or potential hazard, and in 1989 commissioned the then DSIR Division of Land and Soil Sciences Aokautere to identify, evaluate and document the natural hazards and other physical constraints to development. This ULUC survey (Jessen, 1989) was restricted to the Aokautere area, and the hazard areas identified by the survey (generally Class C, D & E Land) have been incorporated in the District Plan on maps (Map 10.1, Aokautere Development Area; Map 10.7.6.2, Cliff Protection Lines) and development restrictions apply to the areas of natural hazard so identified.

3.3 District Plan provisions

3.3.1 Natural hazards

Section 22 of the District Plan addresses natural hazards through a number of stated objectives of policies, and Section 22.9 deals with land instability hazards. These are mainly to identify the areas of hazard and put in place appropriate controls on development. Land delineated as (ULUC) Classes D & E are described as undevelopable, and although Class C land is regarded as developable, it requires engineering design to ensure any structure can be safely established on it.

3.3.2 Subdivision

The District Plan recognises (Section 7.1, p 7-4) that in some cases it is necessary to prevent subdivision or strictly control it in order to avoid adverse effects, and 'the recognition of natural hazards in the design and implementation of subdivisions' is a resource management issue (7.2) specifically identified in the District Plan.

To address this issue, and achieve the stated objective (1)" to ensure that subdivision of land and buildings is consistent with integrated management of the use, development and protection of land and other natural and physical resources", Council has a policy (1.4) "to avoid the intensive urban subdivision of land which is subject to significant physical limitations and/or natural hazards". Council also has a policy (1.5) to enable the subdivision of rural land where; (c) liability to erosion, subsidence, slippage or inundation from any source; and (d) the stability of the land

and its suitability to provide a foundation for the erection of buildings (if necessary, and the reconstruction of the land for that purpose), are among those matters recognised and provided for.

Council also has a stated objective (2) "to ensure that subdivision is carried out in a manner which recognises and gives due regard to the natural and physical characteristics of the land and its future use and development, and avoids, remedies or mitigates any adverse effects on the environment". One of the policies (2.4) to achieve this objective is " to improve land utilisation, to safeguard people, property and the environment from the adverse effects of unstable land by ensuring that:

1. Disturbance to the natural land form, existing vegetation (examples included), natural drainage and significant natural features is minimised, and historic and cultural features are protected commensurate with achieving an efficient and aesthetically pleasing subdivision design and site layout.
2. Earthworks withstand and remain stable under anticipated loads.
3. Safe and adequate building sites, roading and sites for activities in the context of an enhancement of the physical landform and the preservation of significant natural, historic and cultural features are produced.
4. Planning and design of earthworks is carried out after thorough investigation of the nature on the existing land, its ability to support the construction proposed and its general suitability for subdivision.
5. Earthworks are to be designed and constructed to (amongst other matters):
    - provide safe and adequate building platforms and foundation for roads and services;
    - provide for the adequate control of stormwater;
    - avoid the likelihood of erosion and instability;
    - not unnecessarily alter the natural landscape;
    - remain safe and stable for the duration of the intended land use;
    - not unnecessarily rely on artificial or human-built structures for stability; and where such structures are employed these shall remain safe and stable for the duration of the intended land use;
    - cater for the natural groundwater flows and be geotechnically sound.
6. In Aokautere, earthworks, and in particular the restructuring of land, are to be the subject of specific design by a registered engineer experienced in soil mechanics or geotechnical matters and shall take into account the predicted improvements to soil slope and stability which will be achieved and the impact on existing vegetation and landscape values.

The principal methods used to implement the policies are District Plan Rules. For example in the Residential and Rural Zones, minimum contiguous areas of developable or stable land are specified as performance conditions for controlled activities. However, in some cases reliance on the provisions of the statute itself will implement policies. For instance, Section 106 (of the RM Act 1991) in respect of refusal of consent or the imposition of conditions in respect of natural hazards and Section 220 in respect of the imposition of certain subdivision conditions.

3.3.3 Building

In addressing the issue of building on land prone to landslip or erosion hazards, it is noted that objective 1 of the residential section of the District Plan, page 10-5, and its related policy 1.4, relate to avoidance of development in areas subject to natural hazards. This policy framework forms the basis for controls which are imposed through the residential section of the District Plan.

With the erosion and slippage hazard identified by the ULUC survey in the Aokautere area, a special series of controls are applied in that area as a precondition to the development or placement of a dwelling on a particular section. In the Aokautere Development Area as shown on Map 10.1 Rule (R) 10.7.1.1 (d) of the District Plan states that there must be a minimum net site area of 400 m2 of developable land or land for which a restructured land resource consent has been granted, the explanation being that it is essential that there is sufficient usable or restructured land to ensure that there is a stable building platform on which to safely establish a dwelling and associated facilities such as garaging and open space.

In addition to the application of R 10.7.1.1 the District Plan also seeks to avoid the development of residential land which is prone to stability and erosion hazards in the vicinity of Anzac Park. The plan seeks to achieve this through:

- the application of R 10.7.6.2 which defines an area prone to an identified stability and erosion hazard and prohibits development within this area, and;
- avoiding residential development of land identified as (ULUC) Classes D & E through the application of R 10.8.1.7.

R 10.7.6.2 recognises the fact that the banks of the Manawatu River in this area are being actively eroded forming unstable near-vertical cliffs. These unstable cliffs present a particular threat to any structures sited close to the edge of the cliffs.

3.4 Identification of areas subject to erosion or landslippage

3.4.1 General

Council has acknowledged its "duty of care" through imposing on itself Policies 1.1 and 1.2 of Section 22.3 of the natural hazard section of the District Plan, these being:

1.1 "*to identify any land subject to the effects of a natural hazard*"

1.2 "*to educate the community with regard to the existence, nature and threats posed by natural hazards*".

A fundamental objective of this Policy Document is to provide a guideline which will assist Council in its administration of subdivision and building consent applications by delineating in general terms the degree of land instability existing in the various parts of the city, and by setting out the extent of further investigations which should be carried out to support subdivisional and building consent applications in those delineated parts.

All developments on sloping land need to consider the stability of the land. However, slopes will vary in their landslip hazard potential, and it is reasonable that the level of investigation should reflect the relative hazard potential.

The philosophy adopted in this Policy Document is to identify development criteria (effectively performance standards) appropriate to the various levels of apparent hazard potential. This should enable the identification of an at risk site without placing overly onerous and conservative investigation and site assessment requirements on sites which are likely to be relatively stable. It is also intended that, with the exception of those areas delineated on maps within the District Plan as being unsuitable for development, development on high risk sites is not prevented, provided that adequate investigation, assessment and design has been carried out to reduce the risks of instability to an acceptable level, to the satisfaction of Council.

3.4.2 Landslip hazard potential

Palmerston North City is fortunate in having a relatively simple, though not necessarily uniform, geology and geomorphology, and consequential landslip hazard potential.

Although the ULUC study utilised a factor overlay, or sieve mapping (rock type, soil type, slope angle, landform and erosion severity) technique in determining areas of relative land hazard increasing in severity from Class A to Class E, the classes derived from the ULUC study are determined essentially by slope alone, as per:

Class	Slope angle (in degrees)
A	0 - 7
B	7 - 11
C	11 - 20
D	20 - 35
E	35 - 45+

As the ULUC classes also encompasses flood hazard as well as erosion and slippage, Class E also includes some flat land.

Accordingly, for Palmerston North City, slope angle alone can be taken as a clear indication of erosion or slippage potential. This has been confirmed by air photo interpretation and field reconnaissance. However, in addition to slope angle, other slope factors, together with water, geological and climatic factors, will also affect the relative landslip hazard potential of a particular site, as set out in Table 2.1.

Table 2.1 – Schematic illustration of factors which will affect the landslip hazard potential of a particular site.

← *LESS PRONE TO INSTABILITY*			*MORE PRONE TO INSTABILITY* →
SLOPE FACTORS			
SLOPE ANGLE			
Flat to shallow <11°	Shallow to moderate 11-20°	Steep 20-30°	Very Steep to precipitous >30°
SLOPE HEIGHT (H)			
Low Slope (i.e. H<1.5 m)			High Slope (i.e. H>20 m)
SLOPE SHAPE			
Uniform gradient	Convex or Concave		Overhanging
SLOPE COVER			
Full vegetation cover			Exposed soil/rock
WATER			
GROUNDWATER			
Water table at depth Fully drained slope			Fully saturated slope Poorly drained slope
SURFACE WATER			
No overland flow Covered/protected slope			Inundated slopes Slope subject to erosion
GEOLOGICAL FACTORS			
SOIL TYPE			
Fully drained sediments Engineered fill	Sandy soils, loess	Clayey soils	Saturated soils (all types) Uncontrolled fill
ROCK TYPE			
Unweathered greywacke	Weathered greywacke	Coarse sediments	Fine sediments
EARTHQUAKE			
Static conditions			Large earthquake loading
CLIMATIC FACTORS			
Sheltered slope (uniform temperature and saturation) Low rainfall		Exposed slope (freeze thaw and wetting/drying)	High rainfall

Mapping hazard areas is an effective method of presenting important information to the public, to developers, and to regulatory authorities. However, where the hazard can be simply described, as is the case for Palmerston North City, it may be better to describe the hazard rather than present it pictorially. Descriptive identification of hazard areas has the advantage that it can encompass small areas which may not be picked up on maps because of the mapping scale, and the onus for the inclusion or exclusion of specific areas therefore becomes the responsibility of applicants rather than Council. Mapping is, however, clearly appropriate in areas of complex geology and/or geomorphology, and also if Council is wanting to alert existing

landowners to actual or potential hazards. For Palmerston North City, however, it is considered that landslip hazard maps based on general information only would result in either an over simplification of a hazard at any particular site, or the arbitrary application of rules which may be inappropriate for a given site.

Accordingly, the recommended approach to the identification of erosion and slippage hazard within the City boundary, takes the slope basis of the ULUC Survey and applies this to the whole of the City area as follows:

Classes A & B (Not at Risk)	This land has an overall slope of less than 11 degrees, does not exhibit any evidence of erosion or shrinkage, and is not likely to be subject to erosion or slippage being further away from (i.e. above or below) a line projecting at 20 degrees from the foot of a slope to the top of that slope, and a line projecting downslope at 20ı from the mid-point of the slope, provided the slope is not subject to river bank erosion.
Class C (Low Risk)	(Low Risk) This land has an overall slope of between 11 and 20 degrees, does not exhibit evidence of erosion, or slippage, or inundation from landslip debris, but could be subject to erosion or slippage, if not developed carefully. This land is not likely to be subject to erosion or slippage, and is unlikely to be adversely effected by upslope landslippage inundating the site or downslope landslippage removing, or removing support to, the land.
Class D & E (Moderate to High Risk)	This land is steep, and/or very steep to precipitous, (i.e. steeper than 20 degrees) and/or is either subject to erosion or slippage, or is likely to be subject to erosion or slippage. This land includes more gently sloping land which is within (i.e. above and below) a line projecting at 20 degrees from the foot of the slope to the top of the slope, and a line projecting downslope at 20ı from the mid-point of the slope.

The various land hazard classes are shown diagrammatically on Figure 2.1.

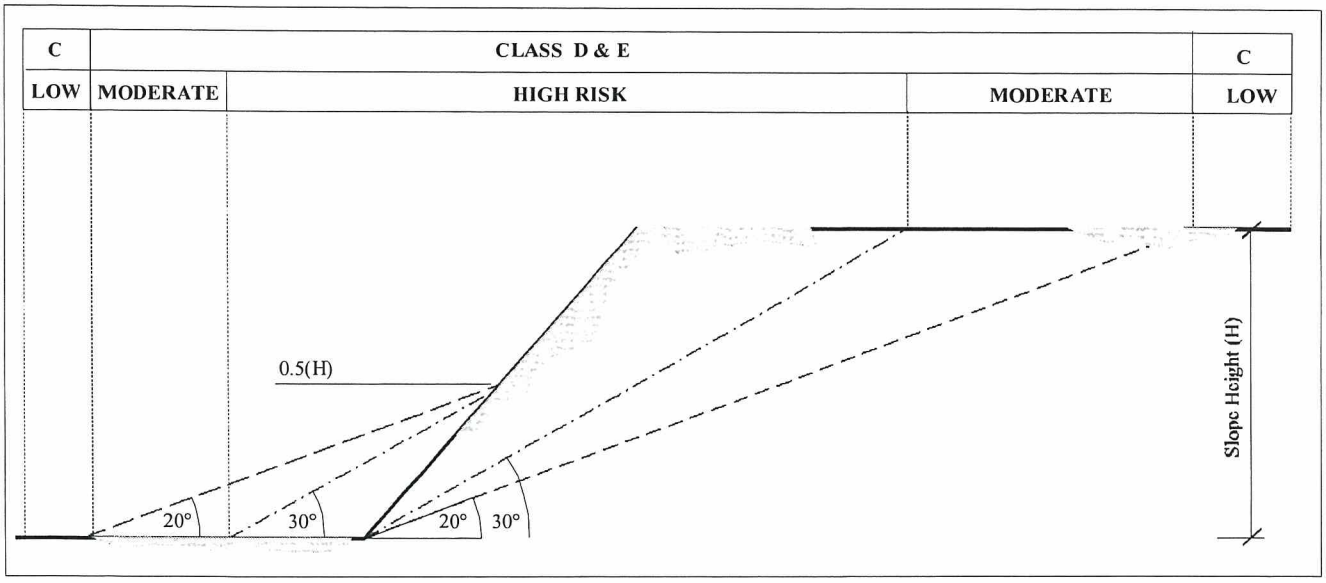


FIGURE 2.1

Where the foot of the slope is subject to active erosion, the rate at which the bank is regressing also needs to be determined and taken into account.

The areas generally identified as Class D & E within the City boundary, to the extent that available topographic (Council 1:5000 ortho photo series) and soils (1:63360 Map; Cowie, 1974) information allows have been mapped using ARC view (Council's GIS system) and are shown on Map 82096-1. However, for specific sites the land to which this classification applies should be identified and confirmed by detailed topographic information submitted by the applicant, and the areas depicted on the map (82096-1) should be taken as indicative only. There may be areas of Class D & E land outside of these areas mapped, and within those broad areas mapped as D & E there may be areas of land which are not subject to, nor likely to be subject to, erosion or slippage.

4 The role of geotechnical reports

In discharging its duty of care in dealing with land which is, or is likely to be, subject to erosion or slippage, is it common practice for Council to require applicants to submit a geotechnical report in support of their application for resource consent. However, Council must also be satisfied that the factual information contained in a geotechnical report adequately addresses the issues of erosion and/or slippage, and that the opinions expressed by the author(s) of the geotechnical report are substantiated. The level of geotechnical investigation should reflect the relative landslip hazard, not the value of the proposed development.

A copy of Schedule 2A of NZS 4404:2004 Land Development and Subdivision Engineering (Statement of Professional Opinion as to Suitability of land for Building Construction) is attached as appendix one to this document.

5 Development criteria

5.1 General

The following are recommended development criteria applying to the land classes defined in Section 2. It is important to note that these criteria apply only to erosion or slippage. Even where these matters have been addressed to the satisfaction of Council, site specific geotechnical investigations may still be required to satisfy Council as to the adequacy of foundation conditions with respect to bearing capacity and settlement (under both static or seismic loads), including the risk of liquefaction (Rogers et al, 1986). Flood risk may also need to be determined, which would include the main floodways and secondary, or overland, flow paths.

In addition to erosion and slippage of natural ground triggered by rainfall and/or seismic events, development works can accelerate, worsen or result in erosion and/or slippage. These works include oversteepening the land by cutting; surcharging the land by filling; increasing groundwater levels and/or piezometric pressures by putting stormwater and/or effluent waste water onto or into the land; and removal of vegetation (principally removing the effective cohesion provided by the roots).

5.2 Class A & B Land - No landslip hazard potential

As this land is not considered to be at risk from erosion or slippage, no geotechnical report is required to support development applications for resource consent or building consent.

5.3 Class C Land - Low landslip hazard potential

This land has a slope gradient (11 to 20 degrees) such that erosion or slippage is not considered likely to occur, and no erosion or mass movement is evident, but is considered to be sufficiently sensitive that erosion or slippage could occur due to cutting and/or filling and/or site disposal of stormwater and/or effluent waste water.

Accordingly, applications for development of this land should be accompanied by a brief geotechnical report which summarises the results of a walk-over survey and a geological/geomorphological assessment (which describes how the particular landform has been formed, what it is made up of and what slope processes are, or are likely to be, active) and provides an informed opinion on the suitability of the land for the intended purpose.

The geological/geomorphological assessment should entail most or all of the following steps, and the brief report should specifically address the expected effects of the subdivisional and/or building development on the land.

The geotechnical assessment of low risk land would be expected to include most or all of the following steps:

- walk over inspection of the site and the surrounding land,
- inspection of aerial photographs taken at various times to provide insight into the local geomorphology and evidence of any previous instability,
- review of geological data (maps, bulletins),

- enquiry after local information about stability/instability of the ground,
- seek existing data about the soil and rock profile (look for nearby exposures) or perform some simple subsurface investigation,
- examination of the soil profile to confirm that if the soil is in-situ and not colluvium,
- examination of the existing survey records for evidence of slippage or erosion.

5.4 Class D & E Land - Moderate to high landslip hazard potential

5.4.1 Moderate landslip hazard potential

This land is steeper than 20 degrees but does not exhibit any evidence of prior instability. Accordingly, due to the steepness of the slope(s), applications for subdivision, building or other development (such as excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area) will be allowed to proceed through the issuing of the necessary consents only if supported by a geotechnical report which includes a stability assessment demonstrating that the proposed development will not accelerate, worsen or result in the land being subject to, or likely to be subject to, erosion or slippage, to the satisfaction of Council:

A geotechnical assessment on moderate risk land would be expected to include:

a Topographic survey (if not already available).

b A description of the geology and geomorphology of the area.

c Definition of the nature and continuity of the strata over the whole area of land which is proposed to be developed (buildings, access and services) involved and to a depth below which slipping is most unlikely, by means of test pit and/or drilling and/or augering (unless existing exposures are adequate).

d Assessment of the relative strength and the sensitivity of the soil in each stratum in which, or interface on which, sliding is possible.

e Assessment of likely groundwater levels and piezometric pressures in the strata during extreme infiltration conditions.

f An opinion stated by a geotechnical specialist as to the stability and suitability of the land for development.

5.4.2 High landslip hazard potential

This land exhibits evidence of past or present erosion or slippage, or has a slope gradient over 30 degrees and/or is subject to processes (e.g. removal of toe support), such that erosion or slippage is considered likely to occur in future. Accordingly, development of this land presents an identifiable hazard to property and could also, in particular circumstances, threaten life.

On, above and especially below this land, no subdivision, building or other development including excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area will be permitted unless a geotechnical report including a stability analysis is produced to the satisfaction of Council.

The geotechnical report must demonstrate that the proposed development area will not be subject to erosion, or slippage, or inundation by debris from upslope, and how the proposed development, through preventative works or other measures, will ensure that any structure will not become damaged by erosion or slippage arising on or off the site, or that development will not accelerate or worsen, erosion or slippage.

A geotechnical report on high risk land would be expected to include:

a Topographic Survey (if not already available)

b A description of the geology and geomorphology of the area.

c Definition of the nature and continuity of the strata over the whole area of land involved, and to a depth below which slipping is most likely, by means of test pips and/or continuous recovery core drilling (unless existing exposures are adequate).

d Determination of the peak and residual shear strength parameters (either from laboratory tests or back analysis of relevant slope failures) and the sensitivity of the soil in each stratum in which, or interface on which, sliding is possible.

e Assessment of groundwater levels and piezometric pressures in the strata during extreme infiltration conditions.

f Analysis of possible failure mechanisms, relevant to the specific geology and geomorphology of the site using effective stresses.

g An opinion stated by a geotechnical specialist as to the stability of the ground and the preventative (or remedial) measures to be incorporated in the development.

The geotechnical reports requirements for the various hazard classes are summarised in Table 4.1.

Table 4.1 – Summary of reporting requirements for landslip hazard classes

Landslip hazard classes		Landslip hazard potential	Geotechnical reporting [1]
A & B	Development of land with slope angles [1] of < 11°	Negligible	Not required
C	Development of land with slope angles [1] of 11° - 20°	Low	Required [2]
D & E	Development of land with slope angles [1] of 20° - 30°	Moderate	Required [3]
D & E	Development of land with slope angles [1] of > 30°	High	Required [4]
D & E	Development of land within lines projecting at 20° (refer Figure 2.1) above or below **any** slope > 20°	Low - Moderate	Required [3]
D & E	Development of land within lines projecting at 30° (refer Figure 2.1) above or below **any** slope > 20°	Moderate - High	Required [4]
D & E	Development of land exhibiting evidence of instability	High	Required [4]
	Development of filled ground (> than 0.5m thick)	Low -High	Required [2]

Notes:

1. For slopes, or slope components, greater than 1.5 m in height.
2. Brief geotechnical report, walkover survey
3. Geotechnical report, stability assessment
4. Geotechnical investigation which includes a detailed stability analysis.

Even with a thorough geotechnical report which includes a stability analysis, complete avoidance of all risk is not possible and no guarantee of absolute safety can be provided. Site development works in particular need to be carefully planned to ensure development does not result in erosion or slippage (PNCC, 1996a).

Works which can be undertaken to protect or restore the land (Turner, 1996) include earthworks (to reduce slope angles or place buttress fills), drainage works (buttress or counterfort drains aligned down the true slope angle are particularly effective), retaining structures, erosion protection structures, and planting (PNCC, 1996b).

5.5 Subdivision and building consents

5.5.1 Refusal to grant consent

Where, as a result of walk-over surveys and/or geotechnical investigations, the land in question is found to be subject to, or is likely to be subject to erosion or slippage or inundation by debris from upslope, Council shall refuse to grant a subdivision consent (S106 RM Act 1991) or a building consent (S72 Building Act 2004), unless the effects will be avoided, remedied or mitigated (then Council may grant a subdivision consent), or unless adequate provision is made to protect the land or building work (then Council may grant a building consent). In addition, if the building work will not accelerate or worsen the situation or affect the land, then Council shall grant a building consent subject to the title being notated that the land is subject to, or is likely to be subject to, erosion or slippage or inundation by debris from upslope, pursuant to Section 72 of the Building Act 2004.

5.5.2 Section 72 of the Building Act, 2004

Section 72 of the Building Act came into being to save Councils from being sued by landowners who had purchased Council approved sections but on which Council could not approve buildings to be built because of land hazard (Rogers, 1982).

Section 72 does, however, allow the landowner to be the arbiter of his or her own destiny, provides a mechanism for alerting subsequent landowners of the hazard, and absolves Council from civil liability.

On currently vacant land subject to, or likely to be subject to, erosion and/or slippage, Council shall refuse to grant a consent for building unless it is satisfied that adequate provision is made to protect the land or building work. If provision is not made, then Council may elect not to issue any building consent, not even under Section 72.

Any application pursuant to Section 72 of the Building Act 2004 must be accompanied by a geotechnical report from a recognised geotechnical specialist that addresses in particular the effect of the building work on the stability of the land and any other property, and how it can comply with the Building Code.

5.5.3 Cut and fill slopes

All subdivisional and building consents should be conditional on all cut and fill slopes steeper than 1 in 3 (18 degrees) being retained or otherwise stabilised. This should ensure that building damage and land boundary disputes are unlikely to arise due to cut or fill slope instability.

5.5.4 Development of filled ground

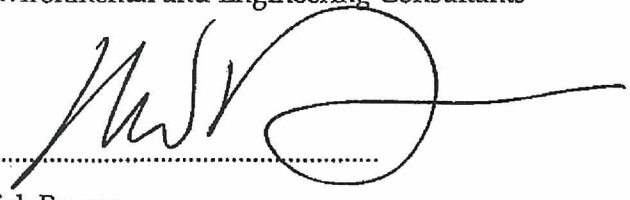
Irrespective of whether or not fill has been certified as suitable for residential purposes, all building consents should be conditional upon a requirement that all foundations will be taken down through any topsoil layers to found in material suitable (with respect to bearing capacity and settlement) to support the particular structure.

6 Applicability

This report has been prepared for the benefit of Palmerston North City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants



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Nick Rogers

Project Coordinator

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15 August 2005