# Dunedin City Council
# Land Information Memorandum
90234

**Issued in accordance with Section 44A of the Local Government Official Information and Meetings Act 1987**

**Should you require further clarification of any of the information listed in this report, please phone our Customer Services Agency on 03 477 4000.**

This Land Information Memoranda (LIM) has been prepared in accordance with Section 44A of the Local Government Official Information and Meetings Act 1987. It contains only information obtained from the records held by the Dunedin City Council as at **30 June 2021**

The Dunedin City Council has not carried out an inspection of the land and/or buildings for the purposes of preparing this LIM. The Dunedin City Council records may not show illegal or unauthorised buildings or works on the land. Accordingly this report may not necessarily reflect the current status of the property. Examples of situations which affect the property but are not recorded in this report include: unauthorised work not known to Council and breaches of Consents or Licences that are not the subject of a formal Requisition or Notice.

The applicant is solely responsible for ensuring that the land or any building or works on the land is suitable for a particular purpose. The applicant should check the Records of Title as this report may not include information that is registered on the Records of Title. The Records of Title may record further information or obligations relating to the land.

Further information about this property may be available from other agencies such as the Otago Regional Council, Nova Gas, Telecom New Zealand (Chorus) or Delta Utility Services Limited.

## PROPERTY ADDRESS

107 Coast Road Waikouaiti

| | |
|---|---|
| **LIM Applicant** | Donald Ray Anderson |
| **Print Date** | 30-Jun-2021 |

## CONTENTS


Property Details
Rates Details
Building, Plumbing and Drainage
Site Hazards
Hazardous Substances
Environmental Health
Licensing
City Planning
Transportation
Water
Waste
Appendix

## PROPERTY DETAILS

| | |
|---|---|
| **Property ID** | 5044901 |
| **Address** | 107 Coast Road Waikouaiti |
| **Parcels** | LOT 21 DP 2137, LOT 2 DP 16586 |
| **Property ID** | 5044902 |
| **Address** | 107 Coast Road Waikouaiti |
| **Parcels** | LOT 21 DP 2137 |
| **Rubbish Day** | Monday |

## RATES DETAILS

| | |
|---|---|
| **Rate Account** | 2044901 |
| Address | 107 Coast Road Waikouaiti |
| Valuation Number | 26520-14600 |
| **Latest Valuation Details** | |
| Capital Value | $405,000 |
| Land Value | $215,000 |
| Value of Improvements | $190,000 |
| Area (Hectares) | 0.2895HA |
| Units of Use | 1 |
| **Current Rates** | |
| Current Rating Year Starting | 01-Jul-2020 |
| Dunedin City Council Rates | $1,743.70 |
| **Rates Outstanding for Year** | $0.00 |

For further explanation on the rate account, or to enquire about information referred to on this page, please contact Rates Staff between 8:30am and 5:00pm weekdays at the enquiries counter on the Ground floor of the Civic Centre, 50 The Octagon, Dunedin, or by phoning 477 4000.

## BUILDING, PLUMBING AND DRAINAGE

**Minimum Floor Levels**
Clause E1.3.2 of the New Zealand Building Code requires that surface water, resulting from an event having a 2% probably of occurring annually, shall not enter buildings. This requirement applies to Housing, Communal Housing, Communal Residential and Communal non-residential buildings. For guidance when establishing minimum floor levels please refer to : https://www.dunedin.govt.nz/services/building-services/minimum-floor-levels and for links to specific areas: https://www.dunedin.govt.nz/services/building-services/minimum-floor-levels/mfl-guidance

**Public Sewer sheets.**
WARNING. Please note that public sewer reticulation sheets are scaled in either Imperial feet or Metric metres. Please check with the Duty Drainage Inspector if in doubt.

**Dunedin City Council Private Drainage plans incomplete.**
WARNING. The Dunedin City Council's private drainage records (plans) prior to 1 January 1993 may be incomplete or not clearly recorded. Owners therefore are advised to carry out work with due care to avoid damage to any private drain not detailed because of the lack of information filed in the Council's records.

**Building and Drainage Information**

**Private Storm Water Drains servicing existing buildings**
There are Private Storm Water drains servicing existing buildings on this land.

**Private Foul Drains servicing existing buildings**
There are Private Foul drains servicing existing buildings on this land.

**Septic Tank and Effluent Disposal**
This property has onsite Septic Tank and Effluent Disposal

**Building and Drainage Consents**
The following consents are recorded for this property:

| | | |
|---|---|---|
| Status Key: | BC - | Building Consent Issued |
| | CCC - | Code Compliance Certificate Issued |
| | Archived /CCC Refused - | In accordance with section 93(2)(b) of the Building Act, the consent was reviewed for code compliance after two years. Compliance with the Building Code could not be established and therefore the Code Compliance Certificate has been refused. |
| | Lapsed - | Work has not commenced and no extension of time applied for within 12 months of date of consent issue. Consent is of no further effect |

NOTE: This is not a comprehensive list of all building consent statuses

ABA-2002-298742 Building Consent Only Lodgement - Erect Garage - Pour Slab for 2nd Garage

| | |
|---|---|
| Lodgement Date | 06-Dec-2002 |
| Decision | Granted |
| Decision Date | 19-Dec-2002 |
| Current Status | **BC Issued** |
| Previous Number *(Applications before 2007)* | ABA23280 |

ABA-2005-307023 Building Consent Only Lodgement - Alt Dwg-Kit/Scullery/Bedrm

| | |
|---|---|
| Lodgement Date | 18-Feb-2005 |
| Decision | Granted |
| Decision Date | 02-Mar-2005 |
| Current Status | **BC Issued** |
| Previous Number | ABA50401 |
| *(Applications before 2007)* | |

ABA-2005-307023/A Building Consent Only Lodgement - Amendment - Reposition Internal Wall to Relocate Ensuite Toilet, Remove Deck, Change Window Size

| | |
|---|---|
| Lodgement Date | 23-Aug-2017 |
| Decision | Granted |
| Decision Date | 20-Sep-2017 |
| Current Status | **BC Issued** |
| Previous Number | |
| *(Applications before 2007)* | |

**Building and Drainage Permits**
Building Permits were issued prior to the introduction of the Building Act 1992. Code Compliance Certificates were not required or issued for permits.

H-1965-272186 AAS19650003 No Permit Number - Erect Dwelling, (Anderson). The permit was lodged on 14-Jun-1965.

H-1965-140665 AAS1965 No Permit Number - Plumbing and Drainage for New Dwelling, (Anderson). The permit was lodged on 14-Jun-1965.

For further explanation on the current status of any consent, or to enquire about information referred to on this page, please contact Building Control Staff between 8:30am and 5:00pm weekdays at the enquiries counter on the Ground floor of the Civic Centre, 50 The Octagon, Dunedin, or by phoning 477 4000.

# HAZARDS

## SITE HAZARDS

Identified within GNS Science Consultancy Report 2017/41 "Revised landslide database for the coastal sector of the Dunedin City district", Barrell, July 2017.

This information is administered by the Otago Regional Council Natural Hazards Database https://www.orc.govt.nz/managing-our-environment/natural-hazards/otago-natural-hazards-database

**The Otago Regional Council has produced a number of reports for the Dunedin City District which outline areas affected by natural hazards including slippage, flooding, subsidence and inundation.**

**These reports are publicly available and can be accessed here: https://www.orc.govt.nz/plans-policies-reports/reports-and-publications/natural-hazards**

**These reports do not provide property specific information, and may not describe all natural hazards that affect the land that is the subject of this LIM report.**

**We recommend that in addition to reading these reports, that you seek independent advice about how this property may be affected by natural hazards including natural hazards that are not described in the reports produced by the Otago Regional Council.**

**Otago Regional Council - Natural Hazards Database**
The characteristics of general natural hazards in the vicinity of this property are also available on the Otago Regional Council's Natural Hazards Database.

http://www.orc.govt.nz/Information-and-Services/Natural-Hazards/hazards/

## HAZARDOUS SUBSTANCES

**WARNING – Change in legislation and management of hazardous substances**
On 1 April 2004, all Dunedin City Council Dangerous Goods Licences expired. From this date they became the responsibility of the Environmental Protection Authority (EPA) under the Hazardous Substances and New Organisms Act 1996. All new licences for hazardous substances were issued by independent Test Certifiers approved by the EPA. The Council no longer holds current information on the use of hazardous substances at these premises and hazardous substances may be present without the Council's knowledge. The Council was advised by the EPA in 2016 that Worksafe had taken over responsibility for managing Location Test certificates under the Hazardous Substances and New Organisms Act 1996. The EPA no longer hold any information in relation to Location Test Certificates If you have any questions, please contact Worksafe.

**Contaminated Site, Hazardous Substances and Dangerous Goods Information**

No information

## ENVIRONMENTAL HEALTH

No records were found of Environmental Health involvement with this property.

## LICENSING

**Health Licensing**
There are no records of any Health Licences for this property.

**Liquor Licensing**
There are no records of any Liquor Licences for this property.

## CITY PLANNING

The information provided with this LIM on District Plan requirements and resource consents has been verified by City Planning in relation to the subject property only. All information included in relation to other land surrounding the site is indicative.

**Accuracy of Boundaries**
Knowing the true location of the property boundaries on the ground is important in determining what can be carried out on the land under the District Plan and in determining whether the current activity complies with the District Plan or any resource consent. Please note that the Council's aerial photographs may not accurately depict the extent of the property. The Record of Title for the site should be checked in the first instance. A surveyor may need to be consulted to establish the true location of the title boundaries on the ground.

**Access to Site**
The legality of any access to the site is important in determining what can be carried out on the land under the District Plan and in determining whether the current activity complies with the District Plan or any resource consent. It is recommended that the Record of Title and/or a lawyer be consulted regarding the legality of any legal and/or physical access to the site (and the maintenance thereof).

**Heritage New Zealand Pouhere Taonga Act 2014**
The Heritage New Zealand Pouhere Taonga Act 2014 applies in addition to any protection provided to a building or site by the District Plan. The Heritage New Zealand Pouhere Taonga Act 2014 makes it unlawful for any person to destroy, or modify the whole or any part of an archaeological site, whether or not the land on which the site is located is designated, or a resource or building consent has been issued, without the prior authority of Heritage New Zealand. The Heritage New Zealand Pouhere Taonga Act 2014 defines an archaeological site as a place associated with pre-1900 activity, where there may be evidence relating to the history of New Zealand. Pre-1900 buildings are considered archaeological sites under the Heritage New Zealand Pouhere Taonga Act 2014 and are also often associated with subsurface archaeological remains that provide evidence of pre-existing use of the site. Council records may not necessarily identify the precise date upon which an existing building was constructed. Contact the Dunedin office of Heritage New Zealand for further information: infodeepsouth@heritage.org.nz ; 03 477 9871.

**Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011**
The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 came into force on 1 January 2012. The National Environmental Standard applies to any piece of land on which an activity or industry described in the current edition of the Hazardous Activities and Industries List (HAIL) is being undertaken, has been undertaken or is more likely than not to have been undertaken. (The current edition of the HAIL is available on the Ministry for the Environment website at www.mfe.govt.nz.) Activities on HAIL sites may need to comply with permitted activity conditions specified in the National Environmental Standard and/or might require resource consent. (The Otago Regional Council should also be consulted for any rules in might have in regards to the use or development of contaminated sites.)

If a person wishes to establish whether a piece of land has had hazardous activities or industries conducted on it, and thus whether activities on that land are controlled by the National Environmental Standard, then the person must pay for a review of the information about the land held by the Council, or pay for a suitably qualified and experienced practitioner to undertake a preliminary site inspection. Formal confirmation from the Council that resource consent is not required under the National Environmental Standard can only be given through a certificate of compliance application.

**Consent Notices**
There are no Consent Notices recorded for this property. It is recommended that the applicant check the Record of Title for any notices or covenants that may affect the property.

**District Plan Information**
Dunedin currently has an Operative Dunedin City District Plan, and the Proposed Second Generation Dunedin City District Plan (2GP). Accordingly, both of these plans may affect the development potential of this site and surrounding properties.

As a general principle, rules in the 2GP must be considered along with the rules of the Operative District Plan until such time as the rules of the 2GP become operative, or are treated as operative. The policies and objectives of both plans should also be considered.

The 2GP was publicly notified on Saturday 26 September 2015. The submission period closed on Tuesday 24 November 2015. Decisions on the 2GP were released on Wednesday 7 November 2018. The appeal period closed on Wednesday 19 December 2018. The schedule of appeals can be viewed at https://www.dunedin.govt.nz/council/district-plan/2nd-generation-district-plan/appeals-received-on-the-2gp.

You are advised to refer to our website to determine which rules in the 2GP have legal effect or are fully operative, and to determine which rules in the Operative District Plan are now inoperative.

The 2GP is subject to change at any time. Variation 2 (Additional Housing Capacity) to the 2GP was notified on Wednesday 3 February 2021. No rule changes proposed in Variation 2 have legal effect from the date of notification. Once the initial submission ends on Thursday 4 March 2021, rules that do not have submissions in opposition to them will be deemed operative. Please refer to our website for more information on Variation 2 at https://www.dunedin.govt.nz/council/district-plan/2nd-generation-district-plan/plan-change-dis-2021-1-variation-2.

Further rules will come into legal effect and/or become fully operative at the release of decisions and the resolution of appeals.

You should check with the Council whether any changes have occurred since the date this LIM report was issued. The information provided with this LIM on district plan requirements is applicable as at the date this LIM is issued: there may be changes to the district plan rules following the release of this LIM that may affect this site and surrounding properties.

You should ensure that you consult the information and relevant planning maps in the Operative District Plan which can be found on our website at https://www.dunedin.govt.nz/council/district-plan/district-plan-2006 and the 2GP which can be found on our website at https://www.dunedin.govt.nz/council/district-plan/2nd-generation-district-plan as well as at all Dunedin City Council service centres and libraries.

**OPERATIVE DISTRICT PLAN INFORMATION**

**Zoning**
This property is zoned as follows in the District Plan.

*Zone*

RESIDENTIAL 5

**Noise**
This property is located in a Noise Area where the noise limits outlined below apply. Rule 21.5.1(i)(b) also specifies a maximum noise limit of 75 dBA Lmax between 9.00 pm on any night and 7.00 am the following day measured at the boundary of the site or within any other site. Note that some activities have a resource consent or existing use rights that allow these limits to be exceeded. Some activities are also exempted from noise limits. Furthermore, the actual limits that apply will also depend on whether this site adjoins a Noise Area Boundary and whether there are Special Audible Characteristics.

Refer to Section 21.5 of the District Plan for further details. Every occupier of land is also under a general duty to adopt the best practicable option to ensure that the emission of noise from land does not exceed a reasonable level.

*Noise Zone*

50Dt/35Nt dBA, 45SP dBA

55 Dt/40Nt dBA within 50m of a residence

**Designations on Adjoining Property/Road**

This property adjoins a property/road that is subject to the designations below. Refer to the Planning Maps and Schedule 25.5 of the District Plan for more information. Contact Planning staff should you wish to know the exact nature of the conditions applying to the designation.

| *Desig. No.* | *Authority* | *Name and Purpose* | *Conditions* |
|---|---|---|---|
| D419 | New Zealand Railways Corporation | Main South Railway - "Railway Purposes" | Yes |

**Road Hierarchy**

The roads listed below adjoining this property are classified as either Collector, District Regional or National Roads in the District Plan Roading Hierarchy. All other roads adjoining this property but not listed here are classified as Local Roads. Refer to Section 20 of the District Plan for more information.

| *Type* | *NZTA Control* |
|---|---|
| DISTRICT | Coast Road |

**SECOND GENERATION PLAN INFORMATION**

**Zoning**

- Township and Settlement (refer Section 15, Residential)

**Scheduled Items**

- Designations
  - Plan ID: D419
  - Authority: Kiwirail Holdings Limited
  - Purpose: Main South Railway - Railway Purposes

**Overlay Zones**

- Nil

**Mapped Areas**

- Archaeological Alert Layer
- No DCC Reticulated Wastewater Mapped Area
- Road Classification Hierarchy (main roads within 30m of site)
  - Coast Rd is a Collector road
- Wahi Tupuna
  - Name: Purakaunui to Hikaroroa to Huriawa
  - ID: 14

[Please note that some of the items above may only extend over part of the property. If there are multiple designations over the property, these may overlap.]

**Resource Consents**
There are no resource consents for this property.

**RESOURCE CONSENTS WITHIN 50 METRES OF 107 COAST ROAD WAIKOUAITI**
**2284 R Coast Road Waikouaiti**
LUC-2021-321 Land Use Consent Karitane Northern Watermain Renewals -Network Utility. There has been no outcome yet.
RMA-2004-368562 Resource Management Act (Historical Data) ALTER DESIGNATION FOR SH1 - WARRINGTON TURN-OFF (Other). The outcome was Granted on 17/08/2005.
RMA-2000-363953 Resource Management Act (Historical Data) CERTIFICATE OF COMPLIANCE FOR THE CONSTRUCTION OF FIVE SPANS OF 11 KV (312 METRES) OF OVERHEAD POWER LINES (Other). The outcome was Declined on 01/05/2000.
RMA-1984-354332 Resource Management Act (Historical Data) ERECT A"LEAN TO"IMPLEMENT SHED Ownr:KM AND AG BENNETT / App: KM AND AH BENNETT COAST RD,WAIKOUAITI (Notified - Non Complying). The outcome was Granted on 08/03/1985.
RMA-1984-354330 Resource Management Act (Historical Data) OPERATE AN OLD PEOPLES HOME / App: DL AND EA COOPER (Notified - Non Complying). The outcome was Granted on 06/03/1985.
**5044903 109 Coast Road Waikouaiti**
LUC-2015-563 Land Use Consent alter and add to dwelling. The outcome was Granted on 18/12/2015.
**5045144 145 Coast Road Waikouaiti**
RMA-2003-366792 Resource Management Act (Historical Data) SUBDIVISION TO CREATE FIVE ALLOTMENTS (Non-Notified - Non Complying). The outcome was Granted on 16/12/2003.
**5108925 PT SEC 86 Dunedin - Tranzrail (N/R) Dunedin**
LUC-2021-88 Land Use Consent To undertake additional earthworks in association with the construction of the shared pathway route from St Leonards to Port Chalmers. The outcome was Granted on 11/05/2021.
LUC-2018-371 Land Use Consent land use consent for alterations to the Otago Harbour Wall, earthworks (including earthworks in a coastal habitat) and construction of a boardwalk (to the extent that is not within the coastal marine area) associated with the shared cycling and pedestrian path. The outcome was Granted on 21/09/2018.
LUC-2017-14 Land Use Consent land use consent being the construction of the St Leonards to Port Chalmers Shared Pathway at Various Sites along the St Leonards to Port Chalmers Shared Pathway Route. The outcome was Granted on 11/04/2017.
LUC-2013-99 Land Use Consent mural on retaining wall. The outcome was Granted on 02/04/2013.
SUB-2011-61 Subdivision Consent amalgamation subdivision - subdivide railway land at Burnside into an industrial lot and a balance lot. The outcome was Granted on 15/07/2011.
RMA-2006-370524 Resource Management Act (Historical Data) construct and operate a self-service fuel facility. The outcome was Granted on 29/10/2007.
RMA-2001-364796 Resource Management Act (Historical Data) ESTABLISH CAR PARK (Non-Notified - Non Complying). The outcome was Granted on 06/06/2001.
RMA-2004-368439 Resource Management Act (Historical Data) CREATE A THREE LOT INDUSTRIAL 1 SUBDIVISION (Non-Notified - Restricted Discretionary). The outcome was Granted on 02/12/2004.
RMA-2001-365039 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.
RMA-2001-365038 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.
RMA-2001-365037 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.
RMA-2001-365036 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.
RMA-2001-365035 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.
RMA-2001-365034 Resource Management Act (Historical Data) ALTER SIGNS/HOARDINGS (Non-Notified - Non Complying). The outcome was Granted on 11/10/2001.

RMA-2002-366126 Resource Management Act (Historical Data) CERTIFICATE OF COMPLIANCE (Other). The outcome was Granted on 04/12/2002.
RMA-1999-362972 Resource Management Act (Historical Data) MURAL FOR WILKIE ROAD/NEVILLE ROAD TRANZ RAIL BRIDGE (Non-Notified - Restricted Discretionary). The outcome was Granted on 20/08/1999.
RMA-1993-357917 Resource Management Act (Historical Data) Subdivision Ownr:NZ RAILWAYS CORP. / App: K.G. Harford Private Bag (Non-Notified - Non Complying). The outcome was Granted on 18/11/1993.
RMA-1997-361305 Resource Management Act (Historical Data) VARIATION TO SUBDIVISION CONSENT AND EXTENSION OF TIME (Non-Notified - Unrestricted Discretionary). The outcome was Granted on 13/10/1997.
RMA-1991-350984 Resource Management Act (Historical Data) Report Ownr:RAILWAYS (Non-Notified - Non Complying). The outcome was Granted on 24/05/1991.
RMA-1993-355755 Resource Management Act (Historical Data) Subdivision for disposal of surplus railway land App: WORKS CONSULTANCY (Non-Notified - Non Complying). The outcome was Granted on 25/06/1993.

If you would like a copy of any Resource Consent decision or advice on the current status and relevance of any planning matter referred to in the LIM, enquiries may be made at the Planning Enquiries desk on the Ground Floor of the Civic Centre, 50 The Octagon, or by phoning 477 4000 and asking for the Duty Planner. Planners are available at the Planning Enquiries desk to answer your enquiries between 8:30am and 5:00pm weekdays.

## TRANSPORTATION

No Transportation information was found for this property

As of the 24th April 2015, the Transportation Group no longer inspects the site as part of a LIM. Only the electronic records since 2002 have been examined for Transportation information in relation to the property.

For further explanations on property owner obligations in regard to local road encroachments, vehicle entrances, vegetation management or retaining structures please refer to the Dunedin City Council website at http://www.dunedin.govt.nz/services/roads-and-footpaths or contact Transportation on 477 4000.

For properties abutting the state highway, the New Zealand Transport Agency (NZTA) is the Road Controlling Authority.

## WATER and WASTE

### WATER

**Rural water supply area - Warrington Scheme - Connected**
The subject property is located within the Warrington Rural Water Scheme as shown in Appendix B of the Dunedin City Council Water Bylaw 2011. The water supply from this scheme is a low-pressure, restricted flow supply. This property has a scheme connection and receives 1 water unit(s)/day (1m3 litres/day). New connections and allocation of new water units or re-allocation of existing units is at the discretion of the Council.

It is a scheme requirement that a storage tank is in place, and capacity of at least 2 days storage for domestic use is recommended. Only part of the scheme is incorporates with fire-fighting capability. Where a property is located beyond the area with fire-fighting capability, it is strongly recommended that water storage facilities also comply with the New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509).

**Terms and conditions of supply**
All new and existing connections to the Dunedin City Council's water supply network are subject to the terms and conditions of the Dunedin City Council Water Bylaw 2011. The bylaw is available to view at www.dunedin.govt.nz/water-bylaw.

**Water pressure**
Indicative network water pressure to the property is shown on maps available at www.dunedin.govt.nz/water-pressure. Specific detail is available on request.

**Water reticulation maps**
A copy of the water reticulation map of Dunedin City Council infrastructure in the vicinity of the subject property is attached. These show the location of the water main in the road. It may or may not show the water service to the property. It is recommended that the applicant check the property

## WASTE

**No Services Available**
No Dunedin City Council-owned stormwater or foul sewer services are available for connection at the subject property

**Information Regarding Watercourses**
The controlling authority for all water and waterbodies in Dunedin City is the Otago Regional Council. The Regional Plan: Water addresses water take and use, diversions, damming, discharges and bed alteration under the Resource Management Act 1991. They are also responsible for the Flood Protection Management Bylaw 2012.

The controlling authority for watercourses in relation to stormwater drainage, and removal of obstructions in accordance with Local Government Act 1974 is the Dunedin City Council. The Council also issues building and resource consents for certain works around watercourses.

Not all watercourses within Dunedin City are recorded or known to the Council, therefore it is recommended that the applicant inspect the property for watercourses.

For further information on watercourses it is recommended the applicant read the Watercourse Information Sheet. A copy of this document is available on request or for download from the Dunedin City Council website www.dunedin.govt.nz

## APPENDIX

**Glossary of terms and abbreviations**

The following are abbreviations and terms that may appear as a part of a LIM.

**Consent, Permit, Licence & Complaint types**

- AAB DCC Building permit
- AAD DCC Drainage permit
- AAG Green Island drainage permit
- AAH Hyde permit
- AAK St Kilda permit
- AAM Mosgiel permit
- AAP Port Chalmers permit
- AAS Silverpeaks permit
- AAT Maniototo permit
- ABA Application Building Act 1991
- AMD Amendment to a Building Consent
- BC Building Consent
- BCC Building Compliance Certificate - Sale of Liquor Act
- BCM Building Complaint
- CER Certifier
- COA Certificate of Acceptance
- DGL Dangerous Goods Licensing
- ENV Health complaint
- HTH Health licence
- LIQ Liquor licence
- NTF Notice to Fix
- NTR Notice to Rectify
- PIM Project Information Memorandum
- POL Planning Other Legislation
- RMA Resource Management Act - Resource consent
- RMC Resource consent complaint
- WOF Building Warrant of Fitness

**Terms used in Permits & Consents**

- ALT Alteration
- ADD Addition
- BD D/C Board drain in common
- BLD Building
- BLDNG Building
- BT Boundary trap
- B/T Boiler tube
- CCC Code Compliance Certificate
- DAP Drainage from adjacent property
- DGE Drainage
- DIC Drain in common
- DR Drainage
- DWG Dwelling
- FS Foul sewer
- HEA Heater
- ICC Interim Code Compliance
- MH Manhole
- PL Plumbing
- PLB Plumbing
- PTE Private
- SIS Sewer in section
- WC Water course
- WT Water table
- SW Stormwater

**General terms**

- RDMS Records and Document Management System

# Photographic Map

Scale at A4:
1:750
24/06/2021
8:02:57 PM

N

PARCEL LINES CAN VARY FROM LEGAL PARCEL BOUNDARES
This map is for illustration purposes only and is not accurate to surveying, engineering or orthophotographic standards. Every effort has been made to ensure correctness and timeliness of the information presented.

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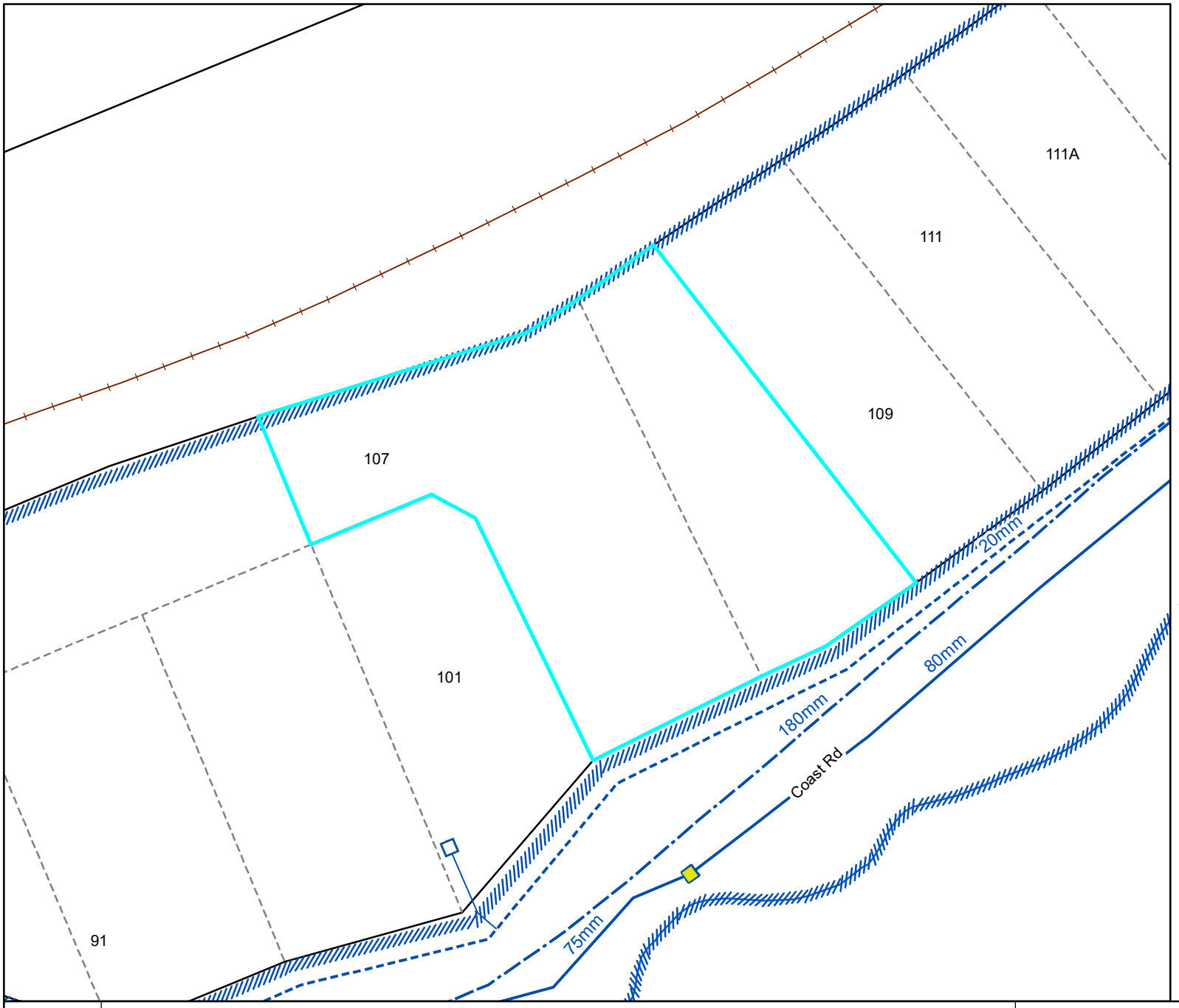



## Legend

### Water Supply

- Manifold Box
- Water Meter
- Toby
- Meter without manifold box
- Retic Flow Meter
- Combination Meter
- Manifold Box With Restrictor
- Water Valve - Zone
- Non Return Valve
- Water Valve - Gate
- Water Valve - Sluice
- Water Hydrant
- Water Backflow Preventor - RPZ
- Water Non-Return Valve
- Water Pump Station
- Water Bore
- Water Treatment Plant
- Water Storage Tank
- Supply Main
- Trunk Main
- Disused
- Reticulation
- Rider
- Scour
- Water Service Lateral
- Water Fire Service Lateral
- Water Critical Service Lateral
- Water Zone Boundary
- Water Reservoir
- Redundant Water Main

NOTE:
Private water services have the same symbols as those above, however they are coloured pink.

### Foul Sewerage

- Standard Manhole
- Valve Chamber (pressurised)
- Boundary Kit Non-Return Valve
- Pump Station Domestic
- Drop Manhole
- Inspection Manhole
- Inspection Opening
- Lamphole
- Outlet
- Pump Station
- Treatment Plant
- Vent
- Foul Sewer Node
- Foul Drains in Common (public)
- Sewer
- Trunk Sewer
- Vent Line
- Rising Main
- Redundant Foul Sewer Pipe

NOTE:
Private foul drains have the same symbols as those above, however they are coloured orange.

### Stormwater

- SW Bubble-up Tank
- SW Drop Manhole
- SW Insp Chamber and Grating Inlet
- SW Inspection Manhole
- SW Inspection Opening
- SW Lamphole
- SW Mudtank Inlet
- SW Outlet
- SW Pipe Inlet
- SW Pressure Manhole
- SW Standard Manhole
- SW Stormwater Node
- Roading Bubble-Up Tank
- Roading Mudtank
- Stormwater Main
- Stormwater Trunk Main
- DCC Open Channel
- Piped WC
- Open WC
- Culvert
- Stormwater Mudtank Pipe
- Redundant Stormwater Main
- SW Sump
- SW Pump Station

NOTE:
Private stormwater drains have the same symbols as those above, however they are coloured light green.

### General

- DCC Water & Waste Structure
- Railway Centreline

### Cadastral

- Parcel
- Road/Rail
- Hydro
- Motorway Parcels
- Strata
- Easment (where recorded)

Full legend can be viewed at https://www.dunedin.govt.nz/council-online/webmaps/waterservices

# Council Water & Drainage Services

Information shown is the best available at the time of publishing. The accuracy and completeness of This information is variable. Private assets are typically not mapped. Recent changes may not be reflected. Verify on site before commencing work. For all enquiries phone 03 477 4000.

Scale at A4:
1:750
24/06/2021
8:03:05 PM

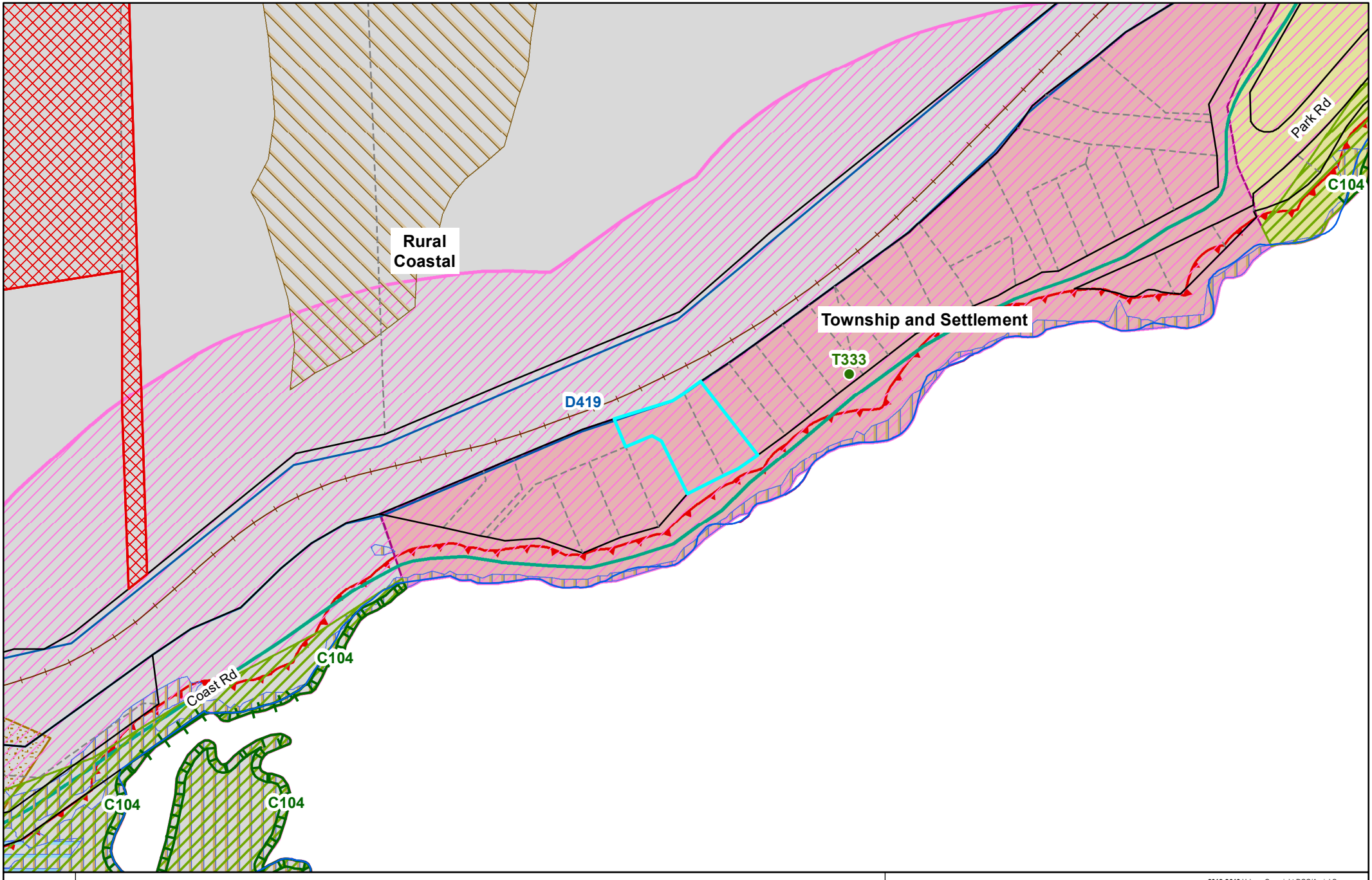
N

PARCEL LINES CAN VARY FROM LEGAL PARCEL BOUNDARES
This map is for illustration purposes only and is not accurate to surveying, engineering or orthophotographic standards. Every effort has been made to ensure correctness and timeliness of the information presented.

**2018-2019** Urban, Copyright DCC/Aerial Surveys Ltd. Rural, ORC/Aerial Surveys Ltd. CC BY 4.0 NZ

**2013** Urban and rural photography Jan/Feb 2013. Copyright DCC. CC BY 3.0 NZ.

**2006/2007** Urban photography March 2007, copyright NZAM. Rural photography March 2006, copyright Terralink International Ltd.




# Second Generation District Plan

Scale at A4:
1:3,000
24/06/2021
8:03:34 PM

N

PARCEL LINES CAN VARY FROM LEGAL PARCEL BOUNDARES
This map is for illustration purposes only and is not accurate to surveying, engineering or orthophotographic standards. Every effort has been made to ensure correctness and timeliness of the information presented.

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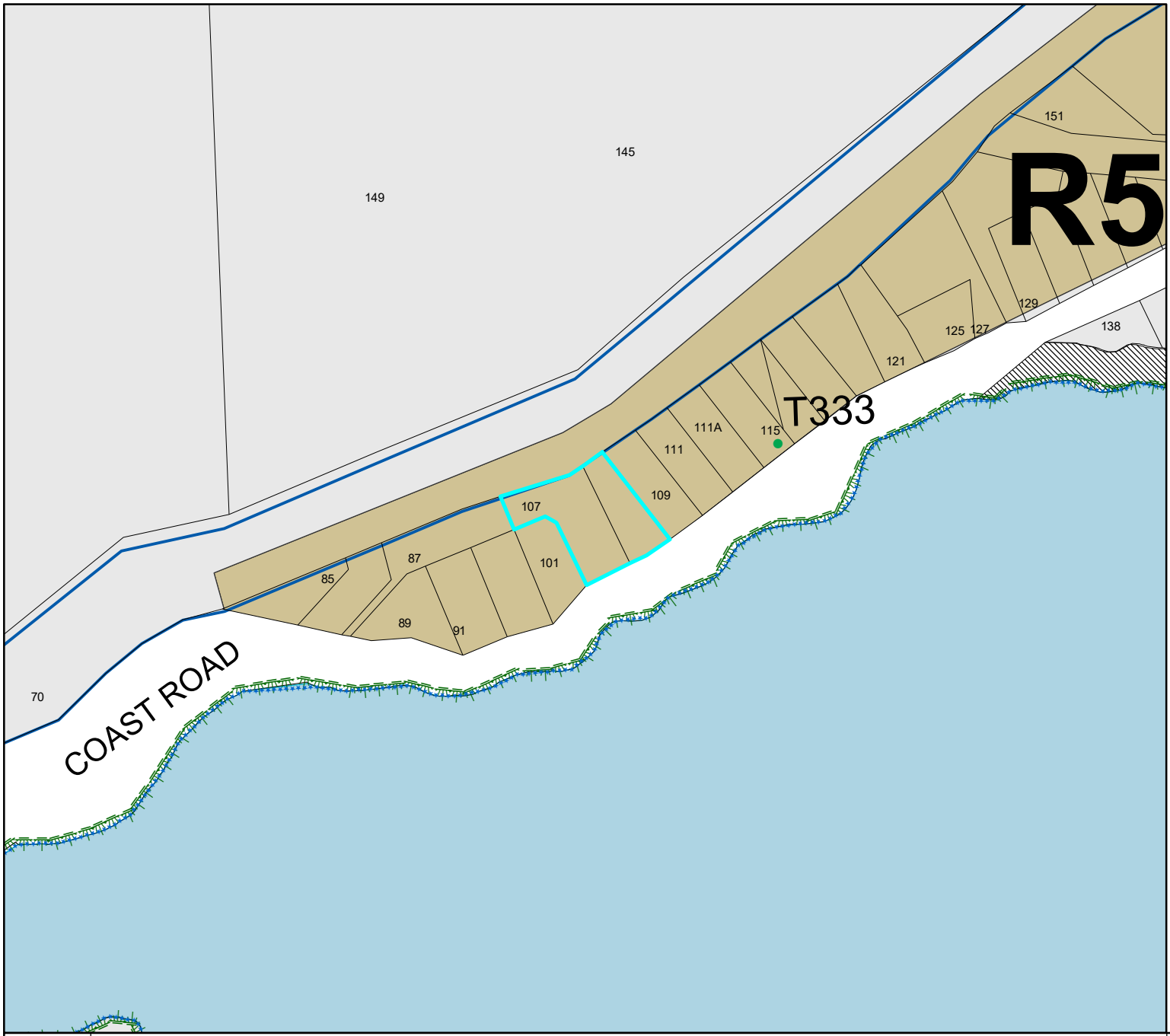
**2013** Urban and rural photography Jan/Feb 2013. Copyright DCC. CC BY 3.0 NZ.

**2006/2007** Urban photography March 2007, copyright NZAM. Rural photography March 2006, copyright Terralink International Ltd.




## Legend

- Significant Trees
- Transpower Structure
- Transpower Lines
- Heritage Structure
- Heritage Facade
- DP Archaeological Sites
- Airport Fan Designation 274 bdy
- Port Height Restrictions
- DP Designations
- Urban Landscape Conservation Area
- DP Taieri Aerodrome
- Restricted Water Supply Area
- Ground Water Protection Zone A
- Ground Water Protection Zone B
- Public Roads not Legal
- Unformed Legal Road

### Zones

- R1 - Residential 1 Zone
- R2 - Residential 2 Zone
- R3 - Residential 3 Zone
- R4 - Residential 4 Zone
- R5 - Residential 5 Zone
- R6 - Residential 6 Zone
- R6A
- Campus Zone
- Airport Zone
- Stadium Zone
- CA -Central Activity Zone
- LSR - Large Scale Retail Zone
- LA1 - Local Activity Zone 1
- LA2 - Local Activity Zone 2
- In1 - Industrial 1 Zone
- In2 or SD - Industrial 2 or Special Development Zone
- Port 1 Zone
- Port 2 Zone
- RR - Rural Residential Zone
- Rural Zone
- H - Harbourside

### Port & Airport Noise

- Air Noise Boundary
- Airport Outer Control Boundary
- Outer Port Control Boundary
- Port Noise Boundary

### Esplanade Requirement

- Esplanade Reserve Required
- Esplanade Strip Required

### Landscape Management Boundary

- outside boundary
- boundary between areas
- prominency boundary

### Townscape

- Townscape and Heritage Precinct Boundary - Internal
- Townscape and Heritage Precinct Boundary

### Pedestrian Frontage

- Identified Pedestrian Crossing
- Verandah Required

### Areas of Significant Conservation Value boundary

- ASCV Boundary
- ASCV Boundary - Internal
- Areas of Significant Conservation Value (Esturine edge)
- Areas of Significant Conservation Value (Wetland)

Most detail not shown at scales smaller than 1:25,000
Optimal scale range is 1:2000 - 1:5000

This Planning Map is indicative.

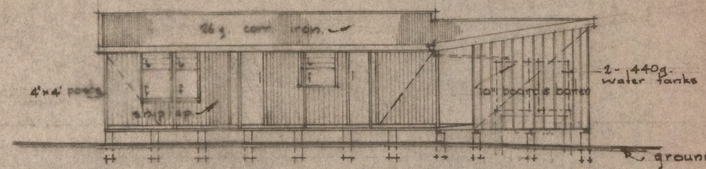
The official Planning Maps are compiled within the District Plan (Volume 2). This map is a representation of the official maps. However, due to the ability to display these maps at different scales, and the dynamic nature of the underlying cadastre, some inconsistencies or misalignment of data may be depicted which is not visible on the official maps. Consult Dunedin City Coucil for any clarification.

# Operative District Plan Map

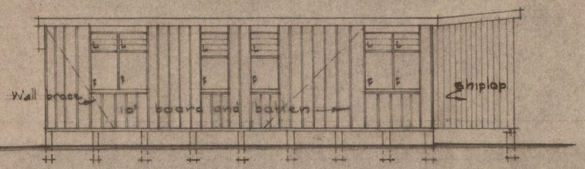
Scale at A4:
1:3,000
24/06/2021
8:03:40 PM

N

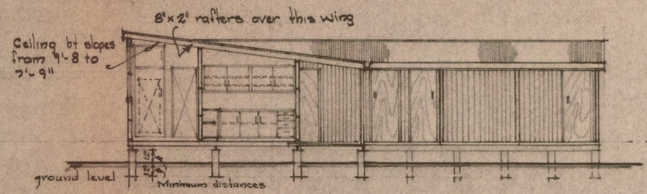
PARCEL LINES CAN VARY FROM LEGAL PARCEL BOUNDARES
This map is for illustration purposes only and is not accurate to surveying, engineering or orthophotographic standards. Every effort has been made to ensure correctness and timeliness of the information presented.



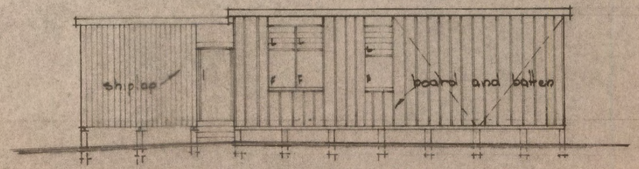

WEST ELEVATION



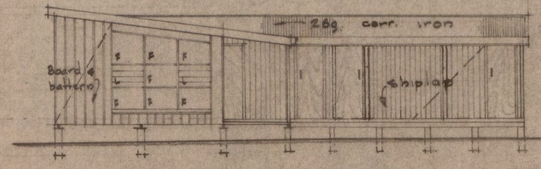

SOUTH ELEVATION



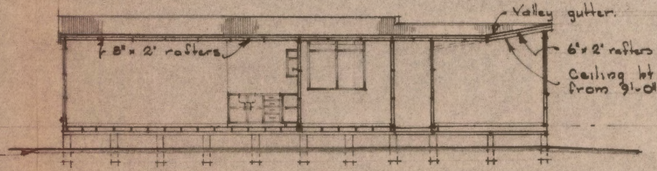

SECTION A-A



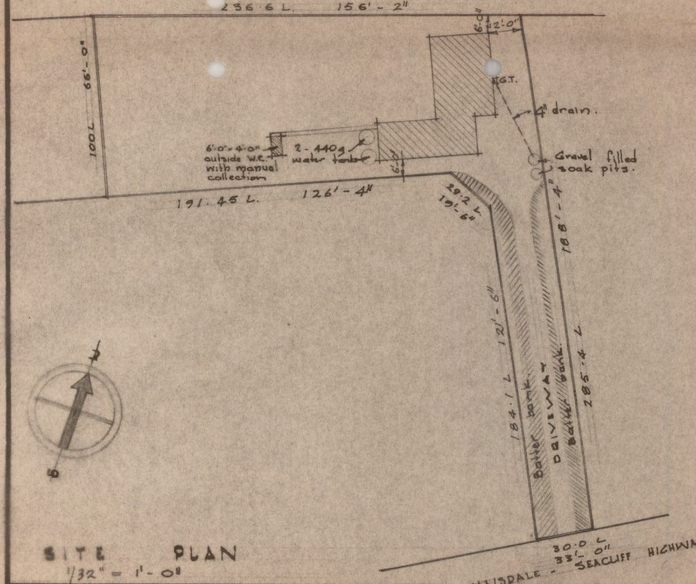

EAST ELEVATION



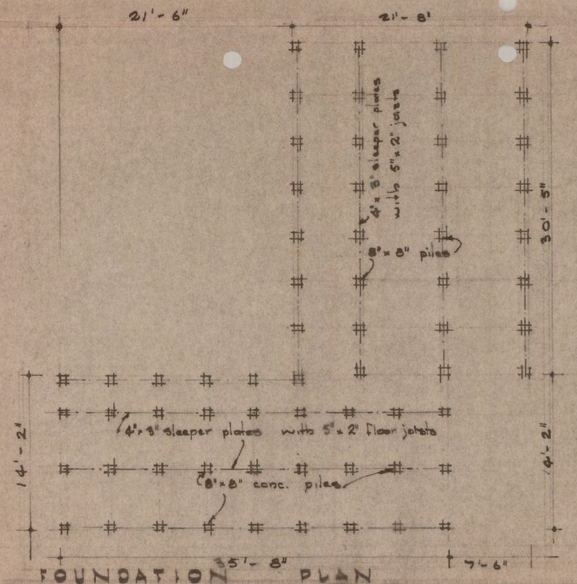

NORTH ELEVATION



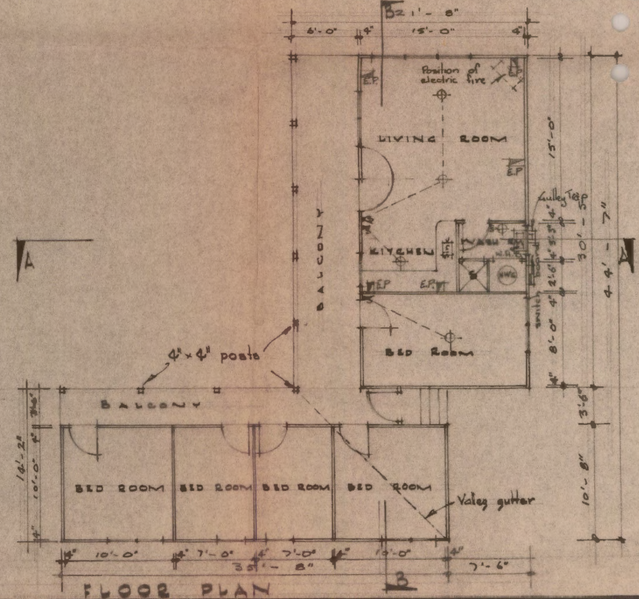

SECTION B-B




SITE PLAN
1/32" = 1'-0"




FOUNDATION PLAN



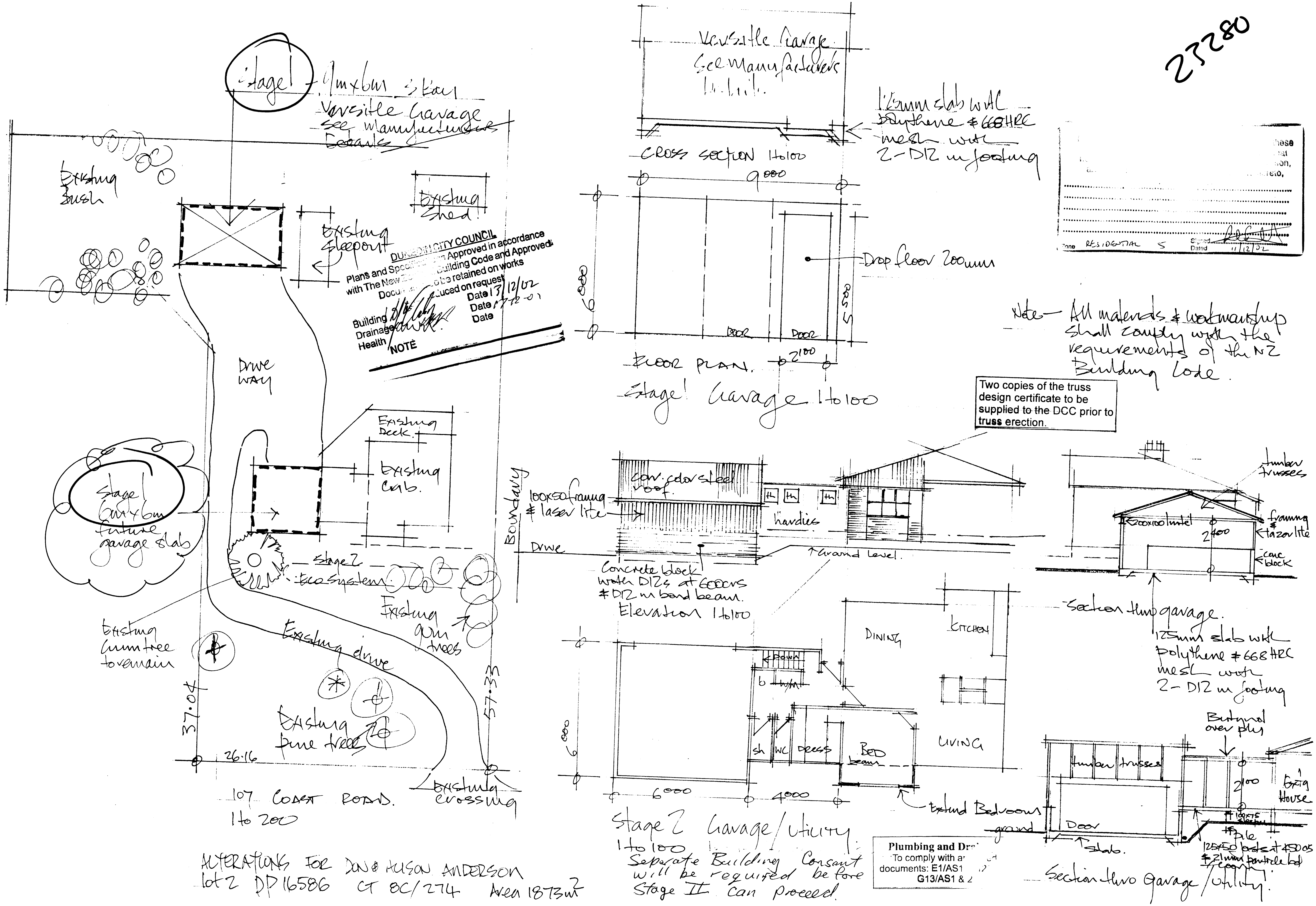

FLOOR PLAN

TIMBER SCHEDULE

| | |
|---|---|
| Plates | 4"x3" Rimu B&H. |
| Floor joists | 8"x2" Rimu B.A. at 18" crs. |
| Frames | 4"x2" at 18" crs. |
| Dwangs | 3 rows exterior frames<br>2 rows interior frames |
| Ceiling joists | 8"x2" at 20" crs in living Rm<br>6"x2" at 20" crs in bed room wing |
| Purlins | 3"x2" at 2'-6" crs. |
| Window frames | ex 6"x2" |

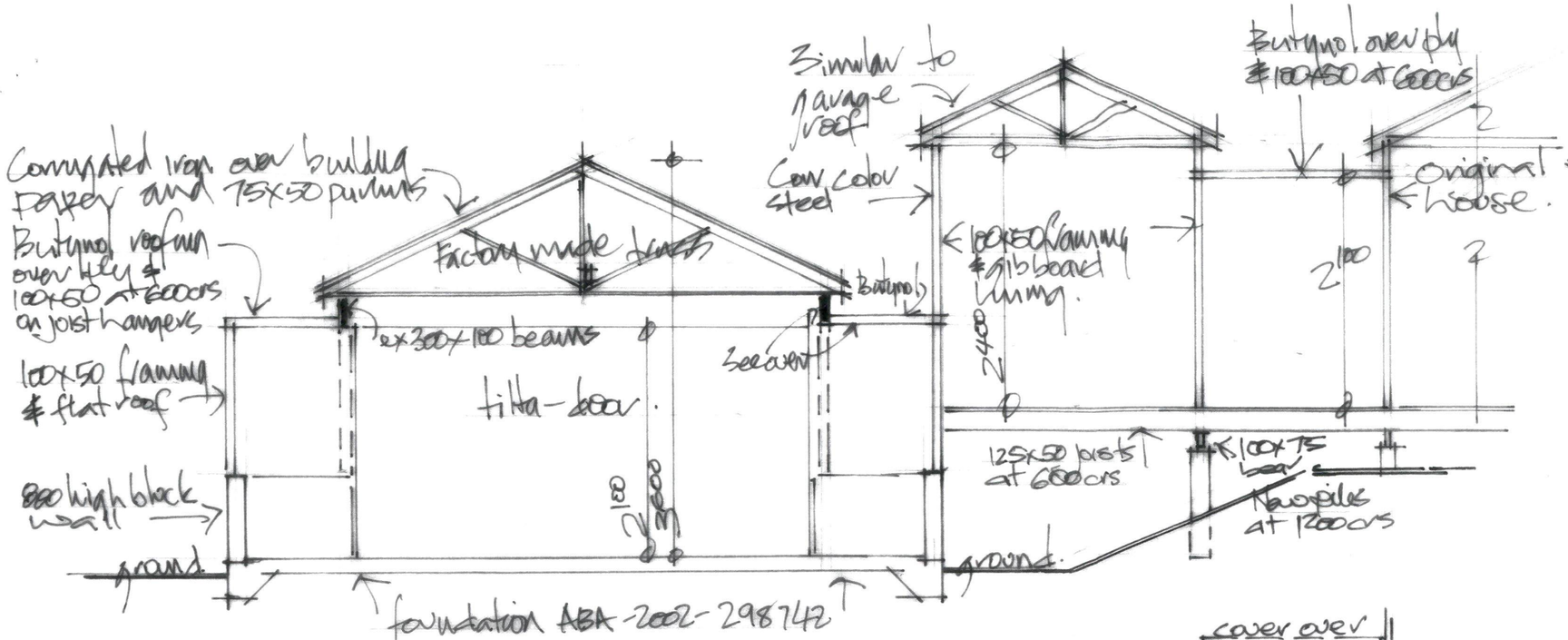
# HOLIDAY RESIDENCE FOR Mr J. S. ANDERSON. WARRINGTON

SCALES 1/32" & 1/8" = 1'-0" DATE: MAY 1965
DRAWN BY D.R. ANDERSON. MACANDREW BAY

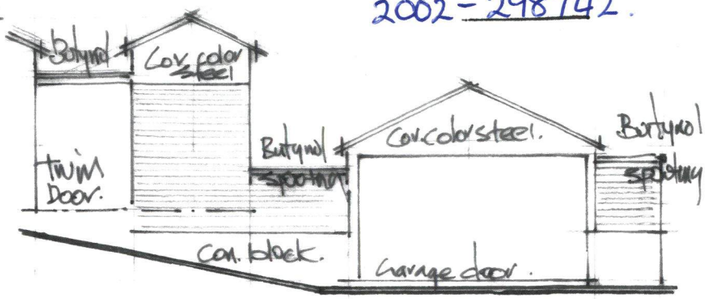


23280
Stage 1
9m x 6m 3 bay Versitile Garage see Manufacturers Details
Existing Bush
Existing Shed
Existing Sleepout
DUNEDIN CITY COUNCIL
Plans and Specifications Approved in accordance with The New Zealand Building Code and Approved Documents to be retained on works
Document produced on request
Building Date 13/12/02
Drainage Date
Health Date
NOTE
Drive way
Existing Deck
Existing Cab.
Stage 1 6m x 6m future garage slab
Boundary
Stage 2 Eco System
Existing gum trees
Existing Gum tree to remain
Existing drive
Existing pine trees
37.04
26.16
57.33
Existing crossing
107 COAST ROAD.
1 to 200
ALTERATIONS FOR DON & ALISON ANDERSON
lot 2 DP 16586 CT 8C/274 Area 1873m²
Versitile Garage See Manufacturers Details
125mm slab with polythene & 668 HRC mesh with 2-D12 in footing
CROSS SECTION 1 to 100
9000
6000
5500
Drop floor 200mm
DOOR
DOOR
2100
FLOOR PLAN.
Stage 1 Garage 1 to 100
Note — All materials & workmanship shall comply with the requirements of the NZ Building Code
Two copies of the truss design certificate to be supplied to the DCC prior to truss erection.
RESIDENTIAL 5
11/12/02
Corr. colorsteel roof
100x50 framing & laser lite
Hardies
Drive
Ground level
Concrete block with D12s at 600crs & D12 in bond beam.
Elevation 1 to 100
timber trusses
200x100 lintel
2400
framing & lazerlite
conc block
Section thru garage.
125mm slab with polythene & 668 HRC mesh with 2-D12 in footing
DINING
KITCHEN
LIVING
Down
W/M
SH
WC
DRESS
BED
beam
6000
4000
Extend Bedrooms
Stage 2 Garage/Utility 1 to 100
Separate Building Consent will be required before Stage II can proceed.
Plumbing and Dr
To comply with a
documents: E1/AS1
G13/AS1 &
Butynol over ply
timber trusses
2100
Exg House
Door
ground
Slab.
Pile
125x50 joists at 450crs
Section thru Garage/Utility.

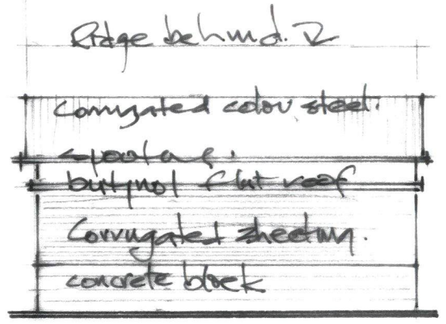
Built Plan
Received by: MARC GENT
6 5 2021
2002 - 298742




cross section scale 1 to 50



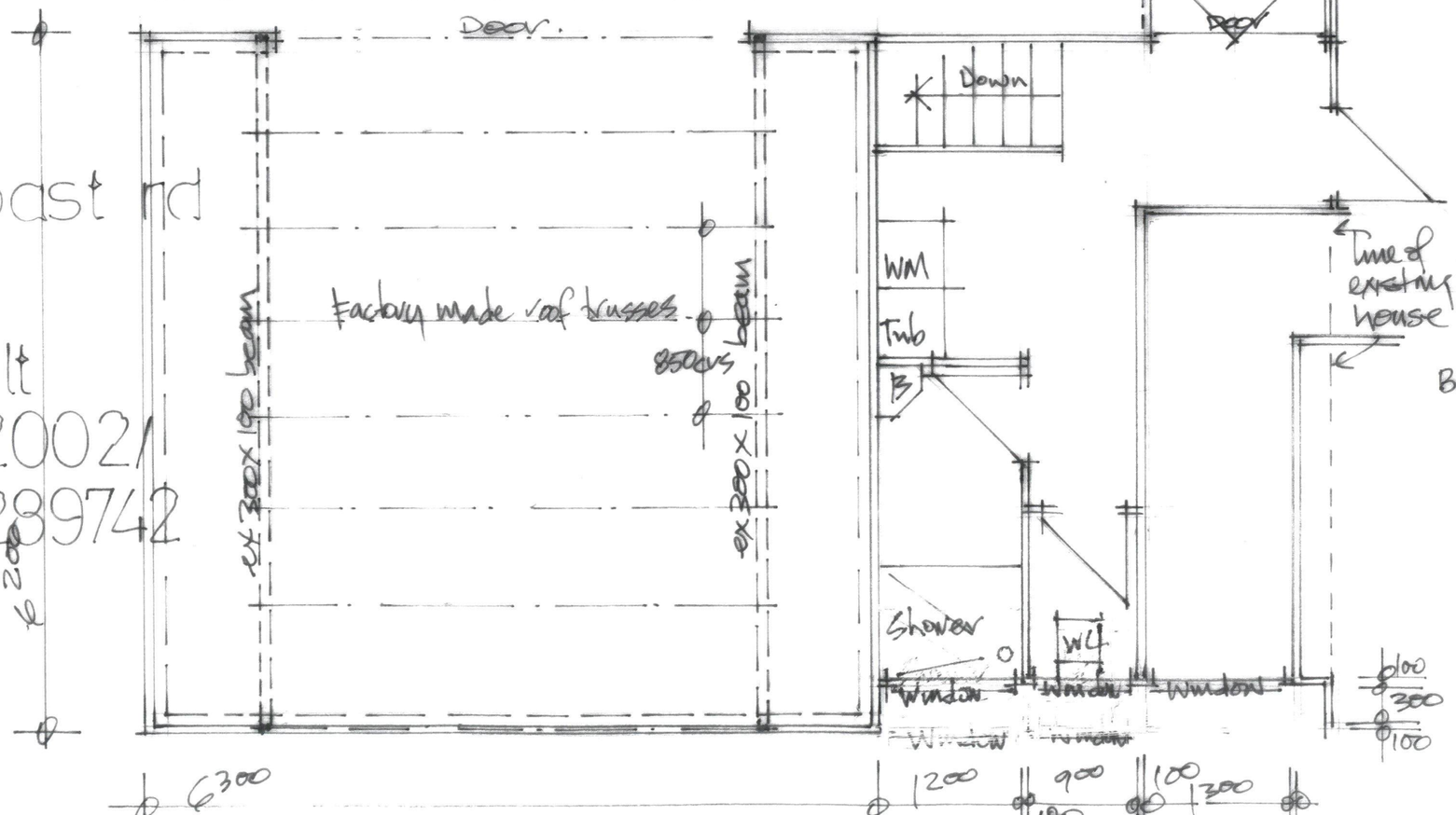

north elevation
scale 1 to 100

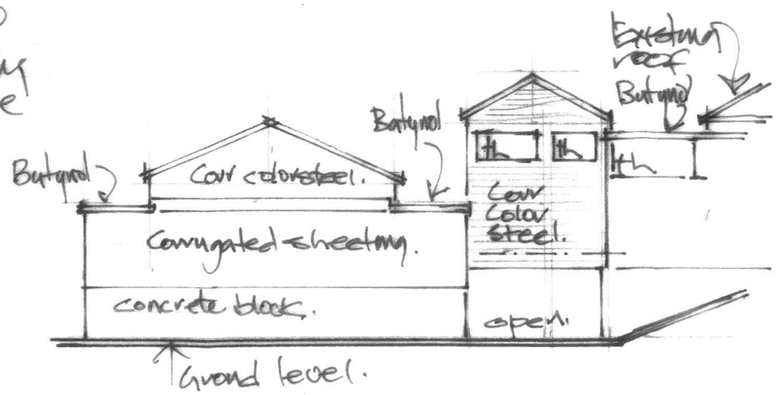



west elevation
scale 1 to 100

107 coast rd

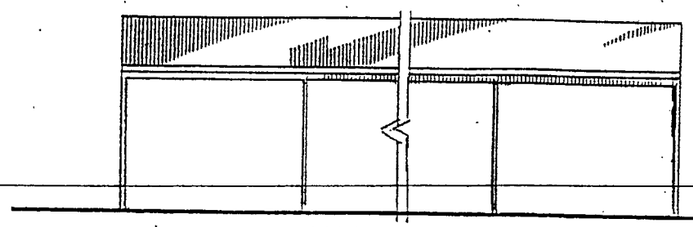
as built
ABA 2002/
289742



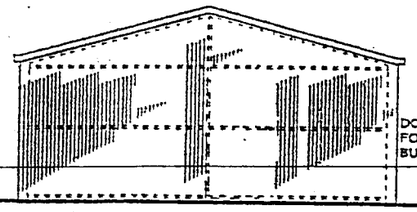




south elevation
scale 1 to 100

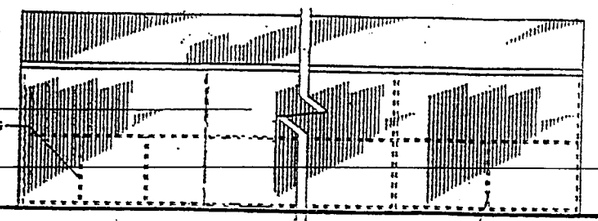
stage 2 floor plan and elevations and cross section



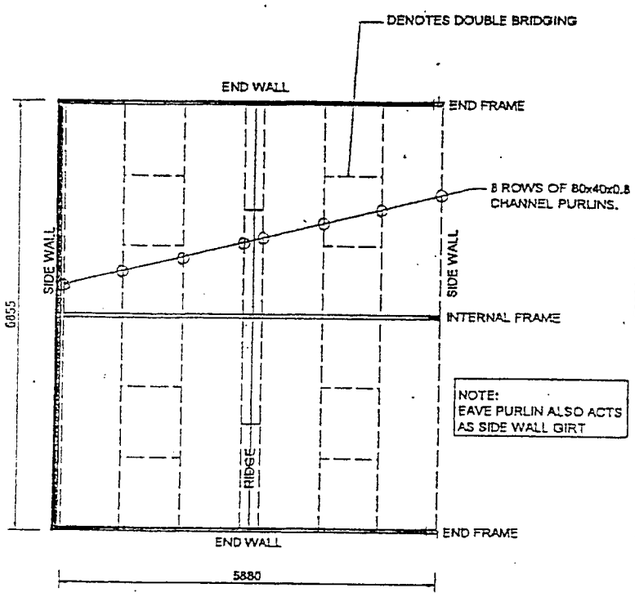
FRONT WALL ELEVATION -



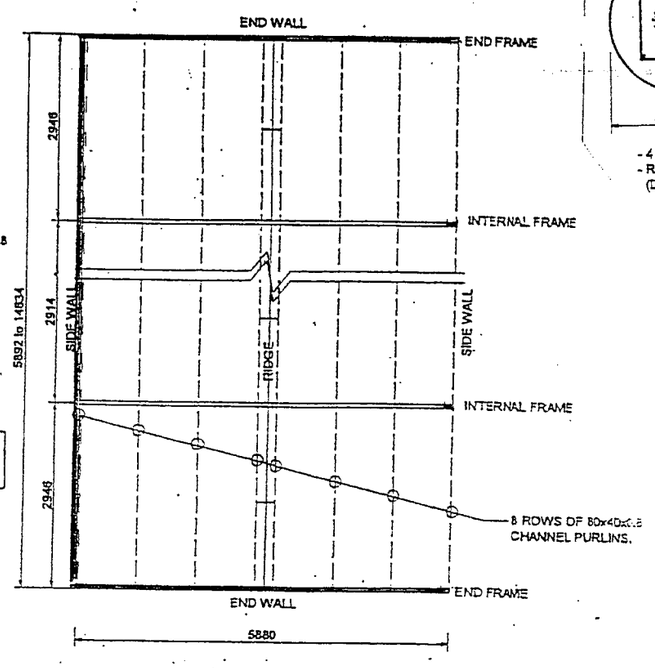

END WALL ELEVATION - 1:100



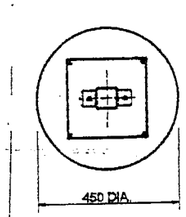

TYP. SIDE WALL ELEVATION 1:100

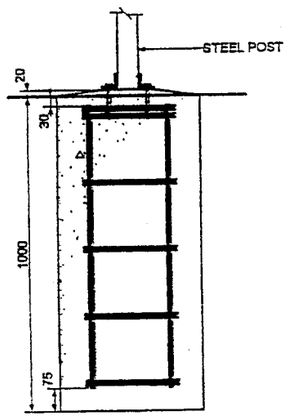



FRAMING PLAN 7m LONG




FRAMING PLAN 6 TO 15m LONG



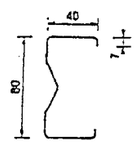




## CONCRETE FOOTINGS

(FOR AWNINGS AND WHERE CONCRETE FLOOR SLABS ARE NOT REQUIRED) REFER SHEET 3

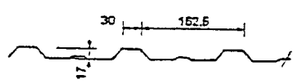
NOTE: DELETE NON APPLICABLE ELEVATIONS

GIRT BRIDGING:
GIRT BRIDGING SHALL CONSIST OF 80x40x0.8 LIPPED CRIMPED CHANNEL SECTION.




TYPICAL CRIMPED LIPPED CHANNEL SECTION (EX 0.8 BMT)

ALL PURLINS AND GIRTS SINGLE UNLESS NOTED TO BE BOXED.




SHEETING PROFILE 0.25 T.C.T.




TYPICAL SECTION 1:50

23280

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FREDERICK R. SMITH
Registered Consulting Engineer
22 Glamorgan Drve.
Torbay AUCKLAND
Phone 09 473 1262

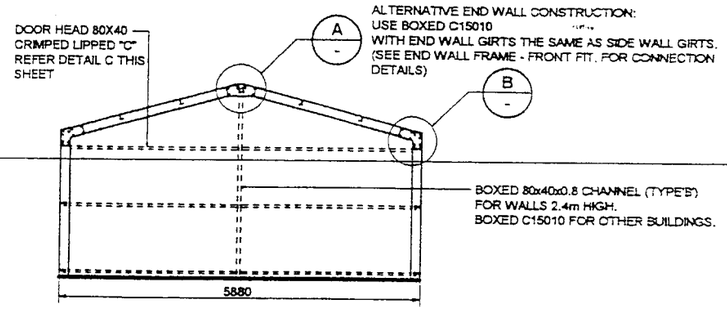
DES NEWPORT
CONSULTING ENGINEERS Pty. Ltd.
208 CONSTANCE STREET, FORTITUDE VALLEY
BRISBANE QLD. 4006
Phone (07) 3252 9822 Fax (07) 3252 9844

TOTALSPAN
Phone 0800 10 35 45

STEEL FRAMED FARMSHEDS
S45 (HIGH)
BASIC WIND SPEED
V = 45 m/s T.C.2

6.0m SPAN PORTALS
6, 7, 9, 12 & 15m LONG
2.4, 2.7 & 3.0m HIGH
(NOMINAL DIMENSIONS)

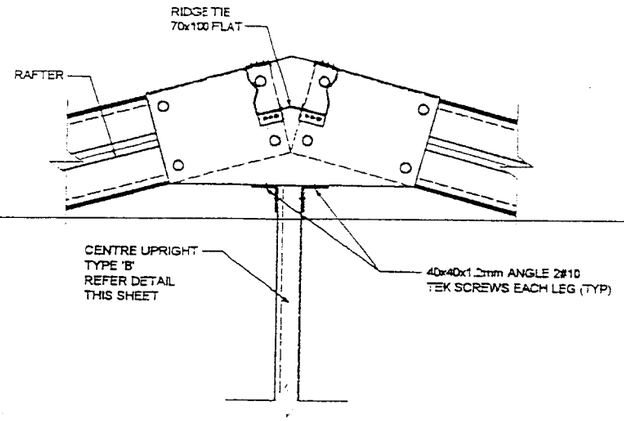
JOB No 97057NZ
DRAWING No. 60/S45/1 F
REVISION SUFFIX




## END WALL FRAME

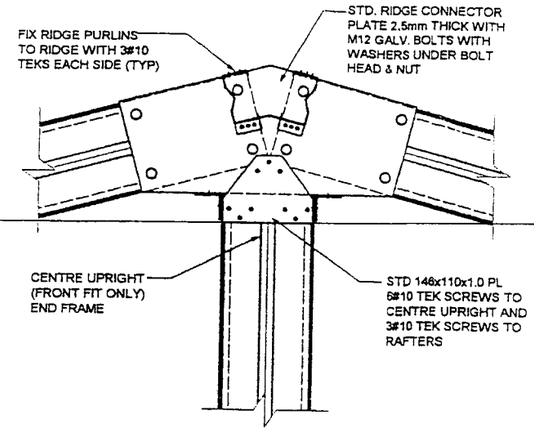
GIRT SCHEDULE

1. GIRTS TO BE AT SAME LEVEL ON ALL WALLS EXCEPT DOOR HEAD MEMBERS.
2. ALL GIRTS TO BE 80x40x0.8 LIPPED CRIMPED CHANNELS EXCEPT FOR 3m HIGH x 7m LONG BUILDINGS WHICH SHALL HAVE BOXED GIRTS (TYPE'B').
3. GIRTS FOR 7m LONG BUILDINGS TO HAVE DOUBLE 80x40x0.8 CHANNEL BRIDGING AT THIRD POINTS OF GIRT LENGTHS.

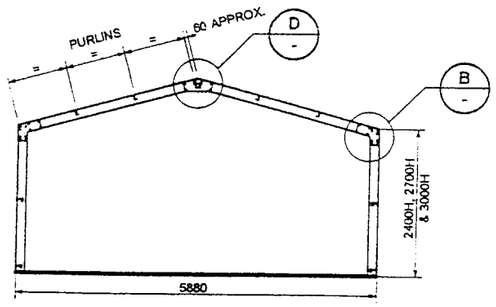



## TYP. DETAIL A

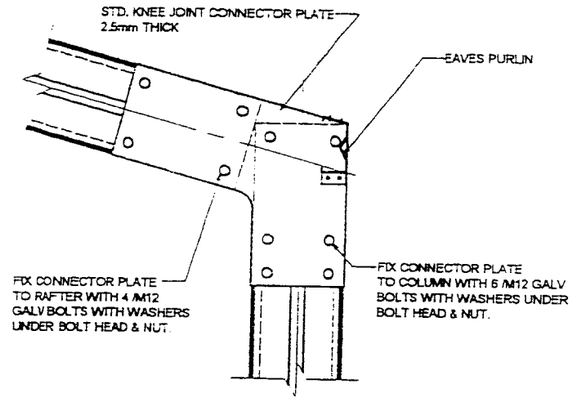
(DETAIL D SIMILAR BUT WITH CENTRE UPRIGHT OMITTED)



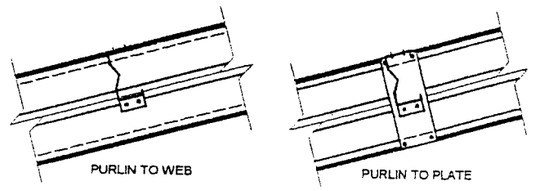

## TYP. DETAIL E

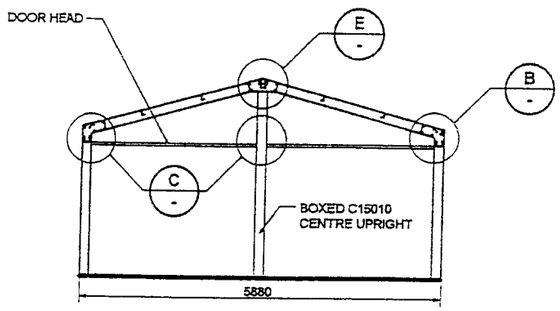



## INTERNAL FRAME

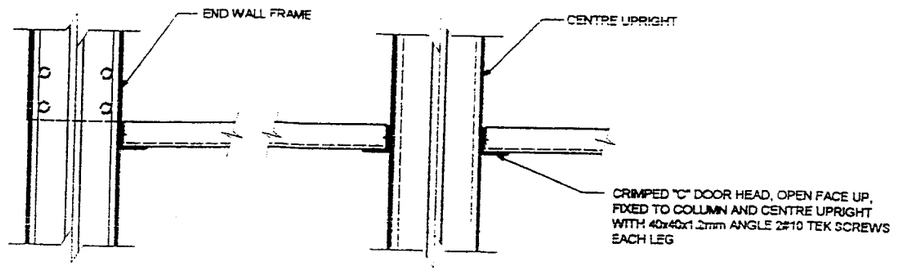



## TYP. DETAIL B

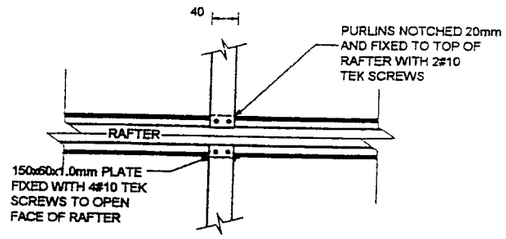



## END WALL FRAME - FRONT FIT




## TYP. DETAIL C




## TYPICAL PURLIN TO RAFTER DETAILS

TYPE 'B'

80x40 CRIMPED "C" BOXED

## END WALL POSTS

© COLMARK (AUSTRALIA) PTY. LTD. 1999

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Registered Consulting Engineer
22 Glamorgan Drve.
Torbay AUCKLAND
Phone 09 473 1262

**DES NEWPORT**
CONSULTING ENGINEERS Pty. Ltd.
208 CONSTANCE STREET, FORTITUDE VALLEY
BRISBANE QLD. 4006
Phone (07) 3252 9822 Fax (07) 3252 9844

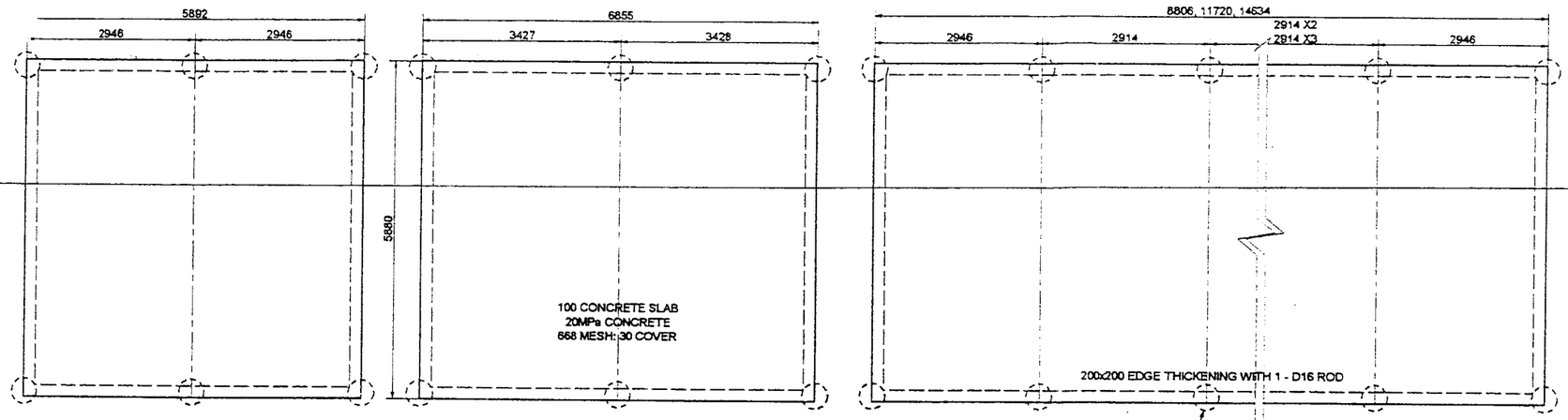
**TOTALSPAN**
Phone 0800 10 35 45

2320

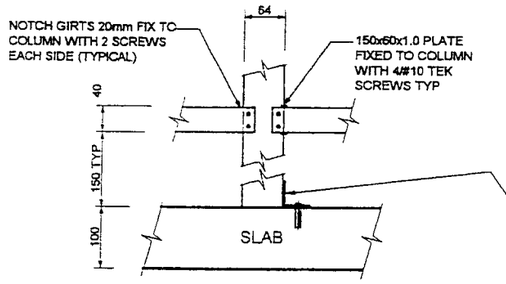
[redacted]
S45 (HIGH)
BASIC WIND SPEED
V = 45 m/s T.C.2

**6.0m SPAN PORTALS**
6, 7, 9, 12 & 15m LONG
2.4, 2.7 & 3.0m HIGH
(NOMINAL DIMENSIONS)

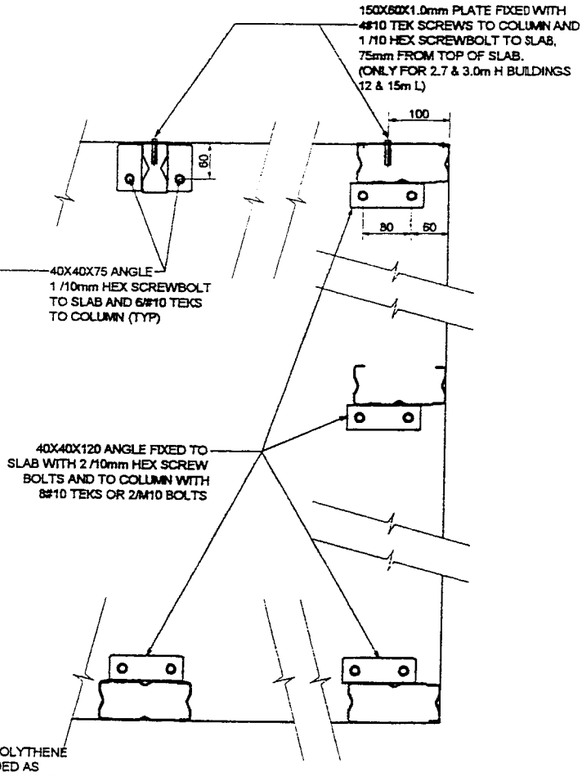
JOB No. 97057NZ
DRAWING No. 60/S45/2
REVISION SUFFIX



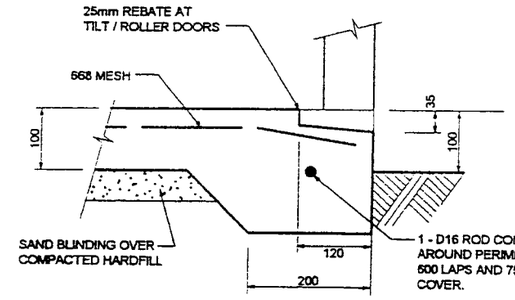

## 6, 7, 9, 12 & 15m LONG SLAB PLANS 1:100



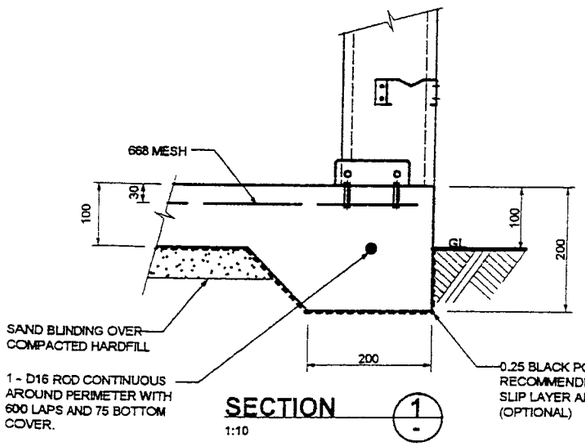

TYP. GIRT TO COLUMN DETAIL 1:10




FRAME HOLD DOWN PLAN




P.A. DOOR & GARAGE ENTRY SLAB EDGE DETAIL (TYP.) 1:10




SECTION 1/- 1:10

### SCREWBOLT NOTE

1 EMBEDMENT DEPTH OF SCREW BOLTS= 75mm
2 SCREWBOLTS FIXED TO OUTSIDE OF SLAB ARE REQUIRED ONLY FOR CORNER COLUMNS FOR BUILDINGS 2.7 & 3.0 HIGH AND 12 OR 15m LONG. (EXCEPT WHEN AWNING IS ATTACHED TO SHED)

### GENERAL

1- All work shall conform to the New Zealand Building Code.
2- Check diagonals to ensure building is square.

### LOADINGS

1- Buildings are designed to NZS 4203 for NZS 3604 HIGH and VERY HIGH. Design Wind Speeds to limit state levels of 45 and 50 m/s, T.C.2; roof live load of 0.25 kPa, and Basic Roof Snow loads of 1.2kPa (600mm thick snow). Heavier snow loads will be specific design as will buildings for sites above 1000m altitude and for buildings to be used for habitable purposes.
2- The roofing is not designed for point loads of 1 Kn.

### FOUNDATIONS

1- Support ground to have a safe bearing capacity of at least 75 kPa. In weaker ground or expansive clays, building loads to be taken to subsoil which has a bearing capacity of at least 75 kPa.

### CONCRETE

1- Remove vegetation and loose material from the site of the building, backfill with compacted hardfill, if required, and lay a blinding of sand to the underside of the concrete slab. Ensure the surface of the slab will be at least 100mm above the highest level of cleared ground around the slab.
2- Concrete shall have a maximum aggregate size of 20mm, slump of 80mm maximum and a 20 MPa compression strength at 28 days.
3- The concrete floor slab shall be 100mm thick with a 200 x 200 mm. edge thickening and a D16 rod continuous around the perimeter of the slab with 600 laps and 75 bottom cover.
4- Concrete slab to be reinforced with 668 mesh placed 30mm maximum below the slab surface with 225mm laps.
5- Provide a 0.25mm black polythene dampproof and slip layer under the slab taped with 100mm laps (optional but recommended).
6- Fix roof frames to concrete with M10 galvanised screwbolts screwed into holes drilled in the slab.

### STEELWORK

1- All structural framing members shall be G500 grade steel galvanised to Z200 (G550 for 80 x 40 boxed and single channels). Cleats to be G450, Z200.
2- Purlins and girts shall be 80 x 40 x 0.8 B.M.T. lipped, crimped channel located at centres shown on the drawings.
3- Boxed members to be flange fixed with #10 Tek screws at 600 centres.
4- Screws to be #10 x 16mm long Tek screws Class 3 zinc plated, fixed at a minimum edge distance of 6mm and to a 12mm minimum pitch.
5- Girts to be connected to frames with 2 #10 Tek screws each side of girt.
6- Steelwork shall conform to:
NZS 4203 Loadings Code
NZ/AS 4600 Cold Formed Steel Structures Code
NZ/AS 1397:1993
AS 1562:1962 Design and Installation of Metal Roofing
AS 1111/1112 Hex Commercial Bolts and Screws
AS 3566 Self Drilling Screws for Building

### CLADDING

1- Roof and wall sheeting shall be 0.35 B.M.T., G550 grade steel zincalumed to AZ150 and rolled to profile as detailed.
2- Roof sheets shall be fixed to ridge and eaves purlins with a Tek screw at the centre of every pan and a Tek screw to second pans at intermediate fixings, all complete with neoprene washers.
3- Wall sheeting shall be fixed with 1 Tek screw to each second pan to all girts, for walls square to the ridge, and to the centre of every pan to all girts, for walls parallel to the ridge.
4- Ridges, barges and all penetrations to be flashed with 0.4mm zincalumed steel.
5- Guttering to be sealed with silicone and fixed with Tek screws. Fit guttering to downpipes to discharge to an approved stormwater drainage system.
6- Frame for personnel door with 80 x 40 x 0.8 unlipped channels. Flange connect members with 2 screws to each flange (similar for window openings). Fix jambs to floor with 40 x 40 x 1.2 angle cleat and 1/M10 dynabolt to concrete and 2 screws to jamb.
7- Frame personnel door out of 40 x 40 x 1.2 angle and clad with standard sheeting profile.

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Phone (07) 3252 9822 Fax (07) 3252 9844

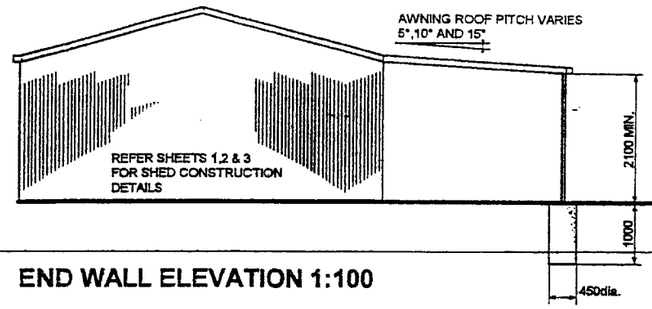
TOTALSPAN
Phone 0800 10 35 45

2250

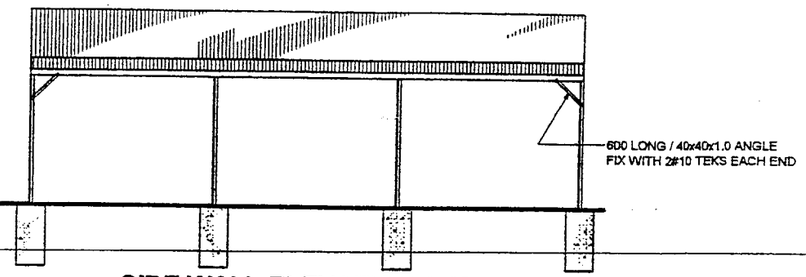
STEEL [redacted]ES
S45 (HIGH)
BASIC WIND SPEED
V = 45 m/s T.C.2

6.0m SPAN PORTALS
6, 7, 9, 12 & 15m LONG
2.4, 2.7 & 3.0m HIGH
(NOMINAL DIMENSIONS)

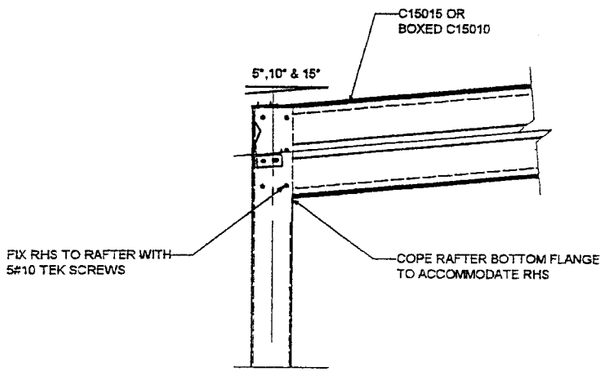
JOB No. 97057NZ
DRAWING No. 60/S45/3
REVISION SUFFIX



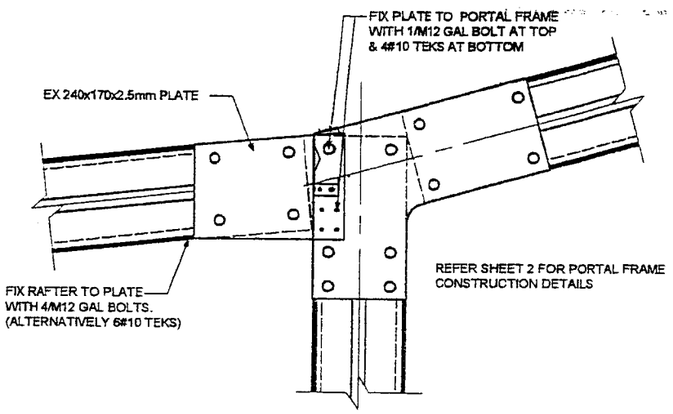

END WALL ELEVATION 1:100



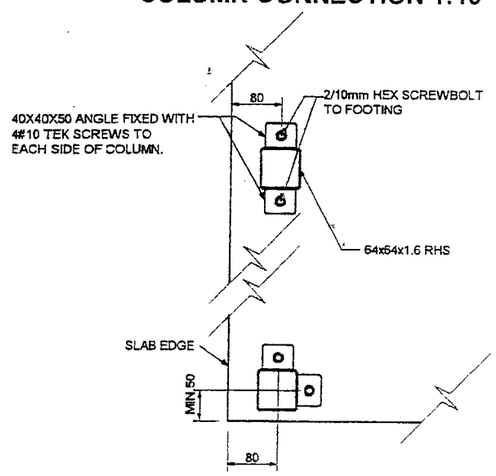

SIDE WALL ELEVATION 1:100



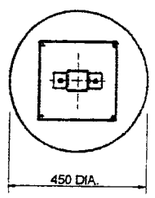

COLUMN CONNECTION 1:10



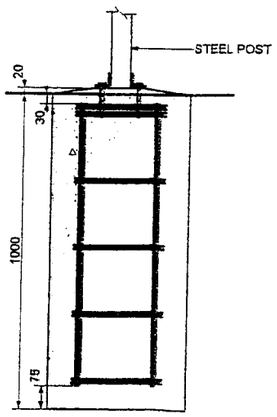

PORTAL CONNECTION 1:10



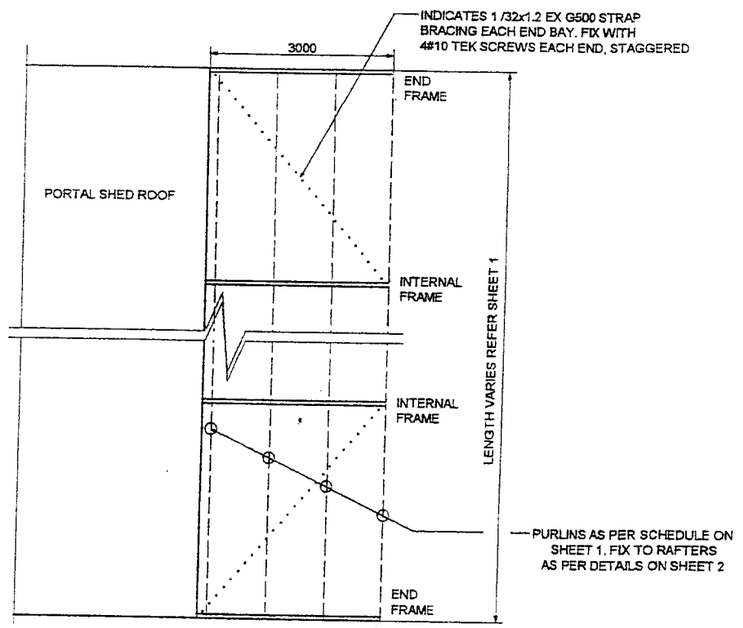

COLUMN HOLD DOWN DETAILS 1:10




- 4 - D12 RODS
- R6 TIES AT 200
(DOUBLE TOP)




CONCRETE FOOTINGS
(FOR AWNINGS AND WHERE CONCRETE FLOOR SLABS ARE NOT REQUIRED) REFER SHEET 3




AWNING ROOF LAYOUT 1:100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**TOTALSPAN**
Phone 0800 10 35 45


2320

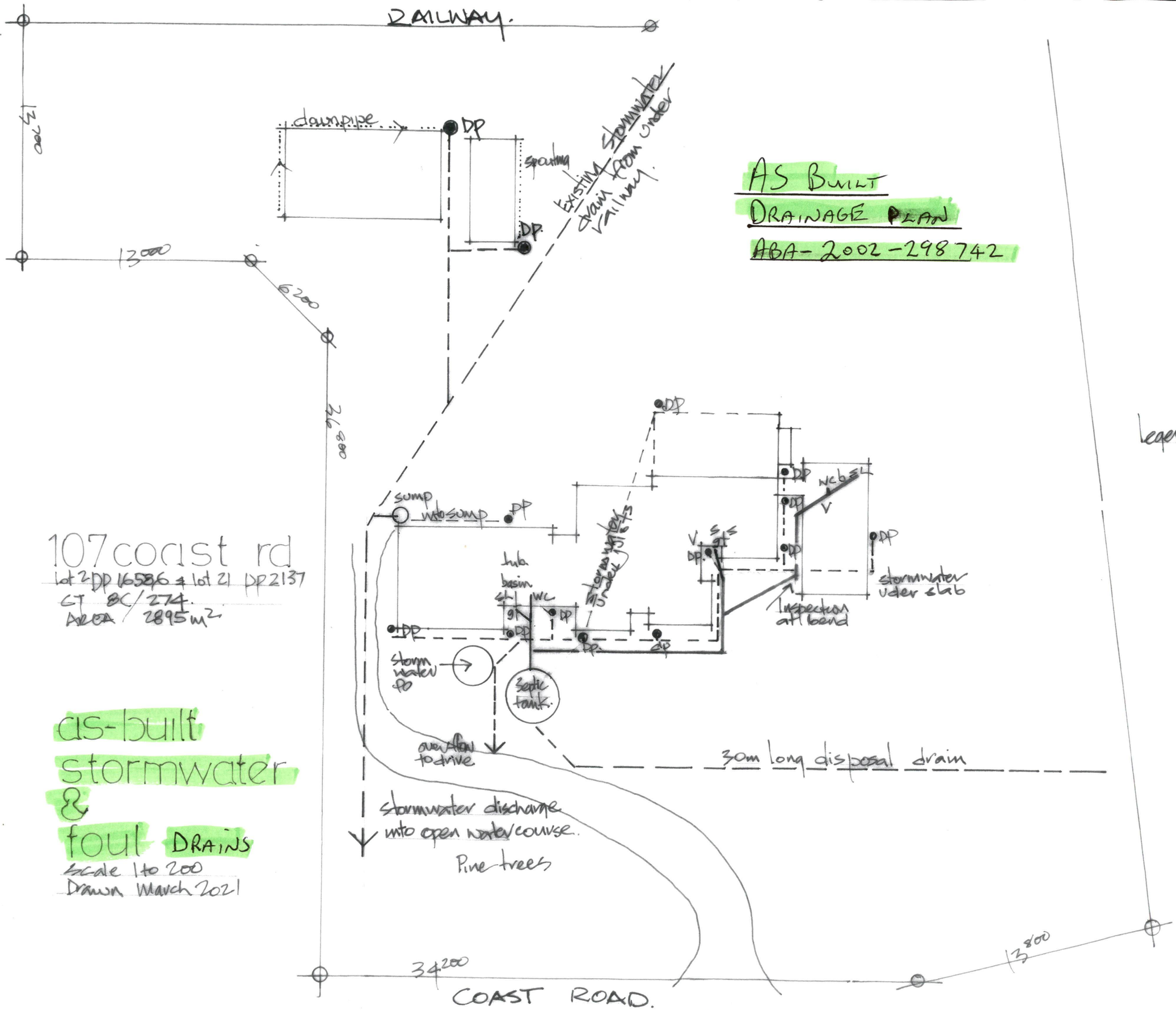
STEEL FRAMED GARAGES
**S45 (HIGH)**
BASIC WIND SPEED
V = 45 m/s T.C.2

**6.0m SPAN PORTALS**
6, 7, 9, 12 & 15m LONG
2.4, 2.7 & 3.0m HIGH
(NOMINAL DIMENSIONS)

JOB No. 97057NZ
DRAWING No. 60/S45/4
REVISION SUFFIX

RAILWAY.

AS BUILT
DRAINAGE PLAN
ABA-2002-298742

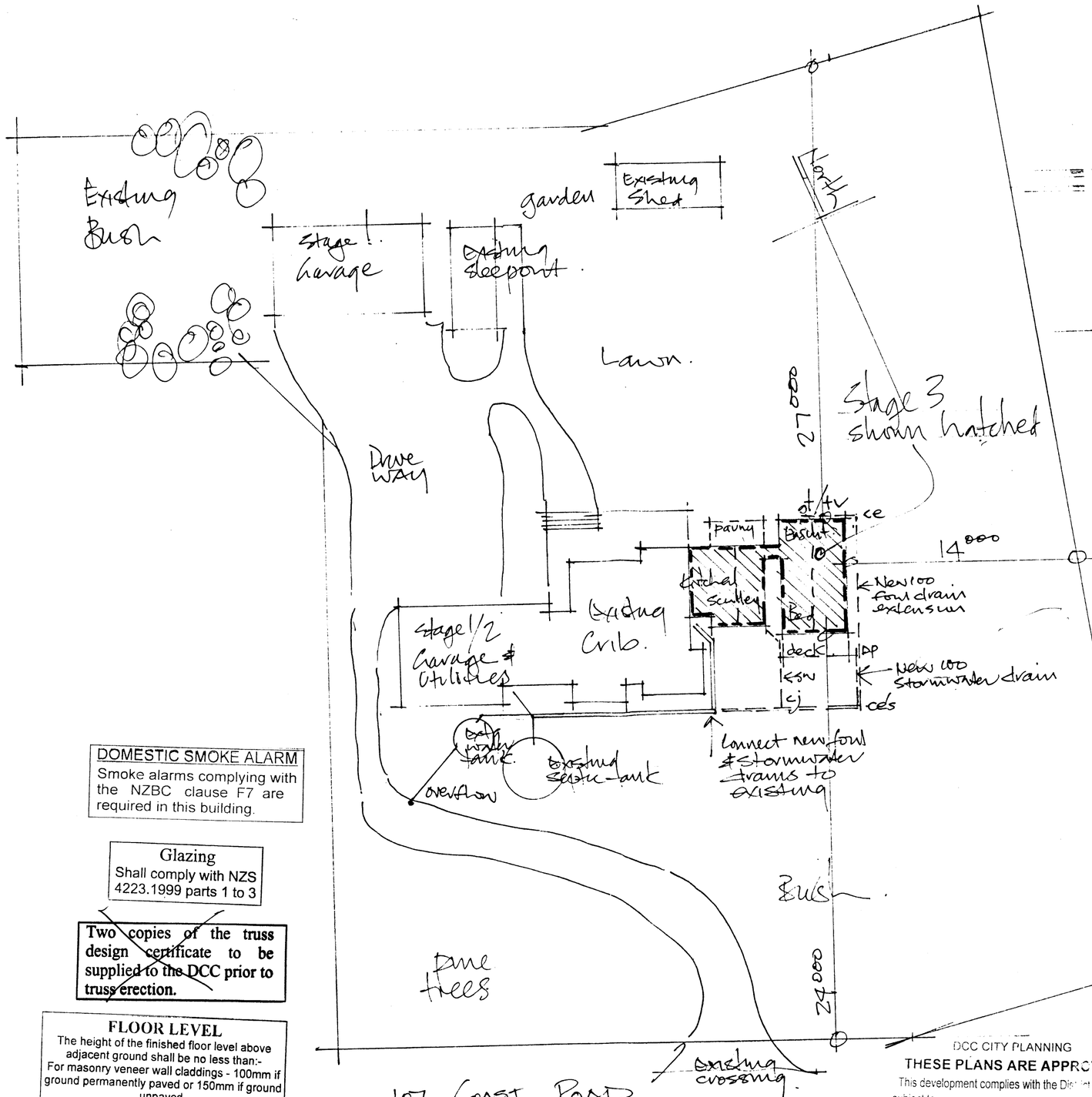


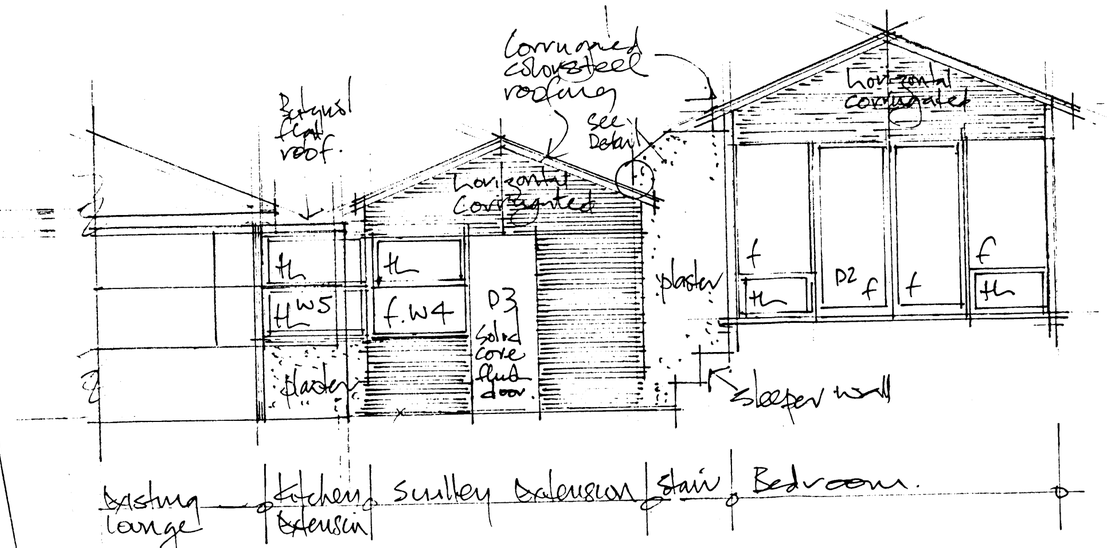

Legend DP- downpipe
sh = shower
b = basin
WC = Toilet.
tub = tub
gt = gully trap.
V = Vent.
S = Sink
--- = 100 mm stormwater
—— = 100 mm foul.

107 coast rd
lot 2 DP 16586 & lot 21 DP 2137
CT 8C/274.
AREA 2895 m².

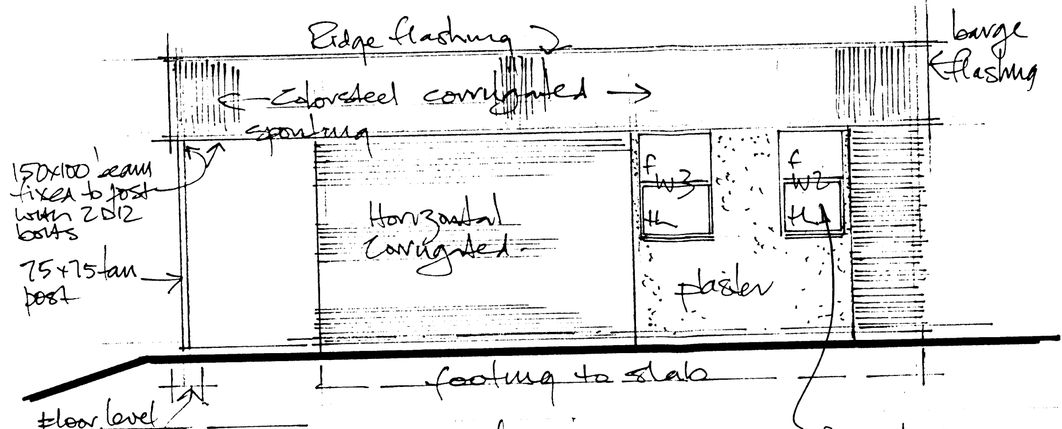
as-built stormwater & foul DRAINS
Scale 1 to 200
Drawn March 2021

As Built Plan
Received by: DJK
Date: 6-5-21
ABA No: 2002-298742




SOUTH EAST ELEVATION
SCALE 1 to 50




NORTH EAST ELEVATION
SCALE to 50

DOMESTIC SMOKE ALARM
Smoke alarms complying with the NZBC clause F7 are required in this building.

Glazing
Shall comply with NZS 4223.1999 parts 1 to 3

Two copies of the truss design certificate to be supplied to the DCC prior to truss erection.

FLOOR LEVEL
The height of the finished floor level above adjacent ground shall be no less than:-
For masonry veneer wall claddings - 100mm if ground permanently paved or 150mm if ground unpaved.
For cladding other than masonry - 150mm if ground permanently paved or 225 if unpaved.

DCC CITY PLANNING
THESE PLANS ARE APPROVED
This development complies with the District Plan subject to: _____
Signed 28/2/05 Date

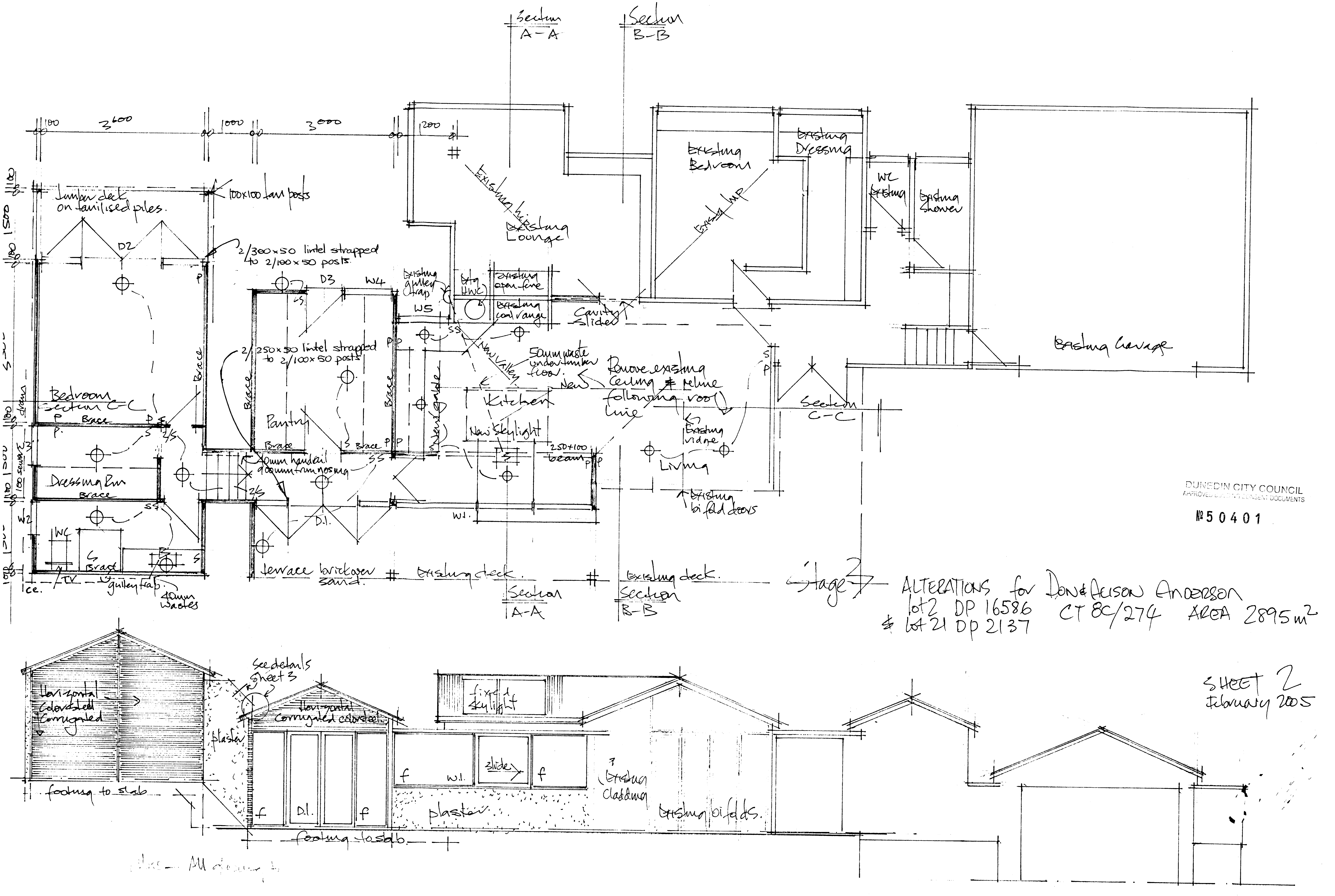
DUNEDIN CITY COUNCIL
Plans and Specifications Approved in accordance with The New Zealand Building Code and Approved Documents. To be retained on works and produced on request
Building [signature] Date 25-2-05
Drainage [signature] Date 21-2-05
Health Date
NOTE

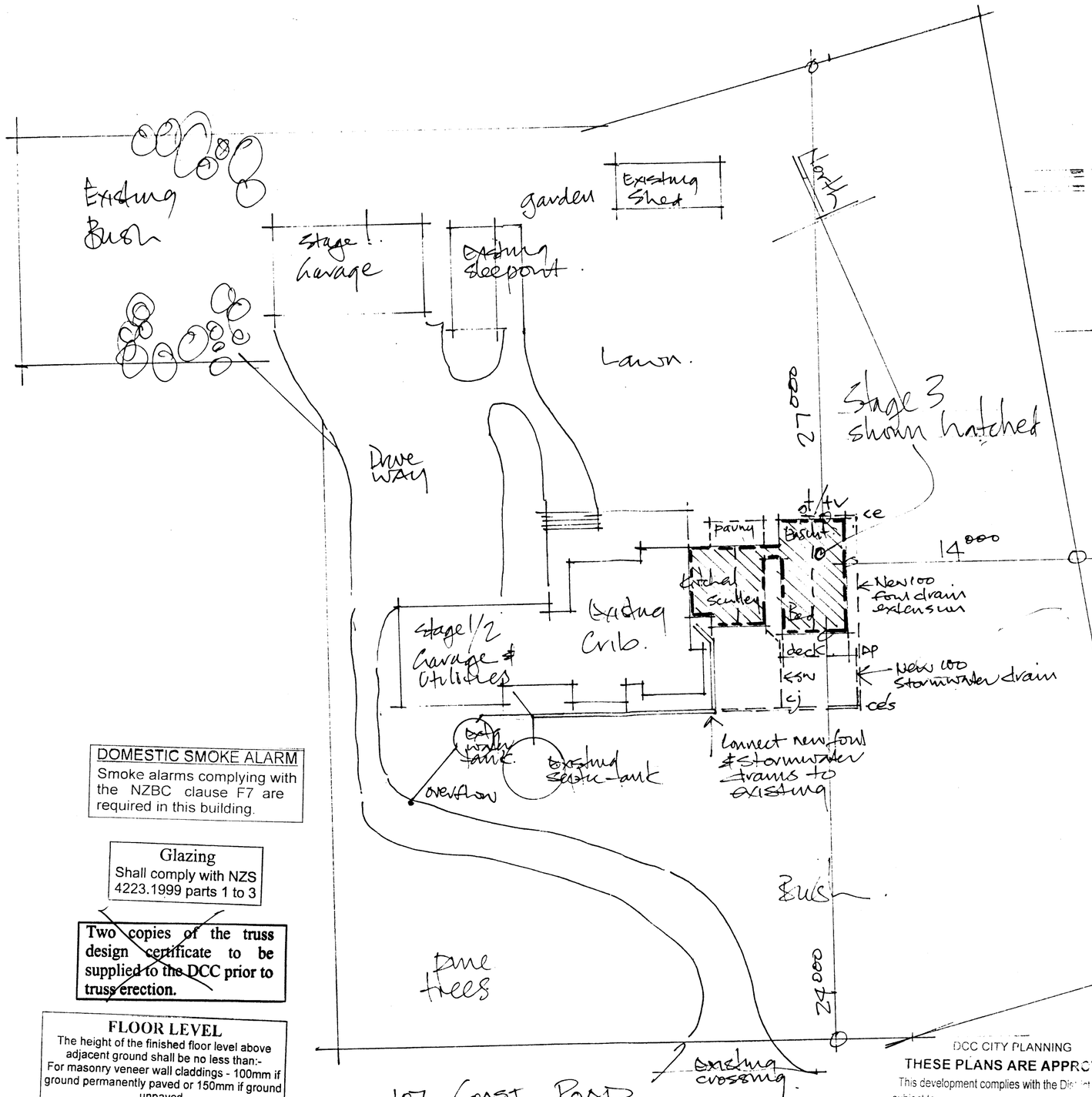
DUNEDIN CITY COUNCIL
APPROVED CONSENT DOCUMENTS
№ 50401

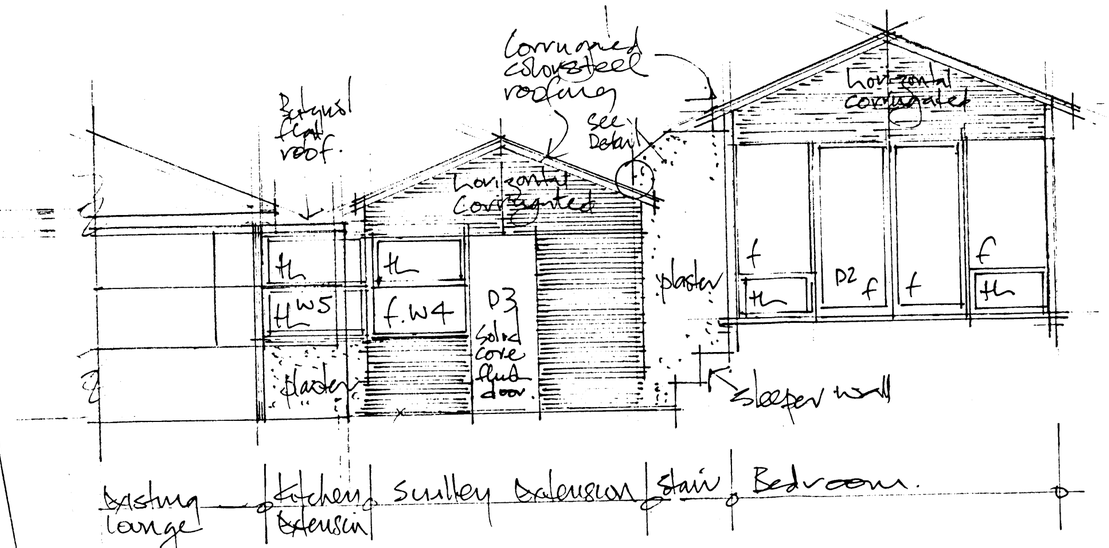
107 COAST ROAD
1 to 200

Stage 2 ALTERATIONS for DOUG & ALISON ANDERSON
Lot 2 DP 16586 CT 8C/274 Area 2895m²
& Lot 2 DP 2137

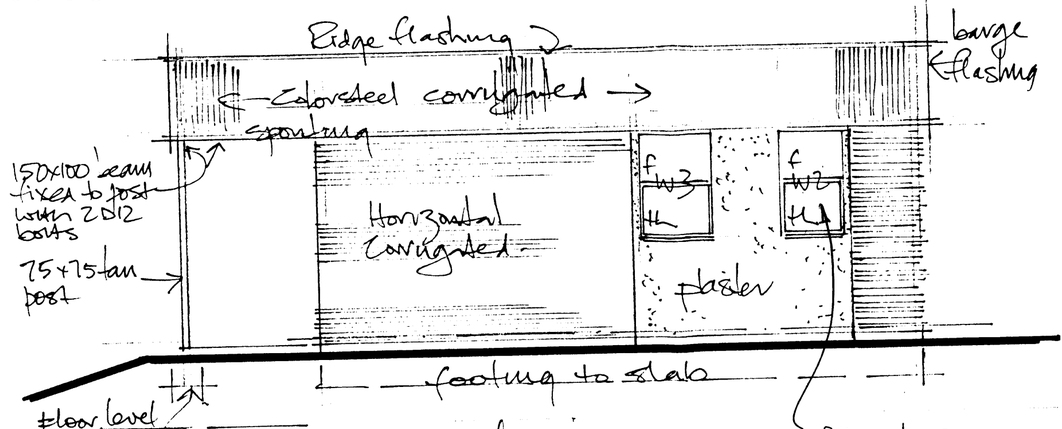
SHEET 1
February 2005


Section A-A
Section B-B
100
3600
1000
3000
200
Timber deck on tanalised piles.
100x100 tan posts
D2
2/300x50 lintel strapped to 2/100x50 posts.
D3
W4
W5
Existing gulley trap
Existing open fire
Existing coal range
Existing Lounge
Existing Bedroom
Existing Dressing
Existing WIR
WC Existing
Existing Shower
Existing Garage
Cavity slider
2/250x50 lintel strapped to 2/100x50 posts
50mm waste under timber floor.
New valley
Remove existing ceiling & reline following roof line
Kitchen
New skylight
Existing ridge
Section C-C
Bedroom
Pantry
Brace
250x100 beam
Living
Existing bi fold doors
Dressing Rm
WC
gulley trap
40mm wastes
D.1.
W.1.
Terrace brick over sand.
Existing deck.
Stage 2
ALTERATIONS for Don & Alison Anderson
lot 2 DP 16586 CT 8C/274 AREA 2895 m²
& lot 21 DP 2137
DUNEDIN CITY COUNCIL
APPROVED BUILDING CONSENT DOCUMENTS
№50401
see details sheet 3
Horizontal colorsteel Corrugated
Horizontal Corrugated colorsteel.
fixed skylight
plaster
slider
f
Existing Cladding
Existing bifold ds.
footing to slab
SHEET 2
February 2005




SOUTH EAST ELEVATION
SCALE 1 to 50




NORTH EAST ELEVATION
SCALE to 50

DOMESTIC SMOKE ALARM
Smoke alarms complying with the NZBC clause F7 are required in this building.

Glazing
Shall comply with NZS 4223.1999 parts 1 to 3

Two copies of the truss design certificate to be supplied to the DCC prior to truss erection.

FLOOR LEVEL
The height of the finished floor level above adjacent ground shall be no less than:-
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Building [signature] Date 25-2-05
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NOTE

DUNEDIN CITY COUNCIL
APPROVED CONSENT DOCUMENTS
№ 50401

107 COAST ROAD
1 to 200

Stage 2 ALTERATIONS for DOUG & ALISON ANDERSON
Lot 2 DP 16586 CT 8C/274 Area 2895m²
& Lot 2 DP 2137

SHEET 1
February 2005

Section A–A

Section B–B

Timber deck on tanilised piles.

100×100 tanalised posts

2/300×50 lintel strapped to 2/100×50 posts.

2/250×50 lintel strapped to 2/100×50 posts

Existing kwikstang Lounge

Existing Bedroom

Existing Dressing

WC Existing

Existing Shower

Existing Coverage

Existing gutter trap

Existing HWC

Existing open fire

Existing coal range

Cavity slider

W5

New Valley

50mm waste under timber floor.

Remove existing ceiling & purline following roof line

Kitchen

Section C–C

New Skylight

250×100 beam

Existing ridge

Living

Existing bi fold doors

Bedroom

Section C–C

Dressing Rm

Brace

Pantry

Brace

50mm handrail 90mm from nosing

D1.

W1.

W2

W3

W4

D2

D3

WC

Shower

TV

gutter trap

ice.

50mm wastes

Terrace bricklayer sand.

Existing deck.

Existing deck.

Section A–A

Section B–B

Stage 2

ALTERATIONS for Don & Alison Anderson
lot 2 DP 16586 CT 8C/274 AREA 2895m²
& lot 21 DP 2137

DUNEDIN CITY COUNCIL
APPROVED BUILDING CONSENT DOCUMENTS
№ 50401

SHEET 2
February 2005

Horizontal Colorsteel Corrugated

See details sheet 3

Horizontal corrugated colorsteel

plaster

fixed skylight

slider

f

W.I.

D.I.

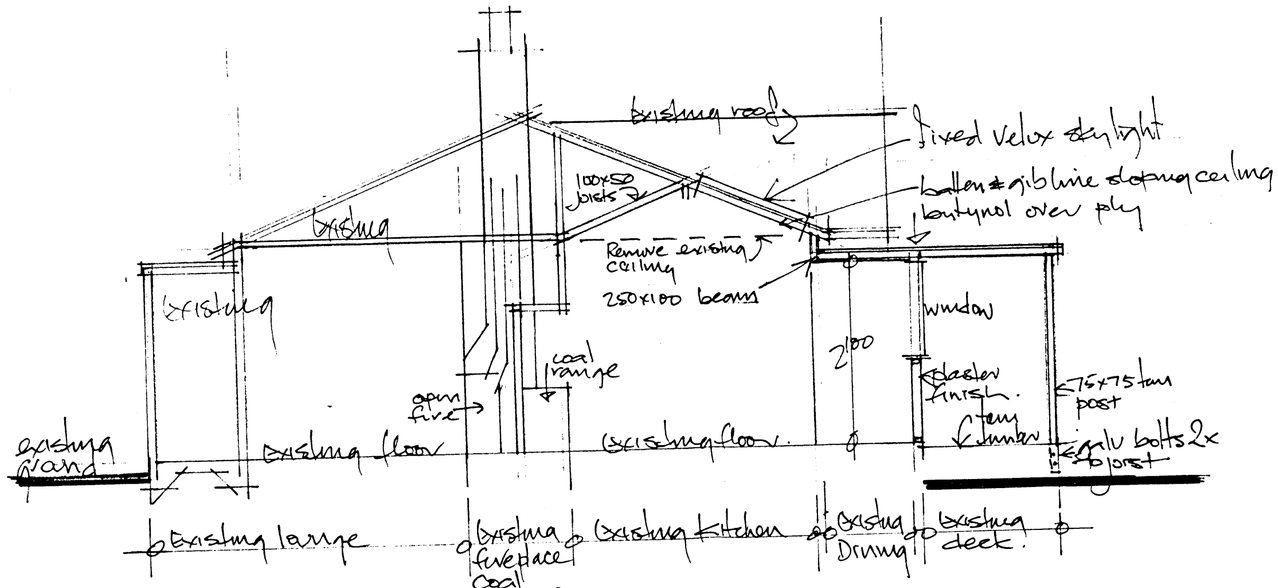
Existing Cladding

Existing bi folds.

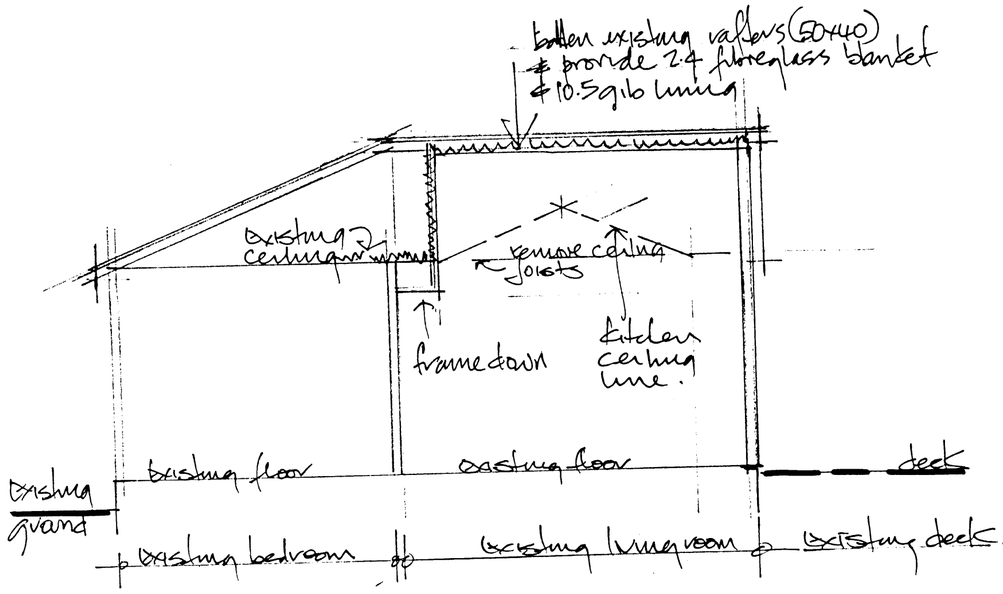
footing to slab

plaster

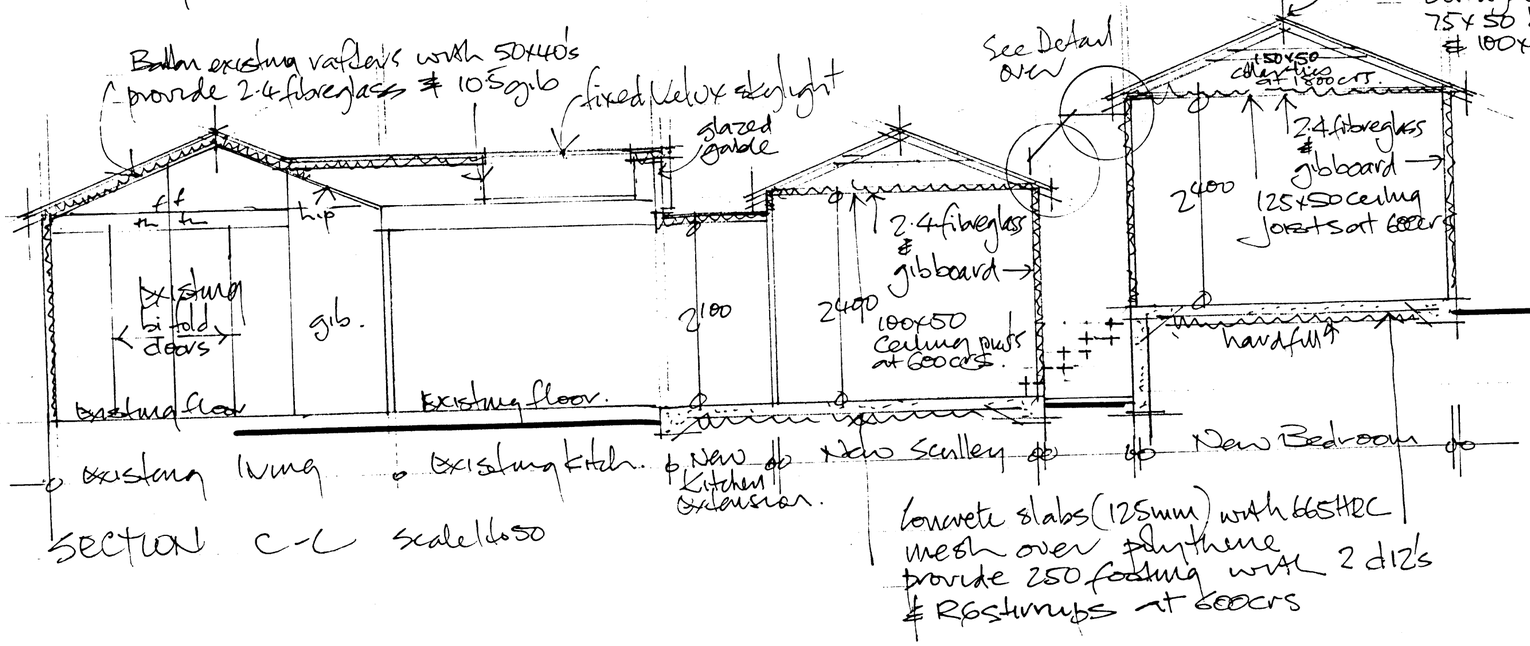
footing to slab



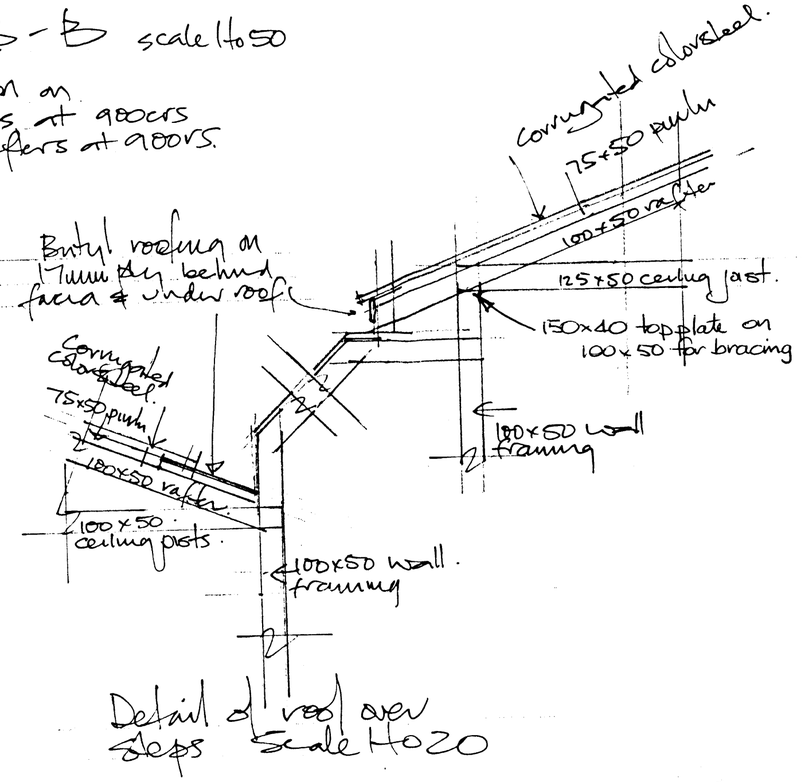

SECTION A-A scale 1:50




SECTION B-B scale 1:50




SECTION C-C scale 1:50




Detail of roof over steps Scale 1:20

DUNEDIN CITY COUNCIL
APPROVED BUILDING CONSENT DOCUMENTS
№ 50401

SHEET 3
February 2005

Stage 2 ALTERATIONS for DON & ALISON ANDERSON
lot 2 DP 16586 CT 8C/274 AREA 2895m²
lot 21 DP 2137

5 December 2013

Manufactured by: **Warmington Industries Ltd -** PO Box 58652 Botany 2163, Auckland NZ

## Model: .....Studio Stove

Serial No: S - .....

Emission Report No: **05/1196 Applied Research Services LTD**

TESTED TO **AS/NZS 4013**.

BURN ONLY UNTREATED WOOD WITH A MOISTURE CONTENT LESS THAN 25% (DRY BASIS)

AVERAGE PARTICULATE EMMISSION FACTOR BURNING SOFTWOOD – **0.95g/kg**

MAXIUM AVERAGE HEAT OUTPUT BURNING SOFTWOOD – **8.9KW**

OVERALL AVERAGE EFFICIENCY BURNING SOFTWOOD - **69.9%**

When Tested in Accordance with **AS/NZS 4012**

| Council | Authorization No: | Expiry date: |
|---|---|---|
| ECan | 017226 | 01 Jan 9999 |
| NCC | 017226 | N/A |

Performance may vary from tested values depending on actual operating conditions.

Date of installation: _____/_____/20_____

***Free down load of operating instructions from the website .***

***www.warmington.co.nz***

DUNEDIN CITY COUNCIL
APPROVED BUILDING CONSENT DOCUMENTS
ABA: 2005-3040-23

DCC COPY

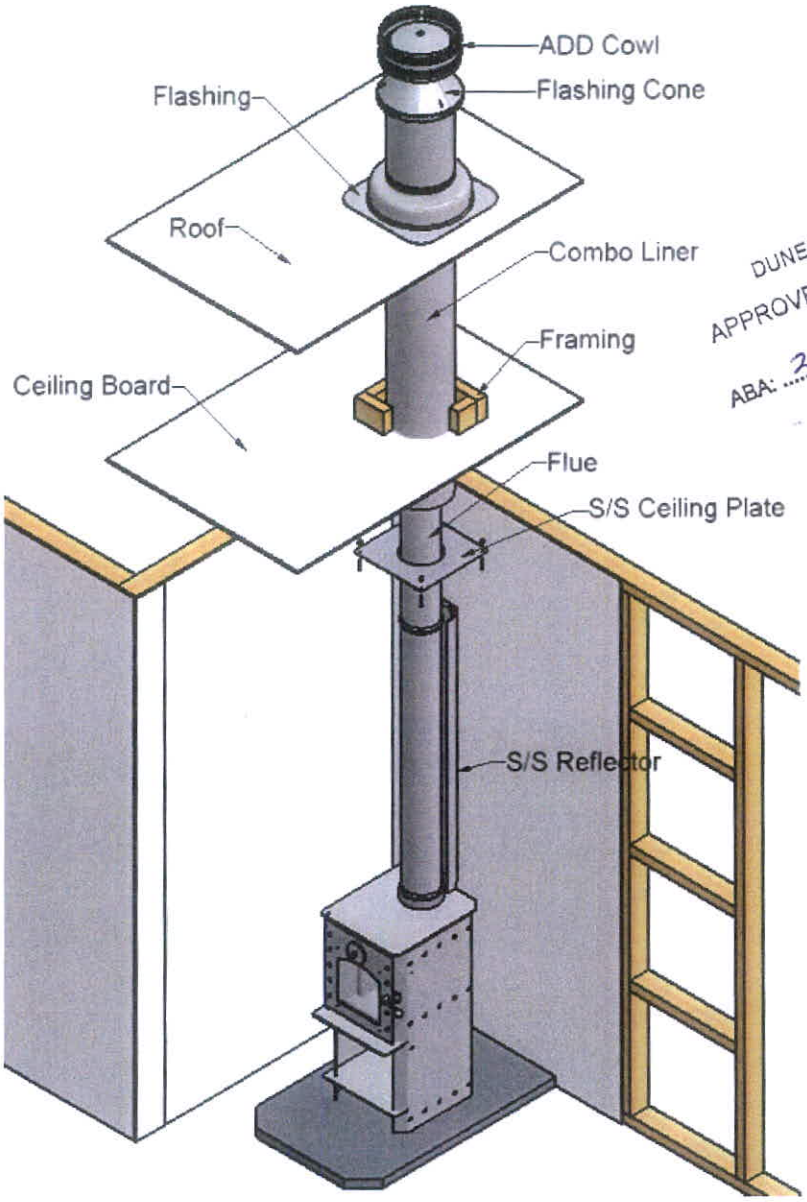
Due to continued product improvement, Warmington Ind LTD reserves the right to change product specifications without prior notification.



All Dimension are in mm.....Copyright ©

# Studio Stove

## Studio Stove—Clean Air Approved Wood Burner Installation Instructions

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***Visit www.warmington.co.nz for Spec's, DWG's and PDF uploads of Fires***

**Fire, Flue System and instructions to comply with ASNZS 2918:2001**

Keep these Instructions for future reference.....Ensure that you have the correct and current Installation details for the Warmington Fire

**Installation**

The Warmington unit is to be Installed by a Certified Warmington Installer or an Approved NZHHA Installation Technician .
See www.homeheat.co.nz/members for a Certified NZHHA SFAIT Installer in your area .

**IMPORTANT**

Read all the Instructions carefully before commencing the Installation. Failure to follow these Instructions may result in a Fire Hazard and void the warranty

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## FLUE SYSTEM INSTALLATION GUIDE

| Minimum Flue Height | |
|---|---|
| Flue Height | 3600 |
| Measured From Top of Fire | C + 3600 |

| Flue details | No: | Studio Stove |
|---|---|---|
| Cowl | 1 | 150 |
| Cone | 1 | 150 |
| Top Spider | 1 | 150 |
| Liner Diameter Slip | 1 | 250 |
| Flue Diameter S/S | 1 | 150 |
| Flue Diameter Hi Therm Black | 2 | 150 |
| Combo 250/200 X 1200MM Galv | 1 | 250 |
| Ceiling Plate | 1 | 150 |
| Ceramics | 4 | |
| Double Flue Shield with Brackets | 1 | To Suite 150 |

**Note: FLUE SYSTEMS Casing....**

Flue system may require to be Doubled lined to comply. Ref ASNZS:2918:2001 4.3 Flue pipe casing

**NOTE:**
**Ensure that a Standard Tested Warmington Flue system is used on the Warmington fires.**

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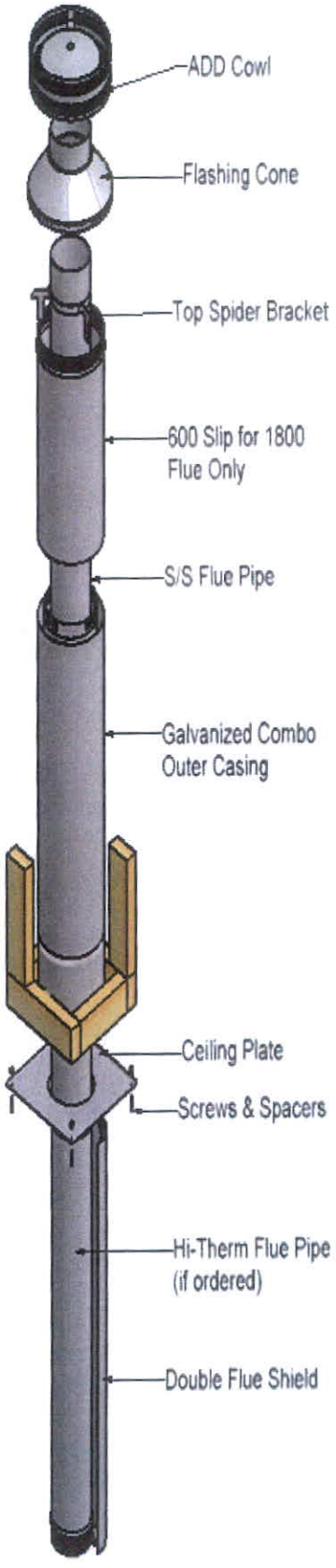


## FLUE SYSTEM INSTALLATION GUIDE

This flue kit has been manufactured in accordance with AS/NZS 2918:2001 and tested to Appendix F. To ensure safety, this flue kit must be installed as outlined in these instructions. Heater and flue pipe clearances from combustible walls must be in accordance with heater manufacture's specifications and AS/NZS 2918:2001. These installation instructions are for tested appliances only.

**THIS IS A GUIDE ONLY—EACH INSTALLATION WILL VARIE DUE TO UNIQUE INSTALLATION REQUIRMENTS.**

**STAGE 1:** Locate heater in its proposed position and mark a point on the ceiling that is directly above the centre of the heater's flue outlet. Check that the heater's location allows the **Outer Casing** to clear all structural roof timbers.

**STAGE 2:** Cut a 250mm **Square** hole in ceiling. Directly above, cut a hole in roof to accommodate **Outer Casing**.

**STAGE 3:** Fit timber nogs around ceiling and roof holes, i.e. Nogs form a 250mm square aperture, which allows air to circulate freely over the **Outer Casing** surface.

**STAGE 4:** Position the **Outer Casing** so that it is flush with the underneath of the ceiling and protrudes through the roof the required height (Refer to AS/NZ 2918:2001 if more details are required. When calculating roof penetration height, allow for an extra 500mm that can be achieved by using the **Outer Cashing Slip Extension**.

**A:** If the flue is within three metres of the ridge, the **Outer Casing** must protrude at least 600mm above the ridge of the roof.
**B:** If the distance from the ridge is more than three metres, the **Outer Casing** must protrude at least 1000mm above roof penetration.

**STAGE 5:** Fix an appropriate flashing around the **Outer Casing** to seal onto the roofing material.

**STAGE 6:** Assemble **Flue Pipes** together ensuring seams are in line. Secure each joint with three rivets or self-tapping screws. **Flue Pipes** must be assembled with crimped ends down (towards heater).

**STAGE 7:** Place **Ceiling Plate** over heater flue spigot, ensuring the folded edge up stands are facing ceiling.

**STAGE 8:** From the roof, lower **Flue Pipes** through **Outer Casing** into position. Ensure not to scratch the Hi Therm Flue coating. The Hi Therm Coating can be touched up with an approved Spray can (Stovebright). **NOTE: Some fires require the crimped end of the flue that fits into the Fires flue spigot to be trimmed back to from a snug fit. Seal flue to Fire box spigot.**

**STAGE 9:** From the roof, slide the **Inner Casing** into the **Outer Casing**, around the flue, until it rests 12mm above ceiling level on the **Swage Ring of the Outer Casing.**

**STAGE 10:** Before securing the **Outer Casing Slip Extension** to the **Outer Casing** with three rivets or self tapping screws, ensure the **Flue Pipes** extends above the top of the **Outer Casing Slip Extension** 145mm APPROX. The fitment of the **Cowl, Flashing Cone** and **Flue** is required to form a seal by the flange on the **Cowl**. Adjust **Slip Extension** to obtain this measurement. If minimum roof penetration heights described earlier can not be achieved, add sufficient stainless steel **Flue Pipe**.

**STAGE 11:** Fit **Top Spacer Bracket** to the **Flue Pipe** making sure the lugs fit snugly inside **Outer Casing Slip Extension.** Make sure **Top Spacer Brackets** fits hard down onto **Outer Casing Slip Extension**.

**STAGE 12:** Fit **Flashing Cone** over the **Flue Pipe** and push down firmly onto **Top Spacer Bracket**. Optional to secure with a rivet or self-tapping screw. The **Flashing Cone** should be flush with or 5mm above the finished **Flue Pipe**.

**STAGE 13:** Fit **ADD Cowl** but do not secure permanently , as removal for flue cleaning will be necessary. The **Cowl** will fit tight down onto the **Flashing Cone** forming a seal—ensure that the seal is formed. (The **Cowl, Flashing Cone** and **Flue** can be secured with a Stainless Steel screw but provision must be made for the removal of the **Cowl** for cleaning of the flue system.

**STAGE 14:** Fasten **Ceiling Plate** to ceiling using screws and spacers provided. Ensure an even air gap around **Flue Pipe** when fixing. Remove protective plastic from **Ceiling Plate**.
**N.B.** 12mm air gap between ceiling plate and ceiling must be maintained.

**STAGE 15:** Fit of the Flue Shield, fit **Bracket** to **Flue Pipe** above firebox and the bracket into the flue spigot on the fire.. Attach **S/S Reflector** to **brackets**, ensure that the plastic coating is removed from all the surfaces before lighting the fire.

**N.B.** **It is the responsibility of the installer to ensure that the installation of the flue kit complies with AS/NZ 2918:2001, the appliance manufacture's specifications for flues and that relevant Local Body requirements are adhered to.**

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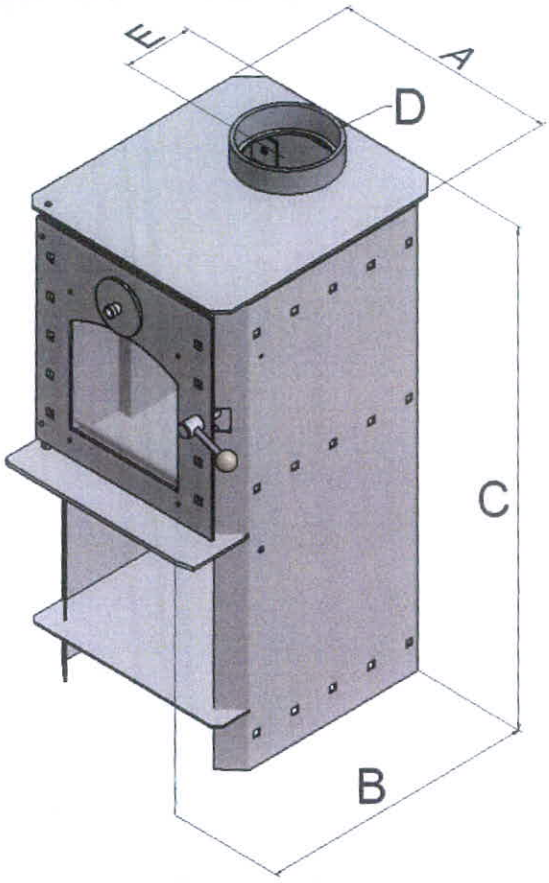
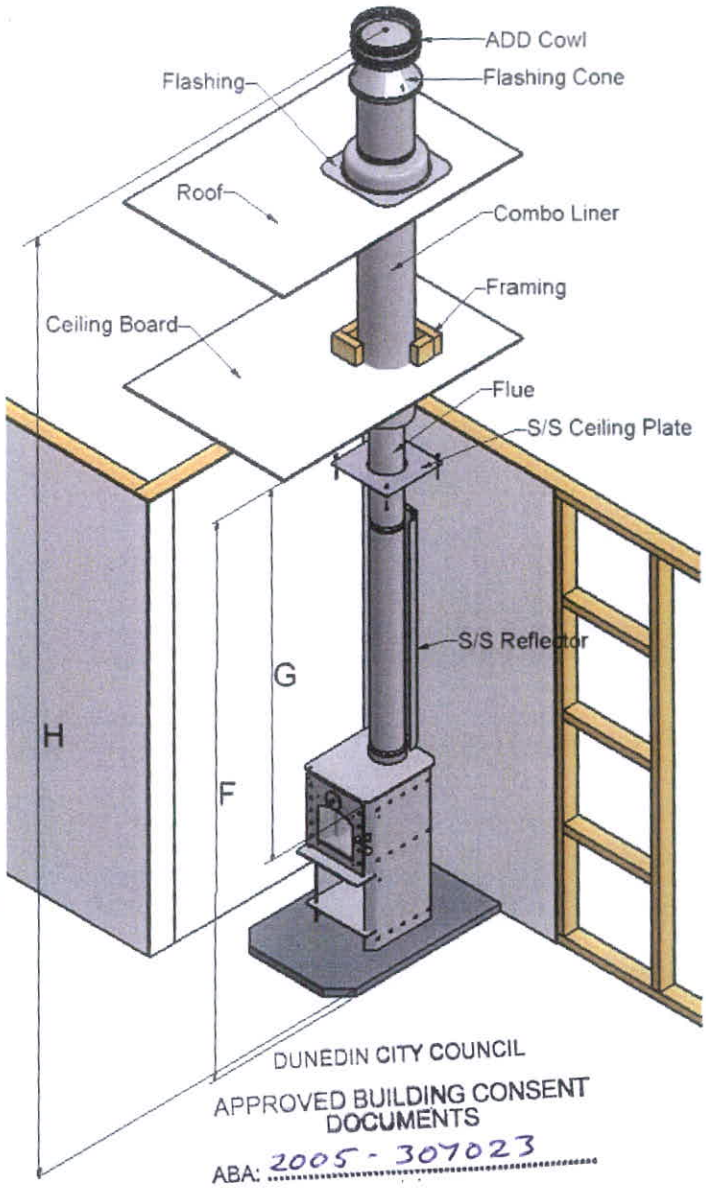
## FIREBOX DETAILS




| Description | | |
|---|---|---|
| Cabinet Width | A | 400 |
| Cabinet Depth | B | 520 |
| Cabinet Height | C | 820 |
| Flue Diameter | D | 150 |
| To Flue Centre | E | 123 |
| Minimum Ceiling Height | F | 2400 |
| Minimum from fire to Ceiling | G | 1500 |
| Height from Floor Protector | H | 4600 |
| Emissions levels (g/kg) | | 0.95g/kg |

## FLOOR PROTECTOR

| *Note: Floor Protection* |
|---|
| Floor Protectors are normally designed to suit each individual "setting". |
| The Studio Stove requires a "Ash Hearth" Floor Protector |
| The Floor Protector is to Comply with ASNZS 2918 : 2001 |




| Check List | |
|---|---|
| Baffle | |
| Holding Down Brackets | |
| Check Door Seal | |
| Check Damper | |
| Bricks (If Required) | |
| Serial Number Check | |
| Loading Badge | |
| Packed By | |

| Minimum Flue Height | |
|---|---|
| Flue Height | 3600 |
| Measured From Top of Cabinet | C + 3600 |

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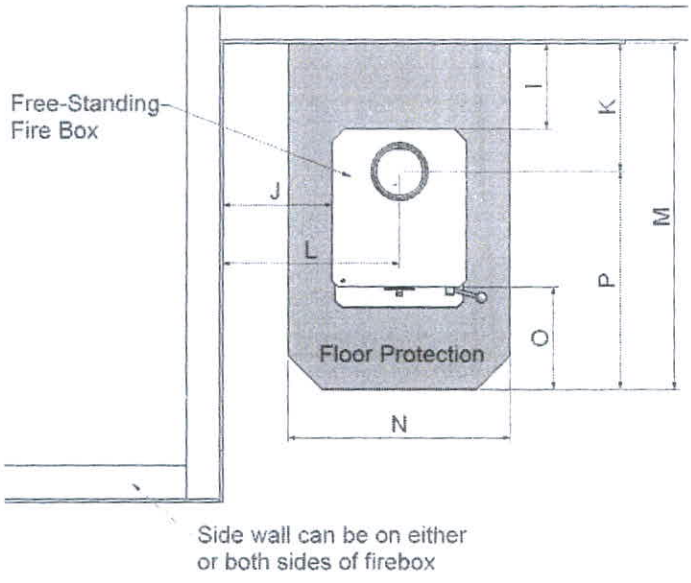
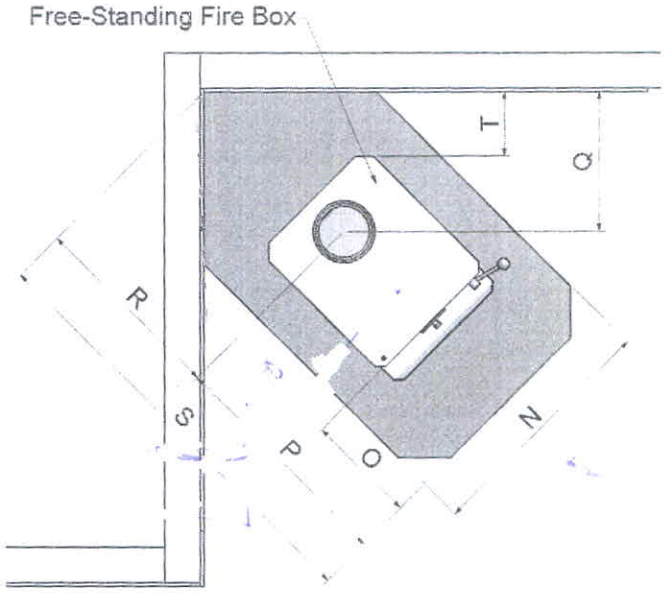
## PLAN VIEW OF CLEARANCES - STRAIGHT & CORNER

| Description | | 1. | 2. | 3. |
|---|---|---|---|---|
| To Wall Behind | I | 325 | 250 | 100 |
| To Wall Side | J | 325 | 325 | 325 |
| To Flue Centre (Back) | K | 448 | 373 | 223 |
| To Flue Centre (Side) | L | 525 | 525 | 525 |
| Hearth Depth | M | 1062 | 987 | 837 |
| Hearth Width | N | 660 | 660 | 660 |
| Hearth Projection | O | 300* | 300* | 300* |
| Hearth Projection from Centre of Flue | P | 614 | 614 | 614 |
| To Flue Centre -Corner | Q | 453 | 378 | 303 |
| To Flue Centre -Corner | R | 641 | 535 | 429 |
| Hearth depth -Corner | S | 1255 | 1149 | 1039 |
| To Wall Side - Corner | T | 250 | 175 | 100 |

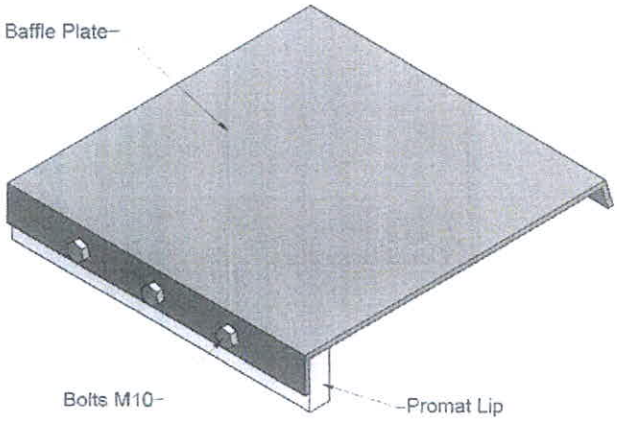
*Measurement taken from front ash lip

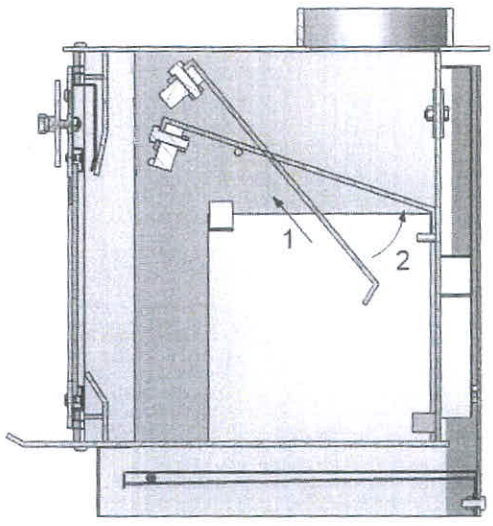
| Situation | |
|---|---|
| 1. | Combustible Surface without Flue Shield. |
| 2. | Combustible Surface with stainless steel reflective Flue Shield* |
| 3. | Non Combustible Surface and including walls without Flue Shield , eg Concrete/ Block/Brick/ACC Block. **Re Clearance to a Non Combustible materials, walls or surfaces Ref to ASNZS:2918:2001 3.2.1. The clearance to a Non Combustible surface and including wall can be less that 100mm if a wet back is not fitted and no requirement for maintenance.** |
| | * Construction of Flue Shield must be in accordance with ASNZS 2918 (minimum Flue Shield height is 1200mm) |




## BAFFLE POSITION

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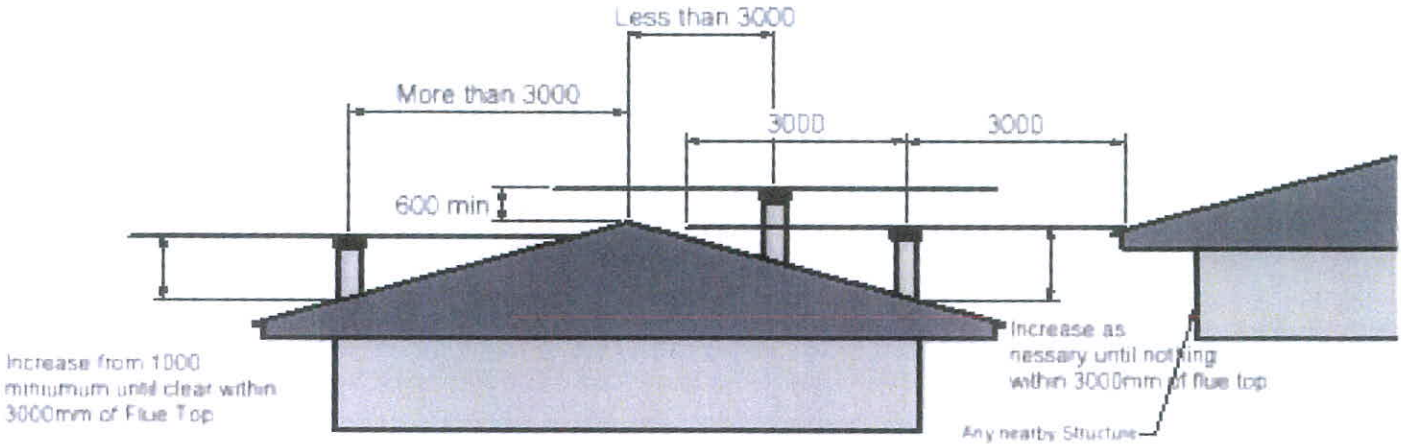
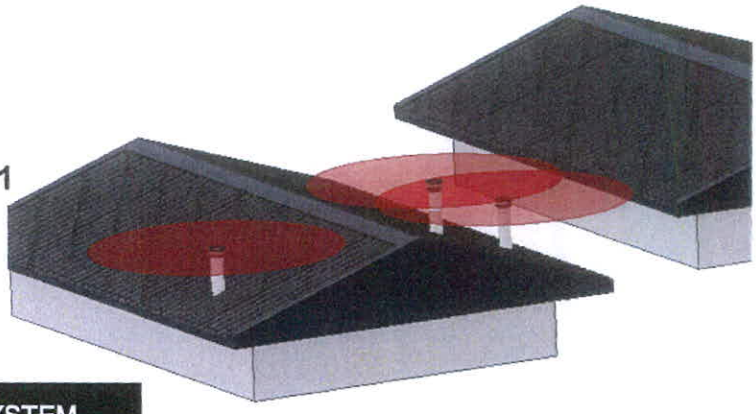
## FLUE HEIGHT MINIMUM DETAILS




**The flue exit is to comply to ASNZS 2918: 2001**

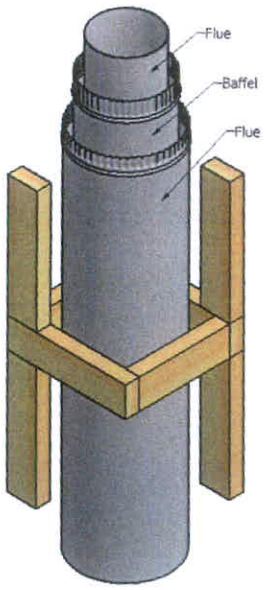


**3D View**

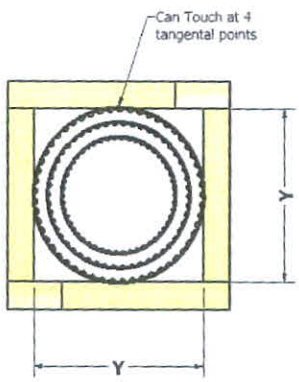
## FRAME OUT AND TRIM OUT DETAILS FOR FLUE SYSTEM

**Note: FLUE SYSTEMS Casing....**

Flue system may require to be Doubled lined to comply.
Ref ASNZS:2918:2001 4.3 Flue pipe casing




**Y= Liner Diameter**

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Amendment
— Remove existing openfire
Replace with Warmington
Studio stove

Amendment to ABA-50401
dated 18/02/2005

Section A-A

Timber deck on tanilised piles.

100x100 laminated posts

2/300x50 lintel strapped to 2/100x50 posts

2/250x50 lintel strapped to 2/100x50 posts

Existing kitchen

Existing bedroom

Existing Dressing

WC existing

Existing shower

Existing garage

Existing openfire

Existing woodburner

Cavity slided

New valley

Sanitary waste underneath floor.

New

Bond centre follow line

Kitchen

New skylight

250+100 beam

Bedroom

Section C-C

Brace

Pantry

Dressing Rm

Existing ridge

Existing bi fold doors

40mm handrail 900mm from nosing

D1.

W1.

W2

W3

W4

D2

D3

INC

TV

gully trap.

down wastes

terrace bricklayers sand.

Existing deck.

Section A-A

Section B-B

Stage 2 — ALTERATIONS for Don & Alison Anderson
lot 2 DP 16586 CT 8C/274 AREA 2895 m²
& lot 21 DP 2137

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New woodburner flue

Extg coal range flue

See details sheet 3

Horizontal Colorsteel Corrugated

fix skylight

plaster

slide

Existing cladding

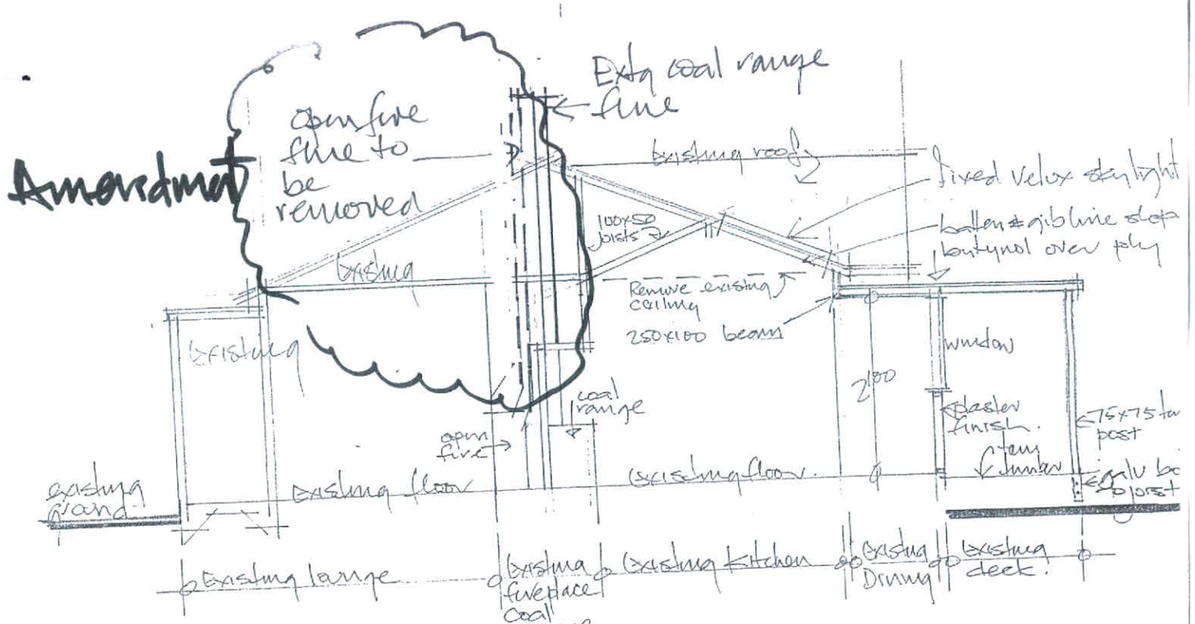
footing to slab

Dl.

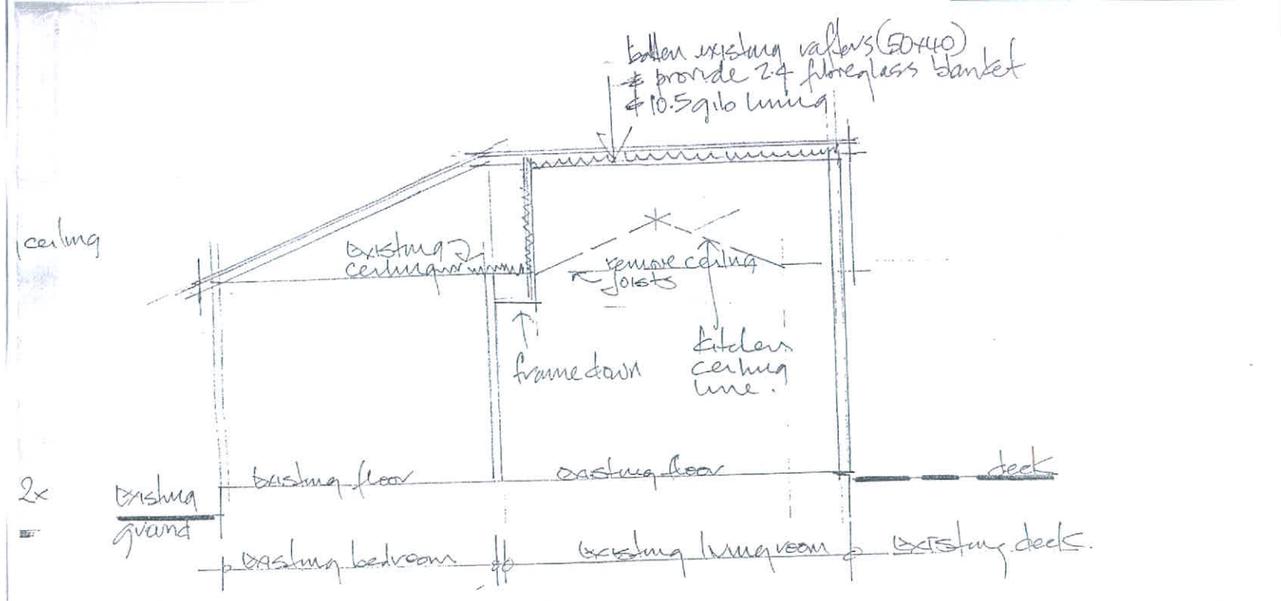
existing bi fold drs.

SHEET 2
February 2005

Amendment




SECTION A-A scale 1:50

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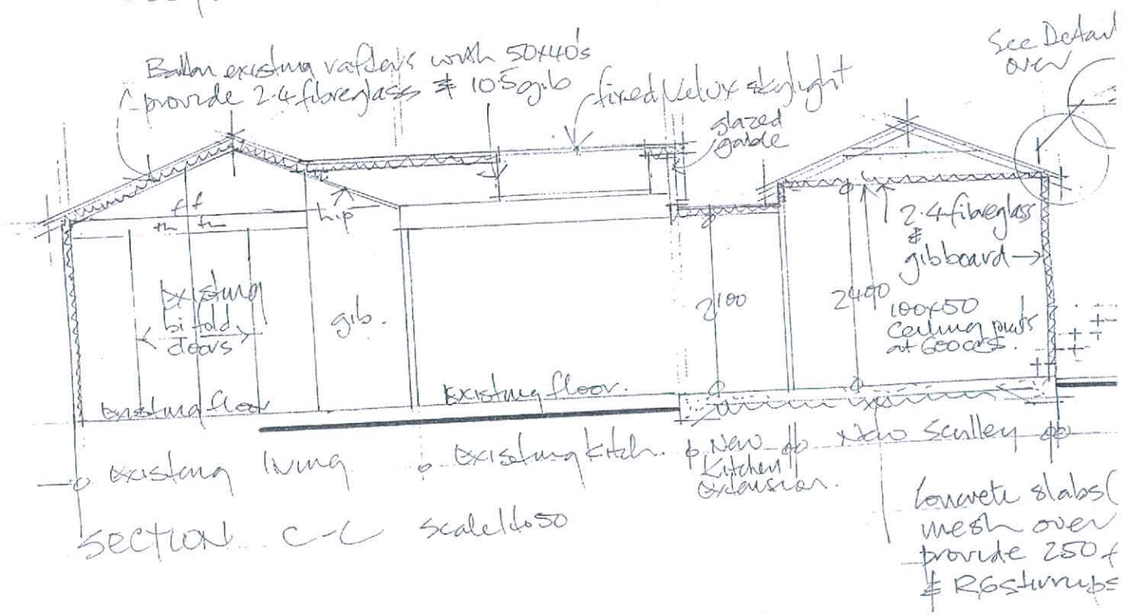


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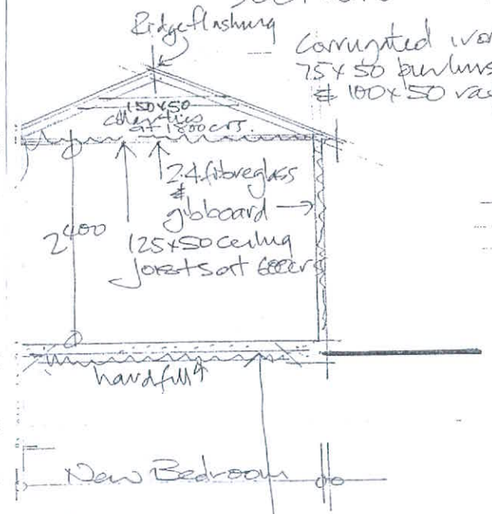


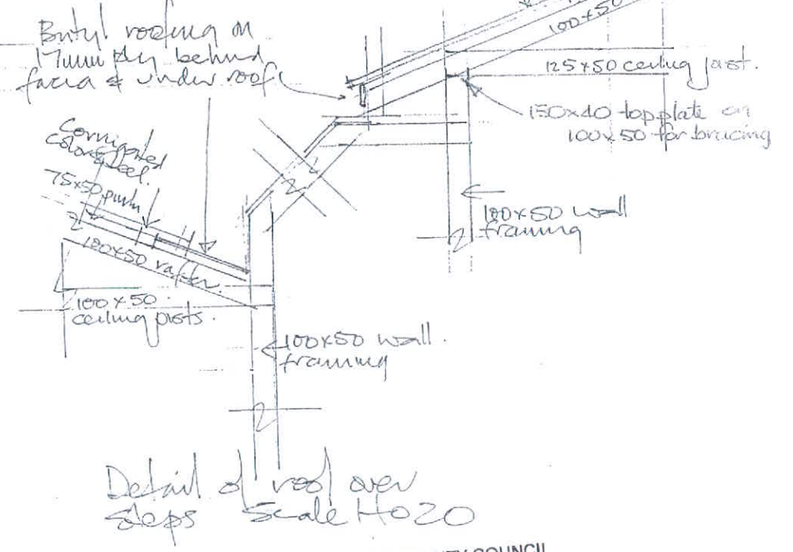


Detail of roof over steps Scale 1:20

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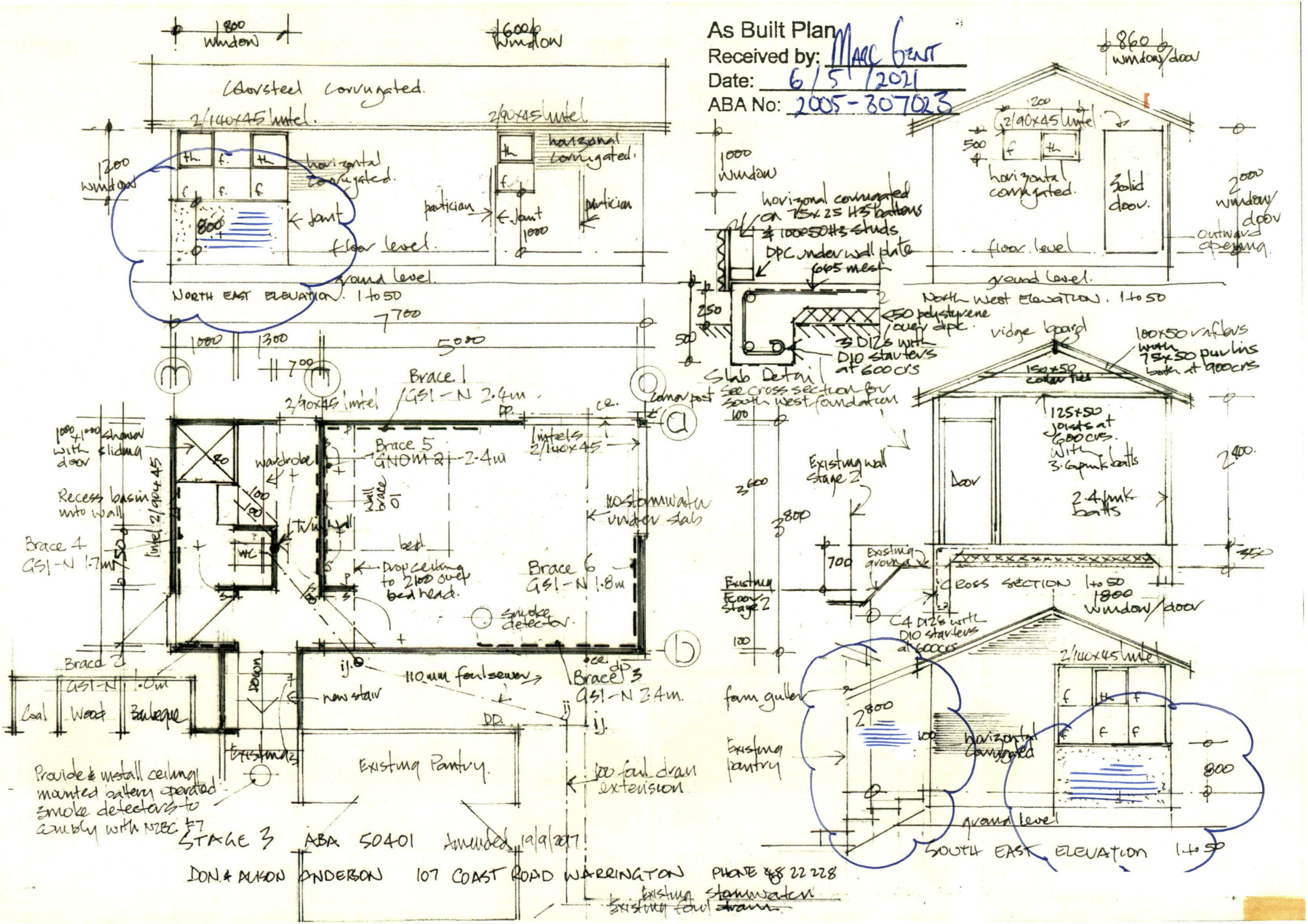
SHEET 3
February 2005

Stage 2 ALTERATIONS for DON & ALISON ANDERSON AREA 289 5m²
lot 2 DP 16586 CT 8C/274
lot 21 DP 2137

As Built Plan
Received by: MARC GRANT
Date: 6/5/2021
ABA No: 2005-30723



# Revised landslide database for the coastal sector of the Dunedin City district.

DJA Barrell B Smith Lyttle PJ Glassey

**GNS Science Consultancy Report 2017/41**
**July 2017**

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**Use of Data:**

Date that GNS Science can use associated data: June 2017

## BIBLIOGRAPHIC REFERENCE

Barrell DJA, Smith Lyttle B, Glassey PJ. 2017. Revised landslide database for the coastal sector of the Dunedin City district. Lower Hutt (NZ): GNS Science. 29 p. (GNS Science consultancy report; 2017/41).

## CONTENTS

**EXECUTIVE SUMMARY** ..... **III**

**1.0 INTRODUCTION** ..... **1**

1.1 BACKGROUND ..... 1

1.2 SCOPE AND PURPOSE ..... 2

1.3 REPORT LAYOUT ..... 3

**2.0 APPROACH USED FOR REVIEW AND REVISION** ..... **4**

**3.0 DATABASE STRUCTURE** ..... **7**

**4.0 DISCUSSION** ..... **8**

**5.0 ACKNOWLEDGEMENTS** ..... **10**

**6.0 REFERENCES** ..... **10**

## FIGURES

**Figure 1.1** The area of revision of landslide mapping described in this report, along with the extent of lidar coverage that was used to assist the mapping. ..... 3

**Figure 2.1** Example of landslide mapping revisions, as illustrated by the Brighton Road Slide, located close to Ocean View village, about 0.5 km east of the Brighton Road/Creamery Road intersection. ..... 5

**Figure 2.2** Illustration of the usefulness of high-resolution aerial photography (the 2013 orthophotos) when draped transparently over a high-resolution terrain model derived from lidar. ..... 6

**Figure 4.1** Illustration of the revised landslide map, coloured according the certainty that each mapped landform feature is actually a landslide. ..... 9

## APPENDICES


**A1.0 COMMENTARY ON LANDSLIDE MAP REVISIONS ..... 12**

A1.1 WEST OF BRIGHTON ..... 12
A1.2 NORTH OF THE TAIERI PLAIN/WEST OF SILVER STREAM ..... 12
A1.3 BRIGHTON – OCEAN VIEW AREA ..... 12
A1.4 WESTWOOD AREA ..... 13
A1.5 SADDLE HILL ..... 13
A1.6 ABBOTSFORD-GREEN ISLAND AREA ..... 14
A1.6.1 Miller Street Landslide ..... 14
A1.6.2 West Abbotsford Slide ..... 14
A1.7 CENTRAL CITY AREA ..... 15
A1.7.1 City Rise – Town Belt ..... 15
A1.7.2 Evans Street Slide ..... 15
A1.8 OTAGO PENINSULA ..... 16
A1.8.1 Howard Street Slide ..... 16
A1.8.2 Dickson Street Slide ..... 16
A1.9 WAITATI VALLEY ..... 17
A1.10 WARRINGTON ..... 17
A1.11 KILMOG SECTOR OF STATE HIGHWAY 1 ..... 18
A1.12 WAIKOUAITI AREA ..... 18
A1.13 REFERENCES ..... 19

**A2.0 DATABASE STRUCTURE AND SCALES ..... 22**

A2.1 DATABASE STRUCTURE ..... 22
A2.2 UNCERTAINTY IMPLICATION OF SCALE VALUES ..... 29


## APPENDIX TABLES


**Table A2.1** Structure of the **Landslide** database table. ..... 23
**Table A2.2** Restricted list of codes and definitions for landslide *activity*. ..... 24
**Table A2.3** Restricted list of codes and definitions for landslide *certainty*. ..... 24
**Table A2.4** Restricted list of codes and definitions for landslide *movement type*. ..... 25
**Table A2.5** Restricted list of codes and definitions for landslide *geological context*. ..... 25
**Table A2.6** Restricted list of codes and definitions for landslide *sensitivity*. ..... 26
**Table A2.7** Restricted list of codes and definitions for *landslide recognition method*. ..... 27
**Table A2.8** Structure of the **Source** database table. ..... 28
**Table A2.9** Restricted list of codes and definitions indicating the availability of each information source in the **Source** table ..... 29

# EXECUTIVE SUMMARY

The Otago Regional Council (ORC) operates a natural hazards database. Landslides are a significant hazard in the Otago Region and an inventory of landslide information is an important dataset in the natural hazard database. The ORC landslide dataset documents the interpreted locations of past landslide movements based on landform characteristics, but does not provide forecasts of future landslides. Information in the ORC landslide dataset has been compiled from a variety of sources and at a variety of scales. As a result, there is considerable variation in the precision and quality of information on individual landslides. Of particular significance to communities is the exact geographic location of landslides, especially in regard to where the positions of landslide boundaries have been mapped. This is because there are potential implications for hazards associated with future landslide movement.

The ORC landslide dataset was first compiled in a comprehensive way in 2006 for all of Otago. A major revision for the Dunedin City district sector of the ORC landslide dataset was carried out in 2012. Further work was commissioned in 2014 and 2015 to refine the Dunedin sector of the dataset, with emphasis on areas of existing and future urban development, during of the formulation of the Dunedin 2nd Generation District Plan (2GP). However, it became apparent during consultation for the 2GP that the existing landslide mapping in the Dunedin area was too imprecise to be useful at the scale of individual property boundaries.

ORC and GNS Science then undertook a collaborative project to make an improved map of landslides for the near-coastal sector of the Dunedin district, with the revised map footprint encompassing all land that is proposed in the 2GP to be zoned as residential, rural residential, commercial and mixed use, major facilities and industrial. The intent was to produce a map of landslide locations that has sufficient precision to be used at the scale of individual property parcels, with clearly expressed accuracy information.

The work made use of high-quality aerial and satellite imagery, as well as topographic models derived from airborne laser scanning (lidar), as well as the more traditional archival resources of aerial photographs dating back to the 1940s. This work has produced a landslide dataset (Dunedin landslide dataset) that is much improved upon previous versions. One of the outcomes of using all of these high-quality resources is that a number of previously-unreported landslides have been detected. The total area of mapped landslides in the revised dataset is greater than in the previous dataset. The revised mapping covers a land area of 668 square kilometres and contains 146 square kilometres that are mapped as landslide terrain. In comparison, within that same footprint, the original dataset contained only 124 square kilometres that were mapped as landslide terrain. This represents a 18% increase in the area that is interpreted to have been affected by past landslide movement.

This report documents the revisions that have been undertaken to the database structure of the Dunedin landslide dataset, provides some examples of the changes that have been made in the mapping of landslide extents, and provides explanatory comments on some of the revisions that have been made in key areas.

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

The Otago Regional Council (ORC) operates a natural hazards database. Landslides are a significant hazard in the Otago region and landslide information is one of the key data sets in the ORC natural hazard database.

In 2012, ORC commissioned GNS Science (GNS) to review, rationalise and update the ORC's landslide dataset for the Dunedin City district (Glassey & Smith Lyttle 2012). As a result of that work, about 1200 additional landslide areas ('polygons') were added, duplicated landslide information was removed, and source(s) of information for each landslide were identified, including any specific report(s) documenting the landslides. Several new categories of information ('fields') were added to the database structure to allow the entry of descriptors ('attributes') that characterise a particular landslide. Point locations of landslide information held by GNS were also incorporated into the dataset. A limitation of the 2012 landslide dataset was that it contained little, if any, information on the significance of the hazard posed by each identified landslide. ORC subsequently contracted GNS to provide more information on that aspect of the mapped landslides in six areas in the Dunedin City district (Glassey et al. 2014).

The Dunedin City Council (DCC) has, since 2012, been in the process of formulating a revised District Plan (2nd Generation District Plan – 2GP), for which ORC has been providing advice on the management of natural hazards. In early 2015, ORC contracted GNS to provide further information on the landslide hazard in Dunedin. That work involved an analysis of landslide locations in the existing Dunedin landslide dataset in relation to factors such as rock type, soil type and slope angle (Barrell & Smith Lyttle 2015). The aim was to highlight not just the locations where landslide movements have previously been identified, but also areas where geological and/or topographical conditions may be unfavourable for slope stability, and thus may possibly be susceptible to future landslide movement. Those areas were identified as 'awareness areas' and comprised the locations of landslides identified in the Dunedin landslide dataset (landslide awareness areas), places where the ground slope is relatively steep (slope awareness areas) and places that are underlain by geological formations that are commonly associated with slope instability (geological awareness areas).

An attempt was made to highlight the uncertainties associated with each of these awareness categories, by generating a band of set width ('buffer') around each defined area using computer technologies. The primary intent of the buffer was to account for inherent imprecision in the mapping of the extent of each landslide. There was considerable variability in the precision of mapping in the Dunedin landslide dataset. The dataset had been compiled from existing information, consisting mostly of maps from published or unpublished reports, and from unpublished files. Those maps had been made for various different purposes and at different scales. The buffers went some way towards highlighting the inaccuracies in the locations of many of the landslides in the dataset.

In the draft 2GP that the DCC issued for consultation in September 2015, the landslides and their buffers were identified as hazard zones. Landowners with a property parcel coinciding with one or more of those hazard zones were notified to that effect in writing, and the hazard zone maps and other information were made available for inspection and interrogation via the internet. A large number of submissions were received in relation to the landslide hazard zonation. Many submissions questioned the accuracy of the landslide

mapping, and the validity of the hazard zonation, especially when viewed at the detailed scale of individual property parcels.

GNS Science administers and maintains a landslide database of national extent (The New Zealand Landslide Database; Rosser et al. 2017). Although the database is still under development, access to selected parts of its content is available via the GNS Science Databases page (https://www.gns.cri.nz/Home/Products/Databases) and the 'New Zealand Landslide Database' link. In the Dunedin district, the online webmap currently only offers point data on historic reported occurrences of landslide events that have occurred since the mid-1990s (the 'Landslide Catalogue' component of the database described by Rosser et al. 2017). Many of those landslide points are not accurately located, and most are identified as 'small', and probably would be sufficiently extensive to include in the Dunedin landslide dataset. The Dunedin landslide dataset described in this report provides more detailed and more complete information than currently exists in the New Zealand Landslide Database.

## 1.2 SCOPE AND PURPOSE

ORC and GNS formulated an approach to address the general concerns about landslides in the 2GP submissions, involving the preparation of a more detailed map of landslide information for the coastal Otago area (Figure 1.1). This initiative took advantage of an in-progress government-funded GNS project to compile an updated geological map for the greater urban area of Dunedin, for which a more detailed map of landslides was desirable. The government funding was used to produce an improved map of landslide extents. ORC contracted GNS to integrate the new landslide extents into the Dunedin landslide dataset, review and refine the database structure, assign descriptive database attributes to the mapped landslides, and document the work in a report. This report provides that documentation.

The revised dataset described in this report builds upon and refines the Dunedin landslide dataset that was compiled by Glassey & Smith Lyttle (2012) and was amended in localised areas by Glassey et al. (2014). The 2016-2017 revisions, identified in the revised dataset and in this report as Barrell (2017), are only in respect of the landslides that are mapped as areas (polygons). No revisions have been made in regard to landslides that have previously been mapped as points. A partial exception is landslides associated with the June 2015 rainstorm, which were all represented by points (Martin & Smith Lyttle 2016). Some of the larger ones are extensive enough to map as polygons, and those are included in the revised polygon dataset. The revised landslide mapping supersedes the landslide polygon map and landslide awareness areas documented by Barrell & Smith Lyttle (2015). The scope of the present project did not extend to redoing the analyses described in the 2015 report.

The new mapping includes all areas of the near-coastal sector of the Dunedin City district that is proposed, in the 2GP, to be zoned as residential, rural residential, commercial and mixed use, major facilities and industrial. The intent was to produce, for the area defined in this report, a map of landslide locations with sufficient precision to be used at the scale of individual property parcels, with clearly specified accuracy information.

## 1.3 REPORT LAYOUT

Section 2 of the report describes the approach and methods used in the 2016-2017 review and revision of the Dunedin landslide dataset, with two illustrative examples. Section 3 provides an overview of some of the key revisions to the database structure, while Section 4 discusses some of the results of the work. Two appendices accompany the report. Appendix 1 provides descriptive notes on the refinements made to some of the landslide features. This focuses predominantly on revisions to the mapping of active or recently active landslides within, or close to, residential areas. Appendix 2 contains tables that set out the new database structure of the Dunedin landslide dataset along with definitions of important terms used in describing the characteristics of the landslides. In the interests of practicality, there is no comprehensive set of maps supplied for the area of the landslide review and revision, as that would require an exhaustive number of pages to cover the full extent of the revision area in appropriate detail. It is anticipated that people will be able to examine, in detail, areas of interest in interactive digital form via the ORC Natural Hazards Database on the ORC website.

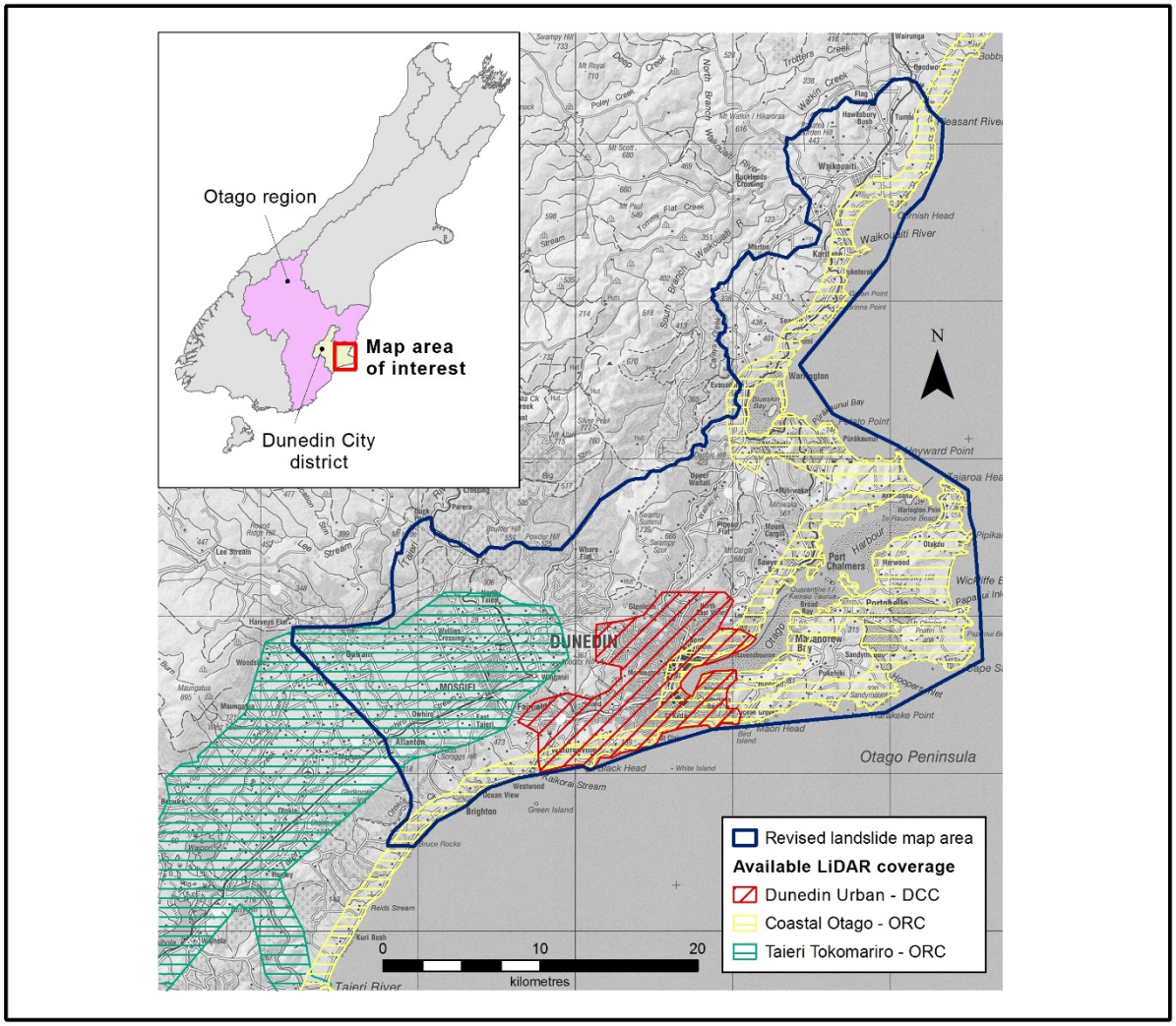


**Figure 1.1** The area of revision of landslide mapping described in this report, along with the extent of lidar coverage that was used to assist the mapping.

## 2.0 APPROACH USED FOR REVIEW AND REVISION

Landslide terrain has distinctive and usually diagnostic topographic characteristics that, except in areas where the ground is obscured by vegetation, can readily be identified and interpreted in aerial photography or when viewed afar from good vantage points on the ground. Of particular and long-standing value are sequences of overlapping aerial photos, taken looking down vertically at the ground from a plane flying a pre-determined straight-line path. The overlap allows the photos to be examined 'stereoscopically', in a 3D perspective. There are archival sets of stereoscopic photos covering almost all of coastal Otago, dating back to the 1940s and 1950s. At that time, land use was almost exclusively pastoral farming, and the ground surface in most places is clearly visible, much more so than in recent decades, when many areas of steep or unstable terrain have been retired from farming and reverted to scrub, or converted to plantation forestry.

Ever-improving capabilities, such as easy access to high-quality aerial and satellite imagery that is registered in an accurate geographic location ('georeferenced') along with the very detailed topographic information from lidar provide a means for the efficient and accurate mapping of landform features related to landsliding. These technological capabilities allow accurate outlines of landslides to be drawn directly on-screen using a Geographic Information System (GIS). This affords far greater precision than was possible using the previously standard method, which involved identifying landslides in stereoscopic aerial photos, transcribing their location and outline as best as possible onto a printed topographic base map, and then digitising them from the base map into a GIS.

In the current review of the Dunedin landslide dataset in the area defined in Figure 1.1, a complete re-examination was made of the terrain, using the archival stereoscopic aerial photo sets held by GNS, the 2013 colour aerial georeferenced 'orthophoto' mosaic available from the DCC, which covers the entire assessment area, the digital 1:50,000 scale topographic map (Topo 50), and lidar datasets where available (Figure 1.1). At the few locations where detailed geotechnical information is available, and in particular where there are detailed technical maps of landslide features, use was made of those resources in compiling the improved map of landslide extents. The landslide locations (especially their perimeters) in the existing dataset were examined in relation to these various information resources. It quickly became apparent that the imprecisions and inconsistencies in the existing landslide dataset were such that a complete overhaul was needed (Figure 2.1). Aerial photograph runs in the collection of the GNS Dunedin Research Centre were examined stereoscopically. On the photos showing the best detail of the ground surface (typically the 1940s to 1950s photos), the outlines of the identifiable landslides were drawn on the photos with an erasable pencil. The annotated photos were then scanned and georeferenced in the GIS.

The annotated photographic interpretations were then examined in the context of detailed topography from 2013 orthophotos, Topo 50 maps, lidar and satellite imagery. Everything in the GIS was scrutinised with the scale typically set at 1:5,000 scale (1 cm on screen equals to 50 m on the ground), and in areas of lidar coverage, at 1:2,500 scale (1 cm on screen equals to 25 m on the ground). This was done to ensure consistency of mapping detail. Where existing landslide features in the dataset were approximately consistent with the new information, their positions and boundaries were adjusted to accord with the new information. In some cases, existing landslides were subdivided into several separate, new, entities, and many new landslides were identified and drawn into the dataset, directly on-screen via the GIS.

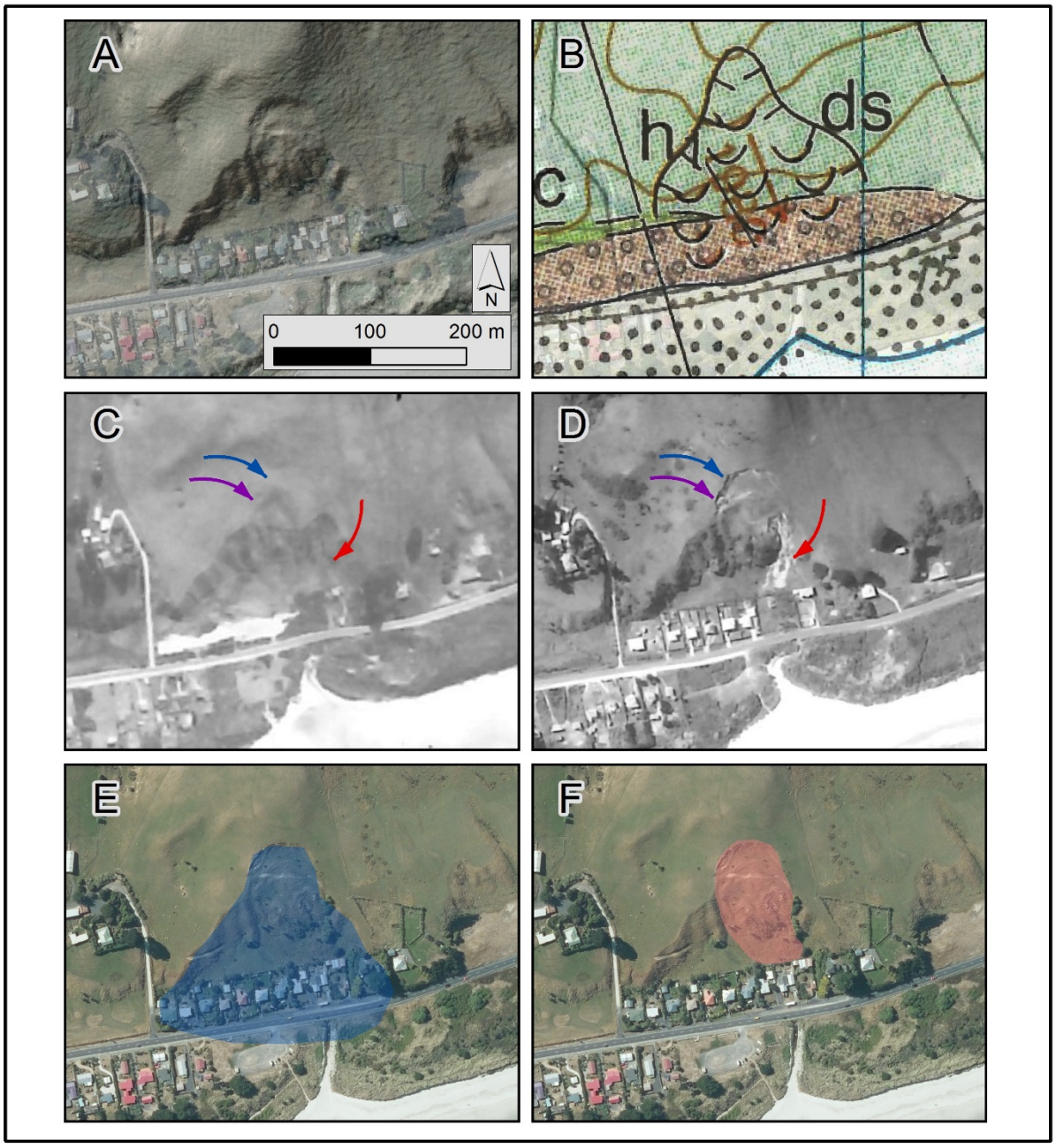


**Figure 2.1** Example of landslide mapping revisions, as illustrated by the Brighton Road Slide, located close to Ocean View village, about 0.5 km east of the Brighton Road/Creamery Road intersection. Each panel of the diagram shows the same scene at the same scale, with different backgrounds displayed. **Panel A** shows the scene, with the 2013 aerial orthophotography draped transparently with the ORC lidar hillshade model. The hillshade model shows, in shade, a steep slope north of the road and houses with a crescentic embayment, which is a former sea cliff, cut by wave action before the present sand dunes built up. **Panel B** shows the geological map of McKellar (1990). The 'bell-shaped' line with tick marks enclosing half-crescent lines denotes the interpreted extent of a pre-existing landslide, with a red arrow and date indicating a movement occurred in 1980. **Panels C and D** have arrows at identical locations in each panel, to illustrate the presence/absence of key features at different times. Panel C shows aerial photo SN1004/56, taken 14th April 1946; landslide features evident in later photos (blue and red arrows) were not present at that time. The purple arrow indicates a small triangular shadow that may possibly be a small pre-existing landslide. Panel D shows aerial photo SN2556/19, taken 20th February 1958; a substantial landslide movement has occurred sometime between 1946 and 1958, with the prominent crack at its head indicated by the blue and purple arrows. At the lower right margin, an elongate light-coloured area (red arrow) is a debris slide that has run out to the back fence line of some of the Brighton Road residential properties. **Panel E** shows, in blue, the interpreted landslide extent shown by McKellar (1990) and refined slightly in its extent by Glassey and Smith Lyttle (2012). It is considered in the present report that McKellar (1990) misinterpreted the embayment in the old sea cliff as a landslide feature. **Panel F** shows the revised interpretation, which limits the landslide extent to the areas of definite movement recorded in imagery and other sources since the 1940s-50s (also see Mackey 2015). The background image in panels E and F is the 2013 orthophotography. Revisions to the mapping of the Brighton Road Slide are described in Appendix 1.

The comparison between the archival aerial photographs and more recent imagery available through Google Earth and the 2013 orthophotos enabled the identification of landslide movements or reactivations that have occurred in recent decades (see Figure 2.1). Google Earth imagery was also used to map, and via the time sequence of images, bracket the dates, of some recent landslides, including those from the June 2015 rainstorm. The lidar has proved to be a valuable resource in some locations where the topography makes it difficult to use other methods. For example, in Dunedin's Town Belt, much of which has been thickly forested since the early days of the city, it was known that northeast of Moana Pool, there were some areas of irregular terrain but the thick vegetation made accurate mapping from aerial photographs impossible. The lidar for that area now reveals rift-like depressions that are likely to have been caused by landslide movements (Figure 2.2).

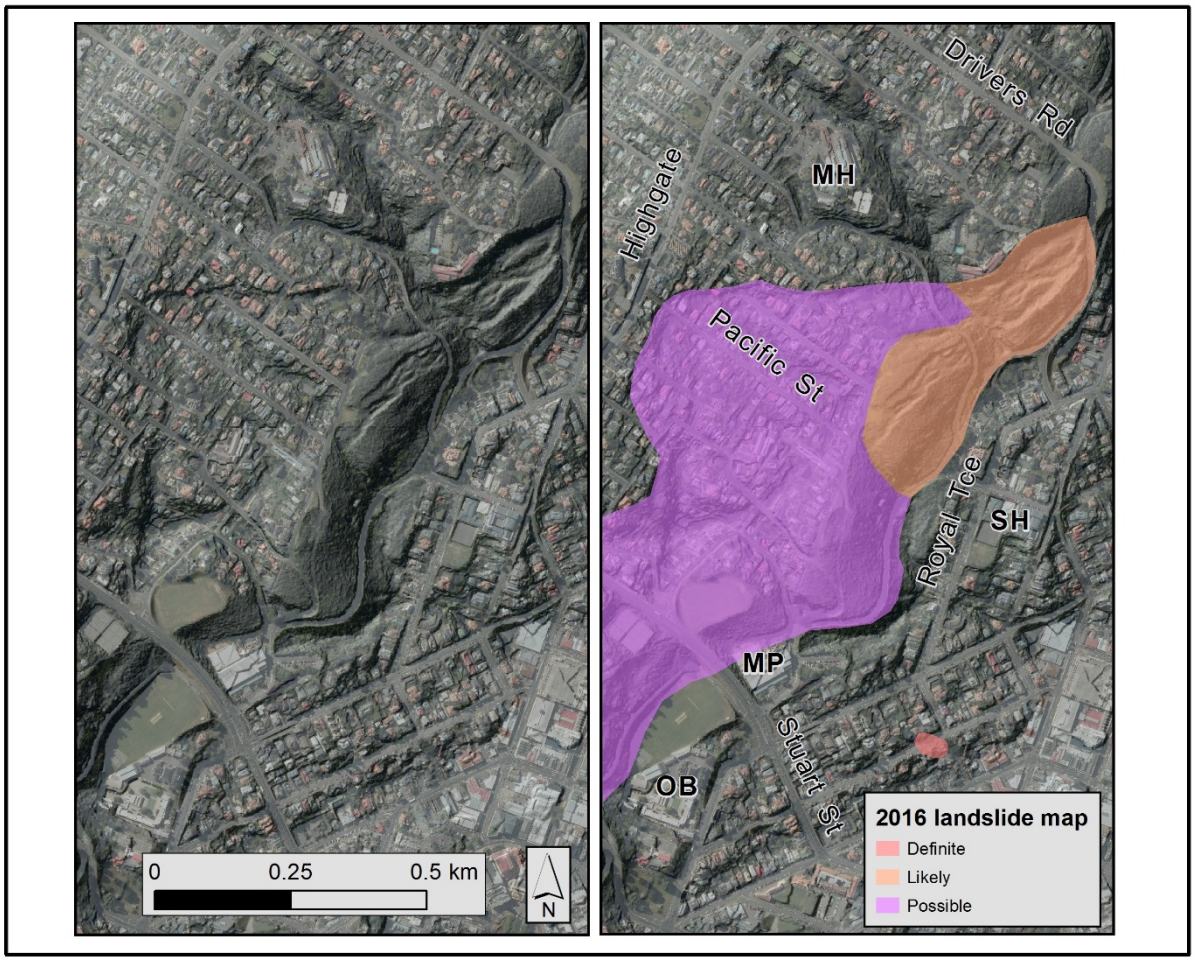


**Figure 2.2** Illustration of the usefulness of high-resolution aerial photography (the 2013 orthophotos) when draped transparently over a high-resolution terrain model derived from lidar. These two panels show the same area but the right hand one includes an interpretation of landslide features, and annotation of some locations, including roads and major facilities. OB = Otago Boys High School, MP = Moana Pool, MH = Mercy Hospital, and SH = St Hilda's Collegiate School. The large area mapped in purple (possible landslide) is identified as such because it has a reasonably sharp topographic step around its upslope perimeter (upper left). Its possible existence was first recorded in an unpublished aerial photograph interpretation by P.J. Glassey (2001) and named the 'Town Belt Block Slide'. The area mapped in orange (likely landslide) was first delineated in the Barrell (2017) dataset. This interpretation is based on the presence of prominent rift-like depressions, revealed by the lidar. Together with the larger possible slide, they are referred to in the revised landslide dataset as the 'Town Belt Slide Complex'. The small pink area at the lower right (definite landslide) is the Cargill Street Slide which has been active in recent historical times. There are no known indications (e.g. historical reports of damaged streets, gutters or underground pipes) that the Town Belt Slide Complex has experienced any movement since Dunedin was established. See discussion in Appendix 1 of this report.

## 3.0 DATABASE STRUCTURE

As part of this project, the Dunedin landslide database structure was reviewed, and a number of revisions were made, primarily to make things simpler. The data field and attribute structure was revised, and the new version is set out in Appendix 2. In this report, the following format convention is used for terms in the Dunedin landslide dataset:

- **Bold** (e.g. **Landslide**) refers to a database table.
- *Italicised* (e.g. *Certainty*) refers to a field (column name) within a database table.
- Underline (e.g. definite) refers to an attribute or value that can populate a data field.

Notable refinements include the addition of fields to the **Landslide** table that enable the documentation of multiple methods used to identify and interpret an individual landslide (*Landslide recognition method*, *Landslide recognition method 2*, *Landslide recognition method 3*, and *Landslide recognition detail*). In addition, fields were added that identify multiple sources for the information (*Source latest*, *Source secondary* and *Source original*), along with a field explicitly stating the scale at which the landslide feature has been mapped in the current iteration of the dataset (*CaptureScale*), and the most detailed scale at which the feature is intended to be viewed (*ResolutionScale*). The *ResolutionScale* is always a larger number (i.e. a less detailed scale) than the *CaptureScale*.

Revisions have also been made to the *Activity* classification of Glassey & Smith Lyttle (2012) with the abandonment of the somewhat subjective terms potentially active and inactive. Instead, more age-descriptive terms have been utilised, comprising ongoing activity, recent historical activity, older historical activity, and prehistoric activity[1]. Building on the refinements introduced by Glassey et al. (2014), the classifications of *Certainty* and *Sensitivity* have been applied to all landslides in the revision area (see Appendix 2). A field called *Geological Context* has been added for the purpose of indicating whether a landslide is thought to have occurred within the underlying geological strata (bedrock) or within thin near-surface soil-related materials (surficial). Another refinement on the 2014 work has been to change the *Remediation* field to allow descriptive text of what stabilising measures are known to have been employed, rather than a shortlist of restricted subjective terms (e.g. major, minor) as applied previously.

Some minor refinements have also been made to the fields in the **Source** table. The addition of the *CaptureScale* and *ResolutionScale* fields to the **Landslide** table has enabled us to remove the *Scale* field within the **Source** table of the previous iterations of the dataset. That field was formerly the only way to infer the accuracy of the mapping of an individual landslide, with such information now being more explicit in the scale fields of the **Landslide** table. In Appendix 2, Section A2.2 sets out the relationship between scale and mapping precision in relation to the Dunedin landslide dataset described in this report.

[1] 'Historical' refers to the period since European settlement, i.e., since the mid-1800s.

## 4.0 DISCUSSION

The revised Dunedin landslide dataset, within the sector of coastal Otago addressed in this report (Figure 4.1), has for the most part been compiled at a *ResolutionScale* of 1:10,000 or better. It is intended that this degree of detail will be generally applicable at the scale of individual property parcels. Nevertheless, it is important to appreciate that the landslide mapping is still based mostly on the interpretation of aerial or satellite imagery, rather than on-the-ground inspection. Doubtless, many refinements could be made in the event of future detailed ground inspections. It is also relevant to note that there are bound to be future landslide movement events that may warrant incorporation in future iterations of the dataset.

In the course of making this methodical review and revision of landslides in the area defined in this report, it was perhaps inevitable that some considerable revisions would be necessary, and also that many previously unreported landslide features would be detected, given the excellent level of detail available in the imagery resources and lidar. By way of statistics, the total area of mapped landslides in the revised dataset is greater than in the previous dataset. The footprint of the mapping revision area (onland area only, of the blue perimeter shown in Figure 1.1) is 668 km², and contains 146 km² that are mapped as landslide terrain (22% by area). In comparison, within that same footprint, the original dataset contained 124 km² that were mapped as landslide terrain (19% by area).

The work undertaken for this project illustrates that many knowledge improvements can be achieved from a comprehensive and methodical review of landslide features. For the revision area, there is now a landslide map in which considerable confidence can be placed. There are several substantial advantages within the new data structure, perhaps the most useful of which will be the distinction that is made between landslides developed on the underlying bedrock (bedrock landslides), versus those associated with movement in the near-surface soils (surficial landslides). By this distinction, it should be possible to undertake more robust future analyses of the relationship between different types of bedrock and the occurrence of landslides. The analyses made by Barrell and Smith Lyttle (2015) in regard to association of landslides with bedrock type were clearly fraught because the previous landslide map was insufficiently complete, as illustrated by the addition of 22 km² of landslide terrain (an 18% increase) as a result of the work reported here.

Another strength of the new data structure is the replacement of subjective terms describing landslide activity with terms that relate to more explicit estimates of when the most recent movement of a particular landslide occurred. While this does not in itself provide any explicit guidance on the degree of hazard presented by particular landslide, it does provide a better knowledge base for evaluating hazard and risk in regard to landslide movement. The sensitivity criterion is intended to provide information related to hazard potential, by highlighting those landslides which may be more sensitive to reactivation on account of natural or human-induced processes.

It is hoped that the revised landslide dataset for this sector of coastal Otago will be a useful resource for future land-use planning and improvements to societal resilience in the greater Dunedin area, in relation to the long-standing significance of slope instability problems in this part of New Zealand.

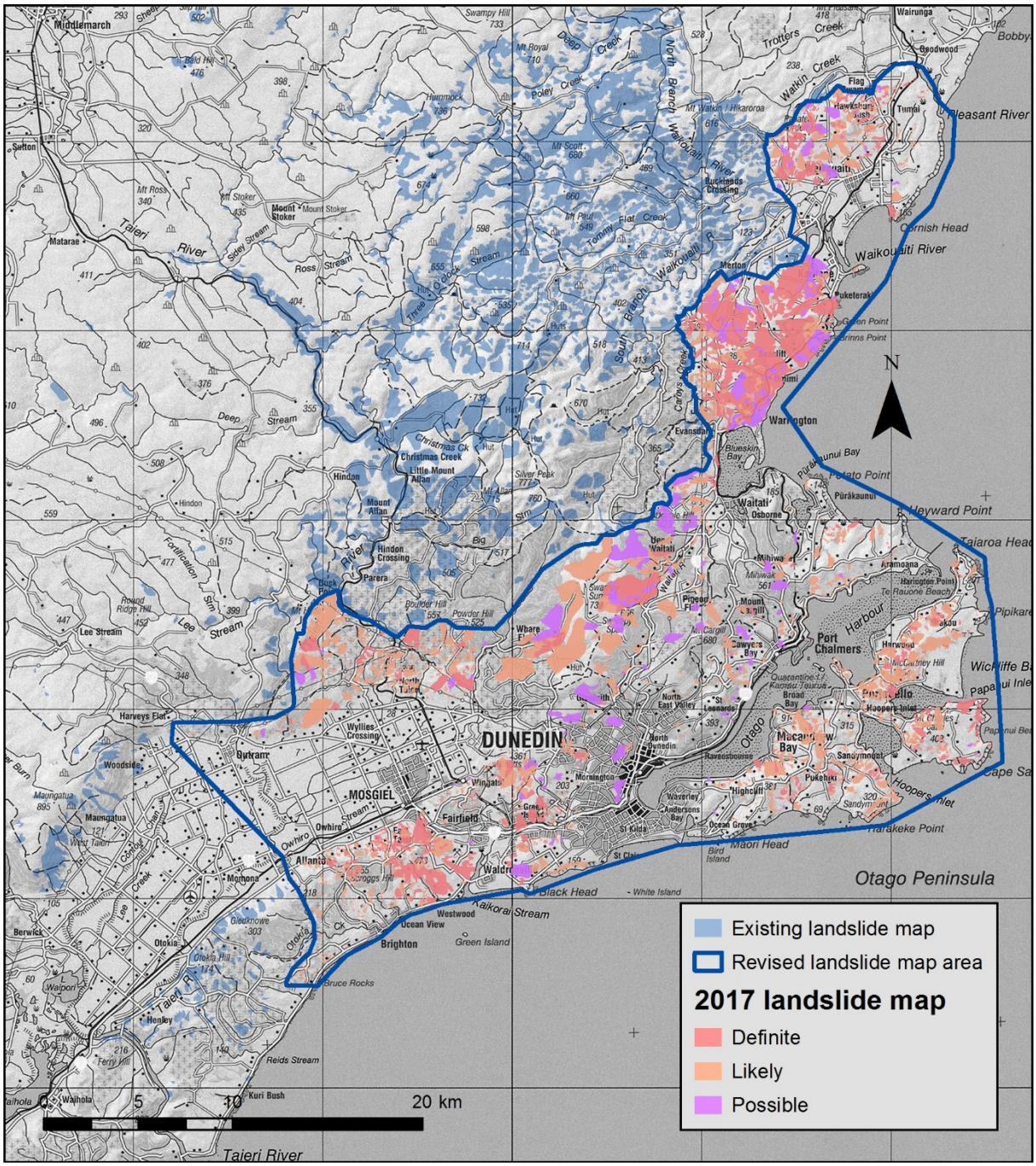


**Figure 4.1** Illustration of the revised landslide map, coloured according the certainty that each mapped landform feature is actually a landslide. Outside the perimeter of the revision, the dataset comprises the previously-mapped landslides (existing landslide map).

## 5.0 ACKNOWLEDGEMENTS

Co-funding for the revised mapping of landslides was provided by GNS Science with Direct Crown Funding through the Minerals, Urban and Regional Geology research programme. This report has benefited from technical reviews by Sally Dellow and Simon Cox of GNS Science and Ben Mackey of Otago Regional Council.

## 6.0 REFERENCES

Barrell DJA. 2017. Revised landslide database for the coastal sector of the Dunedin City district. Geographic Information System geodatabase, provided to Otago Regional Council. Revisions are discussed in the present report.

Barrell DJA, Smith Lyttle B. 2015. Identification of areas possibly susceptible to landsliding in the coastal sector of the Dunedin City district. Lower Hutt (NZ): GNS Science. 38 p. (GNS Science consultancy report; 2015/34). Prepared for Otago Regional Council. Accessible at www.orc.govt.nz, search term < natural hazards >.

Glassey PJ. 2001. Air photo interpretation of landslides in Dunedin for Property Insight. Unpublished Geographic Information System dataset held by GNS Science, Dunedin, NZ.

Glassey PJ, Smith Lyttle B. 2012. Attributing and reconciling source of landslide data within the Dunedin City Council area. Lower Hutt (NZ): GNS Science. 17 p. plus appendices. (GNS Science consultancy report; 2012/279). Prepared for Otago Regional Council. Accessible at www.orc.govt.nz, search term < natural hazards >.

Glassey PJ, Barrell DJA, Smith Lyttle B. 2014. The hazard significance of landslides in and around Dunedin City. Lower Hutt (NZ): GNS Science. 32 p. (GNS Science consultancy report; 2013/339). Prepared for Otago Regional Council. Accessible at www.orc.govt.nz, search term < natural hazards >.

Mackey B. 2015. Active landslides in the Dunedin area. Dunedin (NZ): Otago Regional Council. ISBN 978-0-905324-18-7. 37 p. Accessible at www.orc.govt.nz, search term < natural hazards >.

Martin AP, Smith Lyttle B. 2016. Landslides in the Dunedin area resulting from the June 2015 rainstorm. Lower Hutt (NZ): GNS Science. 24 p. (GNS Science consultancy report; 2015/235). Prepared for Otago Regional Council. Accessible at www.orc.govt.nz, search term < natural hazards >.

McKellar IC. 1990. Geology of the Southwest Dunedin urban area [map]. Lower Hutt (NZ): New Zealand Geological Survey. 1 map + 63 p., scale 1:25,000. (New Zealand Geological Survey miscellaneous series map; 22).

Rosser BJ, Dellow GD, Haubrock SN, Glassey PJ. 2017. New Zealand's National Landslide Database. *Landslides*. Online release, not yet assigned to an Issue. doi: 10.1007/s10346-017-0843-6.

# APPENDICES

# A1.0 COMMENTARY ON LANDSLIDE MAP REVISIONS

## A1.1 WEST OF BRIGHTON

In two locations, one ~400 m NW of the Big Stone Road/Brighton Road intersection (*Landslide ID* 2902) and one immediately SW of Scroggs Hill Road, ~1 km NW of the Brighton Road intersection (*Landslide ID* 2895), the previous dataset showed a landslide feature. These have been deleted from the new dataset because both these features are old quarries. Their mapping as landslides arose from a misinterpretation of the symbol used to show quarries on the McKellar (1990) geological map.

## A1.2 NORTH OF THE TAIERI PLAIN/WEST OF SILVER STREAM

Most areas here were clear of forest in the historic (1940s-60s) black and white aerial photos, but in recent aerial/satellite imagery (2013 orthophotos; Google Earth), there is extensive forest cover in many parts of the area, both exotic plantations and native regrowth. In areas where the ground is obscured in modern high-resolution georeferenced imagery, there is less certainty about delineating the location of landslides seen in the old imagery. In areas of contemporary forest cover, *CaptureScale* of 1:6,000 and *ResolutionScale* of 1:12,000 are assigned. Elsewhere, the equivalent scales are *CaptureScale* 1:5,000 and *ResolutionScale* of 1:10,000. Along the fringe of the Taieri Plain, there is lidar coverage, and in that area, the typical *CaptureScale* and *ResolutionScale* values assigned are 1:2,500 and 1:5,000 respectively.

## A1.3 BRIGHTON – OCEAN VIEW AREA

At a location ~300 m NW of the Creamery Road /Brighton Road intersection (*Landslide ID* 2894), the previous dataset showed a landslide feature. This has been deleted from the new dataset because it is an old quarry shown on the McKellar (1990) geological map, but the quarry symbolisation had been misinterpreted as that of a landslide.

Note that for the purposes of assessing relative ages of slope movements near the coast, the database *Comments* field include reference to the ‘mid-late Holocene sea cliff’, comprising a relatively young coastal cliff that is no longer affected by wave action, generally because a sand dune barrier has built up seaward of the now-abandoned cliff. The abandoned sea cliff is assumed to have an age in the range of ~6,500 to ~1,000 years.

The ‘Brighton Road slide’ (Stevens et al. 2003) or ‘Brighton Slide’ (Mackey 2015) lies northwest of several properties, 702 to 712 Brighton Road, at the eastern end of the Ocean View township. In this report, the name ‘Brighton Road Slide’ is adopted, to avoid any confusion arising from the slide not being within Brighton township. In the revised dataset, this slide has been much reduced in extent from its original depiction by McKellar (1990). The McKellar (1990) map shows what is considered, in this report, to be a substantial over-interpretation of the extent of the slide. Comparison between what is shown on that map, and aerial photography and lidar, indicates that part of the mid-late Holocene coastal cliff (seen in the background of Figure 5 of Mackey 2015) was misinterpreted as a landslide scarp. As a result, the landslide was interpreted as being much wider, and extending farther seaward, than can be justified from the landform evidence. The revised extent shown in the dataset accords well with the obvious landslide headscarp and margin features, and also with movements recorded in the DCC monitoring programme for this slide, as described by Stevens et al. (2003) and Mackey (2015). See Figure 2.1 of the main report.

The McKellar map shows a ‘year of last movement’ of 1980 on the Brighton Road Slide. A further small slip/earthflow occurred from part of the slide area during the 17-19 March 1994 rainstorm (Stewart 1996; feature 111); A further movement event occurred in 2008. Mackey (2015) presented monitoring survey data that show continuing creep in the head area.

Between about 200 and 500 m north of the Brighton Road/Rockview Road intersection, McKellar (1990) showed an elongate landslide to which a ‘year of last movement’ date of 1980 was assigned (*Landslide ID* 100111). Mackey (2015) briefly discussed this landslide and applied the name ‘Rockview Slide’. Examination of aerial photos revealed that this landslide existed in much its present form in 1942 photos. Whether the 1980 movement involved localised or entire reactivation is unknown.

Between about 80 and 130 m east of the Brighton Road/Rockview Road intersection, there is evidence of an active landslide, with bowed road-marginal fences on Rockview Road indicated in Google Earth imagery. Signs of recent ground disruption were noted by Barrell in 2015 during landslide reconnaissance following the June 2015 rainstorm. This appears to be the main locus of recent landslide movement in the Rockview Road area. It is mapped as a triangular slide (*Landslide ID* 100340), interpreted to be a surficial movement that is remobilising earlier-formed landslide debris. In the present iteration of the dataset, the name Rockview Road Slide is not used.

### A1.4 WESTWOOD AREA

The 1870, 1910, 1925 and 1936 slides shown by Benson (1946) are differentiated in the new map. As it is not clear how accurate was the surveying (if any) done by Benson, an accord has been struck in relation to what can be seen in airphotos, and the modern basemaps (ORC 2013 airphotos and lidar). The margins of these slides in the digital dataset should be regarded as approximate.

### A1.5 SADDLE HILL

The feature shown by Coote (1995) as ‘Saddle Hill Earthflow’ has been added, in greatly modified location, aided by aerial photography. In order to avoid confusion with numerous other flows in the vicinity of Saddle Hill, this name is not used in the dataset.

At 44 McMaster Road, it has not been possible to accurately rectify the map of Glassey (2001a) at the scale of the buildings on the property, indicating that buildings and other features on that map were at sketched locations rather than more accurately surveyed. Only a generalised depiction of the limits of the large landslide complex is included in this landslide dataset, rather than the detail of interpreted blocks within the complex shown in the Glassey (2001a) report. The feature in the dataset at this location is a relocated and expanded version of the landslide indicated by McKellar (1990), guided by the descriptions in the Glassey (2001a) report.

## A1.6 ABBOTSFORD-GREEN ISLAND AREA

### A1.6.1 Miller Street Landslide

The 'Miller Street Landslide' was first depicted on a map by Barrell & Glassey (1993), based on the interpretation of landform features in aerial photos, and examined on the ground. This interpreted feature was examined in more detail by Glassey (2005) and Golder Associates (2009). An impediment to understanding is that a prominent topographic step (scarp) marking the uphill extent of the interpreted landslide west of Reeves Street was removed during mining for clay in the 1970s. This scarp is well expressed in vertical aerial photo runs collected in 1942, 1962 and 1970, all of which can be viewed stereoscopically which allows the ground to be seen in 3D.

The original scarp extended to the southeast, where it is still present today, as a ~5 m high and ~40 m broad topographic step evident on the ground and viewable in Google Earth Street View. However, the form of the scarp has been greatly subdued by residential development in Reeves Street, Miller Street and Will Street, and that development had occurred prior to 1942, when the earliest aerial photos were taken. As a result, there is no visual record of the original form of the scarp in the Miller Street area. Golder Associates (2009) undertook a geotechnical investigation in the area where the scarp had been removed, and concluded that there was no offset of the near-surface deposits and thus the topographic step was not of landslide origin. As part of the present assessment, detailed rectification of the historical aerial photos was undertaken, and showed that the base of the now-removed scarp was incorrectly positioned on previous maps, both of Glassey (2005) and Golder Associates (2009). The actual position was between 8 and 15 m northeast of the position shown on maps in those reports. As a result, we consider it highly probable that the test pits G3 and G4 that were crucial to the Golder Associates (2009) interpretation were sited on the landslide block, and not to the northeast of it, as they assumed. In that case, a landslide origin is not disproved. In the present dataset, the interpreted landslide feature is retained, and its location adjusted to accord with the detailed rectified aerial photo evidence. The evidence from aerial photos, and what can be still seen today in the Miller Street area, is judged sufficient to classify the *Certainty* of the feature as likely. The particularly evident landslide terrain farther west, also judged by Golder Associates (2009) to be of landslide origin and to which they confined the name 'Miller Street Landslide', is classified here as definite. There is no evidence for recent activity of the wider slide area, such as might be indicated by cracking or disruption of the Miller Street carriageway where it crosses the scarp. Both components of the Miller Street Landslide are assigned a *Sensitivity* value of low.

### A1.6.2 West Abbotsford Slide

The generalised extent given on the McKellar (1990) map has been replaced by the more detailed information from the original source report and map by Brickell Moss Ltd (1981), refined and repositioned aided by the 2013 orthophotos and DCC lidar. The early 20$^{th}$ century 'Railway Slip' and the 1967 'Motorway Slip' are separated as components within the slide complex. The west margin of the Motorway Slip was defined by a stepped array of shears. Connecting lines have been drawn between each of the south-facing mapped shears from the Brickell Moss report, giving a saw-tooth appearance that approximates the western boundary of moved ground in the 1967 event.

McKellar (1976) described a radiocarbon dating result from basal slide debris overlying Kaikorai Stream alluvium, obtained from samples collected by J.G. Cookson of the Ministry of Works. A median age of 9,000 years BP (uncalibrated radiocarbon years), which equates to

about 10,000 calendar years BP, was given by McKellar. Its location was 'just west' of the Dall Street footbridge over the stream, which is at about the same location as the modern foot overbridge that spans both the motorway and the stream. This means that the sample was collected from the toe of the main lobe of the slide, rather than the frontal slides, which lie a little farther west of that location. The date provides a maximum age for a movement event involving at least part of the main slide body.

## A1.7 CENTRAL CITY AREA

### A1.7.1 City Rise – Town Belt

The existence of several very large ancient block landslides on the southeast-facing slopes of the City Rise – Roslyn – Maori Hill areas has been suspected since the late 1990s, based on topographic evidence. The particularly distinctive feature is the presence of steep, though subdued, steps, of curved or stepped geometry when viewed from above.

The suspected landslide towards the southwest is named the 'City Rise Slide Complex' in this dataset. The step forming the upslope margin of this suspected landslide can be seen, for example, as the steep wooded slope about 70 m southwest of the Maitland Street-Carroll Street intersection, and on Melville Street within about 50 m downhill of the High Street intersection (its form there is more subdued due to urban development landscaping). We are not aware of any historical reports of damage to streets, gutters or underground pipes in that area that would suggest any historic activity of this suspected landslide, and it is classified as a possible landslide with low *Sensitivity*.

The suspected landslide farther north is identified as the 'Town Belt Slide Complex', and several sectors are identified, with two classified with *Certainty* of likely, because although this terrain is heavily wooded, the lidar reveals a number of rift-like basins. The subdued step at the suspected upslope margin of the overall slide complex can be seen, for example, at about the intersection of Tweed and Selkirk streets, and the Melrose Street/Garfield Avenue intersection. The step is clearest at the southwestern edge of the suspected slide complex, near the Town Belt, for example where it is crossed by Sligo Terrace a few tens of metres east of City Road. We are not aware of any historical reports of damage to streets, gutters or underground pipes in that area that would suggest any historic activity of this suspected landslide complex, and it is assigned a low *Sensitivity*.

### A1.7.2 Evans Street Slide

Differing interpretations have been presented for this landslide area in the Opoho suburb. It was examined in detail and documented in technical reports by Johnson (1987a, 1988), and the status of the slide's stability was reviewed by Glassey (1993). Subsequent re-interpretation by Glassey (2001b) delineated a broader, hypothesised, extent of prehistoric movement, encompassing and expanding upon the movement areas mapped by Johnson (1987a, 1988). The 2016-17 landslide review and revision has adjusted the extent of the Evans St Slide back to that as documented by Johnson (1988), comprising two small landslide features, and the wider interpretation was removed. Of the two mapped landslide areas, the larger one close to the dwelling at 193 Evans Street, had documented movement in the 1980s, determined from surface ground cracking and survey monitoring, and is classed as definite. Recognition of the smaller landslide area, some 40 m or so to the northeast, was based on Johnson's (1987a) field observation of a suspected bulge in the ground at the slide toe, and the presence of small, bent, pine trees. No ground cracking was reported. To highlight that its recognition is less definitive, it is classed as likely, with *Last known movement* of probably historic.

## A1.8 OTAGO PENINSULA

### A1.8.1 Howard Street Slide

The slide extents have been amended to accord with the most recent work, as set out in Halliday (2013), Paterson (2013) and Glassey (2014). A 'primary slide' and a 'secondary slide' are recognised. The slide boundaries have been refined using lidar, high-resolution aerial imagery and Google Earth Street View. The area of the 'secondary slide' includes the zones involved in the 1968, 1993-94 and 2013 reactivations. Detailed review of the historical files (Wood 1968; Leslie 1968) in May-June 2017 commissioned by ORC after the hearing of public submissions on the 2GP showed that the extent of the 1968 movement was about the same as occurred in 2013, and that the 1993-94 movement likely extended farther downslope in the subsurface (Barrell 2017). Accordingly, the 'secondary slide' area has been divided into two portions, the upslope sector that was involved in both 1968 and 2013 movement, designated as 'Howard St Slide (secondary slide - 1968, 2013 movement)', and the remainder, identified as the 'Howard St Slide (secondary slide)'.

It should be noted that the survey monitoring data (MWH 2016) indicate that the 2013 movement event also affected survey mark IS 9, located on the 'primary slide' area, and this mark was also involved in movement between 1978-1995 (Glassey 1995). Halliday (2013) also reported a fresh crack at the foot of the slope below the block on which IS 9 is situated. However, no survey marks farther downslope show significant movement. For that reason, a separate block is identified in the dataset as the 'primary slide – IS 9 block'.

Also differentiated explicitly in the 'primary slide' area is the evacuated trough in which the northwestern part of Howard Street lies. Morphologically, this appears to a younger part of the 'primary slide' area, because it has 'eaten back' into the debris of the primary slide. This trough is identified as the 'central lobe' following the term used by Halliday (2013). Notably, an area of high ground within this lobe, at 3 Howard Street, is interpreted to be a displaced block within the lobe, but this is not differentiated separately within the dataset.

That sector of the 'primary slide' area downslope of historically-active 'secondary slide' is identified as the 'primary slide – northern lobe'.

For the purposes of this dataset, both sectors of the 'secondary slide', as well as the 'primary slide – IS 9 block' are identified as having undergone historical activity.

A point worth highlighting is that considerable material has been evacuated from the overall basin of the Howard St Slide, and that material is no longer present at the slide toe. Most likely, erosion by the sea is how it was removed, and serves to highlight that this landslide has been evolving over a considerable amount of prehistoric time. The slide is a long-standing natural feature of the environment, and this helps to give context to the apparent absence of historical activity over much of the slide area. It is likely that the slide in general is quasi-stable, and equilibrated to its present geometry and conditions.

### A1.8.2 Dickson Street Slide

The wider area referred to as the East Macandrew Bay Mass Movement Area (Barrell 1994) is considered to lack sufficient evidence in support of a landslide origin, and has been removed from the dataset. Instead, localised areas with more definitive landslide characteristics are retained as identified landslide features.

Two-yearly survey monitoring indicates that the Dickson Street Slide continues to move slowly (MWH 2015).

## A1.9 WAITATI VALLEY

The southwestern headwaters of the Waitati River, on the eastern flank of Swampy Summit, and including Burns Creek, lie in a broad topographic basin, named 'Burns Creek Slide Complex' in the dataset associated with this report. Benson (1940, 1946) interpreted it to be an ancient landslide, with sufficient differential movement of displaced blocks to enable their mapping as fault-bounded blocks on his geological map (Benson 1968). The land surface texture includes areas of arcuate topographic steps and, where in areas where bush has been cleared to farmland, extensive tracts of irregular hummocky ground. The larger blocks have been mapped as possible landslide, and areas of hummocky terrain as definite landslide. Benson's landslide papers (1940, 1946) both contain an account of his involvement in a 1927 investigation of a proposed DCC water reservoir site in the Burns Creek headwaters. Trench excavations there showed offset Quaternary-age sediments, locally capped by un-deformed alluvium. About '200 yards' to the southeast, Benson described and mapped 'low scarps' that had bare soil exposed in their faces, indicating recent movement. This is within a large area of landslide terrain, and because the extent of the recent movement is not known, an *Activity* of unknown has been applied.

Benson also describes offset of the DCC pipeline corridor that collects water from Burns Creek, and the Waitati River headwater (called 'Williams Creek' on his maps), and conveys it to Sullivans Dam, via a tunnel under Leith Saddle. Benson's 1946 paper describes it as follows:

> *"A line of pipes, diverting the drainage water from Swampy Hill into a reservoir beyond the area illustrated, follows the lower margin of the volcanic rocks and is continuously moving. Here the volcanic rocks rest on Caversham Sandstone, which, as its calcareous cement is removed by percolating waters, is reduced to a mass of readily rolling grains. A displacement of the pipes, 26 feet laterally and 16 feet downwards within 20 years, marks the latest phase of the long continued movements".*

The pipeline follows an excavated bench, and even today two zones of past slope movement are clearly evident, one for ~150 m NE of the Waitati River ('Williams Creek' on Benson's maps) crossing, and a ~120 m long section south of the Burns Creek intake. The latter one is almost certainly the one described by Benson, as there is a considerable depression in the otherwise evenly graded excavated bench. The pipe is buried beneath the bench everywhere except in the zones of slippage, where it is above ground and in places on trestles. In the revised landslide dataset, it is inferred that each historically active area extends into a prominent landslide basin upslope of the pipeline corridor.

## A1.10 WARRINGTON

The entire area of Warrington township is interpreted to be landslide terrain, much of it classified as possible, with the most recent movements suspected to be prehistoric. S.C. Cox (pers. comm., May 2016) has suggested that broad, elongate NE-trending ridges in Warrington, up to about 100 m wide, could be folds disrupting a late interglacial marine terrace, buckled up as a result of landslide movement, but this hypothesis is as-yet untested. The toe of the suspected slide is the 'mid-late Holocene sea cliff', which is no longer exposed to wave erosion due to the build-up of the Warrington sand-spit. Cessation of coastal erosion at the toe of the suspected slide, and accumulation of sand, will have tended to improve slope stability conditions. There is no evidence of any historical movement of this suspected slide area.

Some northwestern parts of Warrington township are on terrain that is identified as definite or likely landslide.

## A1.11 KILMOG SECTOR OF STATE HIGHWAY 1

Jacobson (1985) documents historical areas of slope movement along the Kilmog section of SH1; information from that report was used to delineate slope movement areas in the landslide dataset. Recommendations from that report led to further studies, such as that of the Site Office Slide (Johnson 1987b). The dataset incorporates the slide names used by Jacobson (1985). We have consulted only the information held in GNS Science files, from 1987 and earlier. More recent information is likely to be held by the New Zealand Transport Agency, and its advisors such as Opus International Consultants Ltd.

The Jacobson (1985) report does not include maps, but rather illustrates the locations of the slides on annotated aerial photos. The slides were mapped from those photos, aided by the 2013 orthophotos and Google Earth imagery (including Street View). Remedial drainage works still evident today aided the locating of the slide areas, such as along the northward downhill sector of SH1 toward Waikouaiti from the Steep Hill Rd/Church Rd intersection. There, cut-off drains on the western side of SH1 across the heads of Terry's Slide and Scott's Slide discharge into surface flumes that carry water downhill away from the slide areas. Relative to the Whites Rd/SH1 junction, pipe-to-flume discharge points are located about 60 m uphill (Terry's Slide) and 520 m downhill (Scott's Slide) from the intersection. Stereoscopic examination of archival aerial photos revealed that both Terry's Slide and Scott's Slide have toes that have encroached into the floor of the small un-named stream valley along which SH1 runs. This indicates movement has occurred sufficiently recently that the stream has not yet trimmed the slide toes. In contrast, the slide areas mapped either side of these small slides have stream cliffs cut along their toes, indicating that their most recent movements are probably prehistoric.

## A1.12 WAIKOUAITI AREA

A large landslide was mapped across much of the Waikouaiti township area during regional geological mapping in the 1990s (Forsyth 2001) on the basis of irregular topography. Glassey et al. (2014) considered it likely that this is not a landslide, and the topographic irregularities are more likely to be ancient, long-stabilised, sand dunes. They retained it in the dataset, but it has been removed from the revised dataset. The reasoning is that even if this terrain does have its origin in landslide movement, it must have formed at a time when the landscape was different from today, because there is no identifiable source area for such a landslide and there is no longer sufficient topographic relief for it to move again. In other words, even this terrain did form by landslide movement, there is no credible threat of further, large-scale, movement in today's landscape.

## A1.13 REFERENCES


Barrell DJA. 1994. Dickson Street slide, Macandrew Bay, Dunedin. Preliminary engineering geological assessment. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 14 p. + 3 figures. (Institute of Geological & Nuclear Sciences client report; 473014.10A). Prepared for Dunedin City Council.

Barrell DJA. 2017. Dunedin City Council 2nd Generation District Plan hearings (natural hazards): evaluation of selected public submissions on land instability. Lower Hutt (NZ): GNS Science. 11 p. (GNS Science consultancy report; 2017/093LR). Prepared for Otago Regional Council.

Barrell DJA, Glassey PJ. 1993. 38 Waldron Crescent, Sunnyvale: slope stability investigation. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 33 p. + figures + appendices. (Institute of Geological & Nuclear Sciences client report; 353902.13A. Prepared for Dunedin City Council.

Benson WN. 1940. Landslides and allied features in the Dunedin district in relation to geological structure, topography and engineering. *Transactions of the Royal Society of New Zealand*. 70:249-263.

Benson WN. 1946. Landslides and their relation to engineering in the Dunedin District. *Economic Geology*. 41:328-347.

Benson WN. 1968. Geology of the Dunedin District 1:50 000. Lower Hutt (NZ): New Zealand Geological Survey. Map + 18 pp. (New Zealand Geological Survey miscellaneous series map; 1).

Brickell, Moss and Partners Ltd. 1981. Slope stability study, Green Island Borough. Report 51323. Prepared for the Earthquake and War Damages Commission.

Coote TP. 1995. Skinner/Pearse Subdivision, Saddle Hill Dunedin. Slope stability assessment. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 21 p. + photos, figures and appendices. (Institute of Geological & Nuclear Sciences client report; 47420B.10A). Prepared for Skinner/Pearse Partnership.

Forsyth PJ. 2001. Geology of the Waitaki area. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. Map + 63 p. (Institute of Geological & Nuclear Sciences 1:250,000 geological map; 19).

Glassey PJ. 1993. Review of slope stability - Evans Street Slide, Dunedin. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. (Institute of Geological & Nuclear Sciences client report; 353901.11A). Prepared for Dunedin City Council.

Glassey PJ. 1995. Howard Street slide, Macandrew Bay, Dunedin. Monitoring assessment July 1991-June 1995. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 9 p. (Institute of Geological & Nuclear Sciences client report; 47414B.11A). Prepared for Dunedin City Council.

Glassey PJ. 2001a. Slope stability assessment, Rapid No. 44, McMaster Road, Saddle Hill, Dunedin. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 10 p. (Institute of Geological & Nuclear Sciences client report; 2001/116). Prepared for J. and D. Koens.

Glassey PJ. 2001b. Air photo interpretation of landslides in Dunedin for Property Insight. Unpublished Geographic Information System dataset held by GNS Science, Dunedin, NZ.

Glassey PJ. 2005. Assessment of slope stability and soil quality - Lot 2, DP 21474, 36 Severn Street, Abbotsford, Dunedin. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 8 p. plus figures and appendix. (Institute of Geological & Nuclear Sciences client report; 2005/43). Prepared for Paterson Pitts Partners Ltd.

Glassey PJ. 2014. Review of Howard Street landslide and monitoring reports. Lower Hutt (NZ): GNS Science. 17 p. (GNS Science consultancy report; 2014/190LR).

Glassey PJ, Barrell DJA, Smith Lyttle B. 2014. The hazard significance of landslides in and around Dunedin City. Lower Hutt (NZ): GNS Science. 32 p. (GNS Science consultancy report; 2013/339). Prepared for Otago Regional Council. Accessible at www.orc.govt.nz, search term < natural hazards >.

Golder Associates Ltd. 2009. Geotechnical assessment, GrandVista Residential Subdivision Development, Abbotsford, Dunedin. Golder Associates Report Number 0978102032/03. 5 p. + figures and appendices. Prepared for Minaret Resources Ltd.

Halliday GS. 2013. The June 2013 Howard St Landslip, Macandrew Bay, Dunedin. Tonkin & Taylor Ltd report prepared for EQC. 15 p. + appendices. T&T ref 893103, updated September 2013.

Jacobson PN. 1985. SH 1: Kilmog instability, with emphasis on Hammonds Landslide. Dunedin (NZ): Ministry of Works & Development, Civil Engineering Division. 105 p. (Materials & Investigations Section Report; 140).

Johnson JD. 1987a. Preliminary assessment of the slope instability at 193 Evans Street, North East Valley, Dunedin City. Dunedin (NZ): New Zealand Geological Survey. (New Zealand Geological Survey Engineering Geology Immediate Report; 87/031).

Johnson JD. 1987b. Engineering geology and stability assessment of the Site Office Slide, State Highway One - Kilmog Hill. Dunedin (NZ): New Zealand Geological Survey. 20 p. plus 14 photos and 6 figures. (New Zealand Geological Survey Engineering Geology Immediate Report; 87/008).

Johnson JD. 1988. Stability assessment of slope failure at 193 Evans Street, Dunedin. Dunedin (NZ): New Zealand Geological Survey. (New Zealand Geological Survey Engineering Geology Immediate Report; 88/005).

Leslie DM. 1968. Dr. S.O. Chin, Howard St, Macandrew Bay: r.e. slumping and earth movements. Otago Catchment Board report, file 6/625. Located at: Otago Regional Council, Dunedin, NZ.

Mackey B. 2015. Active landslides in the Dunedin area. Dunedin (NZ): Otago Regional Council. ISBN 978-0-905324-18-7. 37 p. Accessible at www.orc.govt.nz, search term < natural hazards >.

McKellar IC. 1976. Abbotsford slide area. Lower Hutt (NZ): New Zealand Geological Survey. 14 p. (New Zealand Geological Survey Engineering Geology Report; 247).

McKellar IC. 1990. Geology of the Southwest Dunedin urban area [map]. Lower Hutt (NZ): New Zealand Geological Survey. 1 map + 63 p., scale 1:25,000. (New Zealand Geological Survey miscellaneous series map; 22).

MWH. 2015. Landslide Monitoring 2014/15. MWH (NZ) Ltd letter to Dunedin City Council dated 22 April 2015, containing annual re-survey results.

MWH. 2016. Landslide Monitoring 2016. MWH (NZ) Ltd letter to Dunedin City Council dated 26 February 2016, containing annual re-survey results.

Paterson L. 2013. Review of the June 2013 Howard Street Landslide Report Tonkin & Taylor, dated September 2013 update for the EQC, Ref: 893103. 4 p. MWH (NZ) Ltd letter to Dunedin City Council, 13 December 2013.

Stevens NF, Glassey PJ, Smith Lyttle B. 2003. Assessment of urban slope instability in Dunedin, New Zealand, using orbital differential synthetic aperture radar interferometry. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 42 p. + figures + appendix. (Institute of Geological & Nuclear Sciences client report; 2003/150). Prepared for the Earthquake Commission.

Stewart DL. 1996. Landslides triggered by the 17 – 19 March 1994 rainstorm, Dunedin Area. Lower Hutt (NZ): Institute of Geological & Nuclear Sciences. 16 p. (Institute of Geological & Nuclear Sciences science report; 95/42).

Wood BL. 1968. Instability and potential landslides, Macandrew Bay district. Letter to Dunedin City Engineer. Dunedin (NZ); NZ Geological Survey. 2 p. + 2 diagrams. GNS Science file 144/941. Located at: GNS Science, Dunedin, NZ.

# A2.0 DATABASE STRUCTURE AND SCALES

## A2.1 DATABASE STRUCTURE

The structure and components of the **Landslide** database table are set out in Table A2.1. The structure comprises a set of attribute fields, which are named using database syntax, and each field is accompanied by an Alias, which provides a plain English descriptive name. For each field, Table A2.1 has a Description column stating the type of information that each field contains. Some of the fields have a 'Domain' component that provides a restricted list of attributes that can populate the field. These domains/restricted lists are set out in Table A2.2 (landslide *activity*), Table A2.3 (landslide *certainty*), Table A2.4 (landslide *movement type*), Table A2.5 (landslide *geological context*), Table A2.6 (landslide *sensitivity*), and Table A2.7 (*landslide recognition method*).

The **Landslide** attribute table has an additional restricted list (*landslide_sourceIdentifier*) which gives a reference to existing information sources (usually reports or maps). There is a total of just over 100 of these in the dataset, and it was not thought useful to include a tabulation in this report, as they are only of relevance to someone searching the dataset, who is seeking background information for a specific mapped landslide feature.

Reference to the information sources are compiled in the **Sources** attribute table, whose structure and components are given in Table A2.8. Fields in that table provide details of each information source. The *landslide_sourceIdentifier* restricted list of the **Landslide** layer is populated from the Sources layer attribute field Identifier, describing author(s) and date for each feature in that layer (e.g. Barrell 1994).

There is one domain/restricted list associated with the **Source** table, giving the Source status (Table A2.9). This offers a choice of just two attributes, identifying whether the source is publicly available, or whether enquiry should be made to the source's owner/archiver regarding availability.

**Table A2.1** Structure of the **Landslide** database table. This contains descriptive information for each mapped landslide area in the Landslide polygon feature class of the geodatabase.

| Field | Alias | Type | Size | Description | Restricted list |
|---|---|---|---|---|---|
| landslide_id | Landslide ID | Integer | 4 | Unique identifier assigned to each landslide feature | |
| name | Name | String | 255 | Free text identifying common name of the landslide feature, if any (e.g. West Abbotsford Slide, Evans Street Slide) | |
| initiation | Time of Initiation | String | 50 | Free text estimating when landslide movement began, or giving a date, if known, for historic landslides | |
| lastMovement | Last known movement | String | 50 | Free text estimating when landslide last moved, or giving a date, if known, for historic landslides | |
| activity | Activity | Integer | 4 | Restricted list giving a representative age of activity of the landslide feature (e.g. ongoing activity, older historical activity) | Landslide_activity |
| certainty | Certainty | Integer | 4 | Restricted list describing the level of certainty that the feature is a landslide (e.g. definite, possible) | Landslide_certainty |
| moveType | Movement type | Integer | 4 | Restricted list classifying the type of movement displayed by the landslide feature (e.g. translational slide, flow) | Landslide_movementType |
| geolContext | Geological context | Integer | 4 | Restricted list stating the nature of the geological layer within which the movement is thought to have occurred | Landslide_geologicalContext |
| sensitivity | Sensitivity | Integer | 4 | Restricted list giving an interpretation of how sensitive the landslide feature is to environmental and/or human-induced modifications | Landslide_sensitivity |
| remediation | Remediation | String | 64 | Free text describing what measures, if any or if known, may have been taken to try and improve stability of the landslide feature | |
| recogn | Landslide recognition method | String | 50 | Restricted list identifying the most important method used to determine the spatial extent of the landslide feature | Landslide_unitRecognition |
| recogn2 | Landslide recognition method 2 | String | 50 | Restricted list identifying a supporting method used to determine the spatial extent of the landslide feature | Landslide_unitRecognition |
| recogn3 | Landslide recognition method 3 | String | 50 | Restricted list identifying a supporting method used to determine the spatial extent of the landslide feature | Landslide_unitRecognition |
| recognDetail | Landslide recognition detail | String | 150 | Free text identifying the source materials used in the landslide recognition fields | |
| source1 | Source latest | Integer | 4 | Restricted list identifying the report, map or dataset that provides the latest, most detailed, information on this landslide feature | Landslide_sourceIdentifier |
| source2 | Source secondary | Integer | 4 | Restricted list identifying the report or map that provides additional depiction of this landslide feature, if any | Landslide_sourceIdentifier |
| source3 | Source original | Integer | 4 | Restricted list identifying the report or map that provides the original depiction of this landslide feature, if any | Landslide_sourceIdentifier |
| resScale | ResolutionScale | Integer | 4 | Scale at which the mapped depiction of this landslide feature is intended to be used | |
| capScale | CaptureScale | Integer | 4 | Scale at which the landslide feature was digitised | |
| comments | Comments | String | 255 | Free text identifying any important features or additional information concerning the landslide feature that do not fit into existing attribute fields, or any other information deemed relevant | |
| SHAPE_Length | featurePerimeter | Double | 8 | Geometric descriptor, giving the length of the perimeter of the landslide polygon, in metres | |
| SHAPE_Area | featureArea | Double | 8 | Geometric descriptor, giving the area of the landslide polygon, in square metres | |

**Table A2.2** Restricted list of codes and definitions for landslide *activity*. The Geodatabase domain "Landslide_activity" contains this list of codes. These definitions are modified from Glassey et al (2014).

| Code | Definition |
|---|---|
| not assessed | No assessment has been made of landslide activity |
| unknown | There is insufficient information to make a definitive statement on the activity of the landslide |
| ongoing activity | Movement has been detected in monitoring surveys, or by observed ground offset, within the past two years or so |
| recent historical activity | Movement was initiated, or has recurred at least once, since the mid-1960s (i.e. in the past 50 years or so) |
| older historical activity | Movement was initiated, or has recurred at least once, between European settlement (mid-1800s) and the mid-1960s (i.e. between about 165 and 50 years ago) |
| prehistoric activity | No landform indications of historical or ongoing activity, and landform features suggest the most recent movement occurred more than 165 years ago. Any additional information on the age(s) of landslide activity should be stated in the *Comments* field |

**Table A2.3** Restricted list of codes and definitions for landslide *certainty*. The Geodatabase domain "Landslide_certainty" contains this list of codes. These definitions are from Glassey et al. (2014) with the addition of an attribute of not assessed.

| Code | Definition |
|---|---|
| definite | Landform features are present that can only be the result of landslide activity [and/or] the landslide has been observed historically to have moved |
| likely | Landform features are present that are most likely the result of landslide activity, and other explanations are less likely |
| possible | Landform features are present that may possibly be indicative of landslide movement having occurred, but other explanations are plausible |
| not assessed | No assessment has been made of landslide certainty |

**Table A2.4** Restricted list of codes and definitions for landslide *movement type*. The Geodatabase domain "Landslide_movementType" contains this list of codes. These definitions are modified from Glassey & Smith Lyttle (2012).

| Code | Definition |
|---|---|
| not assessed | No assessment has been made of landslide movement type |
| unknown | There is insufficient information to make a definitive statement on the movement type of the landslide |
| fall | Detachment of soil or rock from a steep slope along a surface on which little or no shear displacement has taken place |
| rotational slide (slump) | Movement along a surface of rupture that is curved and concave-upwards |
| translational slide | Movement along a surface of rupture that is planar or undulating |
| topple | Forward rotation out of the slope of a mass of soil or rock about a point or axis below the centre of gravity of the displaced mass |
| complex | The landslide has involved 2 or more movement types |
| flow | Spatially contiguous movement in which surfaces of shear are short-lived, closely spaced, and usually not preserved |
| lateral spread | Extension of cohesive soil or rock mass combined with a general subsidence of the fractured mass into softer underlying material. Would include lateral spreading caused by earthquake liquefaction |
| other | Other type of movement as explained in the *Comments* field |

**Table A2.5** Restricted list of codes and definitions for landslide *geological context*. The Geodatabase domain "Landslide_geologicalContext" contains this list of codes.

| Code | Definition |
|---|---|
| bedrock | The landslide is interpreted to be seated within bedrock strata. It is appropriate to assess the landslide in relation to geological map information |
| surficial | The landslide is interpreted to be seated within near-surface materials (e.g. loess, colluvium, topsoil) overlying the bedrock strata. It is appropriate to assess the landslide in relation to soil map information |
| composite | The landslide is interpreted to be seated within some combination of bedrock and surficial materials. This category includes landslides interpreted to be seated within a zone of highly weathered bedrock close to the ground surface, as well as landslides thought to have involved remobilisation of previously-formed bedrock landslide debris. It is appropriate to assess the landslide in relation to geological map information |
| uncertain | The geological context of the landslide is uncertain |
| not assessed | No assessment has been made of the geological context of the landslide |

**Table A2.6** Restricted list of codes and definitions for landslide *sensitivity*. The Geodatabase domain "Landslide_sensitivity" contains this list of codes. These definitions differ from, and supersede, those given by Glassey et al. (2014).

| Code | Definition |
|---|---|
| not assessed | No assessment has been made of the sensitivity of the landslide |
| low | No geomorphic modifiers are currently active |
| medium | Potential geomorphic modifiers are present, such as one or more of: stream channel or valley along slide toe; indications of seepage or swampy ground on the slide or at the slide margins; streams or gullies draining onto the slide head; presence of steep or very steep slopes; human modifications including material added at slide head, material removed at slide toe, or water storage (open or enclosed) on or adjacent to slide area; any other relevant factors as explained in the *Comments* field. |
| high | Significant geomorphic modifiers are present, such as one or more of: sea or river erosion at the slide toe; documented historical activity without remediation; where there is little or no self-buttressing; where there is documented ongoing movement (constant or intermittent); any other relevant factors as explained in the *Comments* field. |
| uncertain | The sensitivity of this landslide is difficult to assess, for reasons explained in the *Comments* field |

**Table A2.7** Restricted list of codes and definitions for *landslide recognition method*. The Geodatabase domain "Landslide_unitRecognition" contains this list of codes.

| Code | Definition |
|---|---|
| aerial observation | Identified by an observer in an aircraft |
| aerial photography | Identified by the interpretation of photography taken from aircraft, including vertical or oblique photographs; the photographic source is identified in the *Landslide recognition detail* field |
| field observation | Identified by an observer on the ground, including close-up inspection or viewing from a distance (the latter is likely to be mentioned or quantified in the *Comments* field) |
| geological map | The interpreted presence of a landslide is recorded on a pre-existing geological map; the map document is identified in a *Source* field(s) |
| geomorphological map | The interpreted presence of a landslide is recorded on a pre-existing geomorphological map; the map document is identified in a *Source* field(s) |
| ground photography | Identified by interpretation of photography taken by an observer on the ground, including from close-up or distant positions; includes Google Earth Street View |
| historical records | Identified from information recorded in unpublished documents; may include anecdotal spoken reports |
| lidar data | Identified by the interpretation of processed lidar data |
| remote sensing | Identified by the interpretation of remotely-obtained measurements not otherwise classifiable by other descriptions (e.g. photography, lidar, etc.) |
| satellite imagery | Identified by the interpretation of imagery obtained from satellites; the imagery source (e.g. Google Earth) is identified in the *Landslide recognition detail* field |
| soil map | The interpreted presence of a landslide is recorded on a pre-existing soil map; the map document is identified in a *Source* field(s) |
| topographic map | The presence of a landslide is interpreted from information recorded on a pre-existing topographic map; the map is identified in the *Landslide recognition detail* field |
| stereoscopic aerial photography | Identified by the interpretation of vertical stereoscopic photography taken from aircraft; the primary photographs used are identified in the *Landslide recognition detail* field |
| technical report | Identified from information recorded in a published or unpublished technical report; the report is identified in a *Source* field(s) |
| digital data | Identified using numerical data; including landslide movement monitoring data; identified in a *Source* field(s) or in the *Landslide recognition detail* field |
| survey | Identified as a result of cadastral surveying; the survey data are identified in a *Source* field(s) or in the *Landslide recognition detail* field |
| sketch map | Identified from a sketch map; the map is identified in a *Source* field(s) |
| detailed field mapping | Determined from detailed field mapping; the map is identified in a *Source* field(s) |

**Table A2.8** Structure of the **Source** database table. This contains reference information for each source identified in the **Landslide** table.

| Field | Alias | Type | Size | Description | Restricted List |
|---|---|---|---|---|---|
| source_id | Source ID | SmallInteger | 2 | Unique identifier assigned to each source extent | |
| authors | Authors | String | 255 | Free text identifying all author(s) of source data (e.g. Barrell DJA, Turnbull IM) | |
| year | Year | SmallInteger | 2 | Free text identifying year of publication/creation of source data | |
| identifier | Identifier | String | 100 | Concatenation of author and year (e.g. Barrell & Turnbull 1997) | |
| title | Title | String | 255 | Free text identifying title of publication, report, map, digital data, etc. of source data | |
| organisation | Author Organisation | String | 100 | Free text identifying the organisation that created the source data | |
| reportNum | Report Number | String | 50 | Free text identifying report number, if any | |
| reportType | Report Type | String | 50 | Free text identifying type of document providing source data. (e.g. science report, unpublished technical record) | |
| mapEquiv | MapNumberEquivalentIdentifier | String | 50 | Free text describing the figure number, map name, number or other designation identifying the source data | |
| notes | Notes | String | 255 | Free text identifying any important features or additional information concerning the source data that do not fit into existing fields | |
| status | Status | Integer | 4 | Restricted list describing the availability of the source data | Source_status |
| capDate | captureDate | Date | 8 | Date when the feature was digitised | |
| modDate | modifiedDate | Date | 8 | Date when the feature was last modified | |
| SHAPE_Length | featurePerimeter | Double | 8 | Geometric descriptor, giving the length of the perimeter of the source map, in metres | |
| SHAPE_Area | featureArea | Double | 8 | Geometric descriptor, giving the area of the source map, in square metres | |

**Table A2.9** Restricted list of codes and definitions indicating the availability of each information source in the **Source** table. The Geodatabase domain "Source_status" contains this list of codes.

| Code | Definition |
|---|---|
| available | The source is understood to be publicly available |
| refer to source organisation | The *author organisation* should be approached to request access to this information source |

## A2.2 UNCERTAINTY IMPLICATION OF SCALE VALUES

The *CaptureScale* field in the **Landslide** database table (Table A2.1) documents the scale (e.g. 1000 = 1:1000 scale) at which the polygon was digitised. The assigned *ResolutionScale* represents the scale at which the polygon is intended to be used/viewed. The *ResolutionScale* is intended to indicate the precision with which the polygon perimeter is located. The *ResolutionScale* parameter is a nominal value, generally equating to about twice the value of the *CaptureScale*. It is not assumed that there is a linear relationship with precision. Rather, the precision values given here are conservative estimates of how much plus or minus is an appropriate representation of the locational accuracy of the mapped landslide perimeters.

The values assigned to the *ResolutionScale* field should be regarded as equating to the following uncertainties in the location of the perimeter of the landslide polygon:

| Scale | Precision |
|---|---|
| 1000 | +/- 5 m |
| 2000 | +/- 5 m |
| 2500 | +/- 10 m |
| 5000 | +/- 15 m |
| 10000 | +/- 25 m |
| 12000 | +/- 30 m |
| 15000 | +/- 40 m |
| 20000 | +/- 80 m |
| 50000 | +/- 120 m |
| 100000 | +/- 200 m |

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