

**NELSON CITY COUNCIL  
ENGINEERING STANDARDS  
2003**

# NELSON CITY COUNCIL ENGINEERING STANDARDS 2003

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## ABBREVIATIONS

CAD:	Computer Aided Draughting
CBD:	Central Business District
CBR:	California Bearing Ratio
Cumec:	Cubic metres per second
LINZ	Land Information New Zealand (formerly Department of Survey and Land Information)
AIS:	Asset Information System
PE:	Polyethylene
kPa:	Kilo Pascal
LHCE:	Lamp Hole Cleaning Eye
l/s:	Litre per second
MPa:	Mega Pascal
m/s:	metre per second
NA:	Not applicable
NCC:	Nelson City Council
RAMMS:	Road Assessment and Maintenance Management System
R.O.W:	Right of Way
Sec.:	Section
TNZ:	Transit New Zealand
PVC:	Polyvinyl chloride
W.W.F.:	Welded wire fabric

# RELATED DOCUMENTS

Reference is made in this standard to the following documents:

AUSTROADS:	National Association of State, Territory and Federal Road and Traffic Authorities in Australia
BA 1991:	Building Act 1991
NZBC:1992	NZ Building Code Health and Safety in Employment Act 1992
LGA:	Local Government Act 1974 and amendments thereto.
RMA 1991:	Resource Management Act 1991
NRMP	Nelson Resource Management Plan
NRB:	National Roads Board Specification
NZECP:	NZ Electrical Codes of Practice NZ Fire Service Code of Practice for Fire Fighting Water Supplies (1992)
TNZ:	Transit New Zealand Roding Design Guidelines Transit New Zealand Specifications Transport Department Design Tables The Transit New Zealand's handbook "WORKING ON THE ROAD" A Handbook for Temporary Traffic Control and Safety at Roadworks Sites (The NCC will in the future be developing its own code of practice for working on the road. In the interim the TNZ handbook "Working on the Road" will be the minimum standard required)
BS 10:	Flanges Draft New Zealand Industry Specification for Underground Fire Hydrants November 2000
NZS/BS 2494:	Rubber Joint Rings for Gas Mains, Water Mains and Sewers
NZS 3107:	Specification for Precast Concrete Drainage and Pressure Pipes
NZS 3108:	Specification for Concrete Production Ordinary Grades
NZS 3109:	Specification for Concrete Construction
NZS 3116:	Interlocking Concrete Block Paving
NZS 3501:	Specification for Copper Tubes for Water, Gas, and Sanitation

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NZS/AS 3725:	Loads on Buried Concrete Pipes
NZS 3910:	Conditions of Contract for Buildings and Civil Engineering Construction
NZS 4402:	Methods of Testing Soils for Civil Engineering Purposes
NZS 4404:	Code of practice for Urban Land Subdivision
NZS 4431:	Code of Practice for Earth Fill for Residential Development
NZS 4442:	Welded Steel Pipes and Fittings for Water, Sewage and Medium Pressure Gas.
NZS 4452:	Code of Practice for the Construction of Underground Pipe Sewers and Drains
NZS/AS 1100.101	Technical drawing
NZS 6701:	Code of Practice for Road Lighting
NZS 6803:	The Measurement and Assessment of Noise from Construction and Demolition Works
NZS 7643, AS 2032:	Installation of PVC Pipe Systems <i>(It is intended to retain reference to NZS 7643 in the short term, but AS 2032 is the primary option. AS 2032:1977 will be upgraded and continue, whereas NZS 7643 will disappear)</i>
AS/NZS 2033:	Installation of Polyethylene Pipe Systems
AS / NZS 4129:	Fittings for PE Pipes for Pressure Applications
AS 2439 Part 1:	Perforated Plastics Drainage and Effluent Pipes and Fittings
AS / NZS 2566:	Buried Flexible Pipelines
AS / NZS 1477:	PVC Pipe and Fittings for Pressure Applications
AS / NZS 4765 (Int): 2000	Modified PVC Pipes and Fittings For Pressure Applications
AS / NZS 1260:1999	PVC pipes and fittings for drain, waste and vent applications
AS/NZS 1254:2002	PVC Pipe and Fittings for Storm and Surface Water Applications
AS/NZS 1646, 2280, 3680, 3681	Ductile Iron Pipe
AS / NZS 4130	Polyethylene Pipe

For other water related documents see Section VII - 12

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# **SECTION I**

# **PRELIMINARY**

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# SECTION I

## PRELIMINARY

### I – 1. SCOPE

These specifications are the Nelson City Council Engineering Standards. They cover the submission of plans and engineering drawings for approval by the Council. These Engineering Standards provide a means of compliance for the provision and construction of new roads, accessways, sewers and stormwater drains, water, telephone and power reticulation and street lighting and all ancillary works.

The Engineering Standards have been produced for the guidance of designers in the preparation of engineering drawings and subdivisional schemes.

Generally the Engineering Standards are applicable in the Residential, Commercial and Industrial zones of the city.

Although these Engineering Standards provide a means of compliance for the work listed above they shall not preclude the submission of a Specific Design. The Designer shall gain prior written approval from the Engineer before proceeding with any aspect which is to be covered by Specific Design. Examples of Specific Design which may be appropriate are stormwater drainage systems involving flood detention and sewage disposal in rural zones. Any Specific Design submitted for approval shall meet any minimum performance requirement specified in these Engineering Standards.

### I – 2. INTERPRETATION

- (a) "The Council" shall mean the Nelson City Council or its officers.
- (b) "The Engineer" shall mean the Manager Infrastructural Assets of the Council.
- (c) "Approved/Approval" shall mean approved by or approval of the Manager Infrastructural Assets.
- (d) "Designer" shall mean the person responsible for producing and/or submitting the Engineering Drawings for approval.
- (e) "Design Professional" shall mean the person responsible for certifying the construction works. Depending on the nature of the works this may be either a Registered Surveyor or Registered Engineer.
- (f) "Landowner" shall mean the person or persons responsible for subdividing or developing the land.

### I – 3. STANDARD DATUM

Unless otherwise specifically permitted by the Council, all works shall be to the Nelson City Council Standard Datum and all plans are required to state the datum.

Relationship of Datums:	<u>Mean Sea Level</u>
To Nelson City Council Datum	12.070
To Land Information New Zealand	0.000

### I – 4. STANDARD SPECIFICATIONS

The Standard Specifications quoted in this document are those current at the time of preparation of the document, and it is to be understood that any subsequent amendments thereto, or substitutions thereof, shall apply as they become operable.

The requirements of NZS 4404: Code of Practice for Urban Land Subdivision are generally applicable and Designers are expected to familiarise themselves with this standard.



**SECTION II**

**DRAWINGS, BONDS AND  
CERTIFICATE**



**SECTION II**  
**DRAWINGS, BONDS AND CERTIFICATES**  
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## **II – 1. REQUIREMENTS FOR EXPERIENCED DESIGNER**

The Council requires the submission of fully detailed Engineering Drawings, covering the design of all new streets, R.O.Ws, access lots and services prepared by a suitably qualified and experienced Designer. The designer will be required to complete and submit a Designers Check Sheet with the Engineering Drawings, see Appendix 1 this section.

## **II – 2. CONSTRUCTION BY STAGES**

Where the Landowner proposes to proceed with construction in a subdivision by stages, then the Engineering Drawings shall cover the whole scheme in the first instance. In the case of major subdivisions, the Council may relax this requirement to the extent that preliminary layout drawings for the total project maybe submitted for initial approval. Fully detailed drawings required for each particular stage shall subsequently be submitted for final approval.

## **II - 3. GENERAL DRAWING STANDARDS & DETAILS**

### **(a) General Format Requirements**

- (i) The standard approval signature block as per NCC Standard Drawing No 21/100, sheet 1 shall be placed on the bottom right hand side of ALL plans provided.
- (ii) The symbols and arrangements shown on NCC Standard Drawing 21/100, sheers 1 and 2 shall be used.
- (iii) The site location, in the form of a locality plan, including major street names and site identification shall be shown.
- (iv) Where more than 5 sheets are involved a Title sheet shall be included showing the sheet numbers and individual sheet titles.
- (v) Existing property boundary lines that abut the work and a north point shall be shown as a reference.
- (vi) Drawing formats for submitted plans shall be one of the following, in order of preference:
  - a. NCC approved LandXml files along with any other required electronic files and one set of hard copy plans.
  - b. AutoCAD drawing files along with any other required electronic files and one set of hard copy plans.
  - c. 'DXF' files (dependant on compatibility with the council system) files along with any other required electronic files and one set of hard copy plans.
  - d. Hard Copy plans along with any other required electronic files.

### **(b) Hard Copy Format Requirements**

- (i) Engineering drawings for final approval shall be submitted on standard A1 or A2 sized sheets.
- (ii) The final sheets submitted to Council for signing must not be folded or creased in order to enable clear reproduction of the plans for Council records.
- (iii) All draughting shall be in opaque black ink (not pencil) and all lettering shall be Micro font, Arial or similar approved style in order to enable clear reproduction of the plans for Council records
- (iv) Minimum line thickness shall be 0.25 mm for all data specified by these Engineering Standards.

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- (v) A minimum letter height of 2.5 mm (INCLUDING the ACTUAL height of lower case text) is required for all data specified by these Engineering Standards, in accordance with the relevant section of AS/NZS 1100.101.

(c) **Electronic Drawing Format Requirements**

In addition to the applicable “HARD COPY” plan requirements the following apply to the supply of electronic DRAWING files.

- (i) Acceptable formats are:
  - LANDXML (when acceptable to NCC.)
  - AUTODESK DWG
  - DXF
- (ii) No OLE (Object Linked or Embedded) entities are acceptable, e.g. EXCEL spread sheets “copy and pasted” into the drawing file.
- (iii) External referencing to image and other DWG files is acceptable as long as the referenced file is supplied with the data.
- (iv) When requested by the Nelson City Council any support files required by the drawing file (e.g. Text Shape files) shall be provided BEFORE the plans are approved.
- (v) Data provided as a drawing file for the purposes of generating contour data, shall be provided as 3D lines and 3D points, to the NCC datum and one of the NCC accepted standard coordinate systems.

(d) **Electronic Coordinate-Data Format Requirements**

Where an electronic file of coordinates is required or supplied the order of preference for the format of the file is as follows:

- (i) Spreadsheet file e.g. Microsoft Excel or similar.
- (ii) Text file e.g. Tab or Comma (CSV) Delimited Text file
- (iii) Document “Table” e.g. Microsoft Word “Table” or similar.
- (iv) Database file e.g. Microsoft Access or similar.

The file must be capable of being processed with one of the Council’s current Microsoft compatible systems and each point (coordinated location) shall appear on a separate line.

Each point (EXCLUDING contouring spot heights) will be cross referenced to a point on the HARD COPY plans to clearly indicate the one that it represents.

The following format for each point (coordinated location) shall apply:

- (i) Cross reference to location as shown on the plan.
- (ii) Easting
- (iii) Northing
- (iv) Level (0.0 if not supplied)
- (v) Invert (0.0 if not supplied)
- (vi) Description as applicable

E.g. for a simple text “comma” separated file:

MH3a,2530000.58,5930000.64,14.53,10.25,Sewer Manhole  
SMP3,2530010.63,5930005.62,15.98,10.25,Sump  
MH4a,2530020.58,5930015.24,14.89,10.55,Sewer Manhole

E.g. for a simple table or spread sheet file:

MH3a	2530000.58	5930000.64	14.53	10.25	Sewer Manhole
SMP3	2530010.63	5930005.62	15.98	10.25	Sump
MH4a	2530020.58	5930015.24	14.89	10.55	Sewer Manhole

(e) **Orientation of Plans and Sections**

- (i) Plans should generally be orientated with either north or west to the top of the sheet.
- (ii) Plans and Longitudinal Sections shall have the lowest distance generally on the left-hand side of the sheet. In drainage longitudinal sections, the lowest end of the drain shall be at the lower distance and the plan should be orientated correspondingly.
- (iii) Cross Sections of the street shall commence at the bottom left hand corner of the sheet and proceed upwards where this is possible.

(f) **Scales**

The scales to be used for plans and sections for DESIGN and / or AS BUILT plans are as follows:

- (i) Location plan To be not less than 1 in 20,000  
and not larger than 1 in 5000
- (ii) Site contours 1:1000    or 1:500    or 1:250    or 1:200
- (iii) Streetworks-plan 1:500    or 1:250    or 1:200
- (iv) Longitudinal sections of channels
  - a. Horizontal 1:500    or 1:250    or 1:200
  - b. Vertical 1:50    or 1:25    or 1:20
- (v) Cross sections
  - a. Horizontal 1:50
  - b. Vertical 1:50    or 1:20
- (vi) Sewer, stormwater and water plan 1:500    or 1:250    or 1:200
  - Longitudinal section
    - a. Horizontal 1:500    or 1:250    or 1:200
    - b. Vertical 1:100    or 1:50
- (vii) Details 1:20    or 1:10    or 1:5
- (viii) Other services
  - a. Plan 1:500    or 1:250    or 1:200
  - b. Cross-section 1:50

NOTE: Longitudinal and cross sections should be drawn at appropriate exaggerated vertical to horizontal scale ratio.

(g) **Special Scales**

Special scales for special cases may be approved by the Council, but only on application before hand. Plans drawn to scales other than those listed will not be accepted without prior approval.

(h) **Coordinate and Elevation Standards**

Northing and Easting Co-ordinates shall be accurate to two decimal places and in terms of either (in order of preference)

- (i) NZMG
- (ii) Local Circuit (NZGD) 1949
- (iii) NZGD 2000

Heights shall be in terms of NCC Datum and accurate to two decimal places.

**II – 4 ENGINEERING DESIGN DETAILS REQUIRED**

- (a) Plans of each street showing the survey lots, street numbers, names of new streets, and also the location of services, including the necessary fittings and manholes, etc.
- (b) A contour plan of the site in terms of NCC Datum shall be provided for all subdivisions and developments of 0.25ha or greater.
- (c) Spot levels shown on a site plan may be acceptable for subdivisions and developments of up to 0.25ha but some discretion may be applicable.
- (d) Separate plans and sections showing:
  - (i) Streets, kerbs and channels, footpaths, roadmarking and signs. Left hand and right hand top of kerb shall be shown separately unless they are identical, when this shall be stated.
  - (ii) Longitudinal and cross sections of the existing ground, and the proposed street levels with batters, and any adjustment of levels of the lots due to general regrading or landscaping. The levels of the proposed services shall also be shown on sections.
  - (iii) Foul sewer, stormwater drains and kerb line. Proposed reticulation shall be shown with dimensions to section boundaries, with longitudinal sections of each line. Where proposed drains cross under or over existing or proposed services, these services shall be shown on plan and section, with reduced levels.  
  
Drainage drawings submitted for checking shall be accompanied by catchment plans showing all the catchment areas to be served.  
  
Sewage and stormwater discharge calculations complying with the NCC Engineering Standards shall be submitted whether a Design Certificate is supplied or not.
  - (iv) Water main and fittings, pump-stations, reservoirs, power cables and substations, telephone cables and kerb line.
  - (v) Erosion and Sedimentation Control.
- (e) Plans shall also show the location of the services in the existing streets which abut the subdivisions. New services shall generally be located as shown on NCC Standard Drawing No 21/305 (4 sheets).

**II – 5. NEIGHBOURS CONSENT**

Where any construction work is required on another property, the owner's consent shall be endorsed on the original drawing in opaque black ink that will permit satisfactory microfilm reproduction. Note that biro will not microfilm satisfactorily.

**II – 6. APPROVAL OF ENGINEERING DESIGN DRAWINGS**

When the Engineering Drawings have been approved, the Designer shall submit the conforming Engineering Drawings in a hard copy format along with the required electronic formats, for the final approval and signing by the Manager Infrastructural Assets.

## **II – 7 "COMMENCED CONSTRUCTION" NOTICE**

The Council and Design Professional shall be notified two working days before any stage of work as listed below is due to commence, and submit the names of the contractors doing the work.

Notification is required at the following stages:

- (a) Earthworks
- (b) Streetworks
  - (i) Subgrade preparation
  - (ii) Basecourse prior to sealing
  - (iii) Footpath
- (c) Drainage
  - (i) Inspection of each line prior to backfill including any pressure test
- (d) Water
  - (i) Pressure test
  - (ii) Chlorination
  - (iii) Connection by the Council required
- (e) Final

After completion of all works including sweeping of road and channels, clearing all drains, manholes and sumps, checking all valve and hydrant operations.

## **II – 8. VARIATIONS**

No variations from the approved drawings shall be made without the proposed amendments being first submitted to, and approved by, the Engineer.

The Designer shall identify the nature and position of the amendments.

## **II – 9. COMPLETION CERTIFICATE AND SUPPLY OF "AS BUILT" DRAWINGS**

On completion of the construction of a road and services, the Design Professional shall submit to the Council their Certificate (see Appendix 2, this section) that the work has been constructed in accordance with the approved Engineering Drawings, Nelson City Council Engineering Standards and manufacturer's instructions.

The completion Certificate shall be accompanied by "As Built" drawings, showing all works as actually constructed and drawn to the standards specified by the NCC.

## **II – 10. ENGINEERING "AS BUILT" DETAILS REQUIRED.**

"As Built" drawings shall be provided and approved before the 224 certificate is issued, or within two weeks of practical completion certificate issue for Council Physical works contracts, and shall show the following details of new and redundant assets:

As Built information showing existing assets that have been made redundant (either marked as abandoned or physically removed), shall be supplied so that the Asset Inventory can be kept up to date and accurate. Where an existing pipe etc. has been partially made redundant the coordinates and invert of the disconnection point is required. All non standard structures, e.g. pump stations, reservoirs, bridges etc, shall be shown as an outline with all lids and surface openings shown and separately positioned. The point of all pipe connections to the structure shall also be located with coordinates and invert.

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- (a) **Sewerage reticulation defined as follows:**
- (i) LHCEs, and valves in terms of co-ordinates and lid level.
  - (ii) Manholes, chambers, storage tanks, wet wells and sumps in terms of co-ordinates, lid level and invert level.
  - (iii) Pump stations, non-standard manholes, underground chambers, storage tanks, intake structures, and outlet structures in terms of outline and pipe connection co-ordinates. Invert levels on all chambers, storage tanks, wet wells and intake and outlet points.
  - (iv) 4 sets of Operations and Maintenance instructions manual enclosed in a hard-back A4 bound folder for pump stations. The folder shall include as built plans of the pump station including electrical wiring and operational schematic diagrams.
  - (v) Coordinate and Inverts on all pipe connections to structures e.g. pump stations, outfalls, intakes (Coordinate requirement is excluded for the connection points standard manholes and sumps).
  - (vi) Upstream and downstream invert levels of each length of pipe. At drop manholes the invert is required, for both the upper and the lower level entry point (for manholes and sumps the levels shown shall be the projected invert of the pipe at the centre of the chamber).
  - (vii) The blank end of pipe laterals or connection point to existing house drains in terms of depth to the blank end from final ground level. The horizontal location shall be defined by measurements from two readily defined, permanent points for which coordinates have been supplied, e.g. boundary pegs.
  - (viii) Pipes are to show material and diameter or height & width for box culverts and channels.
  - (ix) Any change in direction, grade or type not located by the above information is to be defined in terms of co-ordinates and invert level.
- (b) **Stormwater drainage reticulation defined as follows:**
- (i) LHCE's and valves in terms of co-ordinates and lid level only.
  - (ii) Manholes and sumps in terms of co-ordinates, lid level and invert level.
  - (iii) Pump stations, non-standard manholes, underground chambers, storage tanks, intake structures, and outlet structures in terms of outline and pipe connection co-ordinates. Invert levels on all chambers, storage tanks, wet wells and intake and outlet points.
  - (iv) 4 sets of Operations and Maintenance instructions manual enclosed in a hard-back A4 bound folder for pump stations. The folder shall include as built plans of the pump station including electrical wiring and operational schematic diagrams.
  - (v) Coordinate and Inverts on all pipe connections to structures e.g. pump stations, outfalls, intakes etc (Coordinate requirement is excluded for the connection points to standard manholes and sumps).
  - (vi) Upstream and downstream coordinates and invert level of any end of pipe and culvert not connected to a structure.
  - (vii) The blank end of pipe laterals or connection point to existing house drains in terms of depth to the blank end from final ground level. The horizontal location shall be defined by measurements from two readily established, permanent points for which coordinates have been supplied, e.g. boundary pegs.

- (viii) Subsoil drains in terms of coordinates and invert level at all change in direction and grade.
  - (ix) Watercourses, streams and rivers are to be defined by co-ordinates and levels on centreline of watercourse and the top and bottom of both banks.
  - (x) Detention dams are to be specifically identified by 0.5 metre contour data and associated structures by outline and flow path invert.
  - (xi) Pipes, culverts, subsoil drains and channel are to show material and diameter or height & width where more applicable.
  - (xii) Any change in direction, grade or type not located by the above information is to be defined in terms of co-ordinate and invert level.
- (c) **Water reticulation defined as follows:**
- (i) Valves and hydrants, meter boxes in terms of co-ordinates and lid level.
  - (ii) Manholes in terms of co-ordinates, lid level and invert level.
  - (iii) Watermains and ridermains, in terms of co-ordinates at any change in Horizontal direction or material type or diameter. Curves are to be recorded using the tangent points and at least one central point on each curve.
  - (iv) Note: Further meter location, number, type, date of installation and meter reading information required on the standard form (Section VII, Appendix I).
  - (v) Pump stations, storage tanks, reservoirs, chambers and non standard manholes in terms of outline, pipe connection and lid co-ordinates, lid level and pipe connection, tank / wet well inverts as well as floor and overflow levels.
  - (vi) 4 sets of Operations and Maintenance instructions manual enclosed in a hard-back A4 bound folder for pump stations. The folder shall include as built plans of the pump station including electrical wiring and operational schematic diagrams.
  - (vii) Pipe material and diameter.
  - (viii) Any horizontal change in direction or type not covered by the above information is to be defined in terms of co-ordinates. Curves are to be positioned using the tangent points and at least one central point on each curve.
- (d) **Streetworks defined as follows:**
- (i) All kerbing (including traffic islands) and channels where separate from kerb, in terms of co-ordinates and level at the top of kerb front face or centre of channels where channel is separate from kerb.
  - (ii) In the absence of kerbing the edge of seal or formed carriageway is required (co-ordinates and levels)
  - (iii) The width of footpath and offset from boundary or kerb if it significantly varies from the design plans.
  - (iv) All kerb, road edge and formed carriageway in terms of co-ordinates and level shall be shown at changes of type, direction or grade. All curves are to be positioned using the tangent points and at least one central point on each curve.
  - (v) Bridge abutments and piers in terms of outline co-ordinates where they vary significantly from the design plans. Kerbing, carriageway and footpaths on bridges as per above kerb and channel specifications.
  - (vi) Note: Street lighting information is required on the standard form (Section VI, Appendix I).

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- (vii) Note: Further road construction information as required on the standard form (Section VI, Appendix II)
- (e) Sufficient information to clearly identify removed or redundant assets (including the disconnection point in terms of co-ordinates and invert). The location and level of all existing drainage and water services encountered during construction where they significantly differ from the design.
- (f) Electrical, telephone and other reticulation drawings shall be supplied to the relevant Network Utility Operator.
- (g) New and / or altered benchmarks and / or survey standards in terms of co-ordinates and level and clearly defined as either a benchmark or survey standard.
- (h) Where bulk earthworks have been carried out sufficient additional levels, co-ordinates and breaklines to regenerate contours at 1m intervals shall be provided.
- (i) Ground Level in terms of the NCC Datum shall be shown on an appropriate plan at all boundary pegs for all subdivisions regardless of size.
- (j) “As Built” drawings shall only include amended long sections when significant changes to manhole or valve positions, pipeline gradients or levels have occurred.
- (k) A separate tabulation of All the Point Co-ordinates and Levels specified in these standards shall be shown on the drawing set as a cross-referenced table. The designer may choose to exclude spot heights and boundary coordinate information from this table if the information is supplied electronically. The table shall also show the name, coordinates and levels of the control points used to establish the coordinates and level data. This table will be used to assist in the distribution of the data in hard copy format.
- (l) Final survey information on all Lot boundary pegs and any easements, created for the project or development, in favour of the Nelson City Council shall be supplied in an electronic format. This information will be used to maintain the currency of the NCC AIS as far as possible between cadastral information base updates from LINZ.
- (m) A separate electronic “COORDINATE DATA” file of All the Point Co-ordinates and Levels specified in these standards (Including all contour spot heights & breakline points, and all Survey information) shall be supplied in a format in accordance with Sec. II-3. This will be used to assist in maintaining the accuracy of the Council Asset Information System. Note: All contour data and survey information maybe excluded from this file if supplied as an appropriate “ELECTRONIC DRAWING” file, in accordance with II-3.

## **II – 11. APPROVAL OF ENGINEERING AS BUILT DRAWINGS**

When the Engineering Drawings have been approved, the Designer shall submit in a hard copy format along with the required electronic formats, the conforming Engineering Drawings for the final approval and signing by the Manager Infrastructural Assets.

## **II – 12. PERFORMANCE BOND FOR MAINTENANCE and COMPLETION CERTIFICATE**

The landowner shall provide a Performance Bond for Maintenance from a bondsman such as a Bank or Insurance Company or other approved company. This shall apply to all subdivision or development construction works involving more than 3 additional lots or 3 new residential sites or where roads or services are to be vested in the Nelson City Council.

The Performance Bond for Maintenance shall be for the sum of \$1000 per lot or residential site to a maximum of \$20,000.

The term of the Performance Bond for Maintenance shall be for a period of 24 months from the satisfactory completion of the works and the issue of a 224 (c) certificate lodged with the District Land Registrar of Deeds as required under the Resource Management Act 1991.

The Performance Bond for Maintenance shall cover maintenance attributable to defects and the remedy of all defects arising from defective workmanship or materials. This shall cover the services and roading construction works that are to be vested in the Council and other civil and structural engineering construction works to serve the subdivision or development and including electrical supply and telecommunication cable systems.

The landowner shall be liable for the remedy of all attributable defects arising before the end of the period of maintenance.

The Performance Bond for Maintenance shall not be required to cover general earthworks but shall be required to cover earthworks considered to be part of the civil engineering construction.

## **II – 13. MAINTENANCE CERTIFICATE**

On expiry of the 24 month Maintenance Period the Design Professional shall issue a Maintenance Certificate confirming that all outstanding maintenance has been completed.

The Performance Bond for Maintenance will not be released until the work covered by the Maintenance Certificate is verified by the Council.

## DESIGNERS CHECK SHEET

NCC No: ..... Date: .....

Site Address: .....

Site Legal Description: .....

Designer - Name: .....

Address: .....

Phone No.: .....

Fax No.: .....

Landowner - Name: .....

Address: .....

Phone No: .....

Place a tick in a box if information provided, otherwise write NA for not applicable.

Reason for Submission: - Subdivision  R.O.W.

- Development  Other

Design Certificate Provided

Drawing Sheet Size - A1  - A2

Draughting to AS 110.101 and NCC Standard Sec. II 3

Levels to NCC Datum  Locality Diagram

Contour Plan  Spot Levels

Overall Site Plan

Plans and Sections - Streetworks  - Power

- Drainage  - Telecom

- Water

- Erosion & Sediment Control Plan

Sewerage Catchment Plans and Discharge Calculations

Stormwater Catchment Plans and Discharge Calculations

Streetworks Pavement Design

Specific Design - Specify aspect .....

Owners Consent for Work in Private Property



**SECTION III**

**STORMWATER DRAINAGE**

**SECTION III**  
**STORMWATER DRAINAGE**  
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### III – 1. GENERAL

An Engineering Drawing including a longitudinal section shall be required for every public or common private stormwater drain of 150mm diameter or greater.

Stormwater run-off shall be dealt with in the catchment in which it falls, unless approved otherwise by the Engineer

In the case of a temporary intake, the structure shall be adequate for the estimated period before the permanent extension. Permanent intakes and outlets shall be designed to cope with individual requirements.

Generally public stormwater drains shall be Class “2” rubber ring jointed reinforced concrete pipes complying with NZS 3107.

Generally piped stormwater systems shall be designed to flow full or part full under gravity at design flows with pipes aligned soffit to soffit.

Open watercourses shall be designed to carry the design flood with a minimum of 400mm freeboard after allowing for super elevation on curves.

The NCC only accepts responsibility for stormwater drains in public road reserves, recreation reserves and where there is a drainage easement in the City Council's favour.

To assist private landowners having difficulties maintaining and upgrading large stormwater drains on their property the Council will contribute 50% of the cost of upgrading private common drains 300mm diameter and greater providing the Council has set sufficient money aside for this in the Annual Plan. The work must be approved 12 months in advance and the Council will require an easement over the line of the pipe when work is completed. This offer does not include property development or subdivision work.

The NCC is only responsible for the maintenance of those rivers and streams within the city's urban area as follows:

Orphanage Creek	- through existing urban development.
Orchard Creek	- through existing urban development.
Poormans Valley Stream	- outfall to Marsden Cemetery.
Arapiki Stream	- through existing urban development
Jenkins Creek	- outfall to Newman Drive.
York Stream	- outfall to York Valley Detention Structure.
Maitai River	- outfall to Jickells Bridge.
The Brook	- outfall to 320 Brook Street.
Oldham Creek	- through existing urban development.

#### (a) Training

To achieve long life and reliability of a stormwater asset, various materials and standards are required in this section. However, asset performance is also dependent on correct handling and installation techniques of the material. To ensure that those carrying out the maintenance or installation of stormwater reticulation that is owned or will be owned by the Nelson City Council are suitably trained the following will apply:

- (i) From 1 January 2005, at all times that work is being carried out on stormwater reticulation at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Service Person) qualification.
- (ii) From 1 January 2006, at all times that work is being carried out on stormwater reticulation and three or more personnel are working on site, at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Supervisor) qualification.
- (iii) From 1 January 2005 all laying of concrete pipes shall be carried out by an operator who has attended and passed an appropriate and approved concrete pipe-laying course.

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### **III – 2. LOCATION AND ALIGNMENT OF DRAINS**

The layout of the stormwater system shall take into account the requirement to minimise surface water infiltration of the foul sewerage system. Refer to Sec. IV - 2.

Generally deep pipelines exceeding 2.5m deep shall be avoided. Over depth pipelines are difficult to access in the future for maintenance and renewal works.

#### **(b) Drains in Roads**

Main drains shall be aligned within public areas such as roads wherever possible providing stormwater is dealt with generally in its own catchment area.

Drains in roads shall be aligned parallel to kerb lines within the carriageway to ensure they do not clash with other services or occupy the full carriageway width. Adequate clearance from other services and kerb lines shall be maintained to allow for:

- (i) Excavation on existing services
- (ii) The future relaying of the drains
- (iii) The provision of additional future services

In curved roads, drains shall generally follow the road alignment in straight lines between manholes on such alignment that they do not occupy the full carriageway width.

#### **(b) Drains Through Private Property**

The catchment area to be served by main drains aligned through private property shall be kept to a minimum.

In planning the layout of drains through private property consideration shall be given to preserving access to drains for:

- (i) Maintenance purposes
- (ii) Preserving the route for relaying the drains in the future
- (iii) Avoiding likely positions for buildings, garages, carports and retaining walls.
- (iv) Secondary flood paths

The preferred alignments of drains on private property shall be:

- (i) Within R.O.W.s or driveways
- (ii) Outside probable building envelopes
- (iii) Clear of fence lines and kerb lines
- (iv) Adjacent to boundaries
- (v) Parallel to boundaries

Where main drains must be aligned through private property, easements in favour of the Council may be required.

#### **(c) Easements Over Drains**

Where as part of a subdivision or development proposed pipes greater than or equal to 300mm diameter will be located in private property an easement shall be required in favour of the Council. The minimum width of easement shall be 3.0m.

The standard wording required on Engineering Plans shall be:

“Memorandum Easement in Gross shall be provided in favour of NCC to convey stormwater in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work.”

Similar easements may be required over private common drains in favour of the lots served. Pipelines deeper than 2.5m may require easement widths greater than 3.0m to allow for wider than normal trench widths needed to access the pipe in the future.

#### **(d) Crossing Other Services**

Diagonal crossings of other services, including kerb lines and boundaries or fence lines, at acute angles less than 45 degrees shall be avoided wherever possible.

### **III – 3. BUILDING OVER OR ALONGSIDE A COMMON PRIVATE OR PUBLIC STORMWATER DRAIN**

Building over or alongside any Common, Private or Public Stormwater Drain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

The engineering requirements for building over or alongside drains are as follows:

- (a) Structures:
  - (i) Must be located no closer than 1.0 metre measured horizontally from the centreline of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.
  - (ii) Must be located no closer than 1.5 metres measured horizontally from the outside of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
  - (iii) Which are balconies, may overhang the line of the pipe or drain, provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
  - (iv) Which are located within 3 metres measured horizontally from the outside of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer)
- (b) Carports may be constructed over pipes or drains (but not watermains or other pressurized pipelines) provided that:
  - (i) The foundations are located in accordance with (a) (iv) above; and
  - (ii) The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
  - (iii) The carport is not closed in; and
  - (iv) The floor is not concreted to a depth greater than 150mm; and
  - (v) An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that rules (ii), (iii) and (iv) (above) apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner's cost.
- (c) As an alternative to (a) and (b) above, structures may be located over common private or public drains, if they comply with the table below (Acceptable Techniques for Building over Stormwater Pipes or Drains).

<p>Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and recreation, and Inner City</p>	<p>Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential</p>
<p>Structures may be located over common private or public stormwater drains or pipes, if:</p> <ul style="list-style-type: none"> <li>i. There are no changes in direction or junctions in the portion built over; and</li> <li>ii. The drain or pipe is proven to be in good condition by internal inspection or a water test; and</li> <li>iii. The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and.</li> <li>iv. Where the diameter or width of the pipe or pipe equivalent (in the case of a drain) is 300mm or less, the design and use of the structure is such that a an appropriately sized excavator could readily gain access along the line of the pipe or drain for maintenance and replacement work, or appropriate access is available for hand digging; or</li> <li>v. Where the diameter or width of the pipe or pipe equivalent (in the case of a drain) is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe or drain for maintenance and replacement work.</li> </ul>	<p>Structures may be located over common private or public stormwater drains or pipes, if:</p> <ul style="list-style-type: none"> <li>i. The diameter or width of the pipe or pipe equivalent (in the case of a drain) is 150mm or less; and</li> <li>ii. The length of pipe or drain built over is no more than 6 metres; and</li> <li>iii. There are no changes in direction or junctions in the portion built over; and</li> <li>iv. The length of pipe or drain built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and</li> <li>v. There is practical access and the foundations are designed to allow the pipe or drain to be readily exposed at both ends of the sleeve for maintenance and replacement work; and</li> <li>vi. There is a minimum 6 metre clear length at one end of the sleeve to allow replacement of the pipe or drain.</li> </ul>

Detailed Engineering Drawings of the proposed work are required.

### III – 4. DETAILED REQUIREMENTS

- (a) All drainage work shall comply with Nelson City Council requirements; plans shall comply with Nelson City Council Engineering Standards "Drawings, Bonds and Certificates": (Sec II).
- (b) Under no circumstances shall stormwater discharge to a sewerage system.
- (c) All systems shall be designed to accept the flow from upstream of the subdivision and shall be of sufficient capacity to provide for maximum flow from possible future development indicated by zoning in the Resource Management Plan.
- (d) A stormwater drain shall be constructed the full length of each new street, unless approved otherwise by the Council.

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- (e) In all new subdivisions, a stormwater drain shall be provided to the boundary of every section in the subdivision. This does not apply to sections fronting existing legal

streets where these services are available in the street and are within 15m of the new boundaries provided that the drain will not cross any section other than the one being served.

- (f) Road crossings shall be kept to a minimum number.
- (g) On generally flat land, sloping at 1 in 50 or less, each connection shall be capable of serving the entire building area of the section by gravity.

On land steeper than 1 in 50 every effort shall be made to serve the entire section. Where this proves to be impossible and the servicing of the site is limited the area on each lot capable of being serviced shall be shown on the Engineering Drawing.

Individual house/site stormwater shall be disposed of by piping to one of the following approved outfalls.

1. Stormwater pipe
2. Watercourse
3. Kerb entry
4. Bubble-Up Sump
5. Soakaway (applicable only in Stoke, The Wood or The Brook areas within urban zones and subject to testing)

Options (1) to (5) are listed in order of preference. A lesser option will only be considered if a more preferable option is not practical or economically feasible.

Soakage requirements and Soakpit specification (Refer to NCC Standard Drawing No.21/209).

**Residential building:** 4500 litres in 20 minutes.

**Garage/Accessory building:** 200 litres in 4 minutes.

**Existing House** with soakpit at each downpipe; each pit must be exposed and pass 200 litres in 4 minutes test.

**ROW:** must not be drained by soakpit.

**Soakpit minimum area:** 1.2m x 1.2m. At Council's discretion.

**Soakpit depth:** to free draining layer.

**Location:** Minimum 1.5m from boundaries and foundations.

**Silt traps:** are recommended at every soakpit.

- (h) Stormwater discharging to natural watercourses or the sea via a 300mm diameter pipe or greater shall require a Discharge Consent under the Resource Management Act 1991, issued by the Planning and Consents Department.
- (i) Generally watercourses in or adjacent to an area being subdivided or developed shall be required to be piped. For watercourses requiring pipes of greater than 900mm diameter, consideration, in special cases only, may be given to providing the necessary waterway in the form of an appropriately designed open channel.
- (j) In all cases, the size, shape and grade of ditches, and diameter and grade of pipes, shall be required to be approved by the Council before construction.
- (k) Approved cut-off ditches may be required parallel and adjacent to, and within, the uphill boundaries of high-level sections. In this case a Consent Notice shall be placed on the section outlining that the property owner is responsible for maintaining the cut-off ditch.

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### **III – 5. FLOOD RISK ASSESSMENT**

Flood risk assessment shall take account of the characteristics of the total catchment as well as the particular site. Any historical information on flooding shall also be taken into account. This could include reviewing records held by relevant bodies, discussions with the local inhabitants or appropriate field tests.

Site evaluation shall address the following:

- (a) The proximity and nature of any river, stream or watercourse, and associated flood plains.
- (b) The capacity of culverts or watercourses downstream of the site, and the likelihood of upstream ponding resulting from under capacity, or from blockage by debris or slips.
- (c) The upstream culvert and watercourse conditions, and the location of the secondary flow path floodwaters in the event of blockage or under capacity.

### **III – 6. SECONDARY FLOW PATHS**

Secondary flow paths shall be identified, and where appropriate, catered for by specific design taking account of:

- (a) The capacity of the downstream surface water system, and the risk of blockage at its intake.
- (b) The necessity for a secondary intake structure and the relative flow distribution between primary and secondary intakes for the likely degree of blockage.

Refer to NCC Standard Drawing No. 21/203 sheets 2 and 4.

### **III – 7. DETENTION STRUCTURES**

Where detention dams are approved they shall meet the following requirements:

- (a) The 5-year, 15 year and (where required) 50 year return period peak flood flow from the developed catchment shall be no greater than would have occurred from the undeveloped catchment.
- (b) 400mm freeboard shall be provided above the maximum design storage level to the spillway crest.
- (c) The spillway shall be capable of passing the Probable Maximum Precipitation (that the catchment would discharge into the structure) without risk of overtopping the structure or eroding the spillway.
- (d) In locations where the majority of the flow into the structure would be via overland flow the discharge into the downstream stormwater system shall be through a standard stormwater intake (NCC Standard Drawing No.21/203).
- (e) In locations where the majority of the flow into the structure would be via piped systems the systems shall be extended through the dam basin with surcharging capabilities to allow:
  - (i) Multi use options for the dam basin area
  - (ii) Peak flood flows to bubble up out of the pipe system into the storage dam
  - (iii) Stored water to drain once the flood peak has passed.
- (f) In all cases a secondary intake shall be provided (NCC Standard Drawing No 21/203 Sheet 2 Type C) with the top of the manhole riser terminating 400mm below spillway crest level.
- (g) An all weather access track shall be provided from legal road reserve to the basin of the detention dam and intake structures. The track shall be no steeper than 1 in 7, have a physical width of not less than 3.0m and be provided with stormwater control.
- (h) A design and construction certificate shall be provided for each structure by a suitably qualified engineer stating that the dam has been designed and constructed in accordance with the appropriate standards.

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### **III – 8. DISCHARGE FROM OIL AND SILT TRAPS**

Effluent that contains a combination of detergent and/or degreasing agents with oil and/or silt shall be directed to the sewer after first passing through a silt and oil trap built to NCC Standard Drawing No.21/208. To ensure stormwater does not enter the sewer system the area being served by the silt and oil trap must be roofed and have a low bund around the perimeter with a minimum height of at least 50mm.

Any proposal to make such a discharge to the sewer system shall require a Trade Waste application.

In some locations a gravity connection to the sewer may not be possible and the discharge may have to be pumped into the sewer system. This shall require specific design and approval.

Bunded areas around fuel storage areas should discharge to the stormwater via a suitably designed oil interceptor with an appropriate shut off valve system to contain fuel spills.

Where it is considered that there is a high risk of yard runoff being contaminated with oil and silt, then an oil and silt trap shall be required with a connection to the stormwater system. This shall require specific design and approval. An appropriate mechanically or electronically operated wastewater diversion system may be required to be incorporated. Stormwater shall not be allowed to discharge to the sewer system.

Building consents are required for all works.

### **III – 9. SEA OUTFALL DESIGN LEVEL CRITERIA**

Significant areas of catchments that are low lying present a problem to dispose of stormwater adequately.

Mean Sea Level	12.070	NCC Datum
Mean High Water Springs	14.100	NCC Datum

Tidal surges due to atmospheric conditions (low air pressure and on shore winds) can result in an increase in tide level up to approximately 700mm above the predicted level.

Global warming is expected to raise sea levels by 300mm by the year 2050.

For the purpose of pipe and open channel design the hydraulic grade line at the sea outfall shall start at 14.00m (NCC Datum).

### III –10. MINIMUM GROUND AND FLOOR LEVEL REQUIREMENTS

(a) **Nelson Resource Management Plan**

Refer to the appropriate zone section of the Nelson Resource Management Plan for any rules relating to subdivision, earthworks, building on low lying sites, Flood Path Overlays and Inundation Overlays.

(b) **Minimum Ground and Floor Level Requirement Related to Tide Levels to NCC Datum)**

	<b>Ground Level</b>	<b>Concrete Floor</b>	<b>Timber Floor</b>
Tidal Surge Level at Year 2050	15.30	15.30	15.30
Safety Margin	0.05	0.20	0.35
Minimum Finish Level to Year 2050 excluding Monaco and Wood Area served by stormwater Pump Station	15.35	15.50	15.65
Monaco 200mm wave set	0.20	0.20	0.20
Minimum Finish Level to Year 2050 for Monaco (including 200mm wave set)	15.55	15.70	15.85
Minimum Finish Level to Year 2050 for Wood Area to be served by stormwater Pump Station	15.20	15.35	15.50

The minimum ground and floor level requirement shall be reviewed at the time of every Nelson Resource Management Plan Review and shall also be monitored at the beginning of every new decade.

In addition to the absolute minimum floor levels above, floor levels shall also be in accordance with the requirements of the Building Act.

(c) **Minimum Ground Level Requirements for Low Lying Sites below the Adjoining Road Level**

To reduce the rate of catchment stormwater flowing into the site either as backflow via stormwater connections or as surface runoff inundation.

The site shall be filled as necessary to ensure that:

- (i) The minimum finished level is greater than the crown level of the road to which the piped stormwater from the allotment is drained.
- (ii) No filling shall be placed which interferes with the natural runoff from neighbouring land. Where filling of the site obstructs the natural runoff from an adjoining property then provision shall be made for the drainage of that property.
- (iii) There is continuous fall towards the street that the site is draining to. Provision shall be made for potential development and filling of any intermediate sites.

(d) **Minimum Ground Levels for Sites Adjoining Major Rivers and Streams**

The minimum ground level of sites adjoining or draining to major rivers and streams for which a storm with a 2% probability of occurring annually (a 1 in 50 year storm) is applicable (Refer Sec III – 14) shall be:

Q<sub>50</sub> flood level plus 400mm minimum freeboard.

The major rivers and streams to which this requirement applies are:

Reservoir Creek  
Saxton Creek  
Orphanage Creek  
Orchard Creek  
Poormans Valley Stream  
Jenkins Creek  
York Stream  
Maitai River  
The Brook Stream  
Oldham Creek  
Todds Valley Stream  
Wakapuaka River and its Tributaries  
Whangamoia River and its Tributaries

(Also see III – 14. (g) this section.)

(e) **Minimum Ground Level Related to Sewer Manholes**

Refer to Sec IV – 4(g) for the minimum ground level requirements in relation to the upstream sewer manhole lid level.

**III –11. STANDARD STORMWATER INLET STRUCTURE**

Notwithstanding the requirements for modified intakes under Sec. III, 12 "Deep Trap Sumps and Catchpits" below, every inlet to a piped stormwater system shall be provided with a suitable inlet structure and grill. Refer to NCC Standard Drawing No. 21/203 sheet 1 for details of the Standard Stormwater Inlet Structure.

Refer to NCC Standard Drawing No. 21/207 sheet 1 and 3 for details of the Standard Sump. (For use as a minor intake only and where the risk of blockage is minimal).

Under no circumstances shall a grill be placed flush over the intake/inlet of a stormwater pipe.

Pipeline and culverts requiring an inlet structure shall take account of the inherent hydraulic losses associated with flow transition to ensure the inlet is appropriately sized to convey the design flow without heading up and overtopping.

**III –12. DEEP TRAP SUMPS AND CATCHPITS**

Apart from the requirements for inlet structures and grills as detailed on NCC Standard Drawing No. 21/203 sheet 1, modified intakes may be required at specific locations to provide additional protection to the pipe inlet against the risk of blockage by solids and floating debris.

NCC Standard Drawing No. 21/203 sheets 2 and 3 provides details of general examples of deep trap sumps and railway iron trash racks and catchpits. Each case will require specific design to suit the site with regard to peak flows, secondary intakes, expected debris and access for maintenance. Final details shall be submitted to the Council for approval.

An all weather access track for trucks and wheeled excavators shall be provided to the location of all deep trap sumps intakes and catchpits. The access shall consist of a 3m minimum width of 150mm thickness of compacted basecourse.

### III –13. BASIS OF STORMWATER DESIGN

#### Calculation of Run-off

Run-off shall be calculated using the "Rational Method", or other procedure approved by the Council.

The "Rational Method" formula is:

$$Q = C.I.A \times 2.77$$

Where      Q = run-off in litres per second  
              C = run-off co-efficient (see Sec. III -14 (b) below)  
              I = rainfall intensity in mm per hour  
              A = area of catchment in hectares

OR

$$Q = C.I.A \times 0.0028$$

Where      Q = run-off in cubic metres per second (cumecs).

To simplify calculation of stormwater run-off when the intensity of rainfall is 80mm/hr the following run-off factors may be adopted.

$$Q = 0.09 \times A \text{ for rural run-off when } C = 0.40$$

$$Q = 0.12 \times A \text{ for residential run-off when } C = 0.55$$

$$Q = 0.18 \times A \text{ for commercial/industrial run-off when } C = 0.80.$$

Where      Q = run-off in cubic metres per second (cumecs)  
              A = area of catchment in hectares  
              C = run-off co-efficient (see Sec. III - 14 (b) below).

### III –14. DESIGN STANDARDS

#### (a) Rainfall Intensity

In general an intensity of 80mm per hour is to be used except as detailed below.

Where the time of concentration is 20 minutes or less a rainfall intensity of 80mm per hour shall be used.

In large or very flat catchments where the time of concentration is greater than 20 minutes the actual rainfall intensity shall be determined for the time of concentration at the particular point being considered in the catchment. The total time of concentration shall be determined as below (Sec. III -14 (c)).

The rainfall intensity applicable to that total time of concentration for a storm with a 6.67% probability of occurring annually (a 1 in 15 year storm) shall be determined from the Rainfall Intensity Curve (NCC Standard Drawing No. 21/201).

For the following waterways the rainfall intensity curve for a storm with a 2% probability of occurring annually (a 1 in 50 year storm) will be used:

Reservoir Creek  
Saxton Creek  
Orphanage Creek  
Orchard Creek  
Poormans Valley Stream  
Arapiki Stream  
Jenkins Creek  
York Stream  
Maitai River  
The Brook Stream  
Oldham Creek  
Todds Valley Stream  
Wakapuaka River and its Tributaries  
Whangamoia River and its Tributaries

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- (b) **Run-off co-efficient**
- |                           |      |
|---------------------------|------|
| Rural                     | 0.40 |
| Residential               | 0.55 |
| Industrial and Commercial | 0.80 |

(c) **Time of Concentration**

For the calculations of time of flow over the ground surface, the following formula applies.

$$T = \frac{107n^3\sqrt{L}}{\sqrt[5]{S}}$$

Where

T	=	minutes
n	=	Horton's surface values as shown on chart (NCC Standard Drawing No. 21/200)
L	=	Length in metres
S	=	slope in %

The time of flow over the ground surface may be determined directly from the chart of "Times For Surface Flow" (NCC Standard Drawing No. 21/200).

The time for surface flow formula is only applicable to flow over the ground surface and does not apply to channel flow or flow down a gully even when a distinct channel is not discernible.

The total time of concentration may require the summation of the time of flow over the ground surface and the time of flow via a channel or pipe.

(d) **Calculation of Pipe Sizes and Grades**

Pipe sizes and grades shall be calculated using standard hydraulic formulae (Manning, Colebrook-White), or an approved hydraulic calculator based on the above.

A pipe roughness equivalent to one of the following shall be adopted to account for gravel and grit deposits and other insitu variables such as construction performance and pipeline deterioration with age.

	Pipe Roughness
Mannings formula	n = 0.013
Colebrook-White formula	k <sub>s</sub> = 1.5mm
Mears Water Flow Calculator	Rough Concrete

(e) **Velocity**

The pipelines are to be designed to give a minimum velocity of 0.75m/sec, flowing full. The maximum velocity should not exceed 4m/sec whenever possible.

(f) **Steep Gradients - Air Entrainment**

Where a pipe gradient exceeds 1 in 10 an allowance for the bulking of the flow due to air entrainment should be made. This allowance is made by increasing the area of the pipe for the additional volume of air in the flow. The air to water ratio may be calculated from the formula:

$$\frac{\text{air}}{\text{water}} = \frac{kv^2}{gR}$$

- Where
- |   |   |  |
|---|---|--|
| k | = | co-efficient of entrainment (dimensionless)  |
|   | = | 0.004 for smooth pipes                       |
|   | = | 0.008 for cast-in-situ concrete culverts     |
| v | = | velocity m/s                                 |
| R | = | hydraulic radius m                           |
| g | = | acceleration due to gravity m/s <sup>2</sup> |

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(g) **Pressurised Stormwater System**

A pressurised stormwater system shall be subject to Council approval.

Where a pressurised stormwater system is deemed to be necessary the hydraulic grade line shall be plotted on the longitudinal section. Reduced levels and the hydraulic gradient shall be quoted for each section of the drain. (The minimum freeboard from the hydraulic grade line to the finished ground level shall be 400mm). This information shall be included on the "As Built" drawings.

### III –15. COVER

**Pipe systems shall be designed to ensure the following minimum cover over the barrel:**

Location of Drain	Minimum Cover Required	
	Concrete Pipe	PVC pipe
Areas subject to highway traffic loading e.g. within road carriageway.	600mm	750mm
Areas subject to light traffic loading outside road e.g. ROW's, driveways, carpark and berms.	450mm	600mm
Areas never subject to traffic loading.	300mm	450mm
Under continuous concrete encasement for full circumference.	300mm	300mm

Minimum cover may be reduced providing the pipe is concrete encased for concrete pipes and concrete capped for PVC and subject to the Councils' approval.

Where pipes with inadequate cover require concrete encasement or capping the extent and thickness of concrete and concrete strength shall be specified on the drawings. The minimum thickness of concrete encasement and capping shall be 100mm and the minimum concrete strength shall be 15MPa.

To avoid reflective cracking of pavements and differential settlement concrete encasement and capping shall not be permitted to penetrate the basecourse or pavement construction.

No concrete protection shall be placed around the pipe until the line has been inspected and approved by the Council.

PVC piping shall be protected with 6mm thickness of Denso tape or 250 microns polyethylene film or equivalent where adjacent to concrete.

Reduced cover on pipes may be approved providing the appropriate class of pipe is specified and cover is according to the manufacturer's specification.

### III –16. CULVERTS UNDER FILLS

Culverts shall be of sufficient strength to support all designed superimposed loads in accordance with NZS/AS 3725.

Culverts shall have adequate wingwalls, headwalls, aprons, approved grills, traps and /or pits to prevent scouring or blocking. In some situations, headwalls and wingwalls on the upstream side may be required to be designed to protect the fill against the depth of flow of twice the height of the culvert, and fitted with a grill to the approval of the Council.

### III –17. SUMPS

(a) **General**

Sumps shall be to Nelson City Council Standard constructed in accordance with NCC Standard Drawings Nos 21/206 and 21/207.

The vertical alignment of kerb and channel shall be designed to ensure that no low point requiring a standard sump will coincide with any kerb and channel curve of less than 50m radius.

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The tolerance for the location, alignment and level of a sump shall be as follows:

- (i) Lateral alignment of the sump top shall be within a maximum of plus or minus 10mm of the design line of the kerb and channel.
- (ii) The skew of the sump top in relation to the kerb and channel alignment shall be within 10mm of being parallel.
- (iii) The sump shall be placed within 20mm of being vertical.
- (iv) The maximum depth of a sump shall be 1300mm as per NCC Standard Drawing No. 21 /207 sheets 1 and 2.
- (v) The finished level of the sump shall ensure compliance with the tolerance requirements for kerb and channel finished level as per Sec. VI - 12 (a).

(b) **Standard Sumps**

The standard sump to be incorporated with all kerb and channel or mountable kerb and channel is the Back Entry Sump as detailed on NCC Standard Drawing No. 21/207 sheets 1 to 5.

The minimum diameter of pipe serving a standard sump in a road shall be 225mm.

Sumps shall be provided:

- (i) At maximum intervals of 100m on all channels. Closer spacing of sumps may be required depending on the rate of run off expected.  
Where mountable kerb and channel is used the maximum sump interval shall be reduced to 60m.
- (ii) At each tangent point of the channel on the upstream side of road intersections.
- (iii) At any low spot in the channel.
- (iv) Serving any Right of Way (Refer to Sec. III -27).

(c) **Double Sumps**

Where catchment conditions warrant the provision of adequate stormwater entry, double sumps may be required.

Double sumps shall mean duplicate standard back entry sumps.

The minimum diameter of pipe serving double sumps shall be 300mm.

Double sumps may be required:

- (i) Where the length of kerb and channel draining to a low point is excessive.
- (ii) The area of the catchment warrants the provision of adequate stormwater entry.
- (iii) At a low point at the head of a cul-de-sac. Unless standard sumps have been provided at the TPs to the turning head of the cul-de-sac.
- (iv) At a low point in a Crescent.

(d) **Side Entries**

Side Entries constructed in accordance with NCC Standard Drawing No. 21/206 sheets 1 and 2 are required in addition to Standard Back Entry sumps at positions where increased protection from flooding is warranted, such as where grades exceed 1 in 8.

Side entries shall be located on the upstream end of a sump.

Where an existing sump unavoidably coincides with a vehicle crossing (back entry is not feasible) a standard sump or a side entry shall be constructed on the upstream side of the crossing and the pipe extended into the sump.

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- (e) **Cycle Friendly Sumps**  
Cycle friendly sumps constructed in accordance with NCC Standard Drawing No. 21/207 sheet 9 may be required by Council in specific areas where sumps are in the direct path of cyclists.

### **III –18. MANHOLES**

- (a) Manholes must conform to NCC Standard Drawing No. 21/204 sheet 1 for pipe diameters up to 450mm, and NCC Standard Drawing No. 21/204 sheet 4 for pipe diameters over 450mm. Factory-made "T" manholes will be permitted for pipes of 1350mm diameter and over subject to the approval of the Council.
- (b) Distance Between Manholes
- (i) Normal maximum distance - 100m.
  - (ii) Shorter distances may be required according to circumstances.
- (c) Manholes shall be required
- (i) At change in direction
  - (ii) At change in grade
  - (iii) At change of pipe diameter
  - (iv) At pipe intersections
  - (v) At the head of a main drain.
- (d) Notwithstanding Sec. III - 18 (c) above sump connections may be made to the stormwater pipe by use of saddle connections as in Sec III - 23 below where this is physically possible.
- (e) Sumps may only be used in lieu of manholes in certain cases e.g. towards the head of a stormwater drain and linking sumps around a street intersection, provided that the pipe diameter does not exceed 375mm and the depth to invert of the trap does not exceed 1300mm.
- (f) Where site conditions require close spacing of manholes, consideration will be given to the use of some manholes of less than 1050mm diameter.

### **III –19. MINI-MANHOLES OR INSPECTION CHAMBERS**

Shallow mini-manholes shall be in accordance with the requirements set out on NCC Standard Drawing No. 21/204 sheet 6 or proprietary PVC or Polypropylene moulded products approved by the Council.

Mini-manholes are not to be used in areas subject to vehicular traffic, except in formed residential driveways or rights of ways for light domestic vehicles.

The use of mini-manholes is to be limited to:

- Manholes less than 1.0m deep,
- Maximum pipe sizes of 225mm diameter for stormwater,
- Manholes at the head of a line,
- Straight through manholes,
- Changes of grade.

Concrete mini-manholes are not to be used in sewers at junctions or deflections greater than 45 degrees.

### **III –20. LAMP HOLE CLEANING EYES**

- (a) Lamp Hole Cleaning Eyes, (LHCE) may be used in lieu of manholes in any or all of the following circumstances:
  - (i) Generally LHCE are for use on private property only.
  - (ii) Only one LHCE shall be permitted between manholes.
  - (iii) LHCE may be used at the head of a drainage run.
  - (iv) LHCE may be used where access points are required at intervals of less than 50m.
  - (v) LHCE may be used at the top of steep banks where a standard manhole would be impractical.
- (b) LHCE shall not be approved for use within road carriageways, footpaths or berms.
- (c) For details of LHCE see NCC Standard Drawing No. 21/205 sheets 1 and 2.

### **III –21. CONNECTIONS AND FOOTPATH CROSSINGS**

As stormwater construction proceeds, each connection shall be marked by a 75mm x25mm marker stake suitably identified.

The end caps and inside of all new stormwater laterals must be painted with blue acrylic paint to help with future identification. (Note: Sewer laterals are to be marked red). The actual work of pipe laying shall be done by a drainlayer.

Kerb entries may only be installed using approved kerb entry adapters.

Where stormwater disposal is via kerb entries and cover is inadequate to permit the use of PVC pipe, or hot mix is to be laid over the pipe, then pipes under footpaths and berms shall be 100mm diameter galvanised steel.

### **III –22. PIPE SIZE NOT TO BE REDUCED**

It will not be permitted to reduce the diameter of pipe even where changes in grade would produce the required capacity in a smaller diameter of the downstream pipe.

### **III –23. PIPELINE CONNECTIONS**

Where under Sec. III - 18 (c) (iv), a manhole is not required at a pipe junction, the connection shall be made by using a 'y'-junction or a "saddle" junction, as per Sec. III - 28 (d) (vii).

### **III –24. SUB-SOIL DRAINS**

Sub-soil drains shall terminate at a sump.

Sub-soil drains are not to be considered as part of the surface water drainage system.

To avoid the appearance of seepage in dry weather, sub-soil drains shall not discharge to the kerb and channel if an alternative receiving drain exists.

Sub-soil drainage is not a general requirement for a permeable retaining wall such as a crib wall or timber pole wall. There are situations where sub-soil drainage of permeable walls may be required:

- (a) Where walls have a back sloping below ground footing where water may be trapped.
- (b) Where seepage from a retaining wall may cause a nuisance to an adjoining property owner.
- (c) Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly.
- (d) Where a retaining wall is being built in an area of suspect stability and the removal of surface / ground water would be an advantage.

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### **III –25. SUB-SOIL DRAINAGE OF SERVICE TRENCHES**

Adequate provision for draining all service trenches, including cable trenches, on all hillsides as detailed on NCC Standard Drawing No. 21/212 shall be specified on the Engineering Drawings.

Similar requirements in conjunction with more extensive sub-soil drains may be necessary on flatter ground in wet areas.

### **III –26. SURFACE CUT OFF DRAINS**

When required these shall be located within the upper boundary of the property to be protected.

### **III –27. DRAINAGE OF R.O.Ws, DRIVEWAYS**

For common accessways more than 10m in length or more than 30m<sup>2</sup> of sealed surface, the Designer shall design a stormwater control method such that, stormwater is prevented from discharging;

- (a) Across the footpath (existing or proposed) where the R.O.W. falls towards the street.
- (b) Across private property where the R.O.W. falls away from the street, or at any low point within the R.O.W.

This stormwater control may be achieved by one or more of the following:

- (a) Kerb and channel to one or both sides, draining to a standard sump
- (b) Mountable kerb and channel to one or both sides, draining to a standard sump
- (c) A dished concrete channel aligned along the centre of the access with 1 in 33 (3%) crossfall into the channel and draining to a sump, where the longitudinal gradient is between 1 in 400 and 1 in 20.
- (d) A dished sealed channel aligned along the centre of the access with 1 in 33 (3%) crossfall into the channel and draining to a sump, where the longitudinal gradient is between 1 in 60 and 1 in 20.

See also Sec. III - 17 for details on sumps.

Note: New sumps shall not be permitted within a vehicle crossing on the line of the street kerb and channel.

### **III –28. STORMWATER DRAINAGE CONSTRUCTION**

#### **(a) General**

All drainage pipelines shall be constructed in accordance with the requirements of AS 2032 and AS/NZS 2566 except as modified by the NCC Engineering Standards.

#### **(b) Width of Trench**

The maximum width of trench, measured at the level of the top of the pipe shall not exceed:

For pipes up to 1200mm diameter - external diameter of the pipe plus 300mm

For pipes over 1200mm diameter - external diameter of the pipe plus 500mm.

Excavation for manholes shall be only of sufficient size to leave adequate space for construction and for compaction of backfill.

#### **(c) Dewatering**

Excavations shall be kept free of water during construction.

In no circumstances shall stormwater or groundwater be allowed to drain into any existing foul sewer, and pipe ends shall be plugged to prevent such ingress.

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Discharge of stormwater or ground water to existing stormwater drains or the pipes already laid will be permitted providing adequate silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Landowner or the Contractor, then such deposits shall be cleared forthwith at the Landowner's or the Contractor's cost.

Ground water lowering may be permitted except where this practice may present a risk of subsidence.

The Contractor or Landowner shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

(d) **Construction**

(i) **Concrete**

All materials and workmanship in mass or reinforced concrete shall be in conformity with NZS 3109, and structural concrete shall have a minimum crushing strength of 20 MPa at 28 days.

(ii) **Stormwater Pipe Materials**

Stormwater pipes shall comply with the following standards:

Concrete - NZS 3107:1978 Precast concrete drainage and pressure pipes. AS/NZS 3725:1989 Loads on buried concrete pipes

PVC - Plain solid wall pipe, rubber ring jointed to AS/NZS 1254:2002 PVC pipes and fittings for stormwater and surface water applications

The following classes shall apply:

- DN 100mm diameter shall be minimum stiffness class SN 10 for public sewers and SN 6 for private sewers.
- DN 150mm diameter shall be minimum stiffness class SN 8 for public sewers and SN 4 for private sewers.
- DN 175mm and larger shall be minimum stiffness class SN 4 for public and private sewers.

Note: PVC pipes will not be approved for stormwater catchments requiring pipe sizes of 575mm diameter or greater without specific approval from Council.

Aluminium or galvanised steel pipes shall not be incorporated in the city's stormwater pipeline network and will only be considered on an individual basis, eg for isolated drains or culverts.

Backfilling, compaction and maintenance of the circular shape of the pipe is of paramount importance when laying thin walled pipes. The relevant specifications shall be adhered to. Drains to be constructed with thin walled pipe requires close supervision during construction.

Specific design shall apply for depths greater than 6m, or traffic wheel loads greater than 96 kN, using AS/NZS 2566 design method.

(iii) **Bedding**

Bedding metal shall consist of graded metal to the following sizes:

PVC: - chip or pea metal all passing 9.5mm sieve and all retained on 4.75mm sieve.

Concrete Pipe: - 18mm aggregate, with a minimum of 66% crushed,  
- all retained - 9mm mesh,  
- all passing - 18mm mesh.

Alternatively 6mm pea metal may be used as bedding metal. Alternative bedding chip may be used subject to approval by the Council.

For reinforced concrete pipes up to 600mm diameter and all PVC pipes, bedding conforming to Section 5.2 of AS 2032 shall be used unless otherwise approved by the Council.

For reinforced concrete pipes greater than 600mm diameter, Type B bedding, NZS 4452 shall be used unless otherwise approved by the Council. For all pipes the bottom of the trench shall be carefully hand trimmed to the correct line, grade and level and a bedding metal shall be provided, to a minimum thickness of 100mm under the pipe.

At the position of any collar, a hole shall be formed in the bedding so that the pipe barrel rests evenly on the bedding along its length.

The pipes shall be brought to true alignment and level before covering the pipes.

(iv) **Laying and jointing**

The end caps and inside of all new stormwater laterals must be painted with blue acrylic paint to help with future identification. (Note: sewer laterals are to be marked red). The actual work of pipe laying shall be done by a drainlayer approved by the Council.

A laser shall be used by the Contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipe laying work where possible.

Sight Boards and boning rods will only be approved on minor works, eg. infill subdivisions or on steep gradients.

The maximum deviation in level of pipe invert when laid shall be 5mm from design level.

The maximum horizontal deviation from a straight line shall be 10mm.

Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.

Joints shall be flexible and watertight.

Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out.

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- (v) **Cover**  
For minimum pipe cover requirements refer to Sec. III -15.
- (vi) **Manholes**  
Manholes shall be constructed in accordance with NCC Standard Drawings No. 21/ 204 sheets 1 to 8.
- All manholes shall be made watertight by effective sealing of manhole section joints with mastic sealant and around pipe entries and manhole rungs, using epoxy mortar. Manholes must be designed to resist uplift especially in areas where high ground water is experienced.
- All concrete pipes entering or leaving a manhole shall have one flexible joint within 500mm of the manhole and a second flexible joint within 3m of the manhole.
- All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole. Flexible Joints shall be 'Starters', 'Finishers' and short pipes complete with a socket.
- The channel through the manhole shall be formed with in-situ concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half-circle invert. Benching shall be steel float finished to give a regular smooth surface.
- All 1050mm diameter precast manholes of 1200mm depth and over shall be provided with plastic coated manhole rungs. The lowest rung shall be not less than 150mm or more than 450mm above the manhole benching.
- Cast in-situ manholes shall have rungs built in during construction.
- Manhole cover slabs and lids shall be designed for a 51kN wheel load (0.85HN). For manholes in State Highways the cover slabs lids may be required to be designed to full HN-HO-72 loading (60kN wheel load). The Designer must check with Transit NZ on this requirement.
- (vii) **Pipeline Connections**  
Minor pipelines are generally connected to major pipelines through manholes. Direct connection of minor pipelines to major pipelines is acceptable provided it is either through a suitable junction (i.e. a prefabricated and welded junction for large PVC diameter); or as detailed on NCC Standard Drawing No. 21/215 for connections to concrete pipes.
- Saddle junctions shall be formed by cutting the collar end off a pipe of sufficient length below the collar to enter the pipe wall fully without intruding into the main pipe. The hole in the main pipe shall be as neat as possible, and the "saddle" entry shall be neatly and securely epoxy mortared.
- (viii) **Sumps**  
Sumps shall be NCC standard back entry sumps constructed in accordance with NCC Standard Drawing No. 21/207 sheets 1 to 5.
- The tolerance for the location, alignment and level of a sump shall be as specified in Sec. III - 17 (a).
- (ix) **Trench Reinstatement**  
For requirements of backfilling and trench reinstatement within road reserve refer to Sec. X.

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# **SECTION IV**

# **SEWERAGE**

## **SECTION IV**

### **SEWERAGE**

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#### **IV – 1. GENERAL**

An Engineering Drawing including a longitudinal section shall be required for every public sewer drain of 100mm diameter or greater.

Sewerage disposal shall be provided to every allotment by means of a connection to a reticulated sewerage system wherever possible. On-site sewage disposal may be permitted in the rural or conservation zones subject to it being approved by the Council.

Generally the preferred pipe material for sewers will be PVC plain solid wall pipe complying with AS/NZS 1260.

PE (Poly Ethylene) pipe complying with AS/NZS 4130 may be used in specific circumstances e.g. for sleeving or relining existing sewer pipelines.

The extent of the Council's responsibility for public sewer is defined on NCC Standard Drawing No. 21/202.

##### **(a) Training**

To achieve long life and reliability of a sewer asset, various materials and standards are required in this section. However, asset performance is also dependent on correct handling and installation techniques of the material. To ensure that those carrying out the maintenance or installation of sewer reticulation that is owned or will be owned by the Nelson City Council are suitably trained the following will apply:

- (i) From 1 January 2005, at all times that work is being carried out on sewer reticulation at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Service Person) qualification.
- (ii) From 1 January 2006, at all times that work is being carried out on sewer reticulation and three or more personnel are working on site, at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Supervisor) qualification.
- (iii) From 1 January 2005 all laying of concrete pipes shall be carried out by an operator who has attended and passed an appropriate and approved concrete pipe-laying course.

#### **IV – 2. LOCATION AND ALIGNMENT OF PUBLIC SEWERS**

Consideration shall be given to minimising the possibility of surface water infiltration of the sewerage system by ensuring that surface openings shall not be located in secondary flood routes. In particular sewer manholes shall not be located adjacent to kerb and channel or at low points in the finished ground surface.

##### **(a) Sewers in Roads**

Sewer mains shall be aligned within public areas such as roads wherever possible.

Sewers in roads shall be aligned parallel to kerb lines within the carriageway to ensure that they do not clash with other services or occupy the full carriageway width. Adequate clearance from other services and kerb lines shall be maintained to allow for:

- (i) Excavation on existing services
- (ii) The future relaying of the drains
- (iii) The provision of additional future services.

In curved roads, sewers shall generally follow the road alignment in straight lines between manholes on such alignment that they do not occupy the full carriageway width.

##### **(b) Sewers through private property**

The catchment area to be served by public sewer mains aligned through private property shall be kept to a minimum.

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In planning the layout of sewers through private property consideration shall be given to preserving access to the pipelines for:

- (i) Maintenance purposes
- (ii) Preserving the route for relaying the sewers in the future
- (iii) Avoiding likely positions for buildings, garages, carports and retaining walls.

The preferred alignments of drains on private property shall be:

- (i) Within R.O.Ws. or driveways
- (ii) Outside probable building envelopes
- (iii) Clear of fencelines and kerblines
- (iv) Adjacent to boundaries
- (v) Parallel to boundaries

(c) **Easements Over Drains**

Where as part of a subdivision or development existing and/or proposed public sewer pipes will be located in private property an easement shall be required in favour of the Council. The minimum width of easement shall be 2.0m.

The standard wording required on Engineering Plans shall be:

“Memorandum Easement in Gross” shall be provided in favour of NCC to convey sewage in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work.”

(a) **Crossing Other Services**

Diagonal crossing of other services, including kerb lines and boundaries or fencelines, at acute angles less than 45 degrees shall be avoided wherever possible.

### **IV – 3. BUILDING OVER OR ALONGSIDE A COMMON PRIVATE OR PUBLIC SEWER**

Building over or alongside any Common, Private or Public Stormwater drain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

The engineering requirements for building over or alongside drains are as follows:

(a) **Structures:**

- (i) Must be located no closer than 1.0 metre measured horizontally from the centreline of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.
- (ii) Must be located no closer than 1.5 metres measured horizontally from the outside of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
- (iii) Which are balconies, may overhang the line of the pipe or drain, provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
- (iv) Which are located within 3 metres measured horizontally from the outside of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer)

- (b) Carports may be constructed over pipes or drains (but not watermains or other pressurized pipelines) provided that:
- (i) The foundations are located in accordance with (a) (iv) above; and
  - (ii) The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
  - (iii) The carport is not closed in; and
  - (iv) The floor is not concreted to a depth greater than 150mm; and
  - (v) An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that rules (ii), (iii) and (iv) (above) apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner's cost.
- (c) As an alternative to (a) and (b) above, structures may be located over common private or public drains, if they comply with the table below (Acceptable Techniques for Building Over Sewers).

Acceptable Techniques for Building Over Sewers

Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, and Inner City	Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential
<p>Structures may be located over common private or public sewer drains or pipes, if:</p> <ul style="list-style-type: none"> <li>i. There are no changes in direction or junctions in the portion built over; and</li> <li>ii. The pipe is proven to be in good condition by internal inspection or a water test; and</li> <li>iii. The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and</li> <li>iv. Where the diameter of the pipe is 300mm or less, the design and use of the structure is such that an appropriate sized excavator could readily gain access along the line of the pipe for maintenance and replacement work, or appropriate access is available for hand digging; or</li> <li>v. Where the diameter of the pipe is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe for maintenance and replacement work.</li> </ul>	<p>Structures may be located over common private or public sewer pipes, if:</p> <ul style="list-style-type: none"> <li>i. The diameter or width of the pipe is 150mm or less; and</li> <li>ii. The length of pipe built over is no more than 6 metres; and</li> <li>iii. There are no changes in direction or junctions in the portion built over; and</li> <li>iv. The length of pipe built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and</li> <li>v. There is practical access and the foundations are designed to allow the pipe to be readily exposed at both ends of the sleeve for maintenance and replacement work; and</li> <li>vi. There is a minimum 6-metre clear length at one end of the sleeve to allow replacement of the pipe.</li> </ul>

Detailed Engineering Drawings of the proposed work are required.

#### IV – 4. DETAILED REQUIREMENTS

- (a) All sewerage work shall be in accordance with Council requirements, and plans shall be in accordance with the Nelson City Council Engineering Standards "Drawings, Bonds and Certificates" (see Sec. II).
- (b) Under no circumstances shall a sewer be connected to a stormwater drain.
- (c) All systems shall be designed to accept the flow from upstream of the subdivision or development and shall be of sufficient capacity to provide for maximum flow from possible future development, as indicated by zoning in the Nelson Resource Management Plan.
- (d) A main sewer shall be provided in the full length of each new street, unless approved otherwise by the Council.
- (a) In all new subdivisions, a 100mm diameter sewer drain shall be provided to the boundary of every lot. This does not apply to sections fronting existing legal streets where these services are available in the street and are within 15m of the new boundaries provided that the drain will not cross any section other than the one being served.

In commercial and industrial subdivisions the lateral service connections may be omitted until the specific requirements of the consumer are known.

- (e) Road crossings shall be kept to a minimum number.
- (f) Each connection shall be adequate to serve the section.
- (g) To minimise the potential for a sewage overflow into private property the minimum lid level of any gully trap for all new dwellings shall not be less than 100mm above the lid level of the manhole on the public sewer immediately upstream of the lateral connection. The only exception to this requirement would be on hillsides or sloping land where compliance is not practical.

#### IV – 5. BASIS OF SEWER DESIGN - CALCULATION OF FLOW

In the majority of cases 150mm diameter reticulation sewers may be provided without calculation provided that the Council can be satisfied that not more than 150 sections will be served by this reticulation.

Sewerage flows shall be calculated using the area/zoning coefficients given below. The 'area' is that area within a zone comprising lots, roadways, esplanade reserves and neighbourhood parks. Major reserves such as Isel Park and Neale Park shall be excluded.

Where more than one zone contributes to the sewer to be designed the sewage discharge from each zone shall be calculated using the individual zone area multiplied by the appropriate discharge per hectare as for the total catchment area (not the individual zone area).

The total catchment discharge is the sum of the individual zone discharges as calculated above.

SEWAGE DISCHARGE COEFFICIENTS (litres per second per hectare)					
Residential Zone	Total Catchment Area (hectares)				
	0 to 2	Over 2 to 8	Over 8 to 80	Over 80 to 200	Over 200
Low Density	0.81	0.69	0.58	0.45	0.32
Normal Density	0.94	0.81	0.68	0.53	0.38
High Density	1.08	0.96	0.84	0.65	0.47

**NOTES:**

1. The catchment area is defined as the total gravity catchment upstream of the point being considered.
2. Several trunk gravity sewers discharging into one pump station shall be considered as separate catchments.
3. Discharge rates from pump stations may be accumulated but their catchment areas shall not be accumulated.
4. Industrial and commercial areas shall be treated as Residential Normal Density unless a greater rate of discharge is known.
5. The zones referred to in this table are as defined in the Nelson Resource Management Plan

**IV – 6. TRADE WASTE**

The discharge of trade waste into a sewer is subject to the current Nelson City Council Trade Wastes Bylaw. For any trade premises a specific application to discharge liquid wastes shall be made in accordance with the bylaw.

**IV – 7. DISCHARGE FROM OIL AND SILT TRAPS**

Effluent that contains a combination of detergent and/or degreasing agents with oil and/or silt shall be directed to the sewer after first passing through a silt and oil trap built to NCC Standard Drawing No.21/208. To ensure stormwater does not enter the sewer system the area being served by the silt and oil trap must be roofed and have a low bund around the perimeter with a minimum height of at least 50mm.

Any proposal to make such a discharge to the sewer system shall require a Trade Waste application.

In some locations a gravity connection to the sewer may not be possible and the discharge may have to be pumped into the sewer system. This shall require specific design and approval.

Bunded areas around fuel storage areas should discharge to the stormwater via a suitably designed oil interceptor with an appropriate shut off valve system to contain fuel spills.

Where it is considered that there is a high risk of yard runoff being contaminated with oil and silt, then an oil and silt trap shall be required with a connection to the stormwater system. This shall require specific design and approval. An appropriate mechanically or electronically operated wastewater diversion system may be required to be incorporated. Stormwater shall not be allowed to discharge to the sewer system.

Building consents are required for all works.

**IV –8. GRADES AND VELOCITIES**

**(a) Sewer Mains 150mm Diameter or Larger**

Where sewers are to be vested in the Council as public drains allowance shall be made for improved velocity and flow characteristics as detailed in the following table. These improved hydraulic performance requirements are to minimise future maintenance costs.

Data presented in the table below approximates a pipe roughness equivalent to  $k_s = 1.5\text{mm}$  for the "Colebrook White" formula or "rough concrete" for the Mears Water Flow Calculator.

The same roughness factor shall be adopted for all pipe materials to account for sewer slimes, grit deposits and other insitu variables such as construction performance and pipeline deterioration with age.

Nominal Size DN	Approx Internal Dia	Residential Units Served	Minimum Grade	Discharge Flowing Full	Velocity Flowing Full
150	150mm	1 – 5	1.25% - 1 in 80	18 l/s	1.0m/sec
150	150mm	6 – 10	1.00% - 1 in 100	16 l/s	0.9m/sec
150	150mm	11 – 19	0.80% - 1 in 125	14 l/s	0.8m/sec
150	150mm	20 – 150	0.67% - 1 in 150	13 l/s	0.7m/sec
175	190mm	150 – 200	0.67% - 1 in 150	24 l/s	0.84m/sec
175	190mm	200 – 500	0.40% - 1 in 250	18 l/s	0.64m/sec

DN = Dimension Nominal

Where velocity limits cannot be complied with, additional works may be required in order to obtain satisfactory operation of the system.

(b) **100mm Diameter Laterals**

Although the minimum permissible gradient for 100mm diameter private sewer drain shall be 1 in 120, in order to improve hydraulic performance and minimise future maintenance costs the minimum recommended gradient is 1 in 60.

**IV – 9. MANHOLES**

Manholes shall conform to NCC Standard Drawing No. 21/204 unless other detailed drawings are approved by the Council.

**IV – 10. FALL THROUGH MANHOLES**

Additional fall shall be provided through manholes where the gradient is 1 in 50 or less.

- (a) Straight through minimum fall 10mm
- (b) Angle less than 60 degrees minimum fall 20mm
- (c) Angle 60 degrees and over minimum fall 30mm
- (d) Junction minimum fall 30mm

**IV – 11. DISTANCE BETWEEN MANHOLES**

- (a) Normal maximum distance - 100m
- (b) Shorter distances required according to circumstances; e.g. on steep hillsides or to follow the horizontal alignment of road layout.

**IV – 12. MANHOLES REQUIRED**

- (a) At change of direction
- (b) At change of grade
- (c) At change of pipe diameter
- (d) At junctions of main drains
- (e) At the head of a main drain

**IV – 13. MINI-MANHOLES OR INSPECTION CHAMBERS**

Shallow mini-manholes shall be in accordance with the requirements set out on NCC Standard Drawing No. 21/204 sheet 6 or proprietary PVC or Polypropylene moulded products approved by the Council.

Mini-manholes are not to be used in areas subject to vehicular traffic, except in formed residential driveways or rights of ways for light domestic vehicles.

The use of mini-manholes is to be limited to:

- Manholes less than 1.0m deep,
- Maximum pipe sizes of 150mm diameter for sewers,
- Manholes at the head of a line,
- Straight through manholes,
- Changes of grade.

Concrete mini-manholes are not be used in sewers at junctions or deflections greater than 45 degrees.

#### **IV – 14. LAMP HOLE CLEANING EYES**

- (a) Lamp Hole Cleaning Eyes, LHCE may be used in lieu of manholes in any or all of the following circumstances:
- (i) Generally LHCE are for use on private property only.
  - (ii) Only one LHCE shall be permitted between manholes.
  - (iii) LHCE may be used at the head of a sewerage system.
  - (iv) LHCE may be used where access points are required at intervals of less than 50m.
  - (v) LHCE may be used at the top of steep banks where a standard manhole would be impractical.
- (b) LHCE shall not be approved for use within road carriageways, footpaths or berms.
- (c) For details of LHCE see NCC Standard Drawing No. 21/205 sheets 1 and 2.

#### **IV – 15. PIPE DIAMETER**

The minimum permissible diameter for a new public sewer aligned longitudinally in the road reserve shall be 150mm.

The minimum permissible diameter for all other new public sewers is 150mm except as detailed below.

When an Infill Subdivision, Development or Cross Lease Subdivision (hereinafter referred to as Infill Development) occurs in an area served by an existing 100mm diameter public sewer it shall be upgraded to 150mm diameter to the lesser requirement as follows:

- (a) To the point in the sewer where there are a maximum of five residential units being served by the 100mm diameter public sewer.
- (b) To the point of connection of the property being developed.

Where a 100mm diameter public sewer is required to be upgraded to 150mm diameter or where it is proposed to lay 100mm diameter public sewer, an Engineering Drawing including the longitudinal section shall be provided.

Where Infill Development results in existing private drain becoming public sewer the existing pipe shall be either:

- (a) Pressure tested to prove that it is sound or
- (b) Relaid.

In addition, surface opening access points shall be required at every change in direction or change in grade in a 100mm diameter public sewer. In general the minimum access point shall be a LHCE but mini-manholes or standard 1050mm diameter manholes may be required in appropriate circumstances.

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#### **IV – 16. COVER**

Generally shallow sewers, less than 1.2m in depth, shall be avoided. Shallow sewers limit the area which may be adequately serviced and limit the surcharge capacity in the case of blockage before overflow occurs.

**Pipe systems shall be designed to ensure the following minimum cover over the barrel:**

<b>Location of Drain</b>	<b>Minimum Cover Required PVC Pipe</b>
Areas subject to highway traffic loading e.g. within road carriageway	750mm
Areas subject to light traffic loading outside road e.g. ROWS, driveways, carpark and berms	600mm
Areas never subject to traffic loading	450mm
Under continuous concrete encasement for 100mm thick full circumference	300mm

Minimum cover may be reduced providing the pipe is concrete encased for concrete pipes and concrete capped for PVC and subject to the Council's approval.

Where pipes with inadequate cover require concrete encasement the extent and thickness of concrete and concrete strength shall be specified on the drawings. The minimum thickness of concrete encasement and capping shall be 100mm and the minimum concrete strength shall be 15MPa.

To avoid reflective cracking of pavements and differential settlement concrete encasement and capping shall not be permitted to penetrate the basecourse or pavement construction.

No concrete protection shall be placed around the pipe until the line has been inspected and approved by the Council.

PVC piping shall be protected with 6mm thickness of Denso tape or 250 microns polyethylene film or equivalent where adjacent to concrete.

Reduced cover on pipes may be approved providing the appropriate class of pipe is specified and cover is according to the pipe manufacturers specification.

#### **IV – 17. MAXIMUM DEPTH**

Generally deep sewers, exceeding 2.5m depth, shall be avoided. Over depth sewers may only be considered under exceptional circumstances.

#### **IV – 18. SUB-SOIL DRAINAGE OF SERVICE TRENCHES**

Adequate provision for draining all service trenches, including sewer trenches, on all hillsides as detailed on NCC Standard Drawing No. 21/212 shall be specified on the Engineering Drawings where applicable.

Similar requirements in conjunction with more extensive sub-soil drains may be necessary on flatter ground in wet areas.

#### **IV – 19. PRIVATE PUMPING STATIONS**

The Nelson City Council as the Network Utility Operator will not accept the discharge of septic sewage from small private pumping stations.

The only approved pumped systems shall comply with the following requirements.

- (a) Properly designed wet well pumping stations with macerator pumps serving industrial/commercial sites, which employ permanent staff capable of ensuring that adequate maintenance is carried out.

Adequate emergency procedures shall be established which precludes the possibility of uncontrolled overflow for whatever reason, eg power failure, and pump failure.

- (b) Self-contained miniature pumped systems will be approved providing the pump is only to serve a secondary amenity on a lot where the primary service shall be a gravity sewerage system.

#### **IV – 20. SEWERAGE CONSTRUCTION**

(a) **General**

All drainage pipelines shall be constructed in accordance with the requirements of AS 2032 and AS/NZS 2566: 1998.

(b) **Width of Trench**

The maximum width of trench, measured at the level of the top of the pipe shall not exceed a dimension equal to the external diameter of the pipe plus 300mm.

Excavation for manholes shall be only of sufficient size to leave adequate space for construction and for compaction of backfill.

(c) **Dewatering**

Excavations shall be kept free of water during construction.

In no circumstances shall stormwater or ground water be allowed to drain into any existing sewer, and pipe ends shall be plugged to prevent such ingress.

Discharge of stormwater or groundwater to existing stormwater drains or the pipes already laid will be permitted providing adequate silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Landowner or the Contractor such deposits shall be cleared forthwith at the Landowner's or the Contractor's cost as the case may be.

Ground water lowering may be permitted except where this practice may present a risk of subsidence.

The Contractor or Landowner shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

(d) **Construction**

(i) **Concrete**

All materials and workmanship in mass or reinforced concrete shall be in conformity with NZS 3109, and structural concrete shall have a minimum crushing strength of 20 MPa at 28 days.

(ii) **Pipes**

Generally, sewers shall be PVC plain solid wall, rubber ring jointed pipes and fittings complying with AS/NZS 1260:1999 PVC pipes and fittings for drain, waste and vent applications.

The following classes shall apply:

- DN 100mm diameter shall be minimum stiffness class SN 10 for public sewers and SN 6 for private sewers.
- DN 150mm diameter shall be minimum stiffness class SN 8 for public sewers and SN 4 for private sewers.
- DN 175mm and larger shall be minimum stiffness class SN 4 for public and private sewers.
- Specific design shall apply for depths greater than 6m, or traffic wheel loads greater than 96 kN, using AS/NZS 2566 design method.

- (iii) **Bedding**  
Bedding metal shall consist of graded chip or pea metal all passing 9.5mm sieve and all retained on 4.75mm sieve.  
Alternatively 6mm pea metal may be used as bedding metal.  
Alternative bedding chip may be used subject to approval by the Council.  
Bedding conforming to Section 5.2 of AS 2032 shall be used unless otherwise approved by the Council. The bottom of the trench shall be carefully hand trimmed to the correct line, grade and level and bedding metal shall be provided, to a minimum thickness of 100mm under the pipe.  
At the position of any collar, a hole shall be formed in the bedding so that the pipe barrel rests evenly on the bedding along its length.  
The pipes shall be brought to true alignment and level before covering the pipes with pea gravel or bedding metal to a minimum depth of 150mm over the barrel of the pipe.
- (iv) **Laying and jointing**  
The end caps and inside of the end of all new sewer laterals must be painted with red acrylic paint to help with future identification. (Note: stormwater laterals are to be marked blue).  
The actual work of pipelaying shall be done by a drainlayer approved by the Council.  
A laser shall be used by the Contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipelaying work where possible.  
Sight Boards and boning rods will only be approved on minor works, e.g. infill subdivisions, or on steep gradients.  
The maximum deviation in level of pipe invert when laid shall be 5mm from design level.  
The maximum horizontal deviation from a straight line shall be 10mm.  
Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.  
Joints shall be flexible and watertight.  
Pipes shall be kept clear of dirt, or debris, and any pipes that contain such matter shall be required to be cleaned out.
- (v) **Cover**  
For minimum cover requirements refer to Sec IV - 16.
- (vi) **Manholes**  
Manholes shall be constructed in accordance with NCC Standard Drawing No. 21/204 sheets 1 to 8.  
All manholes shall be made watertight by effective sealing of manhole section joints with mastic sealant and around pipe entries and manhole rungs using epoxy mortar. Manholes must be designed to resist uplift especially in areas where high ground water is experienced.  
All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole. Flexible Joints shall be 'Starters', 'Finishers' and short pipes complete with a socket.

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The channel through the manhole shall be formed in insitu concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half-circle invert. Benching shall be steel float finished to give a regular smooth surface. All manholes of 1200mm depth and over shall be provided with plastic coated manhole rungs. The lowest rung shall be not less than 150mm or more than 450mm above the manhole benching.

Cast insitu manholes shall have rungs built in during construction.

Manhole cover slabs and lids shall be designed for a 51kN wheel load (0.85HN). For manholes in State Highways the cover slabs lids may be required to be designed to full HN-HO-72 loading (60kN). The Designer must check with Transit NZ on this requirement.

(vii) **Testing**

All sewers shall be tested in accordance with NZS 4452 Section 11.

(viii) **Trench Reinstatement**

For requirements for backfilling and trench reinstatement within roads refer to Sec. X.

## **IV – 21 PIPELINE TRACER TAPE**

(a) **Requirement**

The location of all pumping mains and gravity pressure mains (swallows) shall be marked with a foil tape buried in the trench.

(b) **Tape**

The tape shall be 50mm wide woven reinforced with acid and alkali resistant polythene plastic with a solid aluminium foil core which shall be visible from both sides. "ThorTec™" tape is an accepted product.

The foil shall be continuously printed with "CAUTION SEWER MAIN BURIED BELOW", with no inks or printing extending to the edges of the tape. All printing shall be encased to avoid ink rub-off.

The adhesives that bond the protective plastic jacket to both sides of the foil shall be applied directly to the film and foil layers to provide a continuous seal.

(c) **Installation**

The tape shall be buried above the centre line of the pipe within 300mm to 400mm from the finished surface. Refer NCC Standard Drawing No. 21/401.

All joints in the tape (eg Roll ends, accidental breaks and at tees) shall be made electrically conductive with purpose made splice clips installed to the specific manufacturer's instructions. Tying together of the tape ends is not acceptable as the polythene coating will prevent electrical conductivity.

The tape shall be brought up inside the surface box risers at all valves and hydrants with a 300mm long tail so that pipe location equipment can be readily connected.

(d) **Tracer Wire**

When a pumping main or swallow pipe is installed by a directional drilling technique or bored through the ground for a distance exceeding 20 metres, the pipe shall have a 'Tracer Wire' attached. This wire shall take the form of a continuous 2.5mm<sup>2</sup> multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0m intervals.

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**SECTION V**

**DRAINAGE IN PRIVATE  
PROPERTY**

**SECTION V**  
**DRAINAGE IN PRIVATE PROPERTY**  
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## **V – 1. GENERAL**

Drainage required to serve private properties, buildings or site works must comply with the Building Act 1991 and subsequent amendments thereto and conform to the requirements of the Building Industry Authority Approved Documents.

### **(a) Training**

One of the biggest causes of premature footpath and road failure is inappropriate trenching and backfilling methods. This can lead to cracking, settlement and water ingress to the formation resulting in significant failures which are an inconvenience to pedestrians and motorists and expensive to repair. To ensure that those carrying out drainlaying in legal road formation that is owned or will be owned by the Nelson City Council are suitably trained, the following will apply:

- (i) From 1 January 2005 at all times that trenching or backfilling is being carried out, at least one member of the contractors staff on site shall have the National Certificate in Road Opening qualification.

## **V – 2. BUILDING/RESOURCE CONSENT**

All drainage work on private property shall require a Building Consent and may require a Resource Consent issued under the Resource Management Act 1991 by the Planning and Consents Division of the Council, e.g. piping any watercourse.

## **V – 3. ENGINEERING DRAWINGS**

Any application for Consent for drainage work requiring a pipe size of 150mm or greater shall include Engineering Drawings to be submitted for approval.

The Engineering Drawings shall comply with Section 11 of these Engineering Standards, "Drawings, Bonds and Certificates".

Where the work is on private property and considered by the Council to be of a minor nature the requirement for the Engineering Drawings to be prepared by a qualified and experienced Designer may be waived.

## **V – 4. REGISTERED DRAINLAYER**

A condition of the Consent shall be that the work shall be carried out by a registered drainlayer.

## **V – 5. NEIGHBOURS CONSENT - DRAINLAYING IN ANOTHER PROPERTY**

Where drainlaying is required on another property the owners consent shall be endorsed on the original transparency in opaque black ink that will permit satisfactory microfilm reproduction. Note that biro will not microfilm satisfactorily.

## **V – 6. APPROVED OUTFALL**

Individual house/site stormwater shall be discharged by piping to one of the following approved outfalls.

- (a) Stormwater pipe
- (b) Watercourse
- (c) Kerb Entry
- (d) Bubble-Up sump
- (e) Soakaway (applicable only in Stoke, The Wood or The Brook areas within urban zones).  
For specific soakage requirements refer to Section III - 4 (g) and NCC Standard Drawing No 21/209

Options (a) to (e) are listed in order of preference. A lesser option will only be considered if a more preferable option is not economically feasible.

**V – 7. BUILDING OVER OR ALONGSIDE A PUBLIC OR PRIVATE COMMON DRAIN**

Building over or alongside any Common, Private or Public Stormwater or Sewer Drain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

The engineering requirements for building over or alongside drains are as follows:

- (a) Structures:
  - (i) Must be located no closer than 1.0 metre measured horizontally from the centreline of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.
  - (ii) Must be located no closer than 1.5 metres measured horizontally from the outside of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
  - (iii) Which are balconies, may overhang the line of the pipe or drain, provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
  - (iv) Which are located within 3 metres measured horizontally from the outside of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer)
- (b) Carports may be constructed over pipes or drains (but not watermains or other pressurized pipelines) provided that:
  - (i) The foundations are located in accordance with (a) (iv) above; and
  - (ii) The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
  - (iii) The carport is not closed in; and
  - (iv) The floor is not concreted to a depth greater than 150mm; and
  - (v) An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that rules (ii), (iii) and (iv) (above) apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner's cost.
- (c) As an alternative to (a) and (b) above, structures may be located over common private or public drains, if they comply with the table below (Acceptable Techniques for Building over Sewers).

## Acceptable Techniques for Building Over Sewers or Drains

Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and recreation, and Inner City	Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential
<p>Structures may be located over common private or public sewer or stormwater drains, if:</p> <ul style="list-style-type: none"> <li>i. There are no changes in direction or junctions in the portion built over; and</li> <li>ii. The drain or pipe is proven to be in good condition by internal inspection or a water test; and</li> <li>iii. The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and</li> <li>iv. Where the diameter or width of the pipe or pipe equivalent (in the case of a drain) is 300mm or less, the design and use of the structure is such that a an appropriately sized excavator could readily gain access along the line of the pipe or drain for maintenance and replacement work, or appropriate access is available for hand digging; or</li> <li>v. Where the diameter or width of the pipe or pipe equivalent (in the case of a drain) is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe or drain for maintenance and replacement work.</li> </ul>	<p>Structures may be located over common private or public sewer or stormwater drains, if:</p> <ul style="list-style-type: none"> <li>i. The diameter of the drain is 150mm or less</li> <li>ii. The length of drain built over is no more than 6 metres.</li> <li>iii. There are no changes in direction or junctions in the portion built over.</li> <li>iv. The length of drain built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe.</li> <li>v. There is practical access and the foundations are designed to allow the drain to be readily exposed at both ends of the sleeve for maintenance and replacement work.</li> <li>vi. There is a minimum 6-metre clear length at one end of the sleeve to allow replacement of the pipe.</li> </ul>

Alternatives may be considered as a Discretionary Activity if application is made for Resource Consent.

Detailed Engineering Drawings of the proposed work are required.

The preferred alignments of drains on private property shall be:

1. Within ROWs or driveways
2. Outside probable building envelopes
3. Clear of fence lines and kerb lines
4. Adjacent to boundaries
5. Parallel to boundaries

Where main drains must be aligned through private property, easements in favour of the Council may be required.

## **V – 8 SUB-SOIL DRAINS**

Sub-soil drains shall terminate at a sump, manhole or other chamber as approved by Council.

Sub-soil drains shall not be considered as part of the surface water drainage system.

To avoid the appearance of seepage in dry weather sub-soil drains shall not discharge to the kerb and channel if an alternative receiving drain exists.

Sub-soil drainage shall not be a general requirement for a permeable retaining wall such as a crib wall or timber pole wall but there are situations where sub-soil drainage of permeable walls shall be required.

- (a) Where walls have a back sloping below ground footing where water may be trapped.
- (b) Where seepage from a retaining wall may cause a nuisance to an adjoining property owner.
- (c) Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly.
- (d) Where a retaining wall is being built in an area of suspect stability and the removal of surface/ground water would be an advantage.

## **V – 9 PRIVATE PUMPING STATIONS**

The Nelson City Council as the Network Utility Operator will not accept the discharge of septic sewage from small private pumping stations.

The only approved pumped systems shall comply with the following requirements.

- (a) Properly designed wet well pumping stations with macerator pumps serving industrial/commercial sites which employ permanent staff capable of ensuring that adequate maintenance is carried out.

Adequate emergency procedures shall be established which precludes the possibility of uncontrolled overflow for whatever reason, eg power failure, and pump failure.

- (b) Self-contained miniature pumped systems such as the "Sani" - range will be approved providing the pump is only to serve a secondary amenity on a lot where the primary service shall be a gravity sewerage system.

## **V – 10 EASEMENTS OVER DRAINS**

Where, as part of a subdivision or development, proposed stormwater pipes greater than or equal to 300mm diameter or public sewers will be located in private property an easement shall be required in favour of the Council. The minimum width of easement shall be 3.0m.

The standard wording required on Engineering Plans shall be:

“Easement in Gross shall be provided in favour of NCC to convey stormwater in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work”.

Similar easements may be required over the other private common drains in favour of the lots served.

*January 2003*

# **SECTION VI**

# **STREETWORKS**

**SECTION VI**  
**STREETWORKS**  
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(Note: For parking details, refer to Nelson Resource Management Plan)

## VI – 1. GENERAL

Roads and Rights of Way shall conform to the general pattern of roading within the City, and they shall comply with all the requirements of any notified or operative District Plan prepared by the Council under Authority of the Resource Management Act 1991.

The streets shall fit in with existing streets, shall be designed to avoid cross intersections wherever possible, shall be extended to the boundaries of the owner's land where the street will require to be ultimately extended into the adjoining land, and a temporary turnaround of 7 metres radius shall be constructed.

## VI – 2. STREET AND CARRIAGEWAY WIDTHS

Minimum street and carriageway widths shall be as defined in table VI - I and may only be varied with a Resource Consent.

## VI – 3. FORMATION

### (a) Compliance

#### (i) Design Period

The carriageway pavement shall be designed to a 25-year design period. If a method of construction other than the standard Transit New Zealand (TNZ) specifications is to be used then this method shall be required to achieve the specified design life.

#### (ii) Method of Compliance

The Designer shall nominate his method of construction for approval by the Council.

If the Designer wishes to use a method of construction other than the standard TNZ specifications then full details of the construction method including programming, plant, etc shall be submitted to the Council for approval. The Designer shall also submit details of where the nominated alternative construction method has previously been employed together with performance details, acceptance testing results and an independent reference in support of this method.

If no specific alternative construction method is nominated and approved by the Council then all works shall comply with the following TNZ Specifications:

Earthworks	TNZ Specification F/1
Subsoil Drains	TNZ Specification F/2
Pipe Culverts	TNZ Specification F/3
Basecourse Aggregates	NCC Specification (NCC Standard Drawing No. 21/300), TNZ Specification M/4 or Transit New Zealand (TNZ) Specification 1990 (Nelson 1)
Sealing Binder	TNZ Specification M / 1 & M / 13
Binder Application	TNZ Specification P/3
Scaling Chip	TNZ Specification M/6
Asphaltic Concrete	TNZ Specification M/10
Paving	TNZ Specification P/9

## VI – 4. ROAD ASSESSMENT MAINTENANCE MANAGEMENT (RAMM) DATA

The Designer shall submit a completed Road Assessment Maintenance Management (RAMM) Data Sheet (see Appendix 2, this section) to the Council for each separate job or section of a continuing job which involves road construction. This shall be submitted at the As Built engineering plan stage.

## VI – 5. FORMATION WIDTH

Where the work needed to provide the formation width extends outside the standard road reserve width the legal road boundary shall be adjusted to accommodate any retaining structure necessary to support the road or adjacent property. This shall include batter slopes steeper than 1.5 horizontal to 1.0 vertical

## VI – 6. GEOMETRICAL DESIGN OF CARRIAGEWAYS

### (a) Design

The geometric design of roads with particular reference to vertical curves, horizontal curves, super-elevation and intersections shall be based on the following TNZ approved documents:

Intersections at Grade (guide to traffic engineering practice) Austroads 1988 part 5;

Rural Road Design (guide to the geometrical design of rural roads), Austroads 1989.

Both of these documents are to be read in conjunction with TNZ supplements issued from time to time to amend any criteria to suit New Zealand conditions and practices.

With regard to the use of the Rural Road Design manual, some modifications and extrapolations may be necessary to suit Residential situations. This guide has been included as it is the current design document for horizontal and vertical curvature, super elevation and curve widening.

Generally at road intersections it is important to ensure that the crown of the intersecting road does not extend out into the carriageway of the through road, to maintain driver safety

### (b) Gradients

In general, road gradients shall not be steeper than 1 in 8 for residential streets and 1 in 20 for heavy traffic routes. In particular cases, steeper gradients may be permitted over short lengths, but the Council reserves the right to impose special conditions of construction. Grades shall be as long as possible and vertical curves provided at all changes of grade. Minimum/maximum gradients shall apply to the inside of any curves.

**Note:** Minimum gradient on a kerb shall be 0.25%, 1 in 400. Centreline gradients are not acceptable even in cases where the channel gradients may be nearly identical.

### (c) Crossfall on Carriageway

Normal crossfall of 1 in 33 (3%) in both directions from the crown shall be developed on all standard carriageways. The shape of the carriageway shall conform to the Camber Table, NCC Standard Drawing No. 21/307. However, where the kerb levels differ for design purposes, crossfalls varying from 1 in 50 to 1 in 25 (2% to 4%) from the crown may be permitted, coupled with a lateral shift in crown position of up to one quarter of the effective road width. Where a uniform crossfall is developed from kerb to kerb, this shall not be flatter than 1 in 50 (2%), unless on a curve, where super-elevation may be permitted.

### (d) Super-Elevation

Super-elevation will not normally be required or permitted in 50km/h zones or areas that in the opinion of the Engineer are likely to become 50km/h zones.

On hillside development super-elevation may be employed where it suits boundary levels up to the allowable design maximum crossfall. However, certain main routes may in the future have an increased speed limit. If this change is a possibility, the Council may require super-elevation to be constructed to a speed value nominated at the time of the request. The maximum crossfall shall not exceed 1 in 12 (8%) where uniform crossfall is developed.

(e) **Kerblines**

Generally, kerbs shall be at the same level on both sides of the street. However, in special circumstances, the left and right hand kerb lines may be better graded individually in conjunction with centre line levels, footpath levels and boundary levels. Under such circumstances, at a given cross section, the left and right hand kerbs may differ from each other in level, provided the following standard design tolerances are not exceeded:

Width of Carriageway	Maximum Difference in Kerb Level
7m	120mm
9m	150mm
11m	180mm
12.4m	200mm
13.4m	225mm

This allows for a shift in the crown to approximately the quarter point, while maintaining a 3% crossfall.

(f) **Curves (and Turning Heads)**

Curves in 50km/h areas may be circular with a minimum radius of 40 metres on the centreline. The Council may approve a speed value of 25km/h or 25 metre circular radius for streets classified as types VI, VII or VIII in table VI - 1.

If reduced radii are approved, widening shall be applied to the inner edge of such curves in accordance with the aforementioned design guides. In areas that could have a higher speed value in the future, the Council may require transition curves with a specified speed value.

At intersections, the kerblines shall have a minimum radius of 6 metres, except at major intersections, when the Engineer may require a larger radius. The minimum radius of the turning circle of a cul-de-sac shall be 7 metres in residential areas and 11 metres in commercial or industrial areas. For residential culdesacs on steep hillsides the turning area may be a 'Hammerhead' or 'Fishtail' layout provided it is sufficient to allow a 90 percentile 2 axle HCV to undertake a three point turn.

(g) **Slope of Berms**

The normal slope of the grass berms from kerb to boundary shall be 1 in 33 (3%). This slope may vary, but shall not be less than 1 in 50 (2%) nor more than 1 in 12 (8%).

In all cases, the crossfall on the footpath shall not vary outside the limits of 1 in 33 (3%) to 1 in 50 (2%).

Where it becomes necessary to have a berm steeper than 1 in 12, it shall be necessary to produce design gradients for individual property access to show that these may be satisfactorily negotiated for a private car, as defined in AP10.4 of the Nelson Resource Management Plan for clearance at sag or summit crossings.

(h) **Batters**

No batter in either cutting or filling shall be steeper than 1.5 horizontal to 1 vertical (33 degrees) without the approval of the Engineer, and in certain cases, a soils report will be required to establish the safe batter slope. On the flat, the bottom edge of the fill batter or the top of a cut batter shall start at least 600mm on the roadside of the property boundary. For hillside subdivisions, the toe of the cut batter may start 1 metre from the kerb or back of footpath, and the top of the fill batters may start 1 metre from the kerb or back of footpath (see NCC Standard Drawing No. 21 /305) providing the requirements of table VI-1 are complied with. Where conditions indicate, crib walls or benching may be required. Where cribs or other walls are required, certified design plans for any such walls shall be submitted and a building consent obtained.

- (i) **Stormwater Drainage**  
All stormwater from the carriageway and footpaths of residential roads and right of ways shall be collected by the use of sumps and piped to an approved stormwater system.  
See Sec. III - 17 for details on sumps.
- (j) **Staged Developments**  
Where a street is developed in stages a turning area shall be provided at the end of the construction or within at least 20m of the end of the road. The pavement shall be formed to the same standard as the street and permanently surfaced to provide an area sufficient to allow a 3-point turn by a 90 percentile 2-axle truck.  
There shall be no requirement for kerb channels and paths to this area.  
Provision shall be made to control stormwater, including the construction of open channels to intercept surface runoff and direct it to an approved stormwater system.

## **VI – 7. EARTHWORKS**

- (a) **Planning and Regulation Requirements**  
Land disturbance and earthworks activities are the subject of rules within Plans prepared by the Nelson City Council under the Resource Management Act 1991.  
Before planning or commencing any such activities the Designer is required to contact the Resource Management Department of the Nelson City Council to determine what rules apply and whether Resource Consent will override the following requirements.
- (b) **Resource Consents**  
Where Resource Consents are required they shall be a condition of approval of the scheme plan and no work is to start until the Resource Consent has been obtained.
- (c) **Site Clearance**  
Prior to the commencement of any earthworks, the Designer shall submit an Erosion and Sedimentation Control Plan to the approval of Council.
- (d) **Topsoil Stripping**  
All topsoil shall be stripped from the earthwork areas with the stripped area being kept to the practical minimum at any one time. Strippings shall be stockpiled in order that they can be respread (except on roadways) immediately after land forming and grassed down when climatic conditions are first favourable. Topsoil is defined as that layer of the surface earth containing humus and organic matter in which plant life can be grown and which is of no structural value.
- (e) **Unsuitable Material**  
All unsuitable material uncovered during stripping or earthworks shall be excavated. Material that can be treated to improve its properties to within earthworks limits may be reused, but materials such as peat shall be removed from the site. Unsuitable material is generally described as any material having a California Bearing Ratio (CBR) value of 3 or less, but the final decision on suitability remains with the Council. Where an area has been undercut to remove unsuitable material, that area shall be filled with general fill material and compacted in accordance with Sec. VI - 8.
- (f) **Stormwater Control**  
Due to the increased rate of run-off brought about by the denuding of the ground of its natural growth in mass earthworks, particular care shall be taken to control stormwater, and to ensure that it is permitted free entry to stormwater culverts at all times. The designer shall be responsible for ensuring that all works shown on the approved Erosion and Sedimentation Control Plan are constructed and maintained during the construction period of the work, and until such times as the land becomes stabilised to the satisfaction of the Council. Any of the Council's stormwater systems obstructed by silt shall be thoroughly cleaned by the Landowner on which the development is taking place at the Landowners cost.

## VI – 8. PLACEMENT OF FILLING (See NZS 4431)

### (a) **General**

The following criteria may be modified where the designer is, or employs the services of a person who specialises in slope stability and soils engineering.

The fill material shall be spread and compacted in uniform homogeneous layers. In road reserves, the material shall be spread parallel to the length of the road. See III-10 for minimum ground levels.

### (b) **Compaction Against Existing Slopes**

In areas of unenclosed filling, where the original ground has a slope steeper than 1 in 2.75 (20°), the original ground surface shall be properly benched before any material is placed against it. The benches shall be of sufficient width to accommodate compaction and spreading equipment, and shall be arranged so as to be adequately drained during the placement of filling material.

### (c) **Depth of Layer**

The depth of the layer shall be related to the type and model of compaction plant proposed to be used and the type and size of material.

The Designer shall nominate the proposed layer depths and plant, and may be required to supply supporting documentation that shows that the proposed compaction method is compatible with the material being used.

When no information is supplied the following shall apply:

- (i) In the carriageway within 500mm of the finished subgrade, the layers shall be spread and compacted to a loose depth not exceeding 150mm.
- (ii) Elsewhere, the layers shall be spread and compacted to a loose depth not exceeding 200mm.

### (d) **Moisture Content**

The material shall at all times be placed at a moisture content close to the optimum moisture content for the material under consideration. The allowable tolerance shall be decided by the Designer for individual cases, but in general shall not exceed the limits of minus 4% or plus 2%. The Designer shall be responsible for supplying a test certificate, quoting optimum moisture contents of the materials encountered on the work.

### (e) **Standard of Compaction**

The Designer shall ensure that the following minimum percentages of maximum dry density of the material are obtained. The maximum dry density shall be obtained by standard compaction at optimum moisture content as detailed in NZS 4402.

#### **Minimum % of Maximum Dry Density**

Heavy Clay Silt, Sandy Clay and Gravel	Sands
95%	100%

Within the carriageway the criteria for sec. VI-10, structural design of pavement shall take precedence over standards of compaction given in this clause.

### (f) **Routine Testing**

Routine testing shall be carried out on earthworks at the rate of one test every one metre depth of filling spaced at 30 metre grid points over the area concerned.

The results of these tests shall be supplied to the Council. All tests prior to and during construction shall be carried out by or under the supervision of a Designer experienced in soil compaction techniques. The Council may carry out further tests at any stage if it considers them necessary.

### (g) **Stability of Embankments**

Where in the opinion of the Council the stability of any embankment as planned is in doubt, then the council may require a stability analysis of the slope, under saturated condition to be carried out.

- (h) **Exemption from the above requirements**  
Where the area of fill does not exceed 100m<sup>2</sup> and the depth does not exceed 600mm maximum, the above requirement concerning testing (Sec. VI-8 (f)) will not be enforced.

#### **VI – 9. MASS EARTHFILLS FOR RESIDENTIAL AREAS**

Where a large earthfill exceeding the limits in Section VI - 8 (h) is proposed, the Council shall require the following information, in addition to any requirements under Sec. VI - 7 and 8.

- (a) A plan showing the contours or levels of the existing site, final contour levels, the existing watercourses, together with any available information on the water table and the ground surface of the area concerned, and logs of any bores taken during investigations.
- (b) A pattern of sections showing the extent of cut and fill and a plan showing batter slopes, drainage or culverting.
- (c) The naming of a Designer experienced in soil compaction techniques, who will be responsible for supervising and controlling the operations on the site as set out in the specification.
- (d) A specification on the compaction methods and degrees of compaction required, also giving moisture/density test results of the soil to be encountered.
- (e) On completion of the earthworks certificates shall be supplied from the Designer, stating that the requirements of the specification have been carried out and giving details of the test results in accordance with the requirements of the specification.

#### **VI – 10. STRUCTURAL DESIGN OF PAVEMENT**

(a) **General Requirements**

The pavement shall be designed in accordance with recognised techniques that include, but are not limited to those listed below.

- (i) CBR Method (CBR design curves are given on NCC Standard Drawing No. 21/301sheet 2 or TNZ State Highway Pavement Design and Rehabilitation Manual.)
- (ii) Scala/Dynamic Cone Penetrometer (Design curves are given on NCC Standard Drawing No. 21/301 sheet 3).
- (iii) Design method based on Benkleman beam deflections (Design curves are given on NCC Standard Drawing No. 21/301 sheet 1).

The Designer shall state the method used and may be requested to supply information to support the design method.

(b) **Submission of Test and Design Data**

The following information shall be submitted at the same time that Engineering Drawings are submitted for approval.

- (i) All test information obtained to provide a basis for pavement design.
- (ii) Copy of design calculations used to determine pavement thickness.

(c) **Minimum depth of Construction Metal Course**

The minimum metal depth shall be 200mm in streets, roads and commercial/industrial Rights Of Way and 150mm for residential Rights Of Way.

(d) **Stabilisation of Construction Courses**

The Designer may choose to use stabilising agents on the construction courses to reduce the depths required. The Designer shall supply supporting information and test results to prove the type and quantity of stabilising agent is compatible with the type of material and projected use of the road.

The Designer shall indicate relevant experience in this field and also supply information on the experience of the proposed contractor.

This design option shall only be permitted after consultation with and approval by the Council.

(e) **Filter Fabrics/Geotextiles**

Depending on the ground conditions, a layer of filter fabric/geotextile may be required to separate the subgrade from construction courses. The filter fabric/geotextile used shall be carefully chosen to achieve the desired results.

The use of geotextiles as a structural element of the pavement design shall only be permitted after consultation with and approval by the Council.

(f) **Acceptance Criteria**

(i) **Pavement Strength**

The Designer shall nominate a method of testing to be used to demonstrate that the construction is within the design criteria. This testing shall be carried out immediately prior to the surfacing of the pavement.

If no method is nominated or approved by the Council then the method of testing for compliance with the pavement design standard shall be the carrying out of Benkleman Beam tests. The maximum allowable deflections shall comply with the following table.

Description	Road type*	Maximum Deflection
Arterial	I	0.8mm
Principal	II	1.0mm
Major Residential/Industrial	III	1.3mm
Minor Residential/Rural	IV-VII	1.5mm
Minor Cul-de-Sac	VIII	1.8mm
Private Access	IX, X, XII	2.0mm
Private Access	XI	NA
Indust/Comm Private Access	XIII-XV	1.5mm

- not more than 5% of the tests shall exceed the maximum as set out in the above table
- no single result shall exceed the maximum allowable by more than 50%
- any area of excessive deflection shall not exceed 5.0 square metres.

\* For road classification details see table VI - 1.

Where any areas of the carriageway fail the acceptance testing the Designer shall nominate his proposed remedial action for approval by the Council.

If required by the Council the failed areas shall be dug out and clean sub-base and or basecourse compacted in the excavation, and the surface prepared for sealing.

A further set of tests shall be carried out to show that the affected area is up to the required standard.

(ii) **Road Profile**

The finished shape of the road shall be such that when a straight edge is laid parallel to the centre line of the road or a camber board laid perpendicular to the centre line, the surface shall not vary from the straight edge or camber board by more than 10mm in any 3-metre length.

Prior to sealing, the surface of the road shall be clean, reasonably dry, and free of ice, frost, or loose material, tightly compacted and shall present a clean mosaic appearance. All concrete surfaces, channels, sump surrounds, service boxes, manholes etc shall be completed to their final height to fit the finished (sealed) road profile. All service boxes and manhole lids shall be finished to within 5 to 10mm above the finished (sealed) road profile.

**VI – 11. SUBGRADE CHECKING**

Where the extent of cut or fill for the project is too great to make subgrade CBR testing feasible at the design stage it may be done on completion of earthworks when subgrade levels have been exposed. Even in cases where subgrade has been tested as part of the design its condition shall be reviewed on exposure during construction and pavement thicknesses adjusted accordingly.

The results of such testing and/or review along with consequent adjustments to pavement layer thicknesses shall be advised to the Council before placing of pavement layers commences.

**VI – 12. SUBGRADE DRAINAGE**

This shall be a 100mm diameter or equivalent proprietary sub-soil drainage system surrounded by bedding chip.

(a) **Sub-soil Drains in Cuts (on hillside subdivisions)**

When the road or right of way is in cut, a sub-soil drain shall be placed at the toe of the batter and connected into the back of the nearest sump downstream.

(b) **Wet Spots in Subgrade**

Any permanent wet spot in the subgrade or any area undercut below adjacent sub-soil drains shall be connected to the nearest piped stormwater system by another sub-soil drain. Where the drain is located under the carriageway, traffic loading shall be taken into consideration for the type of pipe.

(c) **Subgrade Drainage Systems**

In some cases, it may be necessary, due to the nature of the country, to lay an extensive sub-soil drainage system. In such a case, the material covering the pipes shall be graded upwards so that particles cannot enter the pipes. In general, to satisfy the condition that particles do not enter the pipe and no scour occurs in the "filter", the following ratios must be complied with: (Alternatively a suitable filter cloth lining the subsoil trench may be used)

- (i)  $\frac{\text{85\% size of filter material}}{\text{Size of opening in pipe}} \geq 2$
- (ii)  $\frac{\text{15\% size of filter material}}{\text{85\% size of protected soil}} \leq 5$
- (iii)  $\frac{\text{15\% size of filter material}}{\text{15\% size of protected soil}} \geq 5 < 40$

It shall be necessary in most cases to manufacture a suitable filter material to comply with the above requirements.

## VI – 13. KERB, CHANNEL, FOOTPATHS

### (a) **Kerbing and Channelling**

Kerb and channel shall be provided on both sides of the carriageway in all subdivisions.

#### (i) **Excavation and basecourse**

If unsuitable soil conditions are encountered at the base of kerb and channel excavations the site shall be trenched out below this depth and backfilled with gravel or other approved fill material in layers of a thickness that is compatible with the type of compaction equipment and material being used. Compaction shall be to a minimum of 98% of maximum dry density. A minimum depth of 50mm of compacted base course shall be placed under the kerb and channel.

#### (ii) **Concrete**

All concrete shall be mixed using separately graded fine and coarse aggregates in a power-driven weight batch mixer, or it may be supplied by an approved "ready mix" concrete works. In either case, the concrete shall comply with specified requirements of High Grade Concrete in NZS 3108 that is, have a minimum cement content of 362kg per cubic metre and a maximum water/cement ratio of 0.52, giving a minimum specified crushing strength at 28 days standard cured of 27.5 MPa.

#### (iii) **Formwork**

Slip forming of the kerb and channel is generally acceptable provided the standard of work produced by an individual machine has been approved by the Council.

Formwork for kerb and channel shall be approved dressed timber, steel or aluminium alloy sections adequately oiled or otherwise treated to allow ease of striking without staining of the stripped concrete surface. All formwork shall be accurately placed to the lines and levels of the works and shall be such as to give the finished kerbs smooth and pleasing lines free of kinks and angles.

The profile shall conform with NCC Standard Drawing No. 21/302 and the finish and accuracy of the work comply with that stated in Sec. VI-13 (a) (iv).

#### (iv) **Accuracy and Standard of Workmanship**

Kerbs and channels shall be so finished that on straight portions there is nowhere a deviation of more than 5mm within the length of a 3m straight edge; nor is to anywhere a deviation of more than 5mm from the line and level.

Kerbing and channelling be finished with a steel float and any concrete work showing honeycombing or scale in the face is to be removed and replaced with fresh concrete of the grade specified in Sec. VI-13 (a) (ii).

#### (v) **Curves**

The Council may direct that horizontal or vertical curves of less than 60 metres radius shall be constructed using special insitu formwork.

Use of regular forms to produce a chorded effect shall not be accepted.

Changes of grade shall be made with a smooth vertical curve, and horizontal curves shall be true.

#### (vi) **Benchmarks**

The Designer shall install NCC standard benchmark plaques on the top of the kerb. A minimum of one plaque shall be installed in each new street, at maximum intervals of 300m. Where a plaque is installed to meet the requirement of Land Information NZ (LINZ) this shall be used as the benchmark and the NCC plaque omitted.

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The proposed location shall be shown on the engineering plans. The Designer shall establish a reduced level and coordinates on each new benchmark and show this on the "As Built" plans to two decimal places. The origin for the levels shall be from a previously established benchmark, and the origin stated on the drawings. A closed circuit run shall be used to establish each new benchmark level. The coordinates shall be established to Fourth Order survey standard accuracy.

The levelling shall be carried out to second order standards and levels are to be shown to two decimal places.

Where a subdivision is staged the Designer may not be required to install a benchmark in each stage.

NCC benchmark plaques will be supplied by the Council at no cost to the Designer.

(b) **Footpaths**

The number, location and width of footpaths is shown in table VI - I.

The surface may be concrete, asphaltic concrete or block paving where specifically approved by the Council.

The crossfall on the footpath shall not vary outside the limits of 1 in 33 (3%) to 1 in 50 (2%).

Where a footpath is constructed and there is a mountable kerb, both shall be designed to carry the same vehicle loadings as the carriageway. (Also see VI - 14 (a)).

The footpath pavement shall be designed in accordance with recognised techniques that include but are not limited to those listed below.

- CBR Method (CBR Design curves are given on NCC Standard Drawing No. 21/301 sheet 2).
- Scala/Dynamic Cone Penetrometer (Design curves are given on NCC Standard Drawing No. 21/301 sheet 3).

(i) **Concrete Footpaths**

The minimum construction is to be 100mm thickness of 25MPa at 28 days concrete. The finish shall be wooden float, or other equivalent non-skid surface.

Residential entrance slabs shall be increased to a minimum of 150mm thick for full width of crossing including wings.

Concrete for commercial and industrial entrance slabs shall be reinforced with approved polypropylene fibre at the manufacturer's recommended rate.

Commercial entrance slabs shall have a minimum thickness of 200mm and industrial entrance slabs shall have a minimum thickness of 300mm.

Construction joints are required at 6m intervals, and on both sides of entrance slabs. Refer to NCC Standard Drawing Nos.21/304, sheet 1 for full details

(ii) **Asphaltic Concrete Footpaths**

The path shall be paved with 25mm compacted depth of asphaltic concrete. (See TNZ M/10 MIX 10). All areas to be paved must be tack-coated prior to paving.

A ground treated (H4) timber batten 100mm x 25mm minimum shall be firmly pegged along the edges of the footpath with the top of the batten at finished level, and shall remain intact after the completion of the work. Refer to NCC Standard Drawing 21/304, sheet 2.

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Joints in the asphalt surfacing shall be either saw cut or formed to produce a neat straight line at right angles to the edge of the footpath and a flush smooth finish to the surface of the footpath. Joints shall have a tack coat applied.

The compacted basecourse depth shall be a minimum depth of 150mm and the asphaltic concrete to a minimum compacted depth of 25mm.

Commercial and Industrial entrances shall be designed to take the same traffic loadings as the carriageway. Refer to NCC Standard Drawing Nos.21/304, sheet 2 for full details.

(iii) **Acceptance Criteria**

The surface of the finished footpath shall be such that when a straight edge is placed across the footpath no area deviates from the straight edge by more than 5mm from a 3m straight edge when placed along the footpath. The edge of the footpath shall not deviate by more than 5mm from the line and levels shown on the approved Engineering Drawings.

Where adjacent to a kerb, the surface of the footpath shall be flush with or no more than 5mm above the top of the kerb.

(iv) **Handrail**

In situations where there is more than a one metre high drop, within one metre of the back of footpath a handrail complying with NCC Standard Drawing No. 21/311 shall be constructed at the back of the footpath or top of bank.

If the Designer wishes to erect a fence or handrail of an alternative design, then full details shall be submitted to the Council for approval.

## VI – 14. **CROSSINGS**

For minimum distance of a vehicle crossing from an intersection see Nelson Resource Management Plan Appendix 10. Where the footpath is adjacent to the kerb and crossings are within 4m of each other, the vehicle crossing shall be continuous.

(a) **Residential Areas**

For standard kerb and channel one vehicle crossing shall be provided (NCC Standard Drawing Nos. 21/303 and 21/304 sheets 1 and 2) of 4 metres in width at all Lots in residential areas. Where approved by the Council wider crossings may be provided up to a maximum of 6.0m.

Vehicle crossings in mountable kerb and channel will be permitted for rights of way where the ground profile of the lot falls, generally, towards the right of way and the upslope catchment is small.

Continuous crossings may be used round the ends of cul-de-sacs, provided the footpath for the corresponding length is located immediately behind the kerb and is constructed to take the same traffic loadings as the carriageway and suitable provision is made for the disposal of stormwater.

For further information on siting of vehicle crossings, see the Nelson City Council Resource Management Plan.

(b) **Commercial Areas**

Excluding service stations and where verandas are required.

(i) One crossing of 5.0 metres in width on any one frontage. (NCC Standard Drawing Nos. 21/303, and 21/304 sheets 1 and 2). Where approved by the Council wider crossings may be provided up to a maximum of 7.0 metres.

(ii) Two 5.0 metre crossings may be permitted provided the following points are complied with:

They are separated by at least 7.0 metres.

They are marked 'in' and 'out' and result in a continuous undisturbed one-way route through the area.

- (iii) In the case of adjacent property owners wishing to have a mutual crossing at their shared boundary, the maximum permitted total length is 8.0m.

(c) **Industrial Areas**

- (i) One crossing of 6.0 metres in width on any frontage. Where approved by the Council wider crossings may be provided up to a maximum of 8m.
- (ii) Two crossings may be permitted provided they are separated by at least 7.5 metres.
- (iii) In the case of adjacent property owners wishing to have a mutual crossing at their shared boundary, the maximum permitted total length is 8.0 metres.

A wider crossing may be permitted at the discretion of the Council.

Industrial crossings shall be designed to carry the same vehicle loading as the carriageway having regard to the foundation conditions of the site. The footpath crossings associated with them shall also be designed to carry the same loading as the carriageway.

- (iv) Where 'B trains' will be using a vehicle entrance on a regular basis, a crossing width of 9.0m may be permitted on specific application to the Council.

(d) **Pram Crossing**

Pram crossings shall be provided (NCC Standard Drawing No.21/303) of 1.5m in width at road intersections, entrances to pedestrian ways and elsewhere as requested by Council.

Tactile Pavers shall be installed in the footpath at the location of all pram crossings (and elsewhere as required by Council) in types I, II and III roads. Tactile pavers shall be Type B warning indicator pattern and made of concrete coloured "Red".

There shall be 12 pacers laid 4 across and 3 deep. They shall be installed 300mm away from the kerb face and shown on the design engineering plans.

The Tactile Paver Pattern (raised dots) shall be aligned with the direction of pedestrian flow towards the pram crossing on the opposite side of the road.

The footpath surface shall be flush with the edges of the pavers.

## VI – 15. **BERMS**

Where possible, a services free berm of minimum 1.5m width shall be provided between the road and the footpath for the establishment of trees and landscaping. After the construction of the street and footpaths, and the installation of all services has been completed, the berm surfaces not occupied by pavements shall be levelled or graded to conform to the pavement edges and the adjoining properties, so far as is practical, allowing for the addition of topsoil to final grade. Topsoil to a firm minimum thickness of 100mm on clay surfaces and 150mm on sandy or gravelly surfaces shall then be spread so that a smoothly contoured surface is produced, free of ponding areas. The subgrade shall be capable of allowing root penetration and sustaining growth. This final topsoil surface shall be sown with approved seed mixtures. Special soils or conditions shall be treated to Council approval.

(a) **Grassing**

After topsoiling, the berms shall be sown with grass seed that conforms to the following mix proportions:

- 1.0kg chewing fescue
- 4.5kg dwarf rye grass
- 0.5kg browntop

The mixture shall be sown at a rate of 1kg to 40 square metres area.

Prior to the sowing of the grass seed, fertiliser shall be spread and mixed with the topsoil. The recommended fertiliser is Super Phosphate applied at a rate of 30g per square metre.

Alternative fertiliser and application rates may be used subject to prior consultation with the Council. After two months a dressing of Sulphate of Ammonia applied at a rate of 30g per square metre shall be applied.

(b) **Planting and Landscaping**

Opportunities for street landscaping shall be taken where possible to improve the visual amenity of the city. Landscaping shall be designed to meet the following objectives:

- (i) Functional - Provide a sense of separation between the road and the footpath
- (ii) Aesthetic
  - Frame views
  - Emphasise landscape features
  - Soften hard surfaces
  - Enhance aesthetic values

Trees and garden planting shall be located as to not compromise the integrity and efficient operation of infrastructure services

The minimum planting size of a landscape tree is 1.5m unless the local conditions require alternatives.

Species are to be selected in accordance with the councils planting policy and register of suitable species. All plants used shall be healthy vigorous and free of any defects that may be detrimental to plant growth and development. Council requires the use of locally sourced native species where appropriate.

Street trees are to be provided on services free berms or paved areas within the inner city as appropriate.

Street Trees planted within pavement areas of the inner city shall be provided in accordance with planter detail in NCC Standard Drawing No.21/314, sheet 1 and be protected by a tree guard shown in NCC Standard Drawing No.21/314, sheet 2.

## **VI – 16. CARRIAGEWAY SURFACING**

(a) **General**

The minimum requirement for residential streets is a wearing surface of approved two coat Grade 3 and Grade 5 chipseal or 25mm asphaltic concrete mix 10 over a Grade 5 chip seal constructed on the approved basecourse.

The minimum requirement for industrial streets is a wearing surface of 35mm depth of mix 15 asphaltic concrete on an emulsion Grade 5 chipseal constructed on the approved basecourse. Alternative surfacing may be allowed to specific limited areas with the approval of the Council.

For all roundabouts and the turning heads in cul-de-sacs the surface shall be 50mm depth of mix 15 asphaltic concrete on an emulsion Grade 5 chipseal.

The basecourse surface finish shall be such that when swept it presents a tightly compacted, non-glazed, clean stone mosaic surface that will not ravel as a result of sweeping. The standard of sweeping shall be sufficient to remove all loose aggregate, dirt, dust, silt and other deleterious matter.

(b) **Chip Seal**

(i) **Seal Design**

The seal design shall generally be the responsibility of the Designer.

The Designer shall submit his seal design for approval by the Council 7 days prior to any sealing commencing.

The submitted designs shall include details of:

- (a) Bitumen/Emulsion to be used
- (b) Additives to be used
- (c) Application rates
- (d) Construction method

(ii) **Sealing Binder**

The materials used shall meet the requirements of the relevant clauses of the following TNZ specifications.

M/1: Specification for Asphaltic Bitumen

M/13: Specification for Adhesion Agents

Sealing binder shall be either 180/200-penetration grade bitumen or emulsion of a suitable type from an approved supplier.

(iii) **Sealing Chip**

Sealing chip shall meet the requirements of the relevant clauses of TNZ specification: Specification for Sealing Chips.

(iv) **Application of Sealing Binder**

The bitumen distributor used for the work shall meet all the requirements of TNZ E /2: 1987 and shall hold a current certificate of compliance.

Spraying operations shall be carried out so that private property and street furniture are not affected by over spray.

The end of each sealed area shall be a straight line at right angles to the road edge and no binder shall be allowed to drip onto sections of the roadway that have previously been sealed. Edges of sealed areas running across other carriageways shall be a straight line parallel with the edge of the carriageway being sealed.

(v) **Application of Chip**

Chip spreading equipment shall be capable of spreading the aggregate evenly, at a controlled rate and in such a way that chip does not tumble on impact with the sprayed surface.

All excess chip shall be swept from the carriageway and removed from the channels, footpaths, berms and sumps prior to the acceptance of the works by the Council.

(vi) **Acceptance Criteria**

The two coat seal shall provide a fully interlocked surface after rolling. Chip loss, bleeding or flushing shall not exceed 5% in any one metre by one metre square of the total sealed area during the maintenance period.

(c) **Asphaltic Concrete**

For residential streets asphaltic concrete paving (hot mix) shall comply with TNZ Specification M/10 Table 5.1 Mix 10 and shall be a minimum compacted thickness of 25mm. The binder shall be 80/100-penetration bitumen. The construction of the paving shall be carried out in accordance with TNZ P/9 Construction of Asphaltic Concrete Paving, unless otherwise approved by the Council. All areas to be paved must be tack coated prior to paving.

For Industrial streets asphaltic concrete paving (hot mix) shall comply with TNZ Specification M/10 Table 5.1 Mix 15 and shall be a minimum compacted thickness of 35mm. The binder shall be 80/100-penetration bitumen. The construction of the paving shall be carried out in accordance with TNZ P/9 Construction of Asphaltic Concrete Paving, unless otherwise approved by the Council. All areas to be paved must be tack coated prior to paving.

The asphaltic concrete wearing course shall be laid on a Grade 5 chip seal constructed in accordance with Sec. VI - 16. (b).

Note that for all roundabouts and the turning heads in cul-de-sacs the surface shall be 50mm depth of mix 16 asphaltic concrete on an emulsion Grade 5 chipseal.

(d) **Weed Protection**

Immediately prior to any form of surfacing, a strip one metre wide adjacent to each channel shall be applied with an approved ground sterilising weed killer at the manufacturer's recommended rate of application.

## **VI – 17. RIGHTS OF WAY & COMMON ACCESSWAYS - STANDARDS OF FORMATION**

(a) **Residential Areas**

(i) **Formation**

The finished surface shall have a cross-fall of 1 in 33 (3%) and shaped with a crown or camber.

(ii) **Metalling**

All topsoil and growth shall be removed and compacted basecourse and sub basecourse (where required) laid and graded to an even surface.

(iii) **Structural Design of Pavement**

The pavement shall be designed as detailed in Sec. VI - 10.

(iv) **Sealing**

All formations are to be surfaced in accordance with Sec. VI - 16, (but Grade 4 and 6 sealing chip is an acceptable alternative) where required by table VI - I except with the prior approval of the Council the bitumen distributor need not have a current certificate of compliance.

(v) **Channelling**

Kerb and channel or similar shall be provided on one side, and on both sides in some cases, for the full length of the right of way and the crossfall shall fall towards this.

The need for kerb and channelling or similar on common accessways shall arise when any of the following are present:

- (a) Flat Grades less than 1 in 60.
- (b) Long driveways in excess of 20m.
- (c) Three or more potential household units served by the access.

The high side of the formation shall be retained by either of the following: kerb and channel, nib kerb or 25mm x 75mm ground treated (H4) timber batten and pegs.

The kerb and channel shall be constructed in accordance with Sec. VI - 13

(vi) **Stormwater**

For common accessways more than 10m in length or more than 30m<sup>2</sup> of sealed surface, all stormwater off the formation shall be collected in a standard sump, and piped into the Council's stormwater system.

Sumps shall be located at either side of the formation at the end of the kerb and channel and at the street boundary where falls are towards the carriageway. New sumps shall not be permitted within a vehicle crossing on the line of the street kerb and channel.

(vii) **Width**

The minimum formation width shall be as detailed in table VI - 1.

(b) **Commercial and Industrial Areas**

Rights of way in commercial and industrial areas shall be formed as for streets; see Sec. VI - 10 (structural design of pavement), Sec. VI - 16 (carriageway surfacing).

Kerb and channel and stormwater drainage shall be provided.

(c) **Geometrical Design of Rights of Way**

(i) Where there is an existing or designed kerb and footpath, the first 2.2 metres (where the footpath is adjacent to the kerb) or 2.7 metres (where the footpath is offset from the kerb) shall be graded up at 1 in 50 (2%) from the top of kerb level.

(ii) The next 1.5 metres may rise above or fall below this level but shall not exceed a gradient of 1 in 9.

(iii) In all cases the first two metres of the right of way formation from legal boundary shall be at right angles to the carriageway formation. The street carriageway kerb and channel shall continue across the entrance to the Right Of Way, and a normal crossing the width of the Right of Way formation formed in the kerb. This is to define the extent of the Right Of Way, and no radius kerb and channel shall be allowed. (NCC Standard Drawing No. 21/304 sheets 1 and 2 and 3).

(iv) So that adequate sight distance is obtained for vehicles exiting from a Right of Way, batter slopes may have to be eased or splayed. For required sight distance, see Ap10.3.6 of the Nelson Resource Management Plan.

## **VI – 18. STREET NAME SIGNS**

The Designer may submit to the Council, at the time of submission of Engineering Plans, a list of suggested street names, with alternatives, including any supporting information for the preferred choices.

This shall apply to walkways and common accessways, which shall incorporate the word "WAY" on the sign.

The Designer will be advised of the name(s) that have been approved by the Council in terms of its policy and shall be required to pay the prescribed fee. This fee shall cover the supply and erection of a standard street nameplate, as undertaken by the Council's Contractor.

If the Designer wishes to incorporate special signs these shall be in addition to the standard nameplate, and be subject to specific approval by the Council. Supply and erection of any special sign shall be the responsibility of the Designer.

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## **VI – 19. THRESHOLD TREATMENT AND TRAFFIC CALMING**

Designers are encouraged to incorporate "Traffic Calming" measures in the roading design.

These may include but are not limited to threshold treatment using ramps, changes in surface textures, kerb extensions and landscaped medians.

These measures shall only be incorporated in local residential streets (type VI, VII, and VIII, table VI - 1) and following discussion with and approval by the Engineer.

## **VI – 20. ROADMARKING AND TRAFFIC SIGNS**

All new roading within a subdivision shall incorporate road marking and signage to the current TNZ standards. This is likely to involve centrelines, edgelines, continuity lines and signs for hazards, keep left and intersection control.

The Landowner shall arrange for the installation of the above to the requirements of Council and the associated cost shall be a charge on the Landowner.

## **VI – 21. PEDESTRIAN WAYS**

Pedestrian ways linking road to road are to be provided where roadside footpaths do not provide adequate walking access through the subdivision area. The requirement for pedestrian ways in a subdivision shall be assessed by Council and requirements advised to the applicant.

Pedestrian ways shall be constructed in accordance with NCC Standard Drawing No 21/313 sheet 1.

## **VI – 22. RESERVES**

### **(a) General**

A range of reserves are to be provided throughout the city that are accessible and well used by residents and that contribute to the quality of life.

Council purchases and develops reserve land for the following management purposes:

- (i) Neighbourhood Reserves
- (ii) Esplanade/Foreshore Protection
- (iii) Walkways
- (iv) Horticultural Parks
- (v) Recreation and Sports
- (vi) Cemeteries
- (vii) Conservation

### **(b) Neighbourhood Reserves**

General outcomes required are to provide attractive well maintained areas of open space close to local communities within Nelson that may be developed with amenity plantings, paths, park furniture and playgrounds and are available for passive and active recreation. These areas are to be linked with the road pattern to provide an integrated open space framework in the development.

Neighbourhood reserves shall be no less than 2500m<sup>2</sup> in area with a flat useable are of not less than 1250m<sup>2</sup>. A smaller area may be considered if the reserve is taken to protect trees, buildings or site values such as views.

Reserves should have a wide frontage onto the adjacent street with good pedestrian access and access for maintenance vehicles and equipment. Corner sections are able to achieve this most effectively.

A minimum frontage width of 30m is required, where practical.

Reserves shall be of an even and regular shape that allows for maximum usable space and ease of maintenance.

Neighbourhood reserves should be accessible to all neighbourhoods and communities within Nelson. As a guide a neighbourhood reserve should be located within 400m of all properties within residential areas and 5km within rural settlements.

Natural features or features of local interest or significance such as streams, remnant native forest or specimen trees should be included within neighbourhood reserves where appropriate.

(c) **Esplanade Reserves**

General outcomes required are riparian and coastal margins of high value are protected and enhanced and public access is provided to rivers streams and coastal areas.

Minimum location and dimensions are prescribed within the Nelson Resource Management Plan (Appendix 5) although council may seek to purchase additional areas adjacent to add to the amenity and recreational value of the reserve.

(d) **Walkway Reserves**

General outcomes required are to provide a range of opportunities to allow for safe and convenient pedestrian and cycle access through the city and for public walkway access to be provided to strategic, scenic and recreational locations within the city.

Walkways are to be established where key linkages can be made to assist the flow of public throughout the city and connecting with locations such as reserves where recreation opportunities and experiences can be provided.

For walkway details see NCC Standard Drawing No.21/313.

(e) **Horticultural Parks**

General outcomes required are to provide a flagship role for the city's identity and heritage, by providing a number of intensively managed reserves that showcase a wide range amenity horticulture, plant collections and landscape features and styles.

Council currently owns and manages 8 horticultural parks. Further purchase of land for this purpose may occur if a property containing significant gardens, landscaping or tree scape worthy of protection and access by the public becomes available for sale.

Land may also be purchased to enhance or expand existing horticultural parks.

(f) **Recreation and Sports Areas**

General outcomes required are to provide a range of recreation and sports areas that are accessible and meet the changing needs of Nelsons residents.

Recreation and sports areas are distributed throughout the city on large flat versatile sites. Council may seek further land as required in the future for this purpose.

The minimum size for any new sports area is 2 ha.

(g) **Cemeteries**

General outcomes required are to provide cemeteries in a park like setting that meet community expectations and are consistent with the community's beliefs, feelings and personal choice.

Several active and historic cemeteries are currently located within the city. Council may seek to purchase additional land for this purpose, particularly land adjacent to existing cemeteries.

(h) **Conservation Reserves**

Conservation reserves should be owned and managed by council to achieve the following objectives:

- (i) Protect the natural setting of the city
- (iii) Protection of heritage and archaeological features and sites
- (iv) Provision of natural areas that are accessible to the public
- (v) Allowing opportunities for the restoration of vegetation and the protection and enhancement of biodiversity.

Conservation reserves shall be purchased by the council where there are accessible areas of high or potentially high natural or heritage values that require protection and management or where the land may enhance an existing conservation reserve by providing a buffer.

(i) **Presentation of Reserves to Vest**

Land to be vested for reserves purposes shall as a minimum meet the following general requirements:

- (i) All boundaries are to be surveyed and clearly pegged
- (ii) The land is to be free of noxious weeds, tree stumps (above ground) surface rocks and other specified unwanted vegetation.
- (iii) The land shall be stable and not subject to a high erosion risk
- (iv) Specimen and riparian vegetation & habitats that will contribute to the reserve as identified by council are to be left in place.
- (v) Stream banks should be in a stable state with rock protection provided as required by council
- (vi) All land subject to earthworks shall be covered with 150mm topsoil and sown in an approved dwarf rye grass mix with a minimum 80% coverage.
- (vii) Grassed areas should be free of noxious or broadleaf weeds and mown to 75mm at least twice before presentation
- (viii) All previous fences, farm utilities etc, building remains, and rubbish are to be removed or disposed of to the satisfaction of the council
- (ix) A kerb crossing of 4m minimum width shall be provided at an approved access point for service vehicles to the reserve. Crossings shall be reinforced and not located adjacent to boundaries.

## **VI - 23 RESERVE DEVELOPMENT**

(a) **Pedestrian Access**

Paths should be provided at each access point to the reserve where damage is likely to occur to the grass surface and visitor experience or access may be adversely affected as a result.

Where a reserve access strip is required between 2 urban properties, for a distance of 20m or greater this shall be a minimum of 6m to provide for planting and a grass berm, see NCC Standard Drawing No. 21/313.

Pedestrian path should be a minimum of 1.2m wide. Paths catering for cyclists should have passing space of 2m provided or be a minimum of 2m wide.

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The maximum gradient on any paths should be no greater than 1:6. Steps should be avoided. If a gradient is greater than 1:6 and steps are required these shall be constructed to enable comfortable use by children and older people, with a maximum riser height of 0.2m, a minimum tread length of 0.3m and a landing every 12 metres.

A handrail shall be provided on one side of steps and for paths where there is more than a one metre high fall within one metre of the path. The handrail shall be as per NCC Standard Drawing No. 21/311 or such other design approved by council.

Paths should be laid with 3% crossfall to promote drainage and to ensure stormwater does not pond on the pathway or cause other downstream problems. Where paths are steeper than 1:8 a permanent non-skid surface shall be provided.

If concrete surfacing is used this shall be a minimum of 100mm and reinforced with 668 mesh. Any concrete used shall comply with the specified requirements for High Grade Concrete as contained in NZS 3108.

(b) **Vehicle Barriers**

Vehicle Barriers will be required as necessary to control unauthorised vehicles.

This may be in the form of a standard non-mountable kerb, or a physical vehicle barrier or bollards (see NCC Standard Drawing No. 21/312). Vehicle barriers should meet the following objectives:

- (i) Prevent vehicles from accessing reserve land
- (ii) Continue to allow pedestrian access and bicycle access if appropriate
- (iii) Be of a design that ensures uniformity with other reserve structures, does not adversely affect the visual amenity of the area and is able to withstand or discourage vandalism pressure.

(c) **Fencing**

A permanent fence may be required between the reserve and adjacent properties.

Any fence shall meet the following objectives:

- (i) Physical separation of the reserve from private land
- (ii) Maintenance of views from neighbouring properties onto the reserve

Reserve accessway fences should be 1.8m high wooden unpainted fence constructed with H3 tannalised timber with palings on the accessway side (see NCC Standard Drawing No. 21/315) Boundary fencing shall meet the obligations within the Fencing Act 1978.

(d) **Lighting**

Lighting shall be provided where necessary in a manner that is not obtrusive and does not adversely affect the aesthetics of the reserve. Consideration shall be given to the brightness, placement and coverage of any lights to ensure adequate illumination where necessary and to prevent adverse effects on adjacent landowners from light spill.

Lighting standards for neighbourhood reserves shall be the Salisbury Short with Cardiff Column or similar design as approved by council.

For other locations such as major access roads and carparks within parks the standard Type C standard streetlight may be used as approved by council.

(e) **Signs / Park Furniture**

Neighbourhood reserves may have an entrance sign and other information signs as required. A park bench or table may also be provided at appropriate locations.

A rubbish bin should be located at each playground.

## VI - 24 PLANTING

### (a) Neighbourhood Reserves

Plantings of vegetation within neighbourhood reserves shall be established. They will be designed to meet the following objectives:

#### (i) Functional

Define space and create a vegetation barrier

Provide shade and shelter

Screen unsightly outlooks

Control of erosion

Enhancement of recreation and amenity value

Provide habitat and encourage bird life

#### (ii) Aesthetic

Frame views

Emphasise landscape features

Soften hard surfaces

Enhance aesthetic values

All plantings shall be provided in a manner that creates pleasant spaces for active and passive recreation while maintaining enough openness to maintain a safe environment.

**TABLE VI - I**

Type	Hierarchy Note 2	Indicative Traffic (AADT) Volume Note 3	Planning Zone	Lane Width	Cycle Lane Width on Street or Sealed Shoulder	Parking Width	Carriageway Width	No. Of Footpath s & Width	No. Of Berms & Width Note 12		Minimum Street Reserve Width Note 1	Max. Grade	Street Lighting See Note 14	Stormwater Control	Pedestrian/ Pram Crossings	Traffic Calming (including road humps)	Intersection Control Giveaway/ Stop	Minimum Surfacing Requirement see note 15	Refer to Notes (overleaf)
									For Services	For Landscape Note 9									
I	Arterial Road	>10,000 Veh/day	All	2 x 3.5m + 2.5m Flush Median	2 @ 1.2	2 @ 2.0	15.9m	2 @ 3.0 Comm otherwise 2 @ 2.0	NA COMM Otherwise 2 @ 1.6	NA COMM Otherwise 2 @ 1.5	21.9 COMM Otherwise 25.1	1 in 8	12.5m poles Frangible Bases Luminaire 150W SON-T	K/C both sides	1.5m with tactile pavers	No	All	Asphaltic Concrete	
II	Principal Road	5,000-10,000 Veh/day	All	2 @ 3.5	2 @ 1.2	2 @ 2.0	13.4	2 @ 2.0	2 @ 1.6	2 @ 1.5	22.6	1 in 8	12.5 poles with Frangible bases Luminaire 150W SON-T	K/C both sides	1.5m with tactile pavers	No	All	Asphaltic Concrete	
III	Collector Or Industrial Road	1,000-5,000 Veh/day	All Excluding Rural	2 @ 3.0	2 @ 1.2 (may be omitted at Council's discretion)	2 @ 2.0	12.4	2 @ 1.4 away from kerb	2 @ 1.6	2 @ 1.5 adjacent to the kerb	21.4	1 in 8	10.5m poles Luminaire 100 to 110w SON-T	K/C both sides	1.5m with tactile pavers	No	All	Res-2 Coat Chipseal & Slurry Indust- Asphaltic Concrete	
IV	Rural Collector Road	>200 veh/day	Rural	>70km/h 2 @ 3.5	2 @ 1.2 (may be omitted at Council's discretion)	NA	9.4	1 @ 1.4 where small holding	2 @ 2.0	NA	21.0	1 in 8	Flag lighting intersections with frangible bases	Water tables, K/C where small holdings All culverts 450 mm diameter minimum	NA	No	All	2 Coat Chipseal	Note 2 Note 5
				2 @ 3.0 < 70 km/h			8.4				20.0								
V	Rural Local Road	<200 veh/day	Rural	2 @ 3.0	NA	2 @ 0.5	7.0	NA	2 @ 2.0	NA	20.0	1 in 8	Flaglights at intersections	Water tables Culvert all 450 Ø mm Minimum	NA	No	No	2 Coat Chipseal	Note 2 Note 5 Note 16
VI	Residential Local Road	>12 potential household units	All Excluding Rural	2 @ 2.5	NA	2 @ 2.0	9.0	2 @ 1.2 away from kerb	2 @ 1.6	2 @ 1.5 adjacent to kerb	17.6	1 in 8	8.5m poles Luminaire 70W SON-T	K/C both sides	1.0m width	Yes	All	2 coat Chipseal  Where grade exceeds 1 in 10 and all turning heads shall be asphaltic concrete	Note 5 Note 6 Note 16
VII	Residential Local Hillside Road See Note 6	>12 potential household units	All Excluding Rural	2 @ 2.5	NA	1 @ 2.0	7.0	1 @ 1.4 against kerb	1 @ 1.6+ 1 @ 1.1 opposite path	2 @ 1.0	13.1	1 in 7	8.5m poles Luminaire 70W SON-T	K/C both sides	1.0m width	Yes	All	2 Coat Chipseal	Note 5 Note 6 Note 16
VIII	Residential Minor Cul- de-sac Road	<12 potential Household Units	All Excluding Rural	2 @ 2.5	NA	1 @ 2.0	7.0	1 @ 1.4	NA	NA	8.4	1 in 7	Lighting Required	K/C both sides	1.0m width	Yes	All	2 Coat Chipseal	Note 5 Note 16
IX	Residential Private Access	5-6 Potential Household Units	Res	5.0	NA	NA	5.0	NA	NA	NA	5.0	1 in 6 average over any 50m	Not Required	On site control	NA	NA	NA	2 Coat Chipseal	Note 4
X	Residential Private Access	2-4 Potential Household Units	Res	2.9	NA	NA	2.9	NA	NA	NA	3.0 Note 10	1 in 5 max over any 10m	Not Required	On site control	NA	NA	NA	2 Coat Chipseal	Note 4
XI	Residential Private Access	1 Potential Household Unit or Rural Site <2000m <sup>2</sup>	Res	2.6 Unsealed	NA	NA	2.6	NA	0.4	NA	3.0	1 in 5 1 in 4 with concrete surface	Not Required	On site control	NA	NA	NA	Compacted Basecourse	Note 4 Note 11
XII	Rural Private Access	1-6 Potential Household Units		4.0 Unsealed	NA	NA	4.0	2 @ 0.5 Shoulder	2 @ 1.0	NA	7.0 Note 5	1 in 5 1 in 4 with concrete surface	Not Required	On site control	NA	NA	NA	Compacted Basecourse	Note 4 Note 11
XIII	Industrial Private Access	Single Site <2000m <sup>2</sup>		3.0	NA	NA	3.0	1 @ 1.1	NA	1 @ 1.6m Adjoining RES ZONE	5.7m Adjoining RES ZONE Otherwise 4.1m	1 in 7	Not Required	Kerb and Channel	NA	NA	NA	2 Coat Chipseal	
XIV	Industrial Private Access	Land Area 2,000m <sup>2</sup> to 10000m <sup>2</sup>		2 @ 3.0	NA	NA	6.0	1 @ 1.4	NA	1 @ 1.6m Adjoining RES ZONE	9.0m Adjoining RES ZONE Otherwise 7.4m	1 in 8	Not Required	Kerb and Channel	NA	NA	NA	2 Coat Chipseal	
XV	Commercial Private Access	Up to 50HCV/Day or 1000VPD		2 @ 3.0	NA	2 @ 2.0	10.0	3.0m Fronting Commercial Zone	NA	NA	16m	1 in 8	Not Required	Kerb and Channel	NA	NA	NA	2 Coat Chipseal	

NOTE 7; NOTE 8; NOTE 13



<b>Note 1</b>	Additional road reserve width shall be provided to: i) Accommodate any retaining structure or slope necessary to support the road or adjacent property ii) Achieve a complying horizontal alignment iii) Accommodate any turning area required by Note 5.
<b>Note 2</b>	For each side of the road where kerb & channel is provided, a 2.0m parking lane shall be required instead of a 0.5m unsealed shoulder. The berm may also be reduced to 1.0m.
<b>Note 3</b>	In residential areas the number of potential household units shall be based on the relevant minimum allotment size as in the Residential Zone Rules, or the actual number of household units proposed, whichever is the greatest. <b>Veh/day</b> means vehicles per day. <b>AADT</b> means Annual Average Daily Traffic
<b>Note 4</b>	Passing bays shall be provided on any single lane access at intervals of 25m in an industrial, commercial, residential zone and 60m in a rural zone. Passing bays may be used for vehicle access to a site, eg the vehicle entrance to a garage.
<b>Note 5</b>	An area shall be formed at the end of the cul-de-sac as shown in NCC Standard Drawing 21/306 to allow turning.
<b>Note 6</b>	Steep hillside means where a road is formed on ground that has an average slope of greater than 20 degrees.
<b>Note 7</b>	<b>RURAL</b> means land zoned rural or rural small holdings; <b>COMM</b> means the Inner City Zone or the Suburban Commercial Zone; <b>INDUST</b> means an Industrial Zone; <b>RES</b> means in a Residential Zone.
<b>Note 8</b>	All dimensions are in metres
<b>Note 9</b>	The width required for landscape is a continuous strip adjacent to the footpath and free of other services. As a controlled activity, this landscape berm width may be replaced (except in Types I, II, III) by a central island with nominal dimensions of 5m by 20m and kerb extensions at intervals of 150m OR an area nominally 3m wide by 5m long set back at intervals of 150m on each side of the street as defined in plan.
<b>Note 10</b>	For 2-4 household units this may be reduced to a width of 2.6m where the proposed access passes between an existing dwelling and an existing boundary of the site being developed. Provided also that the distance between that dwelling and boundary is less than 3.3m.
<b>Note 11</b>	All private access shall have a permanent surface for a minimum distance of 5m into the property from the legal boundary of the road.
<b>Note 12</b>	The layout for services and landscaping shall be in accordance with the diagrams included in NCC Engineering Standards.
<b>Note 13</b>	Where a road or access serves land in more than one zone the requirements for footpaths and berms on each side of the road or access shall be the maximum required for any of the adjoining zones.
<b>Note 14</b>	Street lighting poles shall comply with NCC street lighting policy. Only approved decorative alternative poles can be used. Cul de sac lighting pole heights and spacing can be varied but must comply with standards. All lighting shall comply with NZS 6701 and AS/NZ 1158: 1997 or other NCC approved alternatives. Pole spacing shall be 45m to 50m, except for arterial or principle which require specific design.
<b>Note 15</b>	Any street within the CBD area bordered by Maitai River, Tasman Street, Nile Street, Rutherford Street, Hardy Street, Vanguard Street, Toi Toi Street, St Vincent Street, Haven Road and QEII Drive shall be surfaced in asphalt concrete.
<b>Note 16</b>	Developers may apply for consent from Council to construct 'Gateway Entrance' for the subdivision. Council accepts no responsibility for depreciation, or maintenance of these assets and reserves the right to remove those assets if they deteriorate to poor level of maintenance. Residents of a street can maintain the 'Gateway Entrance' as a private asset on road reserve.
<b>Note 17</b>	Road hierarchy is determined by the function the road serves in the network. The traffic volume is used as an indicative guide.

## Streetlight Data Collection Form

<b>STREETLIGHT No.:</b>		<b>INSPECTION DATE:</b>	
<b>LOCATION</b>			
<b>Road name:</b>		<b>Side of Road:</b>	Left / Right / Centre / Unknown
<b>House No.:</b>		Same Side / Opposite	
<b>Intersecting Road:</b>		<b>Side of Inters. Road:</b>	Left / Right / Centre / Unknown
<b>Comments:</b>			
<b>POLE GENERAL</b>			
<b>Pole Owner:</b>	NCC / Telecom / Citipower / Network Tasman / Private / Other		
<b>Pole Purpose:</b>	Streetlighting / Telephone / Electricity / Other		
<b>Control:</b>	Photocell / Relay / Time Switch / Other		
<b>Material:</b>	Concrete / Fiberglass / Steel / Spun Fiberglass / Wood		
<b>Shape:</b>		<b>Mounting Height:</b>	
<b>Make:</b>		<b>Condition:</b>	
<b>POLE IDENTIFIER</b>			
<b>Pole No.:</b>		<b>Power Board No.:</b>	
<b>Map Pole ID:</b>		<b>'X' Co-ordinate:</b>	
<b>GPS No.:</b>		<b>'Y' Co-ordinate:</b>	
<b>BRACKET</b>			
<b>Type:</b>			
<b>Mounting Height (m):</b>		<b>Outreach (m):</b>	
<b>Notes:</b>			
<b>LANTERN</b>			
<b>Light Owner:</b>	Streets / Carparks / SH6 / ROW(private) / Walkways / Ped. Crossings / Parks / Other		
<b>Make:</b>		<b>Model:</b>	
<b>Supply Point:</b>	Overhead / Underground / Other	<b>Transformer/ Service Box No.:</b>	
<b>Description:</b>			
<b>Network Owner:</b>	Citipower / Network Tasman	<b>Energy Supplier:</b>	
<b>CONTROL GEAR</b>			
<b>Make:</b>		<b>Model:</b>	
<b>Comments:</b>			
<b>LAMP</b>			
<b>Make:</b>		<b>Model:</b>	
<b>Lamp Type:</b>		<b>Lamp Wattage:</b>	
<b>Comments:</b>			
	<b>Signature</b>		<b>Date</b>
<b>Checked by Contractor</b>			
<b>Entered by SLMC</b>			
<b>Reviewed by NCC</b>			

Date of Liveness:            /            /200

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**RAMM (Road Assessment and Maintenance Management) Data****Contract/Work Details**

Road name			
Brief description of Work (i.e. Subdivision, Reconstruction, Kerb & Channel etc.)			
Start Name		Start Displacement	
End Name		End Displacement	
Carriageway Width		Carriageway Length	
Completion Date			

**Pavement Construction Details**

Subgrade Material		Subgrade CBR	
	Material	Depth	Source
Sub-base			
Basecourse			
Pavement Construction Completion Date			

**Surfacing Details****Chipseal**

Type of Chipseal		Source of Chip	
Size of Chip (1st)		Size of Chip (2nd)	
	Quantity (pph)	Type	
Cutter			
Adhesion Agent			
Additives			
Flux			
Binder Type			
Binder Residual Application Rate			
Sealing Date		Sealing Contractor	

**Asphaltic Concrete**

Type of Asphalt		Depth of Asphalt	
Size of Aggregate		Source of Aggregate	
Binder Type			
Binder Percentage			
Asphalting Date		Asphaltic Contractor	

**Contractor Details**

Contractor Name	
Contractor Address	
Consultant	

# **SECTION VII**

# **WATER**

## **SECTION VII**

### **WATER**

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## **VII – 1. GENERAL**

### **(a) Standard of Duty**

For subdivisions and other urban developments, an urban water supply system shall be installed, adequate for fire fighting purposes and for estimated domestic, commercial and industrial consumption.

### **(b) Level of Service**

The design of the reticulation and storage reservoirs shall as a minimum standard conform to the NZ Fire Service Code of Practice for Fire Fighting Water Supplies, and shall provide a water supply connection for each allotment.

The minimum flow at the point of supply to any property shall be 30 litres/minute

The minimum fire fighting residual running water pressure shall be 100kPa (1 atmosphere, 10m head of water) at any hydrant.

The minimum working residual water pressure, in other than fire fighting conditions, shall be 300 kPa (3 atmospheres, 30m head of water) at the ground level at the normal house site in each lot. Any reduction below this pressure shall require the Engineers prior approval and may mean the installation of pressure pumps and tanks for individual lots.

The maximum static water pressure shall not exceed 950 kPa (95 atmospheres, 95m head of water) at the ground level at the normal house site in each lot. Any increase above this pressure shall require the Engineers prior approval and may mean the installation of additional low-level zone reticulation.

### **(c) Training**

To achieve long life and reliability of a water asset, various materials and standards are required in this section. However, asset performance is also dependent on correct handling and installation techniques of the material. To ensure that those carrying out the maintenance or installation of water reticulation that is owned or will be owned by the Nelson City Council are suitably trained the following will apply:

- (i) From 1 January 2005, at all times that work is being carried out on water reticulation at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Service Person) qualification.
- (ii) From 1 January 2006, at all times that work is being carried out on water reticulation and three or more personnel are working on site, at least one member of the contractors staff on site shall have the National Certificate in Water Reticulation (Supervisor) qualification.
- (iii) From 1 July 2002 all butt or electrofusion of PE pipes shall be carried out by an operator who has attended and passed an appropriate and approved PE welding course.

## **VII – 2. DESIGN**

### **(a) Residential Supply**

In subdivisions and other developments of an average size, the domestic demand is not critical and the supply of water for fire fighting purposes will generally determine the pipe size required. For more extensive areas however, the pipe system shall be designed to provide for annual, seasonal and peak demand utilising the available pressures in the existing mains. The design shall provide for a domestic demand of 280 litre/head/day with a peak flow of four times this amount.

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### **(b) Commercial and Industrial Supply**

The water demand for commercial and industrial areas shall be analysed and specifically allowed for in the design.

(c) **Fire Fighting Supply**

Note:- a draft New Zealand Standard Code of Practice is currently (as at July 2002) open for public submission. This section will be amended when the new Code of Practice is operative. Until then the water reticulation shall be designed along the following basis:

The water reticulation shall be designed to comply with the requirements of the NZ Fire Service Code of Practice for Fire Fighting Water Supplies, and in particular shall meet the code requirements with regard to fire fighting flows, running pressure and the spacing of hydrants, together with any additional requirements set out herein, including storage where available.

The fire risk classification shall be as follows:

**Class A** – (Not Applicable for Nelson)

**Class B** – Congested industrial and commercial areas in the larger cities containing multi-storied buildings, large department stores, extensive shopping malls, factories, commercial and office property. Theatres and cinemas. Bulk liquid fuel terminal.

**Class C** – Concentrated built up areas of cities, secondary cities and larger towns not falling within classes A or B. Areas of multiple industrial risk. Large schools, large colleges, and large hospitals in the city suburbs.

**Class D** – Business and commercial areas of towns of medium size and in city suburbs not falling within classes A, B or C.

**Class E** – Any area within a Fire District that has a reticulated water supply and does not have risks that would place it into classes A, B, C or D including detached and semi-detached household units.

**Isolated Risks** – Any isolated risks within an area with a lower water supply classification should be classed at a level appropriate to the risk.

The minimum standard of water supply for fire fighting shall be as set out in the following table. The required flow shall be from any one hydrant or group of hydrants within 270m of any fire risk with a minimum residual running pressure (at the hydrant) of 100kPa.

Class	Reticulated flow in litres per second	Maximum Number of Hydrants from which the required flow is to be obtained within a 270m radius	Maximum spacing of fire hydrants	Reserve storage capacity or alternative supply in water supply scheme
A	200	8	90 metres	6 hours at 200 litres per second 4,320,000 litres
B	200	8	90 metres	4 hours at 200 litres per second 2,880,000 litres
C	100	4	90 metres	3 hours at 100 litres per second 1,080,000 litres
D	50	3	135 metres	2 hours at 50 litres per second 360,000 litres
E	25	2	135 metres	1 hour at 25 litres per second 90,000 litres

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(d) **Pipe Working Pressures**

Pipe Class (PN)	Maximum Working Pressure		Former Class
	Metre Head	kPa	
9	90	900	C
12	120	1200	D
15	150	1500	E
18	180	1800	F

(e) **Water Supply Reticulation Design**

The Nelson water supply reticulation comprises differing pressure zones, supplied from various reservoirs and pressure reducing valves. The extent of a pressure zone is such that the Level of Service (Performance Criteria) can be achieved for each property included. It is dependent on the available head at the reservoir/pressure reducing valve and elevation of the properties.

The Council's reticulation and asset plans should be carefully referred to when designing extensions to, or amendments to the existing water supply reticulation.

(f) **Design Information**

The Council may provide details of the working pressure or pressures at the point or points of connection to the existing reticulation that may be used for design purposes. When such data is not available or at the Council's request, it will be the responsibility of the designing engineer to obtain the information through independent flow and pressure tests. The Council shall have the right to specify the diameters to be used for the principal water mains within the development with regard to the Council's Strategic and Management Plans.

(g) **Alteration of Existing Infrastructure**

Any alteration of the existing water supply reticulation (upgrading, relocation and lowering of watermains and other water supply element(s), required for compliance of the new development to the Council's standards shall be at the developer's cost. The connections to the existing reticulation shall be undertaken by a contractor approved by the Council at the developer's cost.

(h) **Permitted Head Losses**

The new water supply reticulation shall be designed to mitigate large fluctuations in residual pressure as demands vary and minimise the losses of pressure along the watermains. Head losses in the watermains shall not exceed approximately 20kPa/kilometre at peak domestic demand (i.e. 2 metres of head loss per 1000 metres of pipeline). Higher losses may be approved by the Council on a case-by-case basis.

(i) **Reservoir Head**

For design purposes the hydraulic head at a reservoir shall be taken with the reservoir being fifty percent full.

When the source of supply is a pressure-reducing valve the hydraulic head shall be the head the pressure-reducing valve is set to.

### VII – 3. RETICULATION LAYOUT

A water main of not less than 100mm internal diameter fitted with fire hydrants (hereinafter referred to as the principal main) shall be laid on one side of all through streets and on one side of every cul-de-sac to the cul-de-sac head.

Dead end principal watermains are not permitted without specific approval. Ridermains shall be connected to and supplied from a principal main at both ends, except for private ways.

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A rider main shall be laid to the road frontage of all lots not fronted by a principal main.

Ridermains shall where possible be connected to an independent principal main so that continuity of supply is maintained when one of the mains is shut down.

In industrial areas the pipe sizes shall be adequate for the likely demand. The minimum requirement may be for a 150mm or possibly a 200mm internal diameter principal main on one side of the street, with another principal main on the other side.

#### **VII – 4. ALIGNMENT OF WATER MAINS AND RIDERMAINS**

##### **(a) Position in Street**

The position of water mains and ridermains in the street and right of ways shall be as shown on NCC Standard Drawing No. 21/305 and 21/401.

If the water main is under the carriageway, it shall be on an alignment at a prescribed distance from the kerb face. In any case the Council shall approve a logical combined layout for all underground services in the street.

If the water main crosses under the carriageway, it shall be at right angles to the carriageway.

Trees, manholes and similar structures shall not be positioned in berms where they will interfere with the standard alignment of the water mains.

In private access ways the watermain shall be laid within the grass verge where available. Connections perpendicular to the mains shall be installed to the point of metering.

All watermains shall generally be laid in straight lines. When watermains are laid on curves, the degree of deflection at joints shall not exceed the manufacturer's recommendation.

Where the pipe cannot be laid on its acceptable curvature, bends not sharper than 45° shall be used.

#### **VII – 5. PRINCIPAL MAINS**

##### **(a) Pipe Sizes**

Principal mains shall not be less than 100mm internal diameter, unless approved otherwise by the Council.

By convention, PVC pressure pipes in New Zealand and Australia are usually referred to by their Nominal Internal size (i.e. DN50, 100, 150 etc, a carryover from their Imperial past) whereas the equivalent ISO dimension PE pipes are usually referred to and specified by their Nominal Outside Diameter (i.e. DN63, 125, 180) as used in the ISO system.

Whilst the designer is concerned with Actual Internal Diameter as an essential part of the design, it is no longer acceptable to simply identify a pipe size as, for example '50mm'. It must be clear what dimension is being used (ID or OD). The pipe sizes shall be standardised as 100, 150, 200, 250, 300, 375, 450, 525 and 575mm nominal diameter only.

(b) **Pipe Standards**

The following pipes may be used for principal mains, providing they comply with the following standards:

mPVC	- AS/NZS 4765 (Series 1 or Series 2 dimensions)
uPVC	- AS/NZS 1477 (Series 1 or Series 2 dimensions)
PE 80 Type B (MDPE)	- AS/NZS 4130
PE 100 (HDPE)	- AS/NZS 4130
Hobas GR	- AS 3571/AS 3572
Steel (arc butt welded)	- NZS 4442
Ductile iron	- AS/NZS 2280

(c) **Acceptability of Pipe Materials**

Concrete lined steel pipes may be required in potential unstable ground, for lengths of exposed pipe, or in other special cases, and should be the subject of specific design. Suitable corrosion protection shall be provided. Steel pipes laid underground shall have an extruded blue or black HDPE external coating. Pipe laid above ground shall have a black HDPE coating or shall have an approved epoxy coating applied by a specialist applicator.

Ductile iron pipes may be appropriate in special cases and shall require specific approval by the Council. Ductile iron pipes shall be sleeved with a polythene sleeve to AS 3680 and AS 3681.

uPVC pipes or mPVC pipes for principal mains are acceptable in all normal circumstances. The installation shall be to AS/NZS2032 and AS/NZS 2566, with particular attention to the anchoring of valves and hydrants against displacement in operation. Refer NCC Standard Drawings No. 21/403 and 21/404. PVC pipes shall normally be Series 1 (metric OD sizes). Where mPVC pipe is specified it shall be one pressure class higher than for uPVC.

PE pipes may be appropriate in special cases and shall require specific approval by the Council. For PE pipes generally PE80 material is the standard used; however PE100 may be used where higher pipe strength is required or increased capacity is an important criteria. Pipes of differing compositions shall not be mixed within a common pipe length, (i.e. valve to valve).

Installation of PE pipes shall be to AS/NZS 2033 and AS/NZS 2566.

(d) **Pipe Pressure Classes**

Pipes for water mains shall generally be not less than PN12 (Class D) although a higher class shall be used if necessary to provide for the maximum pressures in the area in which they are to be laid.

(e) **Joints for PVC Pipe**

Elastomeric seal rings shall conform to NZS/BS2494 or AS1646. Joints for PVC or mPVC pipes shall normally be spigot and socket rubber ring type (z joints), with a biocidal lubricant. Solvent cement joints may be permitted where the necessary z ring fitting is not manufactured. Unrestrained Mechanical Couplings (repair couplings) shall only be used to close a section of pipe where no other fittings are possible.

(f) **Joints for PE Pipe**

PE pipes shall be joined with sealing compression fittings to AS/NZS 4129 up to PN16 maximum working pressure.

100mm NB (125mm OD) and larger pipes may be jointed by the use of a butt-welding or electrofusion technique. Certified tradespersons, approved by the Council, shall be employed with equipment specifically designed for the task. The contractor shall provide their own power source and earth leakage protection for the safety of their personnel.

For electrofusion jointing, only personnel trained in the system to be used will be permitted by the Council to carry out the work.

Electrofusion fittings shall conform to AS/NZS 4129.

The pipes shall be installed in accordance with AS 2033 and AS/NZS 2566.

(g) **Joints for Steel Pipe**

Welded joints in steel pipes shall be either butt joints, with an external welding band, spigot and socket joints, or as otherwise approved by the Council. All welds shall be fillet welds of 7mm or larger, applied in the field. Where butt jointed pipes are used, the ends shall be neatly butted where possible with a seal weld applied from the outside before the welding band is affixed. Steel pipes shall be cut to a neat and true line with an abrasive saw.

After welding and testing (if required), all unprotected metal inside and outside, including flanges, shall be thoroughly cleaned by appropriate methods. The exposed steel shall be protected promptly and damaged protective coating repaired in an approved manner by the application of one of the treatments listed below.

- (i) Emer-tan rust converter; Emer-guard primer; Emer-clad membrane.
- (ii) Polyken Synergy™ which includes an appropriate primer coat.
- (iii) Carbomastic 15 primer; Servi-Wrap R15A membrane; and Servi-Wrap Outerwrap

Joints shall be internally protected with a mortar lining to give a smooth and internal bore. Materials for the mortar shall comply with the requirements of NZS 3121. It is important to get a satisfactory mortar consistency to prevent the mortar from sagging or dropping out.

The pipe joint shall be plugged with a suitable plunger prior to applying the mortar, and then withdrawn evenly to smooth out the mortar joint.

Epoxy mortar (eg Humebond) shall be used for making good the mortar lining where pipes have been cut for mitred joints, or the fitting of flanges, etc.

Flange joints shall be to AS/NZS 4087.

(h) **Unrestrained Mechanical Couplings**

Old style Gibault joints have been superseded by new design couplings for all pipes except PE where compression or fusion fittings shall be used.

Unrestrained Mechanical Couplings shall be category 2 (50 year life) to WSA-105-2001 Long Series. Note:- This industry standard will be superseded by an Australian/New Zealand joint standard. This section will be amended when the standard is operative.

## VII – 6. RIDER MAINS

(a) **Pipe Sizes**

By convention PVC pressure pipes in New Zealand and Australia are usually referred to by their Nominal Internal size (i.e. DN50, 100, 150 etc, a carryover from their Imperial past) whereas the equivalent size ISO dimension PE pipes are usually referred to and specified by their Nominal Outside Diameter (i.e. DN63, 125, 180) as used in the ISO system.

Whilst the designer is concerned with the Actual Internal Diameter as an essential part of the design, it is no longer acceptable to simply identify a pipe size as, for example “50mm”. It must be clear what dimension is being used (ID or OD).

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Rider mains shall normally have a minimum internal diameter of 50mm although with the specific approval of the Council, rider mains of 40mm, 25mm or 20mm internal diameter may be permitted. This will depend on the pipe size achieving the level of service of 30 litres/minute in accordance with Sec. VII-1 (b).

The table below sets out the maximum number of dwellings, which maybe permitted to be served by a rider main or service pipe.

Size of Rider Main		Maximum Number of Domestic Service Connections (Home Units not Lots)	
PE63/50, PVC or copper	PE80 (MDPE)	Connected to larger main at one end	Connected to large main at both ends
DN20 ID	DN25 OD	1	NA
DN25 ID	DN32 OD	9	16
DN40 ID	DN50 OD	19	31
DN50 ID	DN63 OD	20	32
Note: ID = Internal Diameter		NOTE: OD = Outside Diameter	

(b) **Pipe Standards**

The following pipes may be used for rider mains, providing they comply with the following standard:

Copper	NZS3501
uPVC	AS/NZS1477
mPVC	AS/NZS4765
PE63/PE50 (HDPE)	NZS7602
MDPE	AS/NZS4130
PE80 type B (MDPE)	AS/NZS4130

(c) **Acceptability of Pipe Materials**

Copper pipes for rider mains are acceptable in all normal circumstances. PVC pipes for rider mains are acceptable in 50mm internal diameter only.

PE pipes for rider mains are acceptable in all normal circumstances.

(d) **Pipe Pressure Classes**

PVC pipes for rider mains shall be not less than PN15 (Class E) to provide additional wall thickness against possible mechanical damage.

PE pipes for rider mains shall be not less than PN12 (Class D) although a higher class shall be used if necessary to provide for the maximum pressures in the area in which they are to be laid.

(e) **Joints for Copper Pipe**

Copper pipe for rider mains shall be jointed using copper phosphorous brazing alloy. The tube shall be expanded with proper tools to form sockets and receive spigots. Joints to threaded fittings shall be by "Crox" nuts and nipples.

(f) **Joints for PVC Pipe**

PVC pipes for rider mains shall be spigot and socket rubber ring type (z joints) with a biocidal lubricant except that solvent cement joints may be permitted where the necessary z ring fitting is not manufactured. Unrestrained Mechanical Coupling joints shall only be used to close a section of pipe where no other fittings are possible.

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(g) **Joints for PE Pipe**

PE pipe shall be jointed by seal ring compression joints to AS/NZS 4129: 2000.

## VII – 7. CONNECTION OF RIDER MAIN TO PRINCIPAL MAIN

- (a) Where a rider main is to be extended at right angles to a principal main, it shall normally be connected with a tapping band without ferrule where the size of the principal main and rider main allow this. Otherwise a cast iron tee with a tapped blank plate shall be used. Refer NCC Standard Drawing No. 21/405.
- (b) Where a rider main is to be extended along the same alignment, beyond the end of the principal main, it shall normally be connected in a similar manner with an anchored blank end plate, and with a vertical socket and right angle (De-Zincification resistant) bronze bend.

## VII – 8. HYDRANTS

### (a) Hydrant Type

Hydrants shall be screw-down type, to Draft New Zealand Industry Specification for Underground Fire Hydrants November 2000. *Note:- This industry standard will be superseded by an Australian/New Zealand joint standard. This section will be amended when the standard is operative.* Normally the short pattern shall be used, except where the Council may approve or require the medium or tall pattern for extra flow capacity. Hydrants shall not be self-draining.

### (b) Hydrant Spacing

*Note:- a draft New Zealand Standard Code of Practice is currently (as at July 2002) open for public submission. This section will be amended when the new Code of Practice is operative. Until then the water reticulation shall be designed along the following basis:*

Fire hydrants shall be installed on all principal mains in accordance to the requirements of the Fire Service Code of Practice.

The distance between the hydrants and from the hydrants to the furthest building platform shall not exceed the following:

- (i) Commercial and industrial areas of fire risk, Classes A, B and C:  
- 90m on each side of the street.
- (ii) Residential areas of fire risk, Classes D & E:  
- 135m

In cul-de-sac or other terminal streets the last hydrant shall be at the head of the cul-de-sac.

Where a residential private way is more than 65m long, a hydrant shall be sited at the street end of the private way or on the other side of the street immediately opposite the entrance where practical.

A principal main shall be constructed and a hydrant(s) placed within the private access way in order to ensure each building is within a distance of a fire hydrant as specified above. The width of the private access way shall be sufficient to enable a fire appliance access to the hydrant (i.e. 3m minimum).

Hydrants must be readily accessible for fire appliances and should generally be positioned near street intersections in conjunction with valves, and not less than 6m from any building.

Single end fed principal mains shall only be used with the approval of the Council.

In area of fire risk classes A and B, hydrants shall be installed in pairs to provide better water flows.

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### (c) Hydrant Installation

Hydrant tees shall be flanged if laid next to other fittings. Otherwise flexible Z ring joints are permitted. Refer NCC Standard Drawing No. 21/404.

Hydrant risers shall be used, or the water main laid deeper, where necessary, in order to ensure that the top of the spindle is between 200mm and 300mm below finished surface level.

Hydrants shall be installed so the spindle cap and riser connection are in line with the watermain below.

(d) **Hydrant Boxes**

The manufacture and installation of hydrant boxes shall be to BS750. Hydrant boxes shall be aligned in the direction of the water main.

Hydrants shall be marked in accordance with NZS4501 and as detailed on NCC Standard Drawing 21/408, sheets 1 and 2.

## **VII – 9. VALVES**

(a) **Sluice Valves**

Valves shall be flanged.

The valves on all principal watermains 100mm diameter NB and larger shall comply with AS 2638.2: 2002, Class 16 and shall be anticlockwise closing. (A class higher than 16 may be required in certain circumstances).

Specific design, subject to the approval of Council, shall be required for valves over 250mm NB.

The valve shall be capable of bi-directional flow of water. Valves shall be set so that the spindle is truly vertical. Bolted joints shall be wrapped with a wrapping system, see NCC Standard Drawing No. 21/407 sheets 1 and 2.

Sluice valves shall be installed in accordance with NCC Standard Drawing No. 21/403 sheet 1.

(b) **Rider Valves**

Valves on rider mains shall be genuine “Saunders” diaphragm valves with cast iron body, rubber diaphragm, and 316 stainless steel bolts.

(c) **Air Release Valves and Scour Valves**

Watermains shall be laid to grade such that for the purpose of the release of the air a fire hydrant, an automatic air valve or a 20mm diameter ferrule and Saunders valve in a permanent surface box shall be installed at highest points/or where required by the Council. They shall be installed so that ground water cannot enter the main at negative pressure and shall be in a permanent valve box.

Automatic air valves shall be Gillies manufacture single or double, large or small orifice and of appropriate nominal bore. Automatic air valves shall be flanged and be mounted on flanged risers with an integral isolating valve accessible from ground level. Automatic air valves shall be installed within a standard manhole (marked ‘AV’) with positive drainage to an outlet such that ground water cannot enter the main at negative mains pressure.

Scour valves shall be either a fire-hydrant or Saunders valve as for air release above shall be installed at low points or to facilitate draining of a watermain where required by the Council.

All dead end mains or rider mains shall be fitted with permanent scour valves complete with valve box.

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In areas where the scouring of mains is needed as a frequent operation, a connection to the stormwater kerb outlets, open channels or sumps shall be

provided. The connection of a scour valve to stormwater pipes or manholes is not permitted.

Where Saunders valves are used for a bleed or scour valve, a copper pipe ('Hockey Stick' shaped) fitted with a crox nipple shall be provided in each box. The box shall be similar to a fire hydrant box but shall be marked 'AV' rather than 'FH'.

(d) **Positioning of Valves**

Valves shall generally be placed on all the three legs leading from each tee intersection in order to minimise the number of customers without water in case of a shutdown or for better operation control of the water supply system. Where practical, valves shall be located in berms.

Line valves shall be installed where the distance between other control valves exceeds 250m. For watermains over 200mm diameter line valves shall be required every 450m and shall be positioned as agreed by Council. Double fed rider mains shall have valves at both ends, located as close to the principal main as practical, but within the berm or footpath.

(e) **Valve Boxes**

Surface boxes shall be supported on a length of 150mm internal diameter uPVC pipe.

These shall be placed vertically over the fitting and supported on a firm foundation so that no direct loading is transmitted from the box to the main. Refer NCC Standard Drawing No. 21/403.

The top of the surface box shall be flush with or a maximum of 5mm above the finished surface level.

(f) **Depth of Valves**

The top of sluice valve spindles shall be 200-300mm below ground level, refer NCC Standard Drawing No. 21/403 sheets 1 and 2.

The top of the hand wheel on a "Saunders" valve shall be 150 to 225mm below ground level.

(g) **Butterfly Valves**

Butterfly valves shall be used only with the specific approval of the Council.

Butterfly valves shall be located in concrete valve chambers.

(h) **Non Return Valves (Swing Check Valves, Reflux Valves)**

Non-return valves shall be installed at reservoir and tank outlets and at reservoir inlets and at the lower extremity of the tank zone.

50mm diameter swing check valves shall be "Cambrian" bronze valves. Valves larger than 50mm diameter shall be "Gillies" swing check valves with external arm. Non-return valves shall be capable of being serviced without removal from the pipework. Cast iron swing check valves shall be fusion bonded thermoplastic coated or epoxy coated. All coatings shall be compatible with potable water and shall be colour blue.

Below ground swing check valves shall be within a standard manhole.

"Wafer" check valves may be approved for specific applications.

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## **VII – 10. DEPTH OF WATER MAINS**

Both principal mains and rider mains shall have the following cover, except in circumstances requiring special protection. Greater depth shall be provided if required by the Council.

### Under grass berms and footpaths

- Residential: top of pipe 600mm (minimum) and 900mm (maximum) below finished surface
- Commercial and industrial: top of pipe 750mm (minimum) and 1000mm (maximum) below finished surface.

### Under carriageways

- Top of pipe 750mm (minimum) and 1000mm (maximum) below finished surface level at the lowest point of the carriageway.

The sections of main adjacent to a carriageway crossing shall be gradually deepened, to allow the required cover under the carriageway without the provision of vertical bends. Similar provision shall be made to give the necessary cover over valve and hydrant spindles.

In berms service connection pipes shall have minimum cover of 350mm and maximum cover of 500mm. In the carriageway, right of way or access service connection pipes shall have minimum cover of 450mm and maximum cover of 750mm. Note - at the meter box or ridermain valve the pipe is permitted to have lesser cover where the pipe is raised to suit the fitting height.

## **VII – 11. PIPE BEDDING AND SURROUND**

All water pipelines shall have fine granular bedding and surround.

Bedding material shall consist of graded metal to the following sizes:

PVC, PE and Ductile Iron Pipe - chip or pea metal all passing 9.5mm sieve, all retained on 4.75mm sieve.

The requirement for bedding and surround of PVC and PE pipe is set out in AS2032 and AS/NZS 2566. Refer NCC Standard Drawing No. 21 /401.

The watermains under existing vehicle crossings, footpaths, and carriageways and in the vicinity of tree roots shall normally be thrust or bored to keep the disruption of access to properties and damage to surfaces and vegetation to a minimum.

Depth of thrusts/drilling shall be the same as for general pipe laying. The pipes shall be installed in a straight line or in a smooth curve. The alignment deviation (both vertical and horizontal) shall not exceed 150mm.

Where the new pipe crosses other services, a clearance of 200mm shall be maintained.

All precautions shall be taken to ensure that the end of the pipe to be passed through the bore is sealed to prevent the ingress of earth or other foreign matter.

## **VII – 12. PIPE FITTINGS**

Fittings such as tees, hydrant tees, crosses, tapers, hydrant risers, blank caps, plugs and bends of various degrees, made of a ductile iron and cast iron, shall be nylon coated in accordance with AS/NZS 4158 unless otherwise approved by the Council. Where mPVC, uPVC or PE pipe is used their respective purpose made fittings shall be used. These shall be Z ring, swept bends. Solvent cement and elbow bends shall not be used without specific approval.

Flanges shall be to AS 4087: 1996, PN16. Fittings laid adjacent to other fittings shall have flanges.

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All bolts, nuts and washers shall be 316 stainless steel with molybond anti-galling coating.

Graphite greases, graphite packing and graphite compounds shall not be used in contact with stainless steel.

Where dissimilar metals are used purpose made delrin thermoplastic inserts shall be installed in the flanges to prevent electrolytic action.

Gaskets for flanged joints shall comply with BS 5292.

Unrestrained Mechanical Couplings shall be category 2 (50 year life) to WSA 105-2001 Long Series.

Where fittings are used which do not have bolts, nuts and washers which are 316 stainless steel and/or fittings which are not nylon coated in accordance with AS/NZS 4158, then these fittings shall be wrapped as detailed in NCC Standard Drawing No. 21/407 sheets 1 and 2.

The following standards and specifications (and latest amendments) shall apply to the various fittings installed in the new reticulation.

NZS/BS 21	: 1985	Pipe threads for tubes and fittings
AS/NZS 1477	: 1999	PVC pipes and fittings for pressure applications
AS/NZS 4129	: 2000	Fittings for PE pipes for pressure applications
AS 1646	: 1992	Rubber Sealing Rings
NZS/AS 1650	: 1989	Hot dipped galvanised coatings on ferrous articles
NZS/AS 1830	: 1986	Iron castings – grey iron
NZS/AS 1831	: 1985	Iron castings – nodular graphite cast iron
AS/NZS 2280	: 1999	Ductile iron pressure press and fittings
NZS/BS 2494	: 1990	Elastomeric seals for joints in pipeworks and pipelines
AS/NZS 2544	: 1995	Grey iron pressure fittings
AS 2638.1	: 2002	Sluice valves for waterworks purposes – Metal seated
AS 2638.2	: 2002	Sluice valves for waterworks purposes – Resilient seated
BS 3412	: 1992	PE materials for moulding and extrusion
AS 4020	: 1999	Products for use in contact with drinking water
NZS/AS 4087	: 1996	Metallic flanges for waterworks purposes
NZS/AS 4131	: 1997	PE compound for pressure pipe and fittings
AS/NZS 4158.1	: 1994	Polymeric coatings on valves and fittings for water industry purposes
AS 4181	: 1999	Stainless steel clamps for water purposes
AS/NZS 4331.2	: 1995	Metallic flanges – Part 2: Cast iron flanges
NZS 4442	: 1988	Welded steel pipes and fittings for water etc.
NZS/BS 5154	: 1991	Copper alloy globe, check and gate valves
NZS/BS 5163	: 1989	Cast iron wedge gate valves for waterworks purposes
BS 5480	: 1990	Glass reinforced plastics (GRP), pipes, joints and fittings
AS 3855	: 1994	Suitability of plumbing and water distribution systems products for contact with potable water.
AS 4130	: 1997	Polyethylene (PE) pipes for pressure applications
AS 1646	: 2000	(3 Parts) Elastomeric seals for waterworks purposes

## VII – 13. ANCHOR OR THRUST BLOCKS

### (a) Bends and Blank Ends

Cast insitu concrete anchor blocks shall be provided at all points where an unbalanced thrust occurs on mains 50mm internal diameter and greater.

This shall include bends, tapers, valves, pressure reducing valves, tees, blank ends etc.

For butt-welded and electrofusion PE pipework of diameter up to 150mm NB anchor blocks are not required.

For PE pipes connecting to other pipework or fittings with flexible joints, anchor blocks are required.

The design of anchor blocks shall be based on the soil bearing capacity of 75 kPa or on the actual bearing capacity of the site soils whichever is lesser. A safety factor of 2 shall be used in the design.

The inner face of the block shall not be of a lesser depth than the diameter of the fittings, and shall be so constructed as not to impair access to the bolts on the fittings. Concrete shall have a minimum compressive strength of 17.5 mPa at 28 days.

A protective membrane to prevent abrasive damage to the water main shall be provided between the pipe (irrespective of the pipe material) and the concrete anchor and thrust blocks.

(b) **Anchorage of Sluice Valves and Hydrants**

Valves and hydrants on PVC pipelines require anchorage to resist torque when the valve is operated.

Valves shall be anchored by attaching a fish-tailed galvanised flat steel bar to the bottom bolt on each flange of the valve and incorporating these into a cast insitu concrete pad 200mm deep, of the same width as the trench and extending 150mm beyond each anchor bar. Care shall be taken to ensure that all bolts can be removed for future maintenance and are not obstructed by concrete. Refer NCC Standard Drawing No. 21/403.

Hydrant tees when flanged shall be anchored as above for valves. Hydrant tees with rubber ring joints shall be anchored by bedding the tee in a concrete pad 200mm deep, of the same width as the trench and not extending beyond the length of the tee. Care shall be taken to ensure that the flexible joints are not encased. Refer NCC Standard Drawing No. 21/404.

## **VII – 14. CONNECTIONS TO PRIVATE PROPERTY**

(a) **Diameter of Service Connections**

The standard connection sizes are 20 mm NB, 25 mm NB, 40 mm NB, 50 mm NB, 100 mm NB and 150 mm NB.

The minimum size shall be 20mm internal diameter.

(b) **Tapping Bands and Ferrules**

Each service connection to a principal main or a rider main shall be by means of a tapping band and a "Talbot" swivel ferrule with the flow of water controlled by a screwed brass plug.

Tapping bands on PVC pipes shall be of an approved cast bronze complying with the manufacture's recommendations, fully encircling the pipe to prevent over tightening and distortion of the pipe.

Refer NCC Standard Drawing No. 21/406.

Tapping bands on HDPE pipes shall be "RX" saddle tees.

Tapping bands on ISO dimension PE80 Type B pipes shall be to AS1460 Part 1 (eg; "Plasson").

If the required service is larger than is possible to connect with a tapping band the main connection shall be by a tee or a tapped elongated joint having a vertically connected ferrule.

(c) **Construction**

Tapping bands and ferrules on the water mains shall be fitted when the mains are first laid.

In commercial and industrial subdivisions tapping bands and service connections may be omitted until the specific requirements of the consumer are known. In this case a condition will be placed on the lot outlining that the lot owner is responsible for the cost of installing the service connection at the time of Building Consent (or earlier if required by the lot owner)

Where the Council requires the subdividing owner to lay the service connections, this shall be as far as and including the manifold and the meter box.

These connections shall be temporarily supported on waratah or similar standards until after the electric power or any other reticulation between the water main and the boundary has been laid.

Service connections shall be laid at right angles to the frontage.

(d) **Service Connection Materials**

Service connection pipes of copper or PE are normally technically adequate. Council may require use of one of these for specific operational reasons. HDPE shall be to NZS7602. Copper shall be to NZS3501. Joints shall be as for rider mains.

ISO dimension PE80 Type B pipes to NZS4130 are normally technically adequate.

(e) **Meter Assembly for 20mm and 25mm ID Connection**

The service connection shall terminate adjacent to the street boundary with a Nelson City Council approved 20mm nominal bore water meter assembly and box.

This shall consist of an "Acuflo" water meter manifold, isolating valve and double check valve housed in an "Everhard" underground meter box. Metal meter boxes are to be used for commercial and industrial accessways.

An approved water meter shall be fitted to the manifold. The meter shall be either an Invensys 501 LN Qn 1.5 Class C or Kent MSM Qn 1.5 Class C.

The meter box shall be within 150mm of the street boundary on the street side of the boundary, clear of regular vehicle traffic movement.

Where there is a service pipe in a Right of Way serving more than one property, the meter assembly shall be located in the Right of Way clear of regular vehicle traffic movements as if it was in the street.

The pipework at the meter box shall have an earth cover of 260mm to 300mm depth over it. Refer NCC Standard Drawing No. 21/406.

The meter box shall be placed on a firm base so that it will not be depressed below the finished surface by settlement or occasional vehicular traffic.

(f) **Meter Assembly for 50mm ID Connection**

For 50mm ID services a meter assembly consisting of genuine Saunders diaphragm valve with stainless steel bolts, a Kent PSM water meter, an approved backflow preventer, and an approved meter box.

- (g) **Meter assembly for larger than 50mm ID Connection**  
Connections larger than 50mm ID shall consist of a tee and sluice valve on the main. The sluice valve shall be bolted to the tee
- All service connections other than dedicated fire sprinkler or fire-fighting mains will be required to be metered.
- An appropriate sized Kent or Meinecke Meter Class B/C shall be installed at the boundary to the manufacturer's specification, and housed along with approved isolating valve and backflow preventer in a meter box of size and construction approved by the Council. If a reduced pressure zone backflow preventer is used, this shall be mounted above ground level.
- (h) **Reuse of Existing Service Connections**  
A proposal to reuse an existing service will only be approved if the service is of adequate size and one of the following conditions applies:
- (i) It can be established that the service is less than 40 years old or;
  - (ii) The service is to continue supplying the same building that it was originally intended for, and no others.
- This policy applies only to the Council portion of the water service i.e. from the main up to and including the meter assembly.
- (i) **Disconnections**  
Redundant services shall be disconnected from the supply line. The service fitting shall be removed or plugged to the satisfaction of the Council.
- Meter box, manifold assembly and meter shall be removed. These remain the property of Nelson City Council and they shall be delivered to the Council representative.
- (j) **Point of Supply to Consumer**  
The point of supply to each customer shall be determined in accordance with the NCC Water Supply Bylaw 199/99. Each individual dwelling or unit shall have a single point of water supply and a meter. Premises of multiple ownership including body corporate, strata title and leasehold/tenancy in common scheme shall be supplied and metered in accordance with the NCC Water Supply Bylaw 199/99.
- (k) **Point of Metering**  
The point of metering will generally be at the point of supply, other than for rear lots where the point of metering may be on private property in accordance with the NCC Water Supply Bylaw 199/99.
- (l) **Individual Connections**  
Water supply to cross leases and subdivisions will be treated on a common basis as follows:
- (i) An individual connection shall be required for each dwelling via its own legal street frontage with the meter assembly located at the street boundary.
  - (ii) For back sections an acceptable alternative will be a common pipe in the Right of Way (ROW)/Common Access serving only those dwellings with legal access onto the ROW/Common Access. Each dwelling shall have an individual connection from the common pipe with a meter assembly located at the edge of the ROW/Common Access. A meter assembly shall be located on the common pipe at the street boundary, where the pipe is 20mm or 25mm internal diameter. A genuine Saunders valve with stainless steel bolts shall be used where the pipe is 40mm to 50mm internal diameter.

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(iii) The supply pipe for one lot shall not pass through another lot unless there is physically no alternative (eg no water main in the street, insufficient water pressure in the main at the street boundary). In such a case an easement shall be required to protect the line of the supply pipe. Refer NCC Standard Drawing No. 21/400.

(m) **Backflow Preventers**

All new industrial and commercial properties shall have a backflow preventer installed on the owner's side at or as close as practical to the point of supply. The type and location of backflow preventers shall comply with the Building Act 1991, Water Supply Protection Regulation 1961, and the NCC Water Bylaw 199/99.

(n) **Water Meters**

Water meters shall be fitted to all connections as follows:

Connection Size, DN (mm)	Meter Size (mm)	Meter Designation	Average Flow m <sup>3</sup> /hr	Maximum flow m <sup>3</sup> /hr	Meter Class	Meter Type	Meter Model
20	20	N1.5	1.5	3.0	C	Manifold	Invensys 501 LM or Kent MSM Mini
25	20 25	N1.5 N2.5	1.5 2.5	3.0 5.0	C C	Manifold	
50	40	N10	10	20	C	In line	Kent PSM
50	50	N15	15	30	C	In line	
100	80 100	N40 N60	40 60	80 120	B/C* B/C*	Compound	Kent or Meinecke
150	100 150	N60 N150	60 150	120 300	B/C* B/C*	Compound	

\*Note: For Compound meters; high flow meters Class B, low flow meters Class C

Meter connections larger than 25 mm diameter shall be subject to the approval of the Council. The applicant may be required to present hydraulic calculations supporting the choice of meter size to the Council for approval.

## VII – 15. TESTING

(a) **Preparation for Test**

Before joints and fittings are covered, but after anchor blocks are completed, each section of the reticulation, together with all specials and fittings connected thereto shall be tested by the designer in the presence of the appropriate Council officer. The test shall be carried out, and all necessary apparatus supplied, by the Designer. Provision shall be made for the installation of the Council officer's test gauge in the test pipework if required.

(b) **Test Procedure**

The test procedure shall be as detailed in Appendix II, this section.

(c) **Final Test**

Before approving connection to the existing reticulation, the Council may require a similar test after completion of backfilling and any other adjoining works, which may affect the water reticulation.

## VII – 16 PIPELINE TRACER TAPE

### (a) Requirement

The location of all non-metallic (eg PE and PVC) water mains and rider mains shall be marked with a foil tape buried in the trench.

### (b) Tape

The tape shall be 50mm wide woven reinforced acid and alkali resistant polythene plastic with a solid aluminium foil core which shall be visible from both sides. “ThorTec™” tape is an accepted product.

The foil shall be continuously printed with “CAUTION WATER MAIN BURIED BELOW”, with no inks or printing extending to the edges of the tape. All printing shall be encased to avoid ink rub-off.

The adhesives that bond the protective plastic jacket to both sides of the foil shall be applied directly to the film and foil layers to provide a continuous seal.

### (c) Installation

The tape shall be buried above the centre line of the pipe within 300mm to 400mm from the finished surface. Refer NCC Standard Drawing No. 21/401.

All joints in the tape (e.g. roll ends, accidental breaks and at tees) shall be made electrically conductive with purpose made splice clips installed to the specific manufacturer’s instructions. Tying together of the tape ends is not acceptable as the polythene coating will prevent electrical conductivity.

The tape shall be brought up inside the surface box risers at all valves and hydrants with a 300mm long tail so that pipe location equipment can be readily connected.

### (d) Tracer Wire

When a pipe is installed by a directional drilling technique or bored through the ground for a distance exceeding 20 metres, the pipe shall have a ‘Tracer Wire’ attached. This wire shall take the form of a continuous 2.5mm<sup>2</sup> multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0m intervals.

## VII – 17. DISINFECTING

After backfilling and before being put into service, all pipes, valves, house connections and other fittings shall be disinfected.

The method to be adopted shall be approved by the Council

Quantity (Grams) of HTH powder required to chlorinate each 100 metres of watermain		
Diameter of water main in mm (DN)	HTH for dose of 50 mg/l	Volume m <sup>3</sup>
100	65 grams	0.8
150	150 grams	1.8
200	260 grams	3.2
250	400 grams	4.9
300	600 grams	7.0

After flushing and disposal of chlorinated water, the line is to be kept loaded for a period of 30 mins, flushed vigorously for a minimum of 10 mins, kept loaded for a further 30 mins then flushed again for a minimum of 10 minutes. Flushing shall be sufficient to ensure the water in the main is changed at least once on each occasion.

## **VII – 18. WATER MAINS TO BE KEPT CHARGED**

After any water main has been laid and tested and disinfected, it shall be kept continually charged with water, and under pressure. If the permanent connection to the existing reticulation is delayed, a temporary small diameter connection shall be made from the existing reticulation. The pressure must be maintained while electric power and other underground services are being laid in the vicinity of the main.

## **VII – 19. CONNECTION TO EXISTING WATER RETICULATION**

The physical work of connecting to the existing reticulation shall be by a Council approved contractor after the new reticulation has been tested and passed as satisfactory. The cost of this shall be met by the developer.

## **VII – 20. SUB-SOIL DRAINAGE OF SERVICE TRENCHES**

Adequate provision for draining all service trenches, including water trenches, on all hillsides as detailed on NCC Standard Drawing No. 21/212 shall be specified on the Engineering Drawings.

Similar requirements in conjunction with more extensive subsoil drains may be necessary on flatter ground in wet areas.

## **VII – 21. CORROSION PROTECTION OF FLANGES AND UNRESTRAINED MECHANICAL COUPLINGS**

This shall normally be provided by the use of 316 stainless steel bolts, nuts and washers, and fittings coated to AS/NZS 4158: 1996. Where metallic pipes and fittings are not coated, delrin thermoplastic inserts shall be installed in the flange to prevent electrolytic action.

Steel and grey cast iron flanges shall be further protected by a wrapping system.

Corrosion protection will be required (as follows) for all new flange and Unrestrained Mechanical Couplings, where materials other than 316 stainless steel and coatings to AS/NZS 4158: 1996 are used.

- (a) Flanges see NCC Standard Drawing 21/407 Sheet 1.
- (b) Unrestrained Mechanical Couplings see NCC Standard Drawing 21/407 Sheet 2.

## **VII – 22. PUMPING AND STORAGE**

Maximum water supply levels are indicated in the Resource Management Plans. For development above these levels, developers will be required to provide a pumping and storage system. Generally where the development contains public roads above the designated contour, the reticulation will be vested in the Council and where the development is served by Rights of Way the reticulation will remain private and be treated as if it is a rear lot.

Where the reticulation system is to be vested in the Council, the pump station and reservoir shall be continuously monitored and the information transmitted back to the Council offices via the Council Scada system.

## **VII – 23. PRESSURE ZONES**

Developments, that will be bridging two or more pressure zones will require to be supplied from different supply points and may need dual reticulation operating at different pressures to ensure flow continuity. A shut valve shall be provided at each zone boundary.

#### **VII – 24. SECURITY OF WATER SUPPLY FACILITIES**

Locks shall be provided on all doors, lids and chamber covers that require limited access for operational or security purpose. All newly constructed facilities shall be keyed to Council Security system prior to the hand over.

#### **VII – 25. PROVISION FOR FUTURE PLANNING**

In some circumstances the Council may require larger watermains or water supply facilities to be installed in accordance with Council Strategic Design Plans and with regard to future developments. In such cases the Council may by agreement:

- (a) Negotiate with the developer and make a financial contribution to the cost of additional capacity over and above that required for the development; or
- (b) Install the whole water supply reticulation or facility in anticipation of development, on terms requiring the developer to meet an appropriate proportion of the costs incurred by the Council.

All cost contributions shall be agreed in writing with the Council prior to construction or at Resource Consent stage.

#### **VII – 26. BUILDING OVER OR ALONGSIDE A PUBLIC WATERMAIN**

Building over or alongside any Public water main is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

The engineering requirements for building over or alongside watermains are as follows:

- (a) **Structures:**
  - (i) Must be located no closer than 1.0 metre measured horizontally from the centre line of any public watermain where the pipe is less than or equal to 300mm in diameter.
  - (ii) Must be located no closer than 1.5 metres measured horizontally from the outside of any public watermain where the pipe is greater than 300mm diameter.
  - (iii) Which are balconies, may overhang the line of the pipe provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
  - (iv) Which are located within 3 metres measured horizontally from the outside of the pipe must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe.



## Water Meter Location

Nelson City Council  
P O Box 645  
Nelson

To: Water Meter Officer

Subdivision/Meter Location

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**Resource Consent No.** \_\_\_\_\_ (If applicable)

The following table defines information required by the Nelson City Council for all new water meters.

In the Meter Type Column please indicate whether the meter is an Invensys (501 LN Qn 1.5 class C) or Kent (MSM Qn 1.5 class C) water meter. Indicate either S or K.

In the Meter Reading Column show the reading to the nearest whole cubic meter only (BLACK NUMBERS on the meter)

In the Location Column, indicate whether the measurement is from the right or left boundary when facing the lot from the road (R or L) Show one measurement to the meter from either the right or left boundary (measured along the front boundary) and one measurement to the meter from the front boundary (measured perpendicular to the front boundary).

Lot No	D.P No.	Street No.	Street Name	Meter Type I or K	Meter No.	Meter Reading (m <sup>3</sup> )	Reading Date	Location (Distance from)		
								R/L	Side Bdy (m)	Front Bdy (m)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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(Use additional page if required)

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Address: \_\_\_\_\_



**NELSON CITY COUNCIL**

# **FIELD ACCEPTANCE PRESSURE TESTING FOR WATER SUPPLY PIPELINES**

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## 1. INTRODUCTION AND GENERAL COMMENTS

The acceptance pressure test requirements used for water supply pipelines have generally been too insensitive to date. It is believed that many pipelines have been allowed to pass with unacceptable leaks, generally through ineffective testing procedures and/or low acceptance requirements. The procedures detailed in this document represent the latest acceptance requirements and procedures from Australia and Europe.

Section 3 gives general pressure test requirements for all pressure testing and Sections 4, 5 and 6 give material-specific test methods in detail. Appendix A has a pressure test record and Appendix B has some general comments on the measurement of make-up water volume and pressure measuring equipment.

## 2. TERMINOLOGY AND DEFINITIONS

**CLS:** Concrete lined steel pipes, generally welded spiral wound steel with a cement mortar lining in accordance with NZS 4441.

**Design Pressure (DP):** The pressure that the designer expects to act on the pipeline in service. In a gravity supply system, this is usually the elevation difference between the reservoir top water level and the lowest elevation of the pipeline in metres head.

**DI:** Ductile iron pipes - generally socket jointed with Tyton elastomeric seal rings.

**DN:** Nominal pipe bore diameter in millimetres. For PE pipes, this relates to the pipes outside diameter.

**GRP:** Glass reinforced plastics pipes, e.g. Hobas. This type of pipe is generally only used for major transfer or transmission mains since pipe diameters of less than DN 300 mm are rare.

**Maximum Design Pressure (MDP):** The DP plus a pressure surge allowance (preferably calculated), or a fixed allowance of 200-500 kPa or such other allowance as the pipeline designer may decide is appropriate.

**Operating Pressure:** The internal pressure which occurs at a particular time and at a particular point in the water reticulation system. For a gravity system, the operating pressure will depend on the water level of the reservoir, the ground level at the point on the pipeline under consideration, and the head loss due to demand in the system.

**PE:** Polyethylene pipes, generally PE 80B or PE 100 for water supply networks. PE 80C is not recommend for long term water reticulation networks.

**Nominal Pressure Rating (PN):** The pressure marked on the pipe or component and the maximum pressure that it can operate at throughout its design life.

**System Test Pressure (STP):** The hydrostatic pressure to be applied to a newly laid pipeline (measured at the lowest point) to ensure its integrity and water tightness.

## 3. ACCEPTANCE PRESSURE TESTS FOR ALL PIPELINE MATERIALS

### 3.1 General

Every pressure pipeline is required to pass a water pressure test to verify the integrity of the pipes, joints, fittings and other components such as thrust blocks.

For drinking-water pipelines, the test medium shall be potable water that may contain sufficient additional disinfectant to minimise the risk of the commissioned pipeline containing potentially harmful organisms. For safety reasons, compressed air shall not be used for pressure testing

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### 3.2 Health and Safety Issues

Appropriate safety equipment shall be available on site prior to commencement of any pressure testing operations. Only suitably qualified personnel shall carry out and oversee the testing and shall have appropriate protective clothing.

All excavations shall be adequately barricaded. Work in pipe trenches that is not related to the pressure test shall not be permitted during the pressure test.

All test equipment shall be correctly calibrated, in good working order, suitable for the test procedure and be correctly fitted to the pipeline.

The section to be tested shall be completed in accordance with the specification and the pipes and fittings etc adequately restrained. Any permanent or temporary concrete thrust blocks shall be designed for and have attained sufficient compressive strength to resist the test thrusts. No temporary thrust blocks or supports shall be removed until the pipeline is depressurised.

Where water for testing purposes is derived from a potable water supply, appropriate backflow prevention equipment shall be incorporated in the connection to the potable water supply to minimise the risk of accidental backflow and possible contamination of the potable water supply occurring.

The contractor shall have contingency plans and sufficient equipment on site to deal with any bursts or other foreseeable emergency that may arise during testing.

### 3.3 Personnel Qualifications

The testing of all pipelines shall only be carried out and supervised by acceptably qualified or accredited personnel.

Qualified or accredited personnel shall:

- hold appropriate qualifications issued by a registered training organisation; or
- have attended a relevant training course, and received accreditation relating to the work being undertaken, and
- show competence and knowledge of the relevant testing methods and procedures

### 3.4 Filling the Pipeline

New pipelines should preferably be filled from the low end of the line. The rate of flow and time of day for filling may be controlled by the availability of water. Where the pipeline is to be charged with water from the existing reticulation network, the filling rate of flow should not cause a pressure drop that will be noticeable or cause inconvenience to consumers. Water from an alternative source shall not be used to fill pipelines for testing purposes unless the quality of the water complies in all respects with grade B (or better) for water Source and Treatment of the Public Health Grading of Drinking-Water Supplies.

It may be necessary to carry out the filling, flushing or swabbing operations at times that do not coincide with peak demands on the reticulation network. The pipeline designer should specify the filling times and rates of flow, especially where large diameter pipelines are involved.

Suitable means of introducing flushing water, including temporary facilities for launching and release of swabs (as appropriate) shall be installed as part of the testing procedure and a means provided for the safe disposal of any water that is flushed from the pipeline.

A suitable backflow preventer shall be used on any connection made to fill, flush out or to drive a swab or swabs through a new pipeline. A dual check valve (without test facilities) will be suitable provided its effectiveness is confirmed prior to use.

### 3.5 Pressure and Volume Measurement

The accuracy and readability of pressure monitoring and make-up volume measurement equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

Appendix B gives detailed requirements for volume and pressure measurement equipment.

### 3.6 Test Section Length

The pipeline length tested may be either the whole or a section of the pipeline, depending on the length and diameter, the availability of water and the spacing between sectioning valves or blank ends. When installing long pipelines, it is advisable to begin testing early in the installation to confirm the adequacy of the laying procedures, and to increase the length tested progressively as experience is gained. The Contract documents may contain specific requirements that effectively control the length/s to be tested.

*Note: Long sections may incorporate large numbers of mechanical joints that may need to be checked for leakage if there is a test failure. Leaks become harder and more costly to pinpoint in longer test sections.*

Pipeline test sections longer than 1,000 m may need to be tested in shorter sections. If long lengths are to be tested, the use of radios or cell phones may be necessary to facilitate the testing procedure.

Pipelines should be tested in suitable lengths so that:

- The overall pressure at the lowest point of the line does not exceed the STP
- The pressure at the highest point in the section is at least equal to the MDP.
- Sufficient suitable water is available for the test and there are appropriate plans in place for the disposal of the test water (including disinfection residual if applicable).
- Site considerations such as; mixed pipe materials, locations of blank ends to ensure safe and convenient accessibility, etc are taken into account

### 3.7 Test Duration

The test duration will vary depending on the testing method used. The main test phase for any method will be at least an hour and may take more than one working day. The test duration given in the specification or in the approved methodology shall be used.

### 3.8 Pipe Temperature

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Refer also to Appendix B for additional comments on temperature effects.

### 3.9 Test Methodology

The Contractor shall provide a test methodology for the Engineers approval prior to commencing testing. The methodology shall include at least the following:

- names and experience/qualifications of the personnel to be used
- details of the test length (including any changes in diameter or pipe material) marked on a longitudinal profile of the pipeline
- details of temporary anchors or thrust blocks and sectioning valves
- timing of, method proposed for and rate of filling the pipeline (including details of backflow prevention equipment proposed)
- details of method for removal of air from the line
- details of the pressurising pump, its capacity and the method proposed for controlling pulsation's and ensuring that the STP is not exceeded
- pressure rating of the lowest rated pipeline component
- system test pressure
- test duration
- details of the test rig (pressure gauges and/or transducer and data logger to be used)
- details of the method (and equipment) proposed for determining make-up water volume or volume discharged in confirming the remaining air for the rebound test
- method for ensuring that line valves seal satisfactorily
- acceptance criteria for the method proposed
- maximum allowable concentration of total available chlorine that can be discharged to a stormwater system or natural channel (if applicable)
- proposals for disposal of water drained on completion of the test, including the method of de-chlorination and the means of measuring the chlorine residual to ensure it does not exceed the allowable value (if applicable)
- test record sheet proposed

### 3.10 Acceptance Test Requirements

#### 3.10.1 General Requirements

The length to be tested shall be as scheduled in the contract documents or as planned by the Contractor in the approved methodology. If any test proves to be unsatisfactory, detect and rectify the fault/s, and re-test. Even if testing procedures produce a satisfactory result, any visible leaks that are discovered shall be rectified and the pipeline re-tested.

Acceptance testing may be done progressively, but shall not be commenced before:

- at least 24 hours notice of the intention to start testing has been given to the Engineer
- the Contractors written testing methodology and all equipment (including backflow prevention device/s, pressure test rig, makeup volume measurement, etc) have been approved
- suitable means for filling and flushing, including temporary facilities for launching and release of swabs (as appropriate) are in place
- the Engineer has approved the source of water and the rate of flow for filling the line
- the section to be tested has been completed and backfilled and is in conformity with the specification

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- any permanent or temporary concrete thrust blocks have been poured and have attained sufficient compressive strength to resist test thrusts
- end caps (that allow for filling and bleeding of air) and any temporary anchors are in place and are adequately braced to resist test thrusts
- air valves (if applicable) are installed and their isolating valves are open
- arrangements have been made for the safe disposal of water flushed from the pipeline
- contingency plans are in place for dealing with a possible pipeline burst
- suitably qualified personnel are on site to carry out, oversee and approve the acceptance test
- appropriate and approved record sheets are available for recording all aspects of the test

### **3.10.2 Filling the Pipeline**

Nelson City Council will make water available from its reticulation for the first filling and flushing operations at no cost to the Contractor. Water used for any subsequent fill/s and flushing will be charged at Council's current supply rate. The quantity of water to be charged shall be as measured by meter or as assessed by the Engineer if suitable metering equipment is not used.

The pipeline shall be filled at the approved rate, in accordance with the following conditions:

- fill from the low end and ensure that air valves and venting points are open and operating
- run a polyurethane foam swab along with the filling water to assist with air removal if specified or approved
- where swabbing is not carried out, flush (if possible and approved) the pipeline at a rate that will transport construction debris to scour point/s and air to vented connections and air valves
- make sure that the filling or flushing operations do not cause an unacceptable pressure drop in the reticulation
- make adequate provision for the safe disposal of any flushed water
- raise the pressure in the pipeline to the pipeline DP as specified or to  $75 \pm 5\%$  of the STP if the DP is not specified
- repair any leaks or make good any defects that are revealed
- allow the pipeline to "soak" for a period of 2 to 24 hours (or more) to allow the temperature to stabilise and any time dependent movement to take place (the longer period may be necessary for saturation of cement mortar linings on pipes or fittings)
- a disinfection solution may be introduced with the fill water or final flushing water if approved by the Engineer

### 3.10.3 System Test Pressure (STP)

The STP shall be as set by the system designer. If the STP has not been specified, the pipeline shall be subjected to a pressure that is the lower of:

- 1.25 x PN of the lowest rated pipe or component installed in the section to be tested, or

Where surge pressures have been included:

- DP + 100kPa, or

Where surge pressures have not been included:

- DP + 500 kPa, or 1.5 x DP (whichever is the greater),

Where short lengths of pipeline are tested separately, e.g. for service pipes of DN ≤ 63 and of ≤ 100 metres the STP may be taken as the DP unless otherwise specified.

### 3.10.4 Pressure Monitoring point

The pressure shall be monitored at the lowest part of the pipeline or if that is not possible, at some other convenient point and the STP adjusted to take account of the elevation difference between the pipelines lowest point and the test rig. The adjustment shall be made by subtracting 10 kPa for every metre elevation that the rig is above the lowest part of the line.

## 3.11 Pressurising the Pipeline

### 3.11.1 Test Pump Capacity

The pump capacity is an important consideration. If its capacity is too small, it may take too long to reach the test pressure, conversely, if its capacity is too great, it may not be controllable and could cause over-pressurisation.

If a motorised test pump is used, it shall be fitted with an adjustable pressure relief valve that is set to discharge the full flow of the pump at a pressure equal to the PN of the pipe. To pressurise the pipeline, the relief valve setting should be gradually adjusted to raise the pressure in a controlled manner until the STP is reached. Continual discharge from the relief valve is preferable to the possibility of overloading the pipeline. The test pump should not create excessive pulsation's that may affect the ability to achieve the STP accurately. A surge-damping device may be needed to control pressure pulsations.

### 3.11.2 General Comments

Pressurising the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) is on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and *must not* be raised to more than 1.5 x the PN of the lowest rated component in the line.

If over pressurisation is considered by the Engineer to have compromised the pipeline materials integrity, the Contractor may be liable for all costs involved in replacing and relaying the over-stressed section of pipeline. The degree and duration of the over pressurisation will have a bearing on the outcome and the Engineer may wish to consult with a recognised expert in pipeline materials before making a ruling. The Contractor shall be responsible for any costs incurred and for any delays that may be associated.

### **3.12 Testing Against a Closed Valve**

Pressure testing against a closed valve is not acceptable. The test line shall be blanked off and suitably anchored.

### **3.13 Final Pressure Test**

When a pipeline has been divided into two or more test sections for pressure testing and all sections have tested satisfactorily, the total pipeline shall be pressurised to the DP. After one hour at the DP, all joints on closer pipes between sections or any additional components that have been installed after the pressure test of the adjacent sections shall be inspected visually for leaks and changes of line or level. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

If, for any reason, it is not possible to observe leakage at joints on closer sections, the final test shall be carried out using a full test procedure as per the appropriate test method for the pipeline material. The STP for this final test shall be selected so that:

- the pressure at the lowest part of the pipeline does not exceed  $1.5 \times PN$  of the lowest rated component in the system
- the pressure at the highest part of the line is at least equal to the MDP.

The Engineer shall be advised so that the final test can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

### **3.14 Connections to Existing Pipelines**

No connection to an existing pipeline shall be made until the new pipeline and any connecting pipes and fittings have been disinfected. The joints between the new pipeline and existing pipelines shall be subjected to the operating pressure for at least one hour and then inspected for leakage. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

The Engineer shall be advised so that the final connecting joints can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

### **3.15 Additional or Failed Pressure Tests**

The cost for the Engineer to attend pressure tests that fail shall be a cost to the contractor for council contracts and a cost to the Developer when the work is for a subdivision.

### 3.16 Reporting

A complete record of all details of the test shall be made. This record shall include the following:

- full details of the pipeline tested (including details of pipe material, diameter and pressure class, pressure rating, manufacturers identification, jointing system, pipeline profile showing changes in pipe material as well as the location of valves and fittings, and the location of test sections)
- failure of any thrust block, pipe, fitting or other component
- any visible leakage detected and repaired
- a detailed record of the pressure in the pipeline at appropriate time intervals. This may be from a pressure data logger or by manually recording times and pressure readings at appropriate intervals
- details of the addition of make-up water (either by volume drawn off or volume pumped in)
- the allowable quantity of make up water for the test conditions
- confirmation that valves sealed when subjected to DP on one side
- whether the pipeline passed or failed the test
- the signatures of the representatives of the Contractor, Engineer and/or Designer who witnessed the test.

A suitable record form is attached as Appendix A.

### 3.17 Completion of the Test

After testing, release the test pressure slowly and if necessary, open air valves and drain points to drain the line. If the pipeline has been disinfected, do not drain it until just prior to final commissioning so that the risk of contamination is minimised.

If it is necessary to drain a line that contains a disinfection residual of chlorine, this residual shall be reduced to an acceptable level before being discharged to a storm water system. Alternatively, (and with the Engineers approval) the chlorinated water may be discharged to the sewage system provided a positive air gap separation is maintained at all times and the rate of discharge does not overload the sewer.

## 4. METHOD FOR PRESSURE TESTING DI, CLS, PVC, PVC-M & GRP PIPELINES

### 4.1 Pressurising the Pipeline

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) are on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and **shall not** be raised to more than 1.5 x PN of the lowest rated component in the line.

Maintain the STP, by pumping at 15-30 minute intervals (if necessary) for the specified test duration (usually at least one hour). Measure and record the quantity of make-up water added at each occasion, either by the volume pumped in or the volume drawn off method as detailed in the Contractors approved test methodology or Appendix B. Restore the STP whenever the pressure drops by more than 5%.

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**4.2 Acceptance Criteria**

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance to locate
- The total make-up water volume does not exceed the maximum allowable quantity as calculated from the equation:

$$Q(\text{litres/hr}) \leq (0.14 \times L \times D \times H)$$

Where:

<i>L</i>	=	<i>Length of pipeline under test (km)</i>
<i>D</i>	=	<i>Internal diameter of pipe (m)</i>
<i>H</i>	=	<i>Average value of head in the pipeline over the full test length (m)</i>

**4.3 Failure of Test**

Should the test fail, the cause shall be located and rectified and the section re-tested until satisfactory results are obtained.

Failure to allow adequate “soak” time for a cement mortar lined pipe or if there is a significant amount of entrapped air in the pipeline may result in an inconclusive test or a marginal failure. In such a case, the test period may be extended for a further one to two hours, as may be agreed between the Contractor and the Engineer.

Provided the quantity of make-up water meets the acceptance criteria during the last hour of this extended period, the pipeline will pass the test.

When PE service connections or sub-mains are tested along with a main pipeline, the visco elastic creep of these pipes may cause a test failure. It may be necessary to isolate the PE sections and test these separately or to apply the methods given in sections 5 or 6.

**4.4 Reporting**

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

**5. Method for Pressure Testing Visco-Elastic Pipes (PE) – Rebound Method****5.1 General**

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer are on site to witness the test, unless the Engineer has given prior approval.

A Pressure transducer and data logger is the preferred means for monitoring the pressure during this test method, however, manual reading of a pressure gauge that complies with the requirements of Appendix B clause 4 at 2-5 minute intervals will be acceptable.

**5.2 Preliminary Phase**

This preliminary phase is necessary before proceeding to the subsequent phases. It is intended to set up the prerequisites for volume alterations that are dependent on pressure, time and temperature.

- After flushing/swabbing and thoroughly venting the pipeline, depressurise to just above atmospheric at the highest point of the line and allow a relaxation period of at least 60 minutes to release pressure related stress. Ensure that no air enters the line

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- After the relaxation period, raise the pressure steadily and smoothly to the STP (it must not be raised to more than 1.5 x PN of the pipe). Maintain the STP for a period of 30 minutes by pumping continuously or at short intervals. Take care not

to exceed the STP. During this time, carry out an inspection to identify any obvious leaks

- Stop pumping and allow the pressure to decay by visco-elastic creep for 1 hour
- Measure the remaining pressure at the end of the hour
- If the pressure has dropped to 70% (or less) of the STP, the pipeline will not pass the test and the cause should be located and rectified. This could be due to leakage or temperature change. If the pressure at the end of the hour >70% of the STP, continue with phase two, the pressure drop test to prove the volume of air in the pipeline is sufficiently low to allow the main test phase to be carried out.

### 5.3 Pressure Drop Test

The main test phase requires that the pipeline has been adequately vented and the volume of remaining air is less than the calculated maximum allowable. The procedure to confirm the air volume is described below. This test (pressure drop test) is carried out immediately after the completion of a successful preliminary phase.

- Reduce the pressure remaining in the pipeline rapidly at the end of the preliminary phase by opening a metered “bleed” connection to produce a pressure drop ( $\Delta p$ ) of 10 – 15% of the STP or to the DP (which ever produces the lowest pressure). The bleed time should be kept as short as possible, (preferably less than 2 minutes). A large diameter/volume test section will require a large connection and meter in order to achieve the bleed time requirement – this should be confirmed by calculation.
- Measure accurately and record the volume of water “bled” from the line ( $\Delta V$ ).
- Calculate the maximum allowable water loss ( $\Delta V_{max}$ ) using the following formula. The volume of water removed should not exceed  $\Delta V_{max}$ .
- If  $\Delta V$  is more than  $\Delta V_{max}$ , stop the test and remove excess air

$$\Delta V_{max} = 1.2 \times V \times \Delta p \times [1/E_w + D/(e \times E_R)]$$

Where:

$\Delta V_{max}$	allowable water loss in litres
$V$	total volume of the tested pipeline in litres
$\Delta p$	measured pressure drop in kPa
$E_w$	bulk modulus of water (kPa) @ test temperature (see Table 1)
$D$	internal pipe diameter in metres
$e$	wall thickness of the pipe in metres
$E_R$	modulus of elasticity of the pipe wall in kPa (see Table2)
1.2	an allowance for remaining air

**Table 1 – Bulk Modulus of Water at Various Temperatures**

TEMPERATURE °C	BULK MODULUS (kPa)
5	2080000
10	2110000
15	2140000
20	2170000
25	2210000
30	2230000

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**Table 2 – E Modulus of PE 80B and PE100 at Various Temperatures**

TEMP. °C	PE 80B - E Modulus (kPa) @ hrs			PE 100 - E Modulus (kPa) @ hrs		
	1 hour	2 hours	3 hours	1 hour	2 hours	3 hours
5	740000	700000	680000	990000	930000	900000
10	670000	630000	610000	900000	850000	820000
15	600000	570000	550000	820000	780000	750000
20	550000	520000	510000	750000	710000	680000
25	510000	490000	470000	690000	650000	630000
30	470000	450000	430000	640000	610000	600000

Notes:

- The value of  $E_R$  should be representative of the temperature and duration of the test (see table 2 above)
- $\Delta p$  and  $\Delta V$  should be measured as accurately as possible, especially where the test section volume is small.

#### 5.4 Main test phase

The visco-elastic creep due to the STP is interrupted by the rapid pressure drop described above. The rapid drop in pressure leads to the contraction of the pipeline. Observe and record the increase in pressure that results from the contraction of the pipeline for a period of 30 or 90 minutes.

#### 5.5 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage
- The pressure shows a rising tendency throughout the 30 minute period
- If doubt exists about the pressure recovery, the monitoring period may be increased to 90-minutes and any pressure drop that does occur shall not exceed 20 kPa over the full 90-minute period
- If the pressure drops by more than 20kPa during the 90 minute extended period, the test fails
- Repetition of the main test phase may only be done by carrying out the whole test procedure including the relaxation period of 60 minutes described in the preliminary phase.

#### 5.6 Failure of Test

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained.

#### 5.7 Reporting

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

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## 6. METHOD FOR PRESSURE TESTING VISCO-ELASTIC PIPES (PE,) – VOLUMETRIC METHOD

**6.1 Purpose**

This method is included as a reference method that can quantify the amount of leakage in a visco-elastic pipeline. It will generally require a greater length of time to achieve a result.

**6.2 Pressurising the Pipeline**

The pressure shall be raised steadily and smoothly to STP. (It *must not* be raised to more than 1.5 x PN of the pipe).

When the STP has been reached, isolate the pipeline and allow the pressure to decay naturally for 12 hours. (The pressure will drop significantly during this pre-stressing period).

After 12 hours, re-apply and maintain the STP for 5 hours as detailed below:

- Restore the STP at the end of the 12 hour pre-stressing period
- Restore the STP at the end of hour 1
- Restore the STP at the end of hour 2
- Measure and record the water volume (V1 Litres) needed to restore the STP at the end of hour 3
- Restore the STP at the end of hour 4
- Measure and record the water volume (V2 Litres) required to restore the STP at the end of hour 5

Calculate

$$V_2 \leq 0.55 \times V_1 + Q$$

Where:  $Q$  is the allowable make-up volume obtained from the equation:  
 $Q$  (litres/hr)  $\leq (0.14 \times L \times D \times H)$

Where:  $L$  = Length of pipeline under test (km)  
 $D$  = Internal diameter of pipe (m)  
 $H$  = Average value of head in the pipeline (m)

**6.3 Acceptance Criteria**

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance
- The make-up water volume (Q) does not exceed the maximum allowable volume as calculated

**6.4 Failure of Test**

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained. Note that the STP and the quantity of water required to restore the STP must be measured as accurately as possible.

**6.5 Reporting**

On satisfactory completion of the test, a test report prepared by the Contractor shall be signed off by the Contractor, Engineer and Consultant witnessing the test.

**7. PRESSURE TEST RECORD**

**Nelson City Council**

**PRESSURE PIPELINE - TEST RECORD**

PIPE PURPOSE: DATE:  
 LOCATION: DESIGNER:  
 CONTRACTOR: FOREMAN:  
 CONSULTANT OBSERVER: COUNCIL OBSERVER:

**OPERATING & TEST DETAILS**

**MAX. OPERATING PRES:**  
**SYSTEM TEST PRESSURE:**  
**PASS CRITERIA:**  
**PASSED THE TEST?**  
 SIGNATURES:

**MAIN PIPELINE DETAILS**

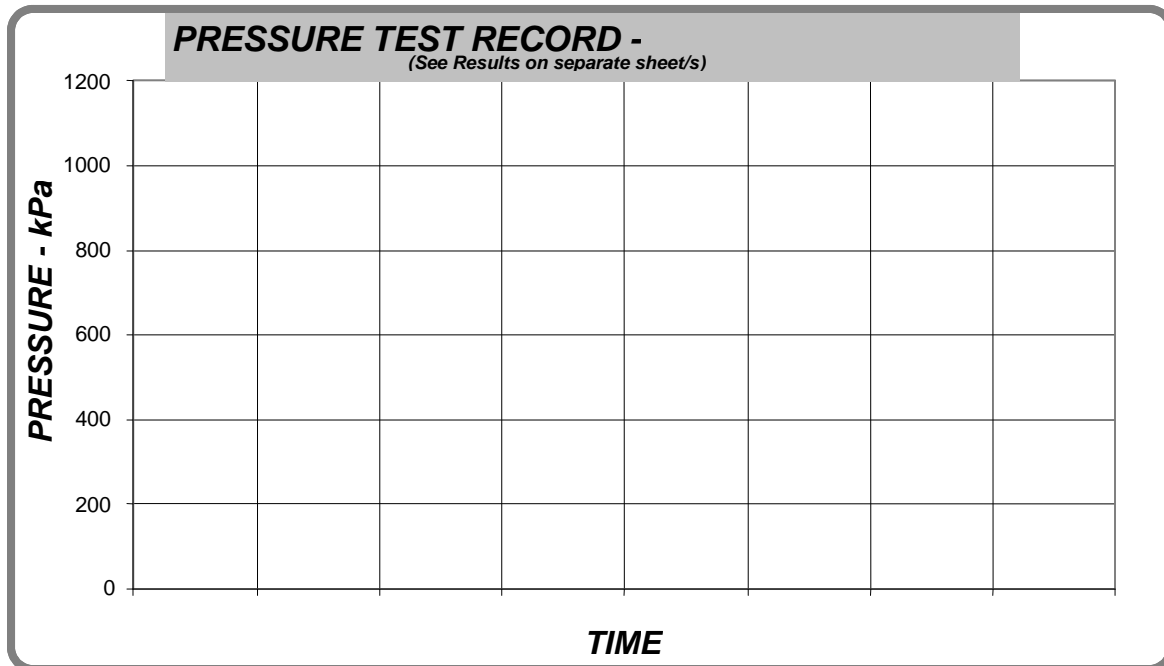
PIPE MAKE/DESCRIPTION: PIPE OD (mm):  
 NOMINAL DIAMETER: PRESSURE CLASS:  
 PIPE MATERIAL: LENGTH OF PIPE:  
 JOINTING SYSTEM:  
 PIPE SERIAL NUMBER/S:

**RIDER MAIN DETAILS**

PIPE MAKE/DESCRIPTION: PIPE OD (mm):  
 NOMINAL DIAMETER: PRESSURE CLASS:  
 PIPE MATERIAL: LENGTH OF PIPE:  
 JOINTING SYSTEM:  
 PIPE SERIAL NUMBER/S:

**HOUSE CONNECTION DETAILS**

PIPE MAKE/DESCRIPTION: PIPE OD (mm):  
 NOMINAL DIAMETER: PRESSURE CLASS:  
 PIPE MATERIAL: LENGTH OF PIPE:  
 JOINTING SYSTEM:  
 PIPE SERIAL NUMBER/S:



Attach a copy of the pressure test methodology and profile of the pipeline.

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## 8. MEASUREMENT OF MAKE-UP WATER VOLUME

There are two equivalent methods for measuring the volume of make-up water; i.e. measurement of the volume drawn off or the volume pumped in.

### 8.1 Measurement of the Volume Pumped in

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Then restore the STP by pumping and measure the volume that is pumped in.

The quantities of water pumped in should be summed if it's necessary to raise the pressure in the line more than once during the test.

The volume of water pumped into the pipeline may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the inflow rate is within the meters'  $Q_{\min}$  and  $Q_{\max}$ .

The quantity of water may be quite small (especially for a small diameter and short length of main). If a motorised test pump is used, it may be difficult to control the rate of pressure rise and pump pulsations may affect the water meters accuracy. If this is the case, the use of a hand pump should be considered or the "volume drawn off" method used.

### 8.2 Measurement of the Volume Drawn off

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Restore the STP by pumping and measure the volume that has to be drawn off to reach the reduced pressure previously recorded, then restore the STP. This whole operation should be carried out as quickly as possible, consistent with ensuring the accuracy of the pressure and volume measurement.

The quantities of water drawn off should be summed if it's necessary to restore the pressure in the line more than once during the test.

The volume of water drawn off may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the outflow rate is within the meters'  $Q_{\min}$  and  $Q_{\max}$ .

### 8.3 Accuracy of Pressure and Volume Measurement

The equipment used to determine the make-up volume shall be capable of measuring the quantity of water to an accuracy of  $\pm 2\%$  or better.

The precision of the pressure measurement will have an effect on the accuracy of the volume measurements, especially if a significant amount of air remains in the pipeline. The precision with which the STP is set and restored will also have an effect on the test results. Measurement of the volume drawn off may be more precise and controllable than the volume pumped in. The equipment (pressure gauges and volume measuring devices) shall be to the accuracy specified and every care shall be taken to ensure that the results are as accurate as the equipment will allow.

### 8.4 Acceptable Pressure Measurement Devices

The accuracy and readability of pressure monitoring equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

The pressure range of the gauges used shall be such that the STP falls within the range 50 - 90% of the full-scale range of the gauge. The main gauge shall have been calibrated within 6 months of use and have a minimum dial diameter of 100-mm (preferably 150 mm). A check gauge of a similar pressure range shall also be used to confirm the calibration of the main gauge. (A "test" pressure gauge with an accuracy of  $\pm 0.5\%$  of full scale is preferred for the main gauge).

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Alternatively, a data logger may be used to log the pressure signal from an accurately calibrated pressure transducer. A suitable “check” pressure gauge shall be used in conjunction with the pressure transducer to confirm the calibration of the transducer. The test gauge shall be read at frequent intervals and the readings recorded for later comparison with the data logger results. The data logger shall be set to log the pressure at suitable intervals that are not more than 2 minutes apart for PE pipeline tests and 5 minutes for testing pipelines of other materials.

Note that pressure pulsations from a motorised test pump may destroy a pressure gauge unless some form of pressure damping is incorporated to protect the gauge.

### 8.5 Preferred Pressure Test Rig

The preferred rig shall have a recently calibrated pressure transducer and check pressure gauge.

The transducer shall have:

- non-linearity and hysteresis within  $\pm 0.2\%$
- a resolution of 0.02 bar or better
- a pressure range so that the output at STP is 50 - 90% of full scale
- been checked for calibration within the last 6 months
- a data logger capable of storing the pressures at 2-minute intervals over a period of up to 24 hours.

The check pressure gauge shall have:

- a dial of  $\geq 100$ -mm
- readability to within 10 kPa
- a pressure range so that the STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The transducer and the check gauge shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractors cost.

### 8.6 Alternative Pressure Test Rig

The pressure test may be conducted using two pressure gauges.

The main “test” gauge shall have:

- an accuracy of  $\pm 0.5\%$  of full scale
- $\geq 100$ -mm dial
- readability of 5 kPa
- a pressure range so that the STP falls within 50 - 90% of the range

The check gauge shall have:

- an accuracy of  $\pm 1\%$  of full scale
- $\geq 100$ -mm dial
- readability of 10 kPa
- a pressure range so that STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The gauges shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractors cost.

The test rig shall incorporate provision for manually bleeding air as well as an isolated 15-mm BSP socket to allow for the installation of an independent check gauge.

In the case of a dispute over a pressure test result, a pressure transducer and data logger and check gauge shall be used for any re-testing that may be necessary.

**8.7 Effects of entrapped air**

Air trapped in a pipeline during the test will affect the test results. As much air as possible should be expelled from the pipeline during filling and before the pressure test is commenced. Air removal may necessitate swabbing.

**8.8 Pipe Temperature and Temperature Changes During the Test**

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Changes in temperature during the test can have a significant effect on the internal pressure as a temperature change can cause the pipe to expand or contract. Under normal circumstances, the temperature of a buried pipeline will remain relatively constant after initial filling and stabilising.

Note that the temperature of any water added to a pipeline (e.g. to restore the STP) should be within  $\pm 3^{\circ}\text{C}$  of the temperature of the water already in the pipeline.

**SECTION VIII**

**ELECTRICAL RETICULATION  
AND STREET LIGHTING**

## SECTION VIII

# ELECTRICAL RETICULATION AND STREET LIGHTING

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## **VIII – 1. INTERPRETATION**

- (a) "Line Owner" means a person or Company that owns electrical reticulation (works) that are used or intended to be used for the conveyance of electricity.
- (b) "Electrical Reticulation" means all "Electric Lines" that are owned by the "Line Owner" and form part of the Line Owner's Electrical Reticulation System or "Network".
- (c) "Network Connection Point". The position where a service main connects to a Line Owner's network.
- (d) "Service" or "Service Main" is the term for the cable (fitting), owned by the owner of a premises and connecting a premises to the electrical reticulation at an agreed network connection point.

## **VIII – 2. ELECTRICAL RETICULATION - GENERAL**

- (a) All new electrical reticulation and service mains shall be by underground cabling in urban areas.

Reinforcement or replacement of existing overhead electrical reticulation shall be by underground cabling apart from specific exemption from the Council. This shall not exclude the carrying out of any replacement or upgrade of existing works as long as the land will not be injuriously affected as a result of the replacement or upgrade.

Specific guidelines are given in Sec. VIII - 7(a) overhead high voltage electrical reticulation in the rural sector.

- (b) New allotments shall be serviced with 400/230v electrical reticulation to the boundary of each lot. Rear lots may have ducts provided from the road reserve frontage to the rear lots ready for future service mains installation at the owner's cost.

Exceptions are catered for where it is impractical to position a supply at a boundary.

- (c) Where practical existing overhead 400/230v electrical reticulation or service mains crossing new subdivisions shall be placed underground.
- (d) High voltage power lines (greater than 6.6kv) crossing new subdivisions shall be relocated clear of the subdivisions or placed underground with the agreement of the Line Owner. Dispensation may be granted by the Council where it is demonstrated to be impractical to achieve this requirement.
- (e) In remote area rural subdivisions where it is demonstrated that subdivision is intended for uses that are not for habitable dwellings or buildings ancillary to the use of the land, the Council may waive the requirement for the supply of electrical reticulation to the boundary.
- (f) Where electrical reticulation referred to in the above paragraphs is not practically accessible or economically viable, local generation e.g. hydro, solar, wind may be considered as an alternative. It shall be demonstrated that local electrical generation of 3KwHr minimum sustainable storage capacity over a 24-hour period per household is feasible for supplying lighting and small electrical appliances with alternative fuel for heating and cooking.

## **VIII – 3. ELECTRICAL RETICULATION - DESIGN**

### **(a) General**

- (i) The design of the electrical reticulation shall, as a minimum requirement, comply with the "ELECTRICITY REGULATIONS 2001" (and any subsequent amendments) and the requirements and standards of the "LINE OWNER".

- (ii) The design of the electrical reticulation shall give consideration to the likely electrical demand requirements per lot and allow for this in the initial design. Residential subdivisions should allow a minimum of 15kVa with diversity per lot and industrial subdivisions should allow a minimum of 40kVa without diversity per lot.
- (iii) The minimum electrical demand design criteria per lot and allowable "after diversity maximum demand factor" shall be to the requirements of the "Line Owner".
- (iv) All new residential, commercial and industrial subdivisions shall be reticulated with underground cabling running along each side of the road reserve. The Council may allow dispensation for a single sided reticulation in exceptional circumstances (e.g. where allotment frontages are greater than 30m in length).
- (v) Provision shall be made by land developers for the continuation of appropriate cabling along road frontages to facilitate the electrical reticulation of adjoining future development. This may be achieved by the installation of cable ducting systems.  
  
The Council may waive this requirement where it is demonstrated with approval from the Line Owner that adjacent subdivisible land may be reticulated from another suitable route.
- (vi) Consideration shall be given to the future extension or reinforcement of the electrical reticulation system without necessitating major road reserve disturbance to achieve such expansion or reinforcement. Where appropriate, spare ducting shall be installed along routes likely to be used for an extension or reinforcement of the electrical system.
- (vii) Road crossings for power cables shall be kept to a minimum and where necessary, shall be at right angles to the carriageway.

#### **VIII – 4. ELECTRICAL RETICULATION DESIGN - SPECIFIC INSTALLATION REQUIREMENTS**

##### **(a) Location of Cabling, Ducting and Service Boxes**

- (i) Access to a 3 phase power supply shall be provided at the boundary of the road frontage of each lot of an industrial, commercial or residential subdivision.  
  
Where existing 11kv distribution is 2 phase, (generally in the rural sector), a single or two phase supply will, (with the line owners approval) be accepted for residential and general farming purposes where it is demonstrated that three phase power is not likely to be required for the management of the land (e.g. irrigation). The design of any 2 phase 11 kV line extension shall be to a standard whereby a 3<sup>rd</sup> phase can be run or livened without changes to poles, crossarms, guys and in the case of underground reticulation, the cables shall be 3 phase.
- (ii) Subdivisions containing rights of way not longer than 60m may have individual service duct systems (orange 50mm minimum diameter PVC) or appropriately sized service mains cable installed from a service box on the road frontage, down the right of way to each rear allotment.
- (iii) Subdivisions containing rights of way exceeding 60m shall have an electrical supply to the 'main body' of the rear allotments. Fusing and connection points shall be to the satisfaction of the Line Owner. No service duct system extending from a service box shall be longer than 60m.

- (iv) Appropriate Memorandum of Easements in Gross to the Line Owner's requirements shall be provided by the Land Developers for all electrical reticulation cables, service boxes and ducting on private property including rights of way.
  - (v) Where multiple driveways on lot boundaries make it impractical to position a service box at a common boundary between lots or, where a narrow road frontage width of a lot makes the location of a service box vulnerable to damage, it is permissible to install a 50mm minimum diameter service main duct in the road reserve from a lot boundary to a service box offset no more than 10m from the affected lot and.
  - (vi) For the purpose of 'infilling' development or replacement of an overhead service main with underground cable, the 10m maximum referred to in Sec. VIII - 4(a)(v) above may, with the Line Owner's consent be extended to the Network Connection Point to the electrical reticulation from which the existing building is supplied. Refer to Sec. VIII - 4(a)(vii) for recording requirements.
  - (vii) Any ducting systems installed in the road reserve area shall be considered as part of the electrical reticulation system for the purpose of 'As Built' records.
  - (viii) Any excavation within the existing road reserve is subject to Council approval and a Road Opening Notice permit issued by Council.
- (b) **Electrical Reticulation Cabling & Capacity**
- (i) Voltage drop shall be no greater than permitted under the "Electricity Regulations 2001" and the requirements and standards of the "Line Owner".
  - (ii) Current rating shall be in accordance with current NZ Electrical Codes of Practice NZECP 28 and manufacturers design parameters.
  - (iii) The design shall take into account the requirements of Sec. VIII - 3(a)(ii) and Sec. VIII - 3(a)(iii) with specific attention given to the following details relating to likely electrical loads:
    - Lot size in relation to permissible coverage.
    - Anticipated usage of the lot (e.g. multiple dwellings, cross lease and potential subdivision permitted within the zoning).
    - An appropriate "After Diversity Maximum Factor".
    - The design of the electrical reticulation shall give consideration to the likely electrical demand requirements per lot and allow for this in the initial design. Residential subdivisions should allow a minimum of 15kVa with diversity per lot and industrial subdivisions should allow a minimum of 40kVa without diversity per lot.
    - Future load growth and electrical reticulation expansion or reinforcement.
  - (iv) Existing overhead electrical cabling shall be dealt with in accordance with Sec. VIII - 2(c) and Sec. VIII - 2(d).
- (c) **Training**
- One of the biggest causes of premature footpath and road failure is inappropriate trenching and backfilling methods. This can lead to cracking, settlement and water ingress to the formation resulting in significant failures which are an inconvenience to pedestrians and motorists and expensive to repair. To ensure that those carrying out excavation and backfilling in legal road formation that is owned or will be owned by the Nelson City Council are suitably trained, the following will apply:

- (i) From 1 January 2005 at all times that trenching or backfilling is being carried out, at least one member of the contractors staff on site shall have the National Certificate in Road Opening qualification.

## VIII – 5. ELECTRICAL RETICULATION - PHYSICAL LOCATION

### (a) Service Boxes

- (i) Service boxes shall be set back as close as possible to section boundaries and are to be clear of designated vehicular access and pedestrian ways.
- (ii) The minimum spacing of any service box from any boundary line or survey peg shall be 150mm so as to enable future fencing construction.

### (b) Cables

- (i) Cable and duct locations in the road reserve area shall be in general accordance with NCC Standard Drawing No. 21/500 sheet 1, being 600mm from section boundaries at a nominal laying depth of 900mm with provision for shared trenching with communication services.
- (ii) Cable and duct locations down rights of way shall, where possible be located 600mm from a boundary in a berm area where provided. Otherwise, the centre of the right of way is the preferred location. The standard cable depth shall be 900mm and may be in a common trench with water and communication services as shown in NCC Standard Drawing No. 21/500 sheet 2. Individual consumer service mains cabling or ducting shall be 600mm minimum depth as shown in NCC Standard Drawing No. 21/500 sheet 2.
- (iii) Any underground or overhead electrical reticulation cable being vested with the Line Owner and installed on private property including rights of way shall be secured by way of an easement or other appropriate legal means in favour of the "Line Owner".
- (iv) Appropriate mechanical protection shall be provided for any underground electrical reticulation in accordance with NZECP 28 (1993). Cable marker warning strip shall be placed along all cable routes at half the cable trench depth.

In addition, where electrical distribution cables are on private property (excluding rights of way), visible 'above ground' warning markers shall be placed where cables change direction and in between not less than 10m spacing in all but rural areas where the minimum spacing shall not be less than 20m.

- (v) Road crossings for electrical reticulation cables shall be orange ducts of soil pipe strength PVC pipes sized to the Line Owner's requirement with a minimum cover of 900mm

Cable marker warning strip shall be placed along the cable route at half the cable trench depth.

## VIII – 6. SUBSTATIONS

### (a) Specific Installation Requirements

- (i) Substations shall be of adequate design capability to supply the anticipated "After Diversity Maximum Demand" with due consideration to Sec. VIII - 4(b)(iii).
- (ii) "Ground mounted" substations will be permitted within new residential, commercial and industrial subdivisions.

Substations will also be permitted within purpose built buildings that meet the Line Owners specifications within residential, commercial and industrial subdivisions or development

- (iii) Pole mounted substations may be permitted in rural subdivisions.
- (iv) Pole mounted substations (up to 75kVA) on a single pole may be allowed in residential and industrial areas. Substations greater than 75kVA shall be ground mounted.
- (b) **Physical Location**
  - (i) Substations shall be located in the berm, clear of designated vehicular access ways and as close as possible to a section frontage or, in a recess into a lot or a public reserve, secured either by easement or preferably designated as 'Road Reserve'.
  - (ii) Adequate public protection shall be provided at all substation sites, giving consideration to:
    - Earthing (NZECP 35).
    - Physical location to -minimising the risk of damage by vehicles.
    - Security to protect against public access to electrical contents.

## VIII – 7. RURAL SUBDIVISIONS

- (a) Recognising the extent of 11,000-volt reticulation in the rural sector together with the difficulty and high cost of providing underground 11,000 volt cabling, the Council may, at its discretion and in agreement with the Line Owner, allow overhead 11,000-volt reticulation and associated substations in the rural sector.
- (b) Easements in Gross are to be provided by the Landowner, in favour of the "Line Owner" for all new electrical reticulation over private property whether owned by the developer or not. All proposed electricity easements on subdivision plans must be listed under a Memorandum of Easement in Gross.
- (c) Substations may be located on lot boundaries or within the lots subdivided to enable an adequate electrical supply to specified or potential building sites on the allotments.
- (d) 400/230v electrical reticulation and 'service mains' to individual premises shall be by underground cable unless precluded by ground profiles or other impediments in which case, the Council may grant dispensation for overhead cables to traverse the area concerned.
- (e) Network Connection Points to individual lot boundaries shall be located to provide practical and legal access for service mains to specified or potential building sites.
- (f) Where the length of a service main cable exceeds 300m from a Network Connection point to a specified or potential building site, the electrical reticulation designer shall state on the application drawing, the proposed service main cable size and design criteria applicable to the lot.
- (g) Where for expediency it is not practical to install a transformer prior to a building site being confirmed by a future property owner, the developer shall make arrangements with the future Line Owner for the provision of the transformer (15Kva capacity) at no cost to the future property owner at the time of installation. The future property owner should only have to pay for the future 11Kv lines and service mains on the property.

## VIII – 8. STREET LIGHTING

- (a) **General**
  - i) Street lighting shall be installed in public roadways and pedestrian and cycle access ways in all residential, commercial and industrial subdivisions to the satisfaction of the Council.

- ii) The lighting of private rights of way is not a requirement. Should a Landowner wish to include private right of way lighting then the electrical supply for the private lighting must be supplied from the private electrical supply serving the lot or lots benefiting from the lighting (The electrical supply for the private lighting will not be permitted to connect to the public road lighting circuit). All future connection, operating and maintenance costs of such lighting shall be charged by the Line Owner to the property owners benefiting from the lighting.
- iii) Street lighting in rural subdivisions shall only be required as a specific condition imposed by the Council.
- iv) Street lighting installations shall comply with section VIII-8 (b) below.
- v) The design shall give consideration to minimising future operating and maintenance costs.
- vi) The preferred location of street light columns shall be on lot boundaries or, where abnormally wide berms or side slopes are encountered, the street light columns should be set back as far as practicable from the kerb edge.
- vii) Street light columns shall be kept clear of any designated vehicular access or pedestrian way.
- viii) Street light cabling shall be a minimum size of 2-core 2.5mm<sup>2</sup> copper neutral screen and shall comply in all respects to the relevant requirements set down for electrical reticulation design, cabling and fusing.
- ix) Road crossing ducts shall be not less than 30mm dia. PVC soil pipe strength pipe (orange).
- x) The on/off control of streetlights may be by photoelectric cell or pilot cable.
- xi) The Council will maintain a schedule of approved street light columns and lanterns that will be made available upon request.

(b) **Design Standards:**

- i) Columns: NZS3404: 1992 'Steel Structures Standard'  
NZS4203: 1992 'Code of Practice for General Structural Design and Design Loadings for Buildings' (*For wind loadings*).
- ii) Luminaries: AS/NZS 60958.2.3 'General Requirements and Test – Luminaires for Roads and Street Lighting
- iii) Installation: AS/NZS 1158.1.1: 1997 Road Lighting Part 1: Vehicular Traffic (**Category V**) Lighting – performance and installation design requirements.  
AS/NZS 1158.1.3: 1997 Road Lighting Part 1.3: Vehicular Traffic (**Category V**) Lighting – Guide to design, installation, operation and maintenance.  
AS/NZS 1158.3.1: 1999 Road Lighting Part 3.1: Pedestrian Area (**Category P**) – Performance and installation design requirements.

**NOTE:**

'Category V' lighting is applicable to roads on which the visual requirements of motorists are dominant, e.g. main traffic routes.

'Category P' lighting is applicable to roads on which the visual requirements of pedestrians are dominant, e.g. local roads.

### **VIII – 9. STREETLIGHT DATA COLLECTION**

The Designer shall submit a completed Streetlight Data Collection Form (see Appendix 1, section VI) to the Council for each separate job or section of a continuing job which involves streetlight construction.

For Subdivisions the Landowner will be required to meet all power supply charges until the final 224 certificate is issued for the subdivision.

### **VIII – 10. CABLE TV AND COMMUNICATION CABLES**

All cable TV and communication reticulation and service mains shall be by underground cabling (See Sec. IX – 5).

### **VIII – 11. SUB-SOIL DRAINAGE OF SERVICE TRENCHES & SUBSTATION SITES**

On hillside developments, adequate provision shall be made for draining substation sites and all cable ducting as detailed on NCC Standard Drawing No. 21/212 and shall be specified on the Engineering Drawings and electrical reticulation design drawings where applicable.

Similar requirements in conjunction with more extensive subsoil drains may be necessary on flatter ground in wet areas.

### **VIII – 12. LIAISON WITH OTHER AUTHORITIES**

Designers are to liaise with other Service Authorities to achieve economical use of road reserve area with due consideration given to ease of maintenance to the electrical reticulation system and other services in the road reserve area.

### **VIII – 13. DESIGN APPROVALS**

- (a) Prior to any works commencing on site the following requirements shall be submitted and approved:
  - (i) A design plan detailing the proposed electrical reticulation and street lighting. The plan shall bear a design statement covering the following:
    - Before diversity load per lot (i.e. 15kVA per residential lot)
    - Compliance with the Line Owners design standards.
    - Compliance with the NCC Engineering Standards Section VIII
    - A schedule of easement requirements for any electrical reticulation on private property to be vested with the Line Owner and a schedule of reciprocal rights for service main cables or ducts over shared rights or way or easements for service main cables crossing private property.
  - (ii) Line Owner signed approval of the design plan.
  - (iii) Council signed approval of the design plan

### **VIII – 14. RECORDS**

- (a) The Landowner or agent shall provide to the Line Owner, clear and accurate As Built records of the new electrical reticulation, prior to the reticulation being livened. The Line Owner shall keep and maintain As Built records of all electrical reticulation within the road reserve and on private property where the electrical reticulation will be owned by the Line Owners.

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- (b) Line Owners shall ensure that they receive and maintain As Built records of the Electrical Reticulation (works) and ensure that such records are made available upon request and as required, mark out cable routes on site for the Council or contractors carrying out works.
- (c) Provision of As Built drawings and on site cable locations for planned works shall be made available to the Nelson City Council within 24 hours prior notice during normal working hours and for emergency call outs with no prior notice at any time.

#### **VIII – 15. COMPLIANCE STATEMENT**

- (a) Prior to the 224 Certification stage, the following certification details shall be forwarded via the Designer to the Council.

A letter of acceptance by the Line Owner that:

- As Built documentation has been filed
- The electrical reticulation has been livened and fulfills the Nelson City Council requirements in accordance with the Nelson City Council Engineering Standards – Section VIII.

*January 2003*

**SECTION IX**

**TELEPHONE,  
TELECOMMUNICATION AND  
OTHER RETICULATION**

*January 2003*

**SECTION IX**  
**TELEPHONE, TELECOMMUNICATION AND OTHER**  
**RETICULATION**

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## **IX – 1. GENERAL**

Telecom New Zealand Limited, hereafter referred to as Telecom, will provide telephone reticulation by all underground means if the following conditions are met.

- (a) The subdivision is suitable in the opinion of Telecom for underground reticulation, (in most instances this will be the case).
- (b) A council approved scheme plan and scale Engineering plans for the subdivision are supplied to Telecom.
- (c) A tentative layout of any future stages in the subdivision would assist Telecom as this would allow Telecom to provide for additional stages and minimise the possibility of having to retrench the subdivision at a later stage.
- (d) The Engineering plans are accompanied by the Subdivision Reticulation Agreement and the required Design and Supervision fees.
- (e) The fees cover the reticulation, design, installation, supervision and the provision of the laying specification and plans for the telephone reticulation system to the standard required for connection to the Telecom network.
- (f) Telecom will supply all duct pipes, cable and pits (from Telecom yard) for the subdivision at no charge to the developer/subdivider. These duct pipes, pits and cable will remain the property of Telecom.
- (g) The Landowner is required to supply all trenching and labour, at their cost, to install Telecom ducting and pits associated with the subdivision. Alternatively, the Landowner may request Telecom to undertake the work, in which case Telecom's current construction sales rate will apply. Telecom reserves the right in such cases to have the work undertaken by its nominated sub-contractor.
- (h) Telecom will require payment of the fees in full prior to the supply of the laying specification and associated plan (pipes and pits).
- (i) At least six weeks notice is required to design the telephone reticulation, arrange the supply of the pipes and pits and schedule time in our works program for a Telecom Representative to supervise the installation of plant.
- (j) Telecom request to be advised if the work is going to be delayed for any reason, such as inclement weather, equipment failure etc. Please advise the Telecom Liaison officer prior to 8.00am, this will enable the Engineer's Representative programmed for these works to rearrange his work schedule.
- (k) A shared services trench is likely to be the most economic option. Separation between the services in subdivisions is required. These will be detailed in the laying specification. However, safe working distances are required for all services with minimum separations for power cables. A table showing the minimum clearances from power cables follows.

### MINIMUM SEPARATIONS FOR POWER CABLES

Voltage and Cable Type	AT CROSSINGS		ON PARALLEL RUNS	
	With Protection	Without Protection	With Protection	Without Protection
LV, MV Neutral Screened, or Armoured	50mm	150mm	50mm No Limit to Length	150mm No Limit to Length
LV, MV Neutral Screened, or Armoured	50mm	450mm	450mm No Limit to Length	450mm No Limit to Length
HV, EHV Single And Multicore	150mm	450mm	450mm 2.4Km Limit to Length	450mm 2.4Km Limit to Length

LV	=	Low Voltage	-	up to 250 Volts
MV	=	Medium Voltage	-	from 250 Volts to 650 Volts
HV	=	High Voltage	-	from 650 Volts to 6600 Volts
EHV	=	Extra High Voltage	-	above 6600 Volts

Protection shall take the form of either:

50mm thick non-metallic reinforced concrete slabs (usually 150mm wide and 500mm long).

OR

100mm x 50mm ground retention treated timber with a minimum specification of the New Zealand Timber Preservation Authority Classification H4 Group B.

#### IX – 2. LAYING OF TELECOM DUCTS

- The depth and offset of trenches will be specified on the laying plan provided by Telecom. It is essential that these be maintained. Minimum cover shall generally be 450mm in footways and 600mm in roadways.
- All services crossing the proposed duct pipe route shall be exposed and the necessary clearances maintained to enable Telecom ducts to be installed either above or below these other services. Telecom ducts shall be laid above power cables.
- All joints in duct pipe shall be watertight and may be glued joint with solvent cement or rubber ring seal depending on the ducting supplied. The rubber "O" ring sealed pipe is the preferred type of duct and will replace solvent cement glued ducting in the long term.
- The base of the trench shall be level with large objects removed. The duct pipe shall be bedded in suitable fine soil or pea metal if required. The suitability of the bedding material will be assessed by the Telecom Representative.

#### IX – 3. INSTALLATION OF DISTRIBUTION PITS

The pits and lids are designed to withstand light vehicular loading only. Therefore installation shall take place only in the footwear or in grassed areas within the defined kerb line.

The grass berm or footwear material shall be excavated to a sufficient depth to ensure that the pit lid will be level with the finished level of the surface. Once the pit has been installed the lid shall be fitted before backfilling and carefully compacted around the sides of the pit. Details will be supplied in the laying specification.

#### IX – 4. PLANT LOCATION

The location of the duct pipes, pits and manholes shall be shown on the design plan, all variations must be authorised by the Telecom Representative.

## **IX – 5. TELECOMMUNICATION AND OTHER UNDERGROUND SERVICES**

Approval must be obtained from Council to install services in the road reserve prior to any work commencing on site. A fully detailed design plan must be submitted to Council for checking and approval purposes. Council will only give approval for services to be installed in road reserve where the service will be owned, maintained and remain the responsibility of an organisation which has attained 'Network Utility Operator' status.

## **IX – 6. RECORDS**

- (a) The Network Utility Operator shall keep and maintain As Built records of their reticulation within the road reserve and on private property where the reticulation will be owned by the Network Utility Operator.
  - (b) The Network Utility Operator shall ensure that they receive and maintain As Built records of the Electrical Reticulation (works) and make ensure that such records are made available upon request and as required, mark out cable routes on site for the Nelson City Council or contractors carrying out works.
  - (c) Provision of As Built drawings and on site cable locations for planned works shall be free of charge to the Nelson City Council made available with 24 hours prior notice during normal working hours and for emergency call outs with no prior notice at any time.
- ### **IX – 6 SUB-SOIL DRAINAGE OF SERVICE TRENCHES**

Adequate provision for draining all service trenches, including cable trenches, on all hillsides as detailed on NCC Standard Drawing No. 21/212 shall be specified on the Engineering Drawings where applicable.

Similar requirements in conjunction with more extensive subsoil drains may be necessary on flatter ground in wet areas.

## **IX – 7. TRAINING**

One of the biggest causes of premature footpath and road failure is inappropriate trenching and backfilling methods. This can lead to cracking, settlement and water ingress to the formation resulting in significant failures which are an inconvenience to pedestrians and motorists and expensive to repair. To ensure that those carrying out excavation and backfilling in legal road formation that is owned or will be owned by the Nelson City Council are suitably trained, the following will apply:

- (i) From 1 January 2005 at all times that trenching or backfilling is being carried out, at least one member of the contractors staff on site shall have the National Certificate in Road Opening qualification.

*January 2003*

**SECTION X**

**EXCAVATION AND  
REINSTATEMENT WORKS  
WITHIN THE ROAD RESERVE**

*January 2003*

**SECTION X**  
**EXCAVATION AND REINSTATEMENT WORKS**  
**WITHIN THE ROAD RESERVE**

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## **X – 1. GENERAL**

### **(a) Scope**

This specification outlines the Council requirements for excavation, backfilling and reinstatement works within the road reserve.

### **(b) Definitions**

- **Council** - shall mean the Nelson City council or its officers.
- **Operator** - shall mean the party or parties either as approved by the Council or as approved as a Network Operator under the Telecommunications Act 1987 or as approved under any other service supply Act to carry out excavation, backfilling or reinstatement works within the road reserve under the control of the Nelson City Council.
- **CBD** - Central Business District (block between and including Halifax Street, Collingwood Street, Rutherford Street and Selwyn Place).
- **Installation** - shall include excavation, the laying or thrusting of the pipe, ducting or cabling service, backfilling and reinstatement of surface.
- **NZS 6803P** - The Measurement and Assessment of Noise From Construction, Maintenance and Demolition Works'.
- **NZS 3116** - 'Interlocking Concrete Block Paving'.

### **(c) New Services to be Underground**

Unless resolved otherwise by the Council, all new telecommunications, broadcasting and electricity cables, fittings and equipment in the road reserve shall be laid underground.

### **(d) Public Liability**

Any operator undertaking excavation and reinstatement works within the road reserve shall have current Public Liability Insurance cover. The policy shall also include a local authority Extension Clause indemnifying the Council against liability for any damage, loss or injury for an amount not less than \$1,000,000 for any claim or series of claims arising out of the existence of a trench or excavation or other obstacle associated with the work.

Compliance with any instruction of the Council, or any person acting on its behalf, in performing what is considered to be necessary actions in terms of this "Specification" shall not absolve the operator from any legal liability that he would otherwise have had in regard to claims for damage or failure of work for his client.

### **(e) Approved Operators**

Only Operators approved by the Council shall be permitted to undertake trenching and reinstatement works within road reserves within the Nelson City area.

Any Operator approved by the Council for excavation or reinstatement works must first lodge a Letter of Intent to Council in the form of Appendix 1, Section X.

In addition the Council may require the Operator to pay to the Council a Cash Deposit or enter into a Bond for the performance of their works in the District prior to work commencing. The amount of this deposit or bond shall be for the full cost of the said works to a maximum of \$10,000.

### **(f) Training**

One of the biggest causes of premature footpath and road failure is inappropriate trenching and backfilling methods. This can lead to cracking, settlement and water ingress to the formation resulting in significant failures which are an inconvenience to pedestrians and motorists and expensive to repair. To ensure that those carrying out excavation and backfilling in legal road formation that is owned or will be owned by the Nelson City Council are suitably trained, the following will apply:

- (i) From 1 January 2005 at all times that trenching or backfilling is being carried out, at least one member of the contractors staff on site shall have the National Certificate in Road Opening qualification.

## **X – 2. NOTIFICATION**

### **(a) Road Opening Notice**

A Road Opening Notice in the form of Appendix 2, Section X is required to be lodged at the Council for each separate job or section of a continuing job, which involves excavation, or the lifting of the surface within a road reserve in the City of Nelson.

A minimum of 21 days notice is to be given for planned excavations (other than Nelson City Council planned works). This will allow sufficient time for the proposal to be examined to ensure that no conflict arises with existing services. Note; a minimum of 10 days notice is to be given for Nelson City Council planned excavations.

Where emergency maintenance is necessary, the notice shall be lodged on the next working day. For routine service connection where the area of surface disturbance is less than 1 square metre, a schedule of work completed shall be required to be submitted on a monthly basis. If the road involved is a State Highway, the notice shall require confirmation that Transit New Zealand has been notified and if any special conditions imposed by that body have been received.

### **(b) Plans**

Plans of the proposed work shall be submitted to the Council with the Road Opening Notice. The plans shall be to a scale of 1:500 or 1:200 where needed for clarity and shall show the location and size of all existing and proposed cables, conduits, pipes, underground structures, property boundaries and kerb lines. Dimensions to boundaries and kerbs shall be shown and proposed depths below existing surface levels shall be shown at regular intervals.

### **(c) Notification to other Service Authorities**

The operator shall advise other affected Service Authorities of proposed construction works. Confirmation that other affected Service Authorities have been advised of planned works shall be indicated on the Road Opening Notice.

### **(d) Issue of Permit**

Providing that all required information has been supplied with the Road Opening Notice, the Council shall issue a permit and advise of existing Council services in the locality and any specific conditions related to the proposal. No works may commence in advance of the permit being issued. Permits are valid for six (6) months from the date of issue.

### **(e) Fees**

A charge for each permit issued will be made in accordance with the rates that may be set by the Council from time to time.

### **(f) Public Relations**

Prior to planned excavation commencing, the operator shall advise all affected properties of the nature of the work and who to contact for further information or to convey complaints. Twenty four (24) hours notice shall be given to property owners when access to their property will be disrupted as a result of the works.

## **X – 3. CONSTRUCTION REQUIREMENTS**

### **(a) Disruption to Public**

Normal work hours shall be between 0700-1800 hours, Monday to Saturday. Works on arterial streets may be limited to 0900-1600 hours or other hours as may be appropriate. Work hours within the CBD (Central Business District) shall be as approved by the Council.

During any construction in the street, the disruption to the public and adjacent residents shall be kept to a minimum.

Noise created by construction shall be kept to a minimum and shall not exceed the levels described in part 5 of NZS 6803P.

Arterial streets comprise of: all State Highway 6, Main Road Stoke, Waimea Road, Rutherford Street, Haven Road and Trafalgar Street between Halifax Street and Queen Elizabeth 2 Drive.

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## **Temporary Traffic Control, Public Safety**

The Operator's attention is drawn to their obligations under the Health and Safety in Employment Act 1992 which came into force on 1 April 1993.

The Operator shall be responsible for the supply, erection and maintenance of all necessary barricades, lights, warning notices, traffic control signs etc.

The Transit New Zealand's handbook "WORKING ON THE ROAD"- A Handbook for Temporary Traffic Control and Safety at Roadwork Sites (Latest edition) shall be regarded as a means of compliance for traffic control measures.

Should the contractor wish to use any alternative methods of traffic control, the prior consultation with and approval of the Council shall be required.

Should the Police (Traffic Safety Branch), Occupational Safety and Health Service or the Council consider at any time there is a risk to traffic, the general public or the contractor's employees, the contractor shall immediately provide such other traffic control etc, necessary to achieve the required standards. This may include the erection of additional barricades, lights, warning notices or traffic control signs including, where necessary, the provision of staff to control traffic.

Failure by the contractor to provide adequate safety measures may result in a work suspension notice being issued by the Council, until such time as adequate control is provided.

The carriageway shall be fully open to traffic during hours of darkness and not more than half the carriageway shall be closed at any one time, except with the express permission in writing of the Council.

### **(b) Closure of Streets**

No street may be closed to any traffic without the specific written approval of the Council.

The closure of any streets requires public notification. This notification will be carried out by the Council at the Operator's expense.

Where any closure is required for less than twelve (12) hours within any twenty four (24) hour period the Council requires a minimum of forty eight (48) hours notice to approve and advertise any closure.

Where any closure is required for more than twelve (12) hours within any twenty four (24) hour period the Council requires a minimum of 45 days to approve and advertise any closure.

Approval for street closure will only be given where all other options are unsatisfactory.

### **(c) Position of Service**

The positioning of services or mains shall, wherever possible, be in accordance with NCC Standard Drawing No. 21/305.

Variations from these alignments shall be by written agreement from the Council, following discussions with other affected Service Authorities.

### **(d) Protection of Existing Services**

The position of existing Water mains, sewers and other services or structures above or below ground, insofar as they are known, are available for the information of the operator at the offices of the Council and respective Service Authorities, but their positions are not guaranteed. The Operator is strongly advised to make itself fully aware of the position of all underground services in the locality, before commencing work.

### **(e) Damage to Existing Services**

Where existing services are damaged as a result of the construction work, the Operator shall immediately advise the owner of the damaged services, (public or private).

The cost of repair or reinstatement of any disturbances or damage to any water pipe, sewer or stormwater drain, other underground services or structure, shall be borne by the Operator.

### **(f) Road Markings**

All works that are likely to cause damage to any road markings must be brought to the attention of the Council in order that they may be replaced at the earliest possible opportunity for the safety of the general public. The Operator shall be responsible for the cost of any remarking that is necessary.

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- (g) **Survey Marks**  
The Operator shall avoid disturbance to any survey marks within the vicinity of their work. Where any survey marks are disturbed, the cost of replacing and re-surveying the mark shall be met by the Operator.
- (h) **Thrusting**  
Unless impractical or unsafe, thrusting or horizontal directional drilling shall be required under concrete carriageways and vehicle crossings; at intersections; where there is a large number of existing services; and in areas with any high quality paving surface.  
Water jetting shall not be permitted.  
Drilling with an auger shall not be permitted under carriageways.
- (i) **Length of Open Trench**  
The maximum permitted length of trench to be open shall be 100m unless specifically authorised by the Council.  
Notwithstanding this the Operator shall not exceed any length that is not capable of being backfilled and opened to traffic in the same day, nor shall it interfere with two-way traffic flow.  
Open trenches shall not be permitted overnight without the prior authority of the Council.
- (j) **Trees, Shrubs etc**  
All works that are likely-to cause damage to any trees, shrubs, or ornamental gardens within the road reserve, shall be brought to the attention of the Council prior to work commencing. It shall be the Operator's responsibility to make good or replace any damaged trees, shrubs or ornamental gardens.
- (k) **Water in Trenches**  
All open trenches shall be maintained in a dewatered condition and water logged material removed to the satisfaction of the Council. Water from any excavation shall be disposed of to the stormwater main so as not to cause any damage or nuisance.
- (l) **Excavated Material and the Stormwater System**  
The Operator shall take all due care to prevent excavated material from being washed into the stormwater system in the event of rain occurring during a trenching operation.
- (m) **Damage to Kerb and Channel**  
Where damage occurs to existing kerb and channel the damage shall be made good to the satisfaction of the Council. Where any kerb and channel requires replacing this shall be done by the Council's approved kerbing contractor at the Operator's expense.
- (n) **Traffic Signals**  
(i) Where work is to take place within 50m of traffic signals the Operator shall consult with the Council.  
(ii) Special conditions when working near traffic signals may be imposed by the Council to protect the detector loops and the operation of the signals.  
(iii) A traffic signals communication network is located in Halifax Street, Collingwood Street, Rutherford Street and Selwyn Place, Putaitai Street and Songer Street. The Operator shall liaise with the Council to locate this network.
- (o) **Dust Nuisance**  
Arrangements shall be made to damp down work areas and excavated material as may be required from time to time to eliminate any dust nuisance.
- (p) **Clean Up and Make Good**  
As work proceeds the Operator shall progressively carry out all restoration and tidying up work. If regular tidying up and restoration is not being done, the Council shall require and instruct the Operator concerned to carry out this work immediately. On completion of the work, the Operator shall remove all plant, materials and other things that may have been brought upon the site in aid of the works, and generally clear away all rubbish and leave the site in a similar or better condition to that which existed before the work was commenced.

Any trees or branches cut down or tree stumps uprooted during the work shall be removed. Branches that require removal should be cut by saw and not broken by machinery. The Operator shall at its own expense, clean out all sumps and repair or reinstate all road surfaces, fencing, walls, floors, lawns, gardens, paths, inclusive of transplanting trees, shrubs etc and make good all damage which may have been caused through his operations to at least as good as the "as found condition" in connection with the work.

(q) **Inspections**

The Operator shall notify the Council immediately upon the completion of final reinstatement so that an inspection may be made of the completed surface reinstatement works.

(r) **Maintenance**

The Operator will be held responsible for any street maintenance work required as a result of the excavation and reinstatement operations until twenty four (24) months after notification to the Council that the final surfacing material has been applied. Any such maintenance work required by Council shall be undertaken by the Operator at the Operator's cost within seven (7) days of being notified by the Council to undertake repair works. If on the grounds of safety there is a need for more immediate action this remedial work shall be completed within forty eight (48) hours or such other time as may be directed by the Council. Should this not be complied with, Council reserves the right to arrange or undertake such maintenance work and this work shall be at the cost of the Operator.

#### **X – 4. EXCAVATIONS**

When an excavation is required to be made through any cement concrete, asphaltic concrete or chip seal surface, the proposed edges of the excavation or trench shall be cut with a power saw prior to the excavation of the trench. The cut is to extend through the full thickness of the surface layer in a clean straight vertical line. The cut shall be 150mm beyond (50mm in footpaths) and parallel to the edge of the trench or to a line outside any pavement damage, whichever is greater. Within footpaths all saw cuts shall be parallel to or at right angles to the centreline of the footpath.

Only wet cutting shall be permitted in the CBD, in the vicinity of Suburban Shopping Centres or where directed by the Council, to minimise the problems caused by dust.

All excavated material unsuitable for backfilling shall be removed from the site immediately as excavation proceeds.

Areas adjacent to the excavation shall not be undercut. If slumping of material from the sides of the excavation causes depressed areas adjacent to the excavation or if the edges of the pavement are lifted during excavation, additional saw cutting outside of the original line of the excavation and outside the area of damage shall be required before reinstatement is permitted.

Trench widths shall be kept to the minimum necessary to lay the service and correctly compact the backfill.

#### **X – 5. BACKFILLING**

The backfilling of excavations shall be undertaken in accordance with NCC Standard Drawing No. 21/700 sheet 1, 2 and 3 using suitable excavated material or imported fill material.

Basecourse used in the Pavement section of the backfill shall be to Transit New Zealand (TNZ) M /4 or Transit New Zealand (TNZ) M /5 (Nelson) 1991 Specifications or NCC Standard Drawing No. 21/300.

The material used for bedding underneath and around the service or service duct shall be as required by the Service Authority. In no case shall it exceed 100mm above the top of the service, unless specific coverage is required by a reticulation pipe laying specification.

*January 2003*

## **X – 6. SURFACE REINSTATEMENT**

### **(a) General**

Surface reinstatement shall be completed within 5 days of the trench being opened or such other period as directed by the Council. Variation from this condition shall require the written agreement of the Council. For works within the CBD or Arterial Roads, surface reinstatement shall be completed within 24 hours of the trench being opened or such other period as directed by the Council.

Failure to complete reinstatement within the specified period may result in Council arranging reinstatement at the Operator's expense.

All excavations shall be backfilled, as detailed on NCC Standard Drawing No. 21/700 sheet 1, 2 and 3, and 21/701 to the underside of the proposed wearing surface, or to the finished level if permanent reinstatement is not being undertaken immediately. This temporary over filling shall be removed when permanent reinstatement is carried out. If permanent reinstatement cannot be undertaken immediately in the CBD (footpaths and carriageway), the carriageways of streets with large traffic flows, footpaths outside shops, or where the Council so specifies, the operator shall arrange for a 10mm thick layer of fine plant mix to be applied to the trench immediately backfilling is completed in order to minimise nuisance and danger to the public.

This is to be regarded as a temporary seal only and shall be removed before the permanent resurfacing of the trench is carried out. The operator shall maintain this surface, even and free draining, until the final restoration is complete. The cost of all temporary resurfacing and subsequent removal shall be born by the Operator.

If Plant Mix is not available a temporary seal of sprayed Emulsion and Grade 6 chip may be substituted with the approval of the Council.

### **(b) Within Carriageways**

All permanent surface reinstatement on carriageways shall be completed as shown on NCC Standard Drawing No. 21/700 sheet 1 and 3, with the finished wearing surface depth, matching that of the existing road and finishing flush with or no more than 5mm above the existing surface. All parts of the surface damaged during or as a result of the work shall be reinstated to an "as found" condition.

On unsealed rural roads and metal shoulders backfilling shall be as for chipsealed carriageways with 50mm of top course being placed as the final reinstatement. Finished levels shall be compatible with the existing pavement.

Surface boxes, e.g. water hydrant boxes, manholes etc shall be installed in their final location during trench compaction and their finished level shall be within 5mm to 10mm above the reinstated pavement surface.

### **(c) Within Footpaths and Vehicle Crossings**

All permanent surface reinstatement on footpaths shall be completed as shown on NCC Standard Drawing No. 21/700 sheet 2 and 21/701 with a finished surface matching the existing and finishing flush with or no more than 5mm above the existing surface. The minimum dimension of any reinstated portion of the footpath shall not be less than 600mm wide. The width of remaining undamaged footpath shall not be less than 600mm. (See NCC Standard Drawing No.21/701). If these criteria cannot be met the reinstatement shall be across the full width of the footpath. Also the full width of the footpath shall be replaced when trenching in footpaths within the Nelson CBD, Stoke shopping area, or Arterial, and Principal roads.

In concrete footpaths the depth shall match the existing with a minimum thickness of 100mm and the concrete shall attain a minimum compressive strength of 25 MPa after 28 days. Construction joints shall be formed at 6.0m centres and the line and level of the finished surface shall match the crossfall and level of the adjacent undamaged surface.

Vehicle crossings which are affected by the work shall be reinstated with a minimum of 150mm thick concrete for residential crossings, 200mm thick concrete for commercial crossings, while industrial crossings are to match existing with a minimum of 300mm thick concrete. Concrete for commercial and industrial entrance slabs shall be reinforced with approved polypropylene fibre at the manufacturer's recommended rate.

*March 2006*

Note: In asphaltic concrete and chipsealed footpaths the depth of basecourse at vehicle crossings shall match the depth of the existing basecourse, with a minimum depth of 200mm for commercial and industrial crossings and 150mm for residential crossings.

Surface boxes etc shall be finished to the tolerances specified in Sec. X - 6(b).

(d) **Within Interlocking Pavement Block Surfaces**

The blocks removed during excavation or new blocks of identical shape, thickness and colour shall be replaced on a subgrade similar to that in adjoining undisturbed areas and compacted and filled to give a true surface in accordance with NZS 3116.

(e) **Within Grassed Berms and Shoulders**

Surface reinstatement to grassed berms and shoulders shall be completed as shown on NCC Standard Drawing No. 21/700 sheet 2. The final 100mm shall consist of topsoil, which shall be raked level with surrounding areas and shall be free of all stones. A dressing of Superphosphate shall be applied at the rate of 30 grams per square metre. Alternative fertiliser and application rates may be used subject to prior consultation and agreement with the Council. After two months a dressing of Sulphate of Ammonia applied at a rate of 30g per square metre shall be applied.

The reinstated area shall be sown with the following grass seed mixture at a rate of 1Kg to 40 square metres and raked into the soil:

1.0kg chewing fescue  
4.5kg dwarf rye grass  
0.5kg browntop

Alternatively, turfs may be cut from the berm 75mm in thickness and 50mm wider than the trench and stacked for re-use. Full reinstatement shall be achieved within 48 hours with screened top soil being raked into all cut joints, with all turfs being adequately watered immediately following completion of reinstatement.

Surface boxes etc shall be finished to the tolerances specified in Sec. X - 6(b).

## ROAD OPENING NOTICE LETTER OF INTENT

I/We, (Company Name)  
(Hereinafter referred to as “the operator”) agree to submit a Traffic Management Plan for appraisal before commencement to working on Council Road Reserve and abide by Health & Safety regulations.

I/We agree to be responsible for maintenance work within the road reserve required as a result of our excavation and reinstatement operations until twenty four (24) months after notification to council that the final surfacing material has been applied.

I/We understand that any such maintenance work required by Council will be undertaken by the Operator at the Operator’s cost within five (5) working days of being notified by Council to undertake repair work.

If on the grounds of safety there is a need for more immediate action, I/ We agree to complete this remedial work as directed by Council.

I/We also accept that if the operator does not comply with the above, Council has the right to arrange or undertake such maintenance work and the cost of this work will be charged against the Operator. The Operator will make payment to the Council for this work within twenty (20) days of being invoiced.

DATE        this                                  day of    20

SIGNED:        -----

NAME:        -----

(Please Print)        (Manager of the above Company)





# ROAD OPENING NOTICE

**Contractor No. ID**  **NCC Use Only**

I wish to carry out the work described in the plans and specification herewith and as described below:

**WORK DETAIL**

Location of work: \_\_\_\_\_  
 \_\_\_\_\_

Description of work \_\_\_\_\_  
 \_\_\_\_\_

**CHECK LIST**  
 (Date & Initials)


- Traffic Management Plan submitted by Contractor
- Traffic Management Plan Accepted by NCC
- Location and Time Notified by Contractor to Customer Services
- Reinstatement completed and notified by Contractor to Customer Services

Location in Street:      Berm                      Carriageway              Footpath

Alignment:              Along                      Across                      Diagonal

Surface Type:            Hotmix                      Chipseal                      Concrete                      Metal                      Other \_\_\_\_\_

Excavation: (trench)    size: \_\_\_\_\_      m long x \_\_\_\_\_      m wide

Applicant:              Name: \_\_\_\_\_  
                                  Address: \_\_\_\_\_                      Fax No. ( ) \_\_\_\_\_

Site Foreman:            Name: \_\_\_\_\_  
                                  Phone (day): \_\_\_\_\_                      Night: \_\_\_\_\_

Proposed starting date: \_\_\_\_\_                      Have the Service Authorities been notified? YES / NO

Proposed duration: \_\_\_\_\_

Any additional information: \_\_\_\_\_

**LOCATION PLAN**

**ACCEPTANCE BY CONTRACTOR**

I hereby agree to comply in full with the requirements of the specification for Excavation and Reinstatement Works within the Road Reserve as stipulated in the Nelson City Councils Engineering Standards. I shall also submit a Traffic Management Plan and notify by telephone to the Council the location and time of the proposal works before the commencement date. I confirm I hold public liability insurance not less than \$100,000,000.

Applicant Signature: \_\_\_\_\_                      Date: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

<b>APPROVAL</b>		
APPLICATION	Approved	Not Approved
CONDITIONS OF APPROVAL _____		
_____		
_____		
For Roading Engineer	Name: _____	
	Designation: _____	
	Phone: _____	Date: _____
<b>BOND</b>		
	Bond Received	Entered GIS
	Covered by long term agreement	Name: _____
	Date: _____	Date: _____
<b>INSPECTIONS</b>		
Date Works Checked: _____ (during excavation)		
Date Works Approved: _____ (accepted into maintenance)		
Comments: _____		
_____		
<b>INSPECTIONS/ REPAIRS DURING MAINTENANCE</b>		
_____		
_____		
_____		
_____		
<b>NCC ACCEPTANCE</b>		
Trench inspected and released from maintenance		For Roading Engineer
Bond Release		Name: _____
		Designation: _____
		Date: _____
<b>RAMM (Input Data)</b>	Comments:	
Existing pavement depth: _____ mm	_____	
Existing pavement type: _____	_____	
Existing seal type: _____	_____	
Existing seal thickness: _____ mm	_____	
Type of Subgrade: _____	_____	
<b>SURFACE REINSTATEMENT FINISHED</b>		
Applicant Signature: _____		Date: _____

# **SECTION XI**

## **EROSION AND SEDIMENTATION CONTROL**

*March 2006*

**SECTION XI**  
**EROSION AND SEDIMENTATION CONTROL**  
**INDEX**

XI - 1.	General
XI - 2.	Principles of Erosion and Sedimentation Control
XI - 3.	Erosion Control
XI - 4.	Sedimentation Control
XI - 5.	Controls on small sites
Appendix A	Erosion and Sedimentation Control Plan Preface

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## XI – 1 GENERAL

An Erosion and Sedimentation Control Plan (E&SCP) is required for any activity where the cumulative disturbed land is greater than 0.3ha, or where the disturbed land is in a sensitive area, to ensure that the adverse environmental effects of the activity are minimised.

Sensitive areas are classed as those within 5m of the banks of any river, within proposed esplanade strip (identified in Appendix 6 of the Nelson Resource Management Plan(RMP)) or within 20m of the coastal marine area, or where the slope of the land is greater than 1 in 2.14 (47%).

A land disturbing activity less than 0.3ha. that requires a resource or building consent, and is outside a sensitive area does not require an E&SCP but is required to provide the minimum level of erosion and sedimentation control identified in Section XI-5. This minimum level shall be indicated on the resource or building consent application for approval by Council.

An E&SCP will not be applicable for general farming and forestry activities. Resource Consent requirements for these activities are covered under rules RUr.25 Vegetation Clearance, RUr.26 Soil Disturbance, RUr.27 Earthworks, RUr.53 Coastal; Environment Overlay (Earthworks), RUr.78 Subdivision.

E&SCP's are required to be submitted to Council, and approval given, prior to commencement of the activity on site. Notification of the start of the land disturbing activity is required a minimum of 1 week prior to commencement.

The E&SCP should be appropriate to the scale of the operation, and should generally include:-

- (a) Consideration of the principles identified in section XI – 2.
- (b) Site drawing(s), to the standards required in Section II , clearly identifying
  - Site boundaries and relevant features, i.e. streams, access points etc.
  - Site description, i.e. topography, vegetation. soil types, including highlighting steep areas where slope of disturbed land or exposed soil is greater than 1 in 20 ( 5%), 1 in 5 (20%), 1 in 2.14 (47%) and 1 in 1.43 (70%).
  - Proposed stages of construction with boundaries and limits of land disturbance identified on the plan.
  - Plans showing proposed erosion and sedimentation controls, i.e. diversion channels, perimeter cut offs, benched drains, stabilisation/revegetation types and locations, stabilised construction entrances, sedimentation ponds, silt fences etc.
  - Details of any stream crossings.
- (c) Specifications and supporting calculations for erosion and sedimentation controls proposed.
- (d) Measures to be taken to ensure the E&SCP is implemented and adequately maintained on site. An example of the proposed erosion and sedimentation control inspection checklist will be required. It is recognised that the Plan will be a working document and may be subject to change as the activity progresses. Provision should be made for identifying and recording necessary changes on the inspection checklist.

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- (e) Details of any other measures designed to reduce the impact of the activity on the environment.

Copies of the inspection checklists should be submitted to Council at regular specified intervals for the duration of the activity.

Where a major variation to the planned site works is proposed a revision to the E&SCP will be submitted to Council, and works shall not commence until approval is given.

Erosion and sedimentation controls should only be removed from each stage of the development when the land from that stage has been fully stabilised.

Disturbance is defined in section 2 of the Nelson RMP.

## **XI - 2 PRINCIPLES OF EROSION AND SEDIMENTATION CONTROL**

Erosion is the process whereby the land surface is worn away by the action of water, wind, or any other geological process. The resultant displaced material is sediment. Sedimentation is the deposition of this eroded material.

The principles that should be considered when preparing an Erosion and Sedimentation Control plan are:

- (a) Minimise disturbance

Design the project with a view to limiting the disturbed land area. Programme the works to keep forward clearing of vegetation to a minimum. Identify in the E&SCP staged vegetation clearance areas and ensure the boundaries of these areas are clearly identified on site using fences, signs and flags.

Erosion from temporary earth stockpiles formed on site should also be addressed in the E&SCP.

- (b) Stage construction

As much as practicable stage construction to minimise the time and area that soil is exposed and prone to erosion.

Ensure that control measures are installed before commencement of the land disturbing activity for each stage.

- (c) Protect steep slopes

Slope length and slope angle are critical factors in erosion potential because they play a large part in determining the speed of run off. Long continuous slopes allow run off to build up speed and to concentrate flows, which produces rill and gully erosion.

Where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%) and the land is to:

- (i) Have measures taken for the land to be stabilised within 14 days, then temporary contour drains (NCC Standard Drawing No. 21/801 sheet 1) will be required, draining to temporary earth bunds (NCC Standard Drawing No. 21/807 sheet 1), until the land is stabilised; or
- (ii) Have no measures taken for the land to be stabilised within 14 days, then temporary contour drains are required, draining to a sedimentation pond (NCC Standard Drawing No. 21/804 sheet 1), until the land is stabilised.

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Where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%) and the land is to:-

- (iii) Have measures taken for the land to be stabilised within 14 days, then temporary benched slopes (NCC Standard Drawing No. 21/801 sheet 2) will be required, draining to temporary earth bunds, until the land is stabilised; or
- (iv) Have no measures taken for the land to be stabilised within 14 days, then temporary benched slopes are required, draining to a sedimentation pond, until the land is stabilised.

For slopes greater than 1 in 1.43 (70%) or less, depending on earth conditions and circumstances, permanent benched slopes may be required.

Divert clean water run off from above steep slopes, away from worked areas and keep separate from sediment prone water.

Compact all fills to reduce erosion and sedimentation.

(d) Stabilise exposed areas rapidly

Vegetated ground cover is the most effective form of erosion control. Vegetation shields the soil structure from rain drop impact, slows the velocity of run off, holds soil particles in place and maintains the soil capacity to absorb water.

Save topsoil and re-spread on disturbed areas as soon as possible.

For disturbed land sloping less than 1 in 20 (5%), revegetate or otherwise protect from erosion as soon as practicable, and not later than 12 months from the date of disturbance.

If permanent rehabilitation / stabilisation is delayed then temporary measures such as mulching will be required.

Keep machinery off areas that have been stabilised.

(e) Protect Watercourses

Vegetation clearance and soil disturbance is not permitted within 5m of the banks of any river or within 20m of the coastal marine area without resource consent. The realignment of a natural watercourse is not permitted without resource consent.

Identify all watercourses in the E&SCP and address:-

- (i) how these watercourses will be protected
- (ii) how sediment laden water will be prevented from flowing into the watercourse
- (iii) how watercourse crossings will be constructed to prevent erosion.

Watercourse includes every river, stream and channel whether natural or not, through which water flows, whether continuously or intermittently, during the duration of construction.

(f) Install perimeter controls

Install diversion drains, silt fences and earth bunds to divert clean water run off away from worked areas and keep separate from sediment prone water.

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## XI – 3 EROSION CONTROL

When developing the E&SCP, emphasis should be placed on erosion control to prevent sediment generation rather than attempting to catch unnecessarily generated sediments downstream. Below is a list of the main techniques that should be considered. There are many more techniques not listed here, which may be used subject to approval.

### (a) Diversion channel or bund

Diversion channels and bunds are to be used to divert clean or sediment laden run off.

Designs are to be submitted with the E&SCP to include:

- (i) Calculations showing that the channel will contain a  $Q_{15}$  return period peak flood flow from the catchment, plus 300mm freeboard.
- (ii) Calculations showing the maximum design velocity. Where channel velocity is greater than 1m/s stabilisation measures such as geotextile, rock check dams or pipe drop structure will be required to prevent channel erosion.
- (iii) Channels are to be of a trapezoidal cross sectional shape.
- (iv) Avoid abrupt changes in grade / direction, or design structure to allow for sediment deposition or super-elevation.
- (v) Incorporate erosion proof outfall, such as a level spreader to prevent scour and reduce outfall velocities.
- (vi) Where there are critical downstream structures, secondary flow path measures may need to be considered.

Refer to NCC Standard Drawing No. 21/800 sheet 1 and 2

### (b) Contour drain or benched slopes

Contour drains and benched slopes are to be used to prevent overland flow velocity build up on long continuous, and steep slopes and convey sediment loaded water across sloping land on a minimal grade to sediment retention structure(s), probably via runoff diversion channels / bunds.

- (i) Contour drains should be used where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%). The spacing of the drains should be in accordance with the table below. The drains gradient should not exceed 1 in 50 (2%).

Slope of land (%)	Spacing of contour drains along the slope (m)
5 to 10	50
10 to 15	40
15 to 20	30

- (ii) Benched slopes should be used where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%). The spacing of the benched slopes should be in accordance with the table below and located to divide the slope evenly. Careful consideration of the diversion channel design draining the benched slopes is required.

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Slope of land (%)	Vertical height between benches (m)
20 to 33	20
33 to 50	15
Greater than 50	10

Designs are to be submitted with the E&SCP to include:-

- a. The benched slope with a maximum reverse angle of 1 in 6.6 (15%), a minimum depth of 300mm and a width suitable to allow access for maintenance.
- b. The benched slope gradient should not exceed 1 in 50 (2%).
- c. Benched slopes are to be a maximum 250m long.
- d. Install additional drainage where natural seepage is present which may affect slope stability or create excessive run off
- e. Consider risk of erosion, sedimentation, slippage, settlement, subsidence and rotation of the slope on downstream land.
- f. Consider design of diversion channel draining the benched slopes.

Refer to NCC Standard Drawing No. 21/801 sheet 1 and 2

(c) Stabilisation techniques

Stabilisation of disturbed and exposed earth will protect the earth from erosion by the action of water, wind, or any other geological process and reduce sediment and run off. Stabilisation measures include seeding, mulching, hydroseeding, turfing and the installation of geosynthetic erosion control systems. Mulching “with sheep foot roller compaction” is the most effective instant protection.

- (i) Seeding may be used to stabilise disturbed ground or exposed soils where the gradient is less than 1 in 4 (25%) and where the seed is applied prior between 1<sup>st</sup> February and 15<sup>th</sup> April and between 1<sup>st</sup> September and 31<sup>st</sup> November.

For slopes greater than 1 in 4 (25%) mulching must be used in conjunction with seeding. Consideration of using sheep foot roller compaction should be considered on slopes steeper than 1 in 2.14 (47%).

Install the seed bed free of large clods, rocks and other unsuitable material and apply a minimum of 100mm topsoil. Fertiliser may be applied where necessary.

Seeded disturbed land is considered stabilised 2 months after sowing.

- (ii) Mulching can be used at any time of the year, where the instant stabilisation of exposed soils is required. Mulching may be used in conjunction with seeding and sheep foot roller compaction on steeper slopes.

Mulch should contain un-rotted small grain straw, an adhesive and fertilizer applied at a minimum rate of 4,000kg per ha. spread uniformly to a minimum depth of 60mm.

In some circumstances, consideration of ground conditions and the season should be taken into consideration when considering the method that the mulch will be anchored to the ground.

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Alternative mulch materials such as wood fibre, wood chip, hay, hydromulch may be acceptable, where appropriate, subject to approval.

(iii) Hydroseeding should be used to establish vegetation quickly for critical areas such as steep slopes and sediment retention pond batters. The limits of application and specification proposed should be specified by the supplier for approval. Hydroseeded disturbed land is considered stabilised when 2 months after application.

(iv) Turf may be used where immediate cover is required (i.e. run off diversion channels and beside watercourses). Turf reinforced with geosynthetic matting should be considered for areas of high erosion potential.

Turf is to be installed in accordance with the supplier's recommendations.

(v) Geosynthetic Erosion Control Systems provide artificial protection of channels and slopes and include matting, geotextiles and erosion matting. There are several types of systems suitable for different circumstances. Systems should be designed, specified and installed in accordance with the manufactures recommendations and submitted with the E & SCP for approval.

For all techniques the following design factors should be considered:

- a. Site preparation – Install all necessary erosion and sedimentation control structures prior to stabilisation
- b. Irrigation – Address water supply measures for seed germination and plant growth. Control irrigation to prevent erosion.
- c. Protection – Protect re-vegetated areas from traffic and other ground disturbing activities.
- d. Maintenance – Reseed where erosion or germination is unsuccessful prior to 31<sup>st</sup> May, otherwise consider mulching.

(d) Stabilised construction entrance

A stabilised construction entrance is required to prevent site access points becoming sediment sources. A stabilised construction entrance is required on all site entrances onto a public road or right of way.

The stabilised construction entrance should be installed in accordance with the standard drawing and drainage should be provided to carry sediment laden runoff from the entrance to an appropriate sediment control measure such as an earth bund or sedimentation pond.

Where it is found or anticipated that a stabilised construction entrance will not prevent sediment being transported onto the road additional measures will be required such as the installation of a wheel wash facility.

Refer to NCC Standard Drawing No. 21/802 sheet 1

(e) Pipe drop structures

A pipe drop structure is required to convey run off down an un-stabilised slope to prevent erosion of that slope. Pipe drop structures can be used as diversion channels where run of velocities are high.

Designs are to be submitted with the E & SCP to include:-

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- (i) Calculations showing that the structure will contain a  $Q_{15}$  return period peak flood flow from the catchment.
- (ii) Materials, inlets and joints should be watertight.
- (iii) Secure the pipe drop structure to the slope at least every 4m.
- (iv) Careful consideration of the inlet and outlet is required to ensure no erosion occurs.
- (v) The structure is placed on suitably compacted or undisturbed material.
- (vi) The structure is constructed in accordance with the standard drawing.

Refer to NCC Standard Drawing No. 21/803 sheet 1

#### **XI – 4 SEDIMENTATION CONTROL**

Below is a list of the sedimentation control techniques that should be considered. There are more techniques not listed here, which may be used subject to Council approval.

##### (a) Sediment retention pond

A sediment retention pond is a temporary structure designed to treat sediment laden run off by dewatering the pond at a rate that allows suspended sediments to settle out. The pond should be designed so that larger run off events will receive partial treatment, while smaller events will receive a high level of treatment. To achieve this, the energy of the inlet water needs to be low to minimise re-suspension of sediment, and the decant rate at the outlet also needs to be low to minimise water currents and to allow time for the suspended sediments to settle.

Design calculations and drawings should be submitted with the E&SCP.

Refer to NCC Standard Drawing No. 21/804 sheet 1

A sediment retention pond should be designed in accordance with the following requirements and figures:-

- (i) for any activity where the disturbed land slopes less than 1 in 10 (10%) and less than 200m in length the pond shall be designed with a minimum volume of 1% of the contributing catchment, i.e.  $100\text{m}^3$  for each ha of contributing catchment.
- (ii) for any activity where the disturbed land slopes greater than 1 in 10 (10%) and / or 200m in length the pond shall be designed with a minimum volume of 2% of the contributing catchment, i.e.  $200\text{m}^3$  for each ha of contributing catchment.
- (iii) For any activity where the disturbed land slopes greater than 1 in 2.14 (47%) and 200m in length the pond shall be designed with a minimum volume of 3% of the contributing catchment, i.e.  $300\text{m}^3$  for each ha of contributing catchment.
- (iv) The slope angle is determined by that slope immediately above the pond, or by the average slope angle over the contributing catchment, whichever is greater.
- (v) Ensure base of pond is level, between 1m and 2m deep and between 3 to 5 times longer than wide. The distance between the pond inlet and decant structure should be as great as possible.

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- (vi) The decant system should be carefully designed to ensure approximately 30% dead storage at the bottom of the pond to dissipate energy flows.
- (vii) Decants work only through the remaining 70% live storage volume. For catchments up to 1.5ha, 1 decant should work through the whole live storage height. For catchments 1.5ha to 3ha, 2 decants required, one through the whole live storage, the second through the top half only. For catchments 3ha to 4.5ha, 3 decants required, one through the whole live storage, the second through upper 2/3's and the third through upper 1/3rd of live storage.
- (viii) A decant should be provided for each 1.5ha catchment with 6 rows of 10mm diameter holes at 60mm spacing (200 holes) along the 2m long decant arm. For catchments less than a multiple of 1.5ha, the appropriate number of holes should be sealed off (i.e. for 1ha catchment drill 133 holes in decant), one 10mm diameter hole per 75m<sup>2</sup> of contributing catchment.
- (ix) Each decant should be weighted to keep it submerged just below the pond surface through all stages of the decant cycle to prevent blockage from debris.
- (x) The discharge pipe should be installed with anti-seep collars.
- (xi) The pond inlet should utilise a level spreader to maximise the pond capacity. The level spreader should be the same width as the pond floor. The inlet slope, below the level spreader should be protected from erosion with geotextile and at a slope no greater than 1 in 3(33%).
- (xii) The level spreader weir should be set 100-200mm above the invert of the emergency spillway.
- (xiii) Incorporate a 1m deep by 2m wide fore bay in front of the level spreader weir.
- (xiv) Silt fences should be installed below the pond prior to construction to prevent downstream sedimentation until the pond batters are stabilised.
- (xv) Stabilise the pond batters, and any other disturbed areas, immediately after construction
- (xvi) For catchments between 1.5ha and 3ha, a 150mm diameter primary spillway pipe is required. For catchments greater than 3ha, a concrete manhole riser and pipe outlet is required, sized for a Q<sub>15</sub> return period peak flood flow from the catchment.
- (xvii) An emergency spillway must be installed on all sediment retention ponds, designed for a Q<sub>50</sub> return period peak flood flow from the catchment. The spillway requires adequate stabilisation to accommodate a Q<sub>50</sub> flow and should be a minimum 6m wide or the width of the pond floor, whichever is the greater. The spillway should have 300mm freeboard above the height of the primary spillway and 300mm below the pond banks.
- (xviii) Fence sediment ponds as necessary in accordance with site safety management plan.
- (xix) Sediment ponds are to be cleaned out when the volume of sediment accumulated reaches 20%. The 20% level should be clearly marked on the decant riser.

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- (xx) Identify sediment disposal locations where there is no risk of erosion.
- (xxi) Chemical treatment of the pond, promoting flocculation to increase the rate of sediment settlement may be considered, subject to council approval, in circumstances where the pond volume cannot be achieved, where there are high levels of downstream sensitivity, or high proportion of clays in the disturbed land.

Refer to NCC Standard Drawing No. 21/804 sheets 1 to 6

(b) Silt fence

Silt fences should be used to detain sheet flow run off so that sedimentation can occur through settlement. They should be used on low gradient sites, or for confined areas where the contributing catchment is small (less than 0.5ha.). Silt fences should not be used as velocity checks in channels or watercourses or to intercept concentrated flows.

Generally, silt fences should be designed in accordance with the following requirements and figures, but alternative designs may be acceptable, subject to approval:

- (i) The maximum slope length, spacing of returns and gradients for silt fences is shown in Table 4.1 below.
- (ii) The silt fences should be constructed in accordance with the standard drawing and should be positioned along the contour, where possible. Where this is not possible, or for long lengths of fence, install short silt fence returns (minimum 2m long) to minimise concentration of flows.
- (iii) Excavate a trench a minimum 100mm wide and 200mm deep along the line of the proposed fence. Install the support post and fence fabric and backfill the trench with compacted soil.
- (iv) Where water may pond behind the fence provide extra support.
- (v) The fence fabric should have minimum tension strength of 0.345pa, minimum tensile modulus of 0.140pa and apparent opening size of 100µm.
- (vi) Fence supporting posts should be a minimum 50mm square of tanalised timber or steel waratahs, a minimum 2m apart.
- (vii) The top of the fence fabric should be reinforced with 2.5mm galvanised wire, tensioned and tied.
- (viii) Repair fences where bulges occur or when sediment accumulation reached 50% of the fabric height.
- (ix) Silt fences should remain in place until the catchment has been stabilised.

Refer to NCC Standard Drawing No. 21/805 sheet 1

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Table 2.2 Silt Fence Design Criteria

Slope Steepness %	Slope Length (m) (Maximum)	Spacing of Returns (m)
Flatter than 2%	Unlimited	N/A
2 – 10%	40	60
10 – 20%	30	50
20 – 33%	20	40
33 – 50%	15	30
> 50%	6	20

**Table 4.1 SILT FENCE DESIGN CRITERIA**

(c) Stormwater sump protection

Stormwater sump protection may be used only as a secondary control device to filter sediment laden runoff before it enters the stormwater reticulation system from small catchments less than 0.5ha. Additional measures are required such as diversion bunds, contour drains, benched slopes and silt fences to minimise the volume of sediment laden water reaching the stormwater inlet.

Stormwater sump protection offers limited treatment because the flows arriving at them are concentrated. Their use may indicate poor erosion and sedimentation control and/or inadequate stabilisation following the activity.

A silt fence can be erected around the inlet or course geotextile fabric wrapped around the cesspit grate with a layer of aggregate material over to act as a primary filter and hold the fabric in place. Back entry sumps require additional fabric protection secured in place. Sandbag check dams should be placed up the gutter to act as sediment traps, ensuring these are lower than the kerb to prevent berm runoff.

Stormwater sump protection and sandbag check dams require high maintenance as the capacity for sediment storage is small. Address maintenance measures in the E&SCP.

Refer to NCC Standard Drawing No. 21/806 sheet 1

(d) Earth bund

Earth bunds are used to intercept and detain sediment laden run off for disturbed land or exposed soils that are to be stabilised within 14 days, where the catchment area is less than 0.3ha. They are to be kept in place until stabilisation is complete.

Earth bund outlets need to be designed as for a sediment retention pond decant system or by using a perforated pipe. The perforated pipe outlet should be 150mm lower than the stabilised spillway which in turn should be 250mm below the top of the earth bund. The outlet should be watertight along the bed of, and through, the bund. The impoundment area of the bund is to be level, and have a minimum volume (measured to the top of the novacoil pipe) of 1m<sup>3</sup> for every 100m<sup>2</sup> of contributing catchment.

Refer to NCC Standard Drawing No. 21/807 sheet 1

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## XI- 5 CONTROLS ON SMALL SITES

For sites with less than 0.3 ha of disturbed land, outside sensitive areas, an E&SCP is not required although the following measures are still necessary to ensure that the activity complies with the soil disturbance and earthworks rules in the Nelson Resource Management Plan. These rules state that some soil disturbance and earthworks activities are permitted without resource consent provided:

- *“soil is contained on the site during the construction period and after, such that there are no adverse effects on adjoining properties or any water bodies”*
- *“all bare soil areas are revegetated or otherwise protected from soil erosion as soon as practicable and not later than 12 months from the date of disturbance”*
- *“no vegetative debris is positioned where it may dam or divert any river or stream or adversely affect instream habitats”*

(a) Stabilised construction entrance

A stabilised construction entrance should be installed in accordance with XI – 3(d) above.

(b) Silt fence

Silt fences should be used to trap sediment laden overland flows before they leave the site. Silt fences should be installed in accordance with XI – 4(b) above.

(c) Earth bund

Earth bunds should be used to treat sediment laden run off and should be constructed in accordance with XI – 4(d) above.

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## APPENDIX A      EROSION AND SEDIMENTATION CONTROL PLAN PREFACE

- 1) Project Details  
Project title  
Eng Plan No.  
Site Address
  
- 2) Client Details  
Name / Company Name  
Address  
Telephone No.  
E-mail  
Name of Contact person
  
- 3) Consultant Details (Architect / Surveyor)  
Name / Company Name  
Address  
Telephone No.  
E-mail  
Name of Contact person
  
- 4) Contractor Details  
Name / Company Name  
Address  
Telephone No.  
E-mail  
Name of Contact person  
After hours contact telephone No.
  
- 5) Type of Development
  
- 6) Programme
  - (i) Activity commencement date
  - (ii) Activity completion date
  
- 7) Site Details
  - (i) Total property area (ha)
  - (ii) Maximum area of disturbed land or exposed soil that will be unvegetated for any one period during the activity.
  - (iii) Maximum slope of disturbed land or exposed soil for any period during the activity
  - (iv) Water body into which runoff will be discharged
  - (v) Is the activity in a sensitive area
  
- 8) Measures to be taken to ensure E & S controls are adequately maintained
  - (i) Person responsible for E & S site controls
  - (ii) Person responsible for E & S site inspections and the submitting of the checklists to Council
  - (iii) Frequency of inspections,    -regular  
  -before and after rain

March 2006





# **FIELD ACCEPTANCE PRESSURE TESTING FOR WATER SUPPLY PIPELINES**



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*January 2003*

## 1. INTRODUCTION AND GENERAL COMMENTS

The acceptance pressure test requirements used for water supply pipelines have generally been too insensitive to date. It is believed that many pipelines have been allowed to pass with unacceptable leaks, generally through ineffective testing procedures and/or low acceptance requirements. The procedures detailed in this document represent the latest acceptance requirements and procedures from Australia and Europe.

Section 3 gives general pressure test requirements for all pressure testing and Sections 4, 5 and 6 give material-specific test methods in detail. Appendix A has a pressure test record and Appendix B has some general comments on the measurement of make-up water volume and pressure measuring equipment.

## 2. TERMINOLOGY AND DEFINITIONS

**CLS:** Concrete lined steel pipes, generally welded spiral wound steel with a cement mortar lining in accordance with NZS 4441.

**Design Pressure (DP):** The pressure that the designer expects to act on the pipeline in service. In a gravity supply system, this is usually the elevation difference between the reservoir top water level and the lowest elevation of the pipeline in metres head.

**DI:** Ductile iron pipes - generally socket jointed with Tyton elastomeric seal rings.

**DN:** Nominal pipe bore diameter in millimetres. For PE pipes, this relates to the pipes outside diameter.

**GRP:** Glass reinforced plastics pipes, e.g. Hobas. This type of pipe is generally only used for major transfer or transmission mains since pipe diameters of less than DN 300 mm are rare.

**Maximum Design Pressure (MDP):** The DP plus a pressure surge allowance (preferably calculated), or a fixed allowance of 200-500 kPa or such other allowance as the pipeline designer may decide is appropriate.

**Operating Pressure:** The internal pressure which occurs at a particular time and at a particular point in the water reticulation system. For a gravity system, the operating pressure will depend on the water level of the reservoir, the ground level at the point on the pipeline under consideration, and the head loss due to demand in the system.

**PE:** Polyethylene pipes, generally PE 80B or PE 100 for water supply networks. PE 80C is not recommend for long term water reticulation networks.

**Nominal Pressure Rating (PN):** The pressure marked on the pipe or component and the maximum pressure that it can operate at throughout its design life.

**System Test Pressure (STP):** The hydrostatic pressure to be applied to a newly laid pipeline (measured at the lowest point) to ensure its integrity and water tightness.

## 3. ACCEPTANCE PRESSURE TESTS FOR ALL PIPELINE MATERIALS

### 3.1 General

Every pressure pipeline is required to pass a water pressure test to verify the integrity of the pipes, joints, fittings and other components such as thrust blocks.

For drinking-water pipelines, the test medium shall be potable water that may contain sufficient additional disinfectant to minimise the risk of the commissioned pipeline containing potentially harmful organisms. For safety reasons, compressed air shall not be used for pressure testing

### 3.2 Health and Safety Issues

Appropriate safety equipment shall be available on site prior to commencement of any pressure testing operations. Only suitably qualified personnel shall carry out and oversee the testing and shall have appropriate protective clothing.

All excavations shall be adequately barricaded. Work in pipe trenches that is not related to the pressure test shall not be permitted during the pressure test.

All test equipment shall be correctly calibrated, in good working order, suitable for the test procedure and be correctly fitted to the pipeline.

The section to be tested shall be completed in accordance with the specification and the pipes and fittings etc adequately restrained. Any permanent or temporary concrete thrust blocks shall be designed for and have attained sufficient compressive strength to resist the test thrusts. No temporary thrust blocks or supports shall be removed until the pipeline is depressurised.

Where water for testing purposes is derived from a potable water supply, appropriate backflow prevention equipment shall be incorporated in the connection to the potable water supply to minimise the risk of accidental backflow and possible contamination of the potable water supply occurring.

The contractor shall have contingency plans and sufficient equipment on site to deal with any bursts or other foreseeable emergency that may arise during testing.

### 3.3 Personnel Qualifications

The testing of all pipelines shall only be carried out and supervised by acceptably qualified or accredited personnel.

Qualified or accredited personnel shall:

- hold appropriate qualifications issued by a registered training organisation; or
- have attended a relevant training course, and received accreditation relating to the work being undertaken, and
- show competence and knowledge of the relevant testing methods and procedures

### 3.4 Filling the Pipeline

New pipelines should preferably be filled from the low end of the line. The rate of flow and time of day for filling may be controlled by the availability of water. Where the pipeline is to be charged with water from the existing reticulation network, the filling rate of flow should not cause a pressure drop that will be noticeable or cause inconvenience to consumers. Water from an alternative source shall not be used to fill pipelines for testing purposes unless the quality of the water complies in all respects with grade B (or better) for water Source and Treatment of the Public Health Grading of Drinking-Water Supplies.

It may be necessary to carry out the filling, flushing or swabbing operations at times that do not coincide with peak demands on the reticulation network. The pipeline designer should specify the filling times and rates of flow, especially where large diameter pipelines are involved.

Suitable means of introducing flushing water, including temporary facilities for launching and release of swabs (as appropriate) shall be installed as part of the testing procedure and a means provided for the safe disposal of any water that is flushed from the pipeline.

A suitable backflow preventer shall be used on any connection made to fill, flush out or to drive a swab or swabs through a new pipeline. A dual check valve (without test facilities) will be suitable provided its effectiveness is confirmed prior to use.

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### 3.5 **Pressure and Volume Measurement**

The accuracy and readability of pressure monitoring and make-up volume measurement equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

Appendix B gives detailed requirements for volume and pressure measurement equipment.

### 3.6 **Test Section Length**

The pipeline length tested may be either the whole or a section of the pipeline, depending on the length and diameter, the availability of water and the spacing between sectioning valves or blank ends. When installing long pipelines, it is advisable to begin testing early in the installation to confirm the adequacy of the laying procedures, and to increase the length tested progressively as experience is gained. The Contract documents may contain specific requirements that effectively control the length/s to be tested.

*Note: Long sections may incorporate large numbers of mechanical joints that may need to be checked for leakage if there is a test failure. Leaks become harder and more costly to pinpoint in longer test sections.*

Pipeline test sections longer than 1,000 m may need to be tested in shorter sections. If long lengths are to be tested, the use of radios or cell phones may be necessary to facilitate the testing procedure.

Pipelines should be tested in suitable lengths so that:

- The overall pressure at the lowest point of the line does not exceed the STP
- The pressure at the highest point in the section is at least equal to the MDP.
- Sufficient suitable water is available for the test and there are appropriate plans in place for the disposal of the test water (including disinfection residual if applicable).
- Site considerations such as; mixed pipe materials, locations of blank ends to ensure safe and convenient accessibility, etc are taken into account

### 3.7 **Test Duration**

The test duration will vary depending on the testing method used. The main test phase for any method will be at least an hour and may take more than one working day. The test duration given in the specification or in the approved methodology shall be used.

### 3.8 **Pipe Temperature**

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Refer also to Appendix B for additional comments on temperature effects.

### 3.9

#### **Test Methodology**

The Contractor shall provide a test methodology for the Engineers approval prior to commencing testing. The methodology shall include at least the following:

- names and experience/qualifications of the personnel to be used
- details of the test length (including any changes in diameter or pipe material) marked on a longitudinal profile of the pipeline
- details of temporary anchors or thrust blocks and sectioning valves
- timing of, method proposed for and rate of filling the pipeline (including details of backflow prevention equipment proposed)
- details of method for removal of air from the line
- details of the pressurising pump, its capacity and the method proposed for controlling pulsation's and ensuring that the STP is not exceeded
- pressure rating of the lowest rated pipeline component
- system test pressure
- test duration
- details of the test rig (pressure gauges and/or transducer and data logger to be used)
- details of the method (and equipment) proposed for determining make-up water volume or volume discharged in confirming the remaining air for the rebound test
- method for ensuring that line valves seal satisfactorily
- acceptance criteria for the method proposed
- maximum allowable concentration of total available chlorine that can be discharged to a stormwater system or natural channel (if applicable)
- proposals for disposal of water drained on completion of the test, including the method of de-chlorination and the means of measuring the chlorine residual to ensure it does not exceed the allowable value (if applicable)
- test record sheet proposed

### 3.10

#### **Acceptance Test Requirements**

##### **3.10.1 General Requirements**

The length to be tested shall be as scheduled in the contract documents or as planned by the Contractor in the approved methodology. If any test proves to be unsatisfactory, detect and rectify the fault/s, and re-test. Even if testing procedures produce a satisfactory result, any visible leaks that are discovered shall be rectified and the pipeline re-tested.

Acceptance testing may be done progressively, but shall not be commenced before:

- at least 24 hours notice of the intention to start testing has been given to the Engineer
- the Contractors written testing methodology and all equipment (including backflow prevention device/s, pressure test rig, makeup volume measurement, etc) have been approved
- suitable means for filling and flushing, including temporary facilities for launching and release of swabs (as appropriate) are in place
- the Engineer has approved the source of water and the rate of flow for filling the line
- the section to be tested has been completed and backfilled and is in conformity with the specification

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- any permanent or temporary concrete thrust blocks have been poured and have attained sufficient compressive strength to resist test thrusts
- end caps (that allow for filling and bleeding of air) and any temporary anchors are in place and are adequately braced to resist test thrusts
- air valves (if applicable) are installed and their isolating valves are open
- arrangements have been made for the safe disposal of water flushed from the pipeline
- contingency plans are in place for dealing with a possible pipeline burst
- suitably qualified personnel are on site to carry out, oversee and approve the acceptance test
- appropriate and approved record sheets are available for recording all aspects of the test

### 3.10.2 **Filling the Pipeline**

Nelson City Council will make water available from its reticulation for the first filling and flushing operations at no cost to the Contractor. Water used for any subsequent fill/s and flushing will be charged at Council's current supply rate. The quantity of water to be charged shall be as measured by meter or as assessed by the Engineer if suitable metering equipment is not used.

The pipeline shall be filled at the approved rate, in accordance with the following conditions:

- fill from the low end and ensure that air valves and venting points are open and operating
- run a polyurethane foam swab along with the filling water to assist with air removal if specified or approved
- where swabbing is not carried out, flush (if possible and approved) the pipeline at a rate that will transport construction debris to scour point/s and air to vented connections and air valves
- make sure that the filling or flushing operations do not cause an unacceptable pressure drop in the reticulation
- make adequate provision for the safe disposal of any flushed water
- raise the pressure in the pipeline to the pipeline DP as specified or to  $75 \pm 5\%$  of the STP if the DP is not specified
- repair any leaks or make good any defects that are revealed
- allow the pipeline to "soak" for a period of 2 to 24 hours (or more) to allow the temperature to stabilise and any time dependent movement to take place (the longer period may be necessary for saturation of cement mortar linings on pipes or fittings)
- a disinfection solution may be introduced with the fill water or final flushing water if approved by the Engineer

### 3.10.3 System Test Pressure (STP)

The STP shall be as set by the system designer. If the STP has not been specified, the pipeline shall be subjected to a pressure that is the lower of:

- 1.25 x PN of the lowest rated pipe or component installed in the section to be tested, or

Where surge pressures have been included:

- DP + 100kPa, or

Where surge pressures have not been included:

- DP + 500 kPa, or 1.5 x DP (whichever is the greater),

Where short lengths of pipeline are tested separately, e.g. for service pipes of DN ≤ 63 and of ≤ 100 metres the STP may be taken as the DP unless otherwise specified.

### 3.10.4 Pressure Monitoring point

The pressure shall be monitored at the lowest part of the pipeline or if that is not possible, at some other convenient point and the STP adjusted to take account of the elevation difference between the pipelines lowest point and the test rig. The adjustment shall be made by subtracting 10 kPa for every metre elevation that the rig is above the lowest part of the line.

## 3.11 Pressurising the Pipeline

### 3.11.1 Test Pump Capacity

The pump capacity is an important consideration. If its capacity is too small, it may take too long to reach the test pressure, conversely, if its capacity is too great, it may not be controllable and could cause over-pressurisation.

If a motorised test pump is used, it shall be fitted with an adjustable pressure relief valve that is set to discharge the full flow of the pump at a pressure equal to the PN of the pipe. To pressurise the pipeline, the relief valve setting should be gradually adjusted to raise the pressure in a controlled manner until the STP is reached. Continual discharge from the relief valve is preferable to the possibility of overloading the pipeline. The test pump should not create excessive pulsation's that may affect the ability to achieve the STP accurately. A surge-damping device may be needed to control pressure pulsations.

### 3.11.2 General Comments

Pressurising the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) is on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and **must not** be raised to more than 1.5 x the PN of the lowest rated component in the line.

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If over pressurisation is considered by the Engineer to have compromised the pipeline materials integrity, the Contractor may be liable for all costs involved in replacing and relaying the over-stressed section of pipeline. The degree and duration of the over pressurisation will have a bearing on the outcome and the Engineer may wish to consult with a recognised expert in pipeline materials before making a ruling. The Contractor shall be responsible for any costs incurred and for any delays that may be associated.

### **3.12 Testing Against a Closed Valve**

Pressure testing against a closed valve is not acceptable. The test line shall be blanked off and suitably anchored.

### **3.13 Final Pressure Test**

When a pipeline has been divided into two or more test sections for pressure testing and all sections have tested satisfactorily, the total pipeline shall be pressurised to the DP. After one hour at the DP, all joints on closer pipes between sections or any additional components that have been installed after the pressure test of the adjacent sections shall be inspected visually for leaks and changes of line or level. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

If, for any reason, it is not possible to observe leakage at joints on closer sections, the final test shall be carried out using a full test procedure as per the appropriate test method for the pipeline material. The STP for this final test shall be selected so that:

- the pressure at the lowest part of the pipeline does not exceed  $1.5 \times PN$  of the lowest rated component in the system
- the pressure at the highest part of the line is at least equal to the MDP.

The Engineer shall be advised so that the final test can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

### **3.14 Connections to Existing Pipelines**

No connection to an existing pipeline shall be made until the new pipeline and any connecting pipes and fittings have been disinfected. The joints between the new pipeline and existing pipelines shall be subjected to the operating pressure for at least one hour and then inspected for leakage. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

The Engineer shall be advised so that the final connecting joints can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

### **3.15 Additional or Failed Pressure Tests**

The cost for the Engineer to attend pressure tests that fail shall be a cost to the contractor for council contracts and a cost to the Developer when the work is for a subdivision.

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### 3.16 Reporting

A complete record of all details of the test shall be made. This record shall include the following:

- full details of the pipeline tested (including details of pipe material, diameter and pressure class, pressure rating, manufacturers identification, jointing system, pipeline profile showing changes in pipe material as well as the location of valves and fittings, and the location of test sections)
- failure of any thrust block, pipe, fitting or other component
- any visible leakage detected and repaired
- a detailed record of the pressure in the pipeline at appropriate time intervals. This may be from a pressure data logger or by manually recording times and pressure readings at appropriate intervals
- details of the addition of make-up water (either by volume drawn off or volume pumped in)
- the allowable quantity of make up water for the test conditions
- confirmation that valves sealed when subjected to DP on one side
- whether the pipeline passed or failed the test
- the signatures of the representatives of the Contractor, Engineer and/or Designer who witnessed the test.

A suitable record form is attached as Appendix A.

### 3.17 Completion of the Test

After testing, release the test pressure slowly and if necessary, open air valves and drain points to drain the line. If the pipeline has been disinfected, do not drain it until just prior to final commissioning so that the risk of contamination is minimised.

If it is necessary to drain a line that contains a disinfection residual of chlorine, this residual shall be reduced to an acceptable level before being discharged to a storm water system. Alternatively, (and with the Engineers approval) the chlorinated water may be discharged to the sewage system provided a positive air gap separation is maintained at all times and the rate of discharge does not overload the sewer.

## 4. METHOD FOR PRESSURE TESTING DI, CLS, PVC, PVC-M & GRP PIPELINES

### 4.1 Pressurising the Pipeline

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) are on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and **shall not** be raised to more than 1.5 x PN of the lowest rated component in the line.

Maintain the STP, by pumping at 15-30 minute intervals (if necessary) for the specified test duration (usually at least one hour). Measure and record the quantity of make-up water added at each occasion, either by the volume pumped in or the volume

drawn off method as detailed in the Contractors approved test methodology or Appendix B. Restore the STP whenever the pressure drops by more than 5%.

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## 4.2 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance to locate
- The total make-up water volume does not exceed the maximum allowable quantity as calculated from the equation:

$$Q(\text{litres/hr}) \leq (0.14 \times L \times D \times H)$$

Where:

<i>L</i>	=	<i>Length of pipeline under test (km)</i>
<i>D</i>	=	<i>Internal diameter of pipe (m)</i>
<i>H</i>	=	<i>Average value of head in the pipeline over the full test length (m)</i>

## 4.3 Failure of Test

Should the test fail, the cause shall be located and rectified and the section re-tested until satisfactory results are obtained.

Failure to allow adequate “soak” time for a cement mortar lined pipe or if there is a significant amount of entrapped air in the pipeline may result in an inconclusive test or a marginal failure. In such a case, the test period may be extended for a further one to two hours, as may be agreed between the Contractor and the Engineer.

Provided the quantity of make-up water meets the acceptance criteria during the last hour of this extended period, the pipeline will pass the test.

When PE service connections or sub-mains are tested along with a main pipeline, the visco elastic creep of these pipes may cause a test failure. It may be necessary to isolate the PE sections and test these separately or to apply the methods given in sections 5 or 6.

## 4.4 Reporting

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

## 5. METHOD FOR PRESSURE TESTING VISCO-ELASTIC PIPES (PE) – REBOUND METHOD

### 5.1 General

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer are on site to witness the test, unless the Engineer has given prior approval.

A Pressure transducer and data logger is the preferred means for monitoring the pressure during this test method, however, manual reading of a pressure gauge that complies with the requirements of Appendix B clause 4 at 2-5 minute intervals will be acceptable.

**5.2 Preliminary Phase**

This preliminary phase is necessary before proceeding to the subsequent phases. It is intended to set up the prerequisites for volume alterations that are dependent on pressure, time and temperature.

- After flushing/swabbing and thoroughly venting the pipeline, depressurise to just above atmospheric at the highest point of the line and allow a relaxation period of at least 60 minutes to release pressure related stress. Ensure that no air enters the line

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- After the relaxation period, raise the pressure steadily and smoothly to the STP (it must not be raised to more than 1.5 x PN of the pipe). Maintain the STP for a period of 30 minutes by pumping continuously or at short intervals. Take care not to exceed the STP. During this time, carry out an inspection to identify any obvious leaks
- Stop pumping and allow the pressure to decay by visco-elastic creep for 1 hour
- Measure the remaining pressure at the end of the hour
- If the pressure has dropped to 70% (or less) of the STP, the pipeline will not pass the test and the cause should be located and rectified. This could be due to leakage or temperature change. If the pressure at the end of the hour >70% of the STP, continue with phase two, the pressure drop test to prove the volume of air in the pipeline is sufficiently low to allow the main test phase to be carried out.

**5.3 Pressure Drop Test**

The main test phase requires that the pipeline has been adequately vented and the volume of remaining air is less than the calculated maximum allowable. The procedure to confirm the air volume is described below. This test (pressure drop test) is carried out immediately after the completion of a successful preliminary phase.

- Reduce the pressure remaining in the pipeline rapidly at the end of the preliminary phase by opening a metered “bleed” connection to produce a pressure drop ( $\Delta p$ ) of 10 – 15% of the STP or to the DP (which ever produces the lowest pressure). The bleed time should be kept as short as possible, (preferably less than 2 minutes). A large diameter/volume test section will require a large connection and meter in order to achieve the bleed time requirement – this should be confirmed by calculation.
- Measure accurately and record the volume of water “bled” from the line ( $\Delta V$ ).
- Calculate the maximum allowable water loss ( $\Delta V_{max}$ ) using the following formula. The volume of water removed should not exceed  $\Delta V_{max}$ .
- If  $\Delta V$  is more than  $\Delta V_{max}$ , stop the test and remove excess air

$$\Delta V_{max} = 1.2 \times V \times \Delta p \times [1/E_w + D/(e \times E_R)]$$

Where:

- $\Delta V_{max}$  allowable water loss in litres
- $V$  total volume of the tested pipeline in litres
- $\Delta p$  measured pressure drop in kPa
- $E_w$  bulk modulus of water (kPa) @ test temperature (see Table 1)
- $D$  internal pipe diameter in metres
- $e$  wall thickness of the pipe in metres
- $E_R$  modulus of elasticity of the pipe wall in kPa (see Table2)
- 1.2 an allowance for remaining air

**Table 1 – Bulk Modulus of Water at Various Temperatures**

TEMPERATURE °C	BULK MODULUS (kPa)
5	2080000
10	2110000
15	2140000
20	2170000
25	2210000

30	2230000
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**Table 2 – E Modulus of PE 80B and PE100 at Various Temperatures**

TEMP. °C	PE 80B - E Modulus (kPa) @ hrs			PE 100 – E Modulus (kPa) @ hrs		
	1 hour	2 hours	3 hours	1 hour	2 hours	3 hours
5	740000	700000	680000	990000	930000	900000
10	670000	630000	610000	900000	850000	820000
15	600000	570000	550000	820000	780000	750000
20	550000	520000	510000	750000	710000	680000
25	510000	490000	470000	690000	650000	630000
30	470000	450000	430000	640000	610000	600000

Notes:

- The value of  $E_R$  should be representative of the temperature and duration of the test (see table 2 above)
- $\Delta p$  and  $\Delta V$  should be measured as accurately as possible, especially where the test section volume is small.

#### 5.4 Main test phase

The visco-elastic creep due to the STP is interrupted by the rapid pressure drop described above. The rapid drop in pressure leads to the contraction of the pipeline. Observe and record the increase in pressure that results from the contraction of the pipeline for a period of 30 or 90 minutes.

#### 5.5 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage
- The pressure shows a rising tendency throughout the 30 minute period
- If doubt exists about the pressure recovery, the monitoring period may be increased to 90-minutes and any pressure drop that does occur shall not exceed 20 kPa over the full 90-minute period
- If the pressure drops by more than 20kPa during the 90 minute extended period, the test fails
- Repetition of the main test phase may only be done by carrying out the whole test procedure including the relaxation period of 60 minutes described in the preliminary phase.

#### 5.6 Failure of Test

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained.

#### 5.7 Reporting

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

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## 6. METHOD FOR PRESSURE TESTING VISCO-ELASTIC PIPES (PE,) – VOLUMETRIC METHOD

### 6.1 Purpose

This method is included as a reference method that can quantify the amount of leakage in a visco-elastic pipeline. It will generally require a greater length of time to achieve a result.

### 6.2 Pressurising the Pipeline

The pressure shall be raised steadily and smoothly to STP. (It *must not* be raised to more than 1.5 x PN of the pipe).

When the STP has been reached, isolate the pipeline and allow the pressure to decay naturally for 12 hours. (The pressure will drop significantly during this pre-stressing period).

After 12 hours, re-apply and maintain the STP for 5 hours as detailed below:

- Restore the STP at the end of the 12 hour pre-stressing period
- Restore the STP at the end of hour 1
- Restore the STP at the end of hour 2
- Measure and record the water volume (V1 Litres) needed to restore the STP at the end of hour 3
- Restore the STP at the end of hour 4
- Measure and record the water volume (V2 Litres) required to restore the STP at the end of hour 5

Calculate

$$V_2 \leq 0.55 \times V_1 + Q$$

Where:  $Q$  is the allowable make-up volume obtained from the equation:  
 $Q \text{ (litres/hr)} \leq (0.14 \times L \times D \times H)$

Where:  $L$  = Length of pipeline under test (km)  
 $D$  = Internal diameter of pipe (m)  
 $H$  = Average value of head in the pipeline (m)

### 6.3 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance
- The make-up water volume (Q) does not exceed the maximum allowable volume as calculated

### 6.4 Failure of Test

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained. Note that the STP and the quantity of water required to restore the STP must be measured as accurately as possible.

**6.5 Reporting**

On satisfactory completion of the test, a test report prepared by the Contractor shall be signed off by the Contractor, Engineer and Consultant witnessing the test.

**Nelson City Council**

**PRESSURE PIPELINE - TEST RECORD**

January 2003

**7. PRESSURE TEST RECORD**

PIPE PURPOSE:  
LOCATION:

DATE:

DESIGNER:

CONTRACTOR:

FOREMAN:

CONSULTANT OBSERVER:

COUNCIL OBSERVER:

**OPERATING & TEST DETAILS**

**MAX. OPERATING PRES:**

**SYSTEM TEST PRESSURE:**

**PASS CRITERIA:**

**PASSED THE TEST?**

SIGNATURES:

**MAIN PIPELINE DETAILS**

PIPE MAKE/DESCRIPTION:

NOMINAL DIAMETER:

PIPE MATERIAL:

JOINTING SYSTEM:

PIPE SERIAL NUMBER/S:

PIPE OD (mm):

PRESSURE CLASS:

LENGTH OF PIPE:

**RIDER MAIN DETAILS**

PIPE MAKE/DESCRIPTION:

NOMINAL DIAMETER:

PIPE MATERIAL:

JOINTING SYSTEM:

PIPE SERIAL NUMBER/S:

PIPE OD (mm):

PRESSURE CLASS:

LENGTH OF PIPE:

**HOUSE CONNECTION DETAILS**

PIPE MAKE/DESCRIPTION:

NOMINAL DIAMETER:

PIPE MATERIAL:

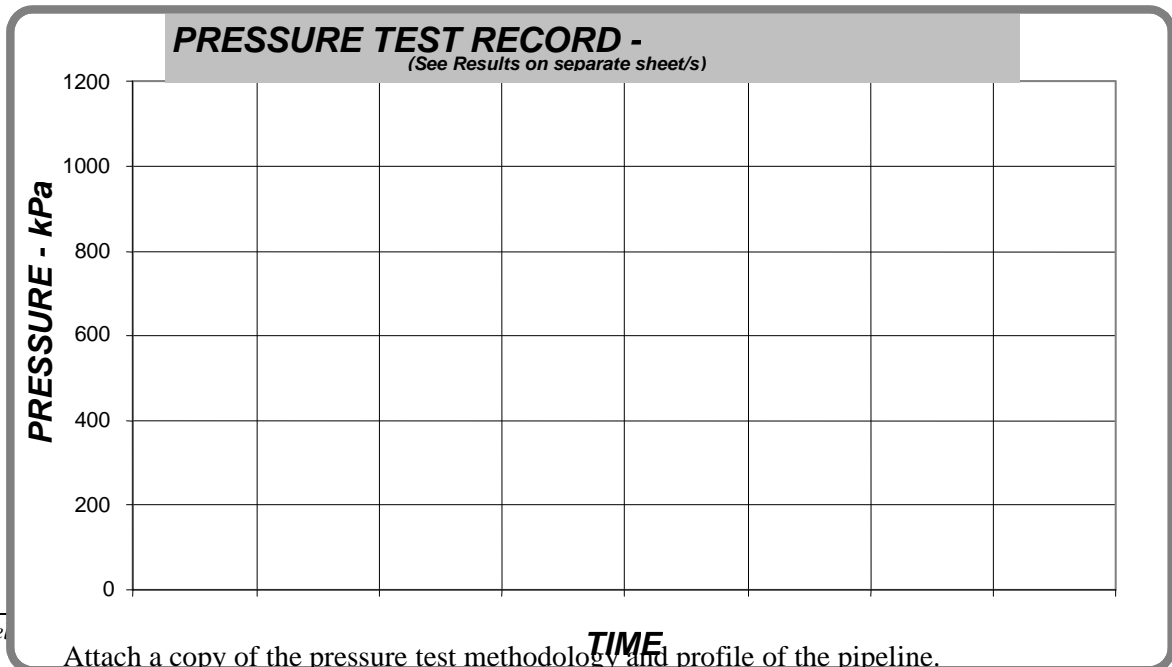
JOINTING SYSTEM:

PIPE SERIAL NUMBER/S:

PIPE OD (mm):

PRESSURE CLASS:

LENGTH OF PIPE:



Nel

Attach a copy of the pressure test methodology and profile of the pipeline.



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## **8. MEASUREMENT OF MAKE-UP WATER VOLUME**

There are two equivalent methods for measuring the volume of make-up water; i.e. measurement of the volume drawn off or the volume pumped in.

### **8.1 Measurement of the Volume Pumped in**

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Then restore the STP by pumping and measure the volume that is pumped in.

The quantities of water pumped in should be summed if it's necessary to raise the pressure in the line more than once during the test.

The volume of water pumped into the pipeline may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the inflow rate is within the meters'  $Q_{\min}$  and  $Q_{\max}$ .

The quantity of water may be quite small (especially for a small diameter and short length of main). If a motorised test pump is used, it may be difficult to control the rate of pressure rise and pump pulsations may affect the water meters accuracy. If this is the case, the use of a hand pump should be considered or the "volume drawn off" method used.

### **8.2 Measurement of the Volume Drawn off**

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Restore the STP by pumping and measure the volume that has to be drawn off to reach the reduced pressure previously recorded, then restore the STP. This whole operation should be carried out as quickly as possible, consistent with ensuring the accuracy of the pressure and volume measurement.

The quantities of water drawn off should be summed if it's necessary to restore the pressure in the line more than once during the test.

The volume of water drawn off may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the outflow rate is within the meters'  $Q_{\min}$  and  $Q_{\max}$ .

### **8.3 Accuracy of Pressure and Volume Measurement**

The equipment used to determine the make-up volume shall be capable of measuring the quantity of water to an accuracy of  $\pm 2\%$  or better.

The precision of the pressure measurement will have an effect on the accuracy of the volume measurements, especially if a significant amount of air remains in the pipeline. The precision with which the STP is set and restored will also have an effect on the test results. Measurement of the volume drawn off may be more precise and controllable than the volume pumped in. The equipment (pressure gauges and volume measuring devices) shall be to the accuracy specified and every care shall be taken to ensure that the results are as accurate as the equipment will allow.

### **8.4 Acceptable Pressure Measurement Devices**

The accuracy and readability of pressure monitoring equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

The pressure range of the gauges used shall be such that the STP falls within the range 50 - 90% of the full-scale range of the gauge. The main gauge shall have been calibrated within 6 months of use and have a minimum dial diameter of 100-mm (preferably 150 mm). A check gauge of a similar pressure range shall also be used to confirm the calibration of the main gauge. (A "test" pressure gauge with an accuracy of  $\pm 0.5\%$  of full scale is preferred for the main gauge).

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Alternatively, a data logger may be used to log the pressure signal from an accurately calibrated pressure transducer. A suitable “check” pressure gauge shall be used in conjunction with the pressure transducer to confirm the calibration of the transducer. The test gauge shall be read at frequent intervals and the readings recorded for later comparison with the data logger results. The data logger shall be set to log the pressure at suitable intervals that are not more than 2 minutes apart for PE pipeline tests and 5 minutes for testing pipelines of other materials.

Note that pressure pulsations from a motorised test pump may destroy a pressure gauge unless some form of pressure damping is incorporated to protect the gauge.

### **8.5 Preferred Pressure Test Rig**

The preferred rig shall have a recently calibrated pressure transducer and check pressure gauge.

The transducer shall have:

- non-linearity and hysteresis within  $\pm 0.2\%$
- a resolution of 0.02 bar or better
- a pressure range so that the output at STP is 50 - 90% of full scale
- been checked for calibration within the last 6 months
- a data logger capable of storing the pressures at 2-minute intervals over a period of up to 24 hours.

The check pressure gauge shall have:

- a dial of  $\geq 100$ -mm
- readability to within 10 kPa
- a pressure range so that the STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The transducer and the check gauge shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractors cost.

### **8.6 Alternative Pressure Test Rig**

The pressure test may be conducted using two pressure gauges.

The main “test” gauge shall have:

- an accuracy of  $\pm 0.5\%$  of full scale
- $\geq 100$ -mm dial
- readability of 5 kPa
- a pressure range so that the STP falls within 50 - 90% of the range

The check gauge shall have:

- an accuracy of  $\pm 1\%$  of full scale
- $\geq 100$ -mm dial
- readability of 10 kPa
- a pressure range so that STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The gauges shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractors cost.

The test rig shall incorporate provision for manually bleeding air as well as an isolated 15-mm BSP socket to allow for the installation of an independent check gauge.

In the case of a dispute over a pressure test result, a pressure transducer and data logger and check gauge shall be used for any re-testing that may be necessary.

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**8.7 Effects of entrapped air**

Air trapped in a pipeline during the test will affect the test results. As much air as possible should be expelled from the pipeline during filling and before the pressure test is commenced. Air removal may necessitate swabbing.

**8.8 Pipe Temperature and Temperature Changes During the Test**

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Changes in temperature during the test can have a significant effect on the internal pressure as a temperature change can cause the pipe to expand or contract. Under normal circumstances, the temperature of a buried pipeline will remain relatively constant after initial filling and stabilising.

Note that the temperature of any water added to a pipeline (e.g. to restore the STP) should be within  $\pm 3^{\circ}\text{C}$  of the temperature of the water already **in** the pipeline.

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