Appendix A - Acceptable Pipe and Fitting Materials

(Informative)

Table A1 and Table A2 give information on acceptable pipe and fitting materials. The information is sourced with permission from the Water Services Association of Australia. Refer also to WSA 02 (Sewerage Code of Australia) and WSA 03 (Water Supply Code of Australia) for further information.

For ALL PE pipes dimensions shall be provided for Outside Diameter (OD), Inside Diameter (ID) and Nominal Diameter (ND).

Table A1 – Acceptable pipe materials and Standards

Note: PVC only used if specifically agreed with TA

NOTE – Refer also to WSA 02 (Sewerage Code of Australia) and WSA 03 (Water Supply Code of Australia)

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1260 (Class SN 4, 8, or 16 as required by TA)	✓	–	✓	–	Gravity applications only. Well established methods of repair. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Can be used for trenchless installation with suitable end load resistant joints.
PVC-U	AS/NZS 1254 (Class SN 4, or 8, as required by TA)	✓	–	–	–	Gravity stormwater applications only.
PVC-O	AS/NZS 4441 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Improved fracture toughness compared with PVC-U. Improved fatigue resistance compared with PVC-U and PVC-M. NOTE – Use only DI fittings in pumped mains to achieve full fatigue resistance. Has increased hydraulic capacity compared with PVC-U and PVC-M. Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PVC-U	AS/NZS 1477 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Well established methods of repair. Alternative installation techniques possible, for example slip lining. Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Can be used for trenchless installation with suitable end load resistant joints. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-M	AS/NZS 4765 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Improved fracture toughness compared with PVC-U. Has increased hydraulic capacity compared with PVC-U. Inferior fatigue resistance compared with PVC-U and PVC-O. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PE (PE 80B or PE 100 as required by the TA)	AS/NZS 4130	–	✓	–	✓	Generally for pressure applications. Can be easily curved to eliminate the need for bends. Alternative installation techniques possible, for example pipe cracking, direction drilling, and slip lining. Can be welded to form an end load resistant system. Compression couplings and end load resistant fittings are available in smaller diameters. Pipe longitudinal flexibility accommodates large differential ground settlement. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings/repair complicated. Specific design for dynamic stresses (fatigue) required for pressure sewer applications. ≤ DN 125 available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic conditions or tidal zones. Suitable for ground with high subsidence potential, for example fill or mining areas.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PE (Stiffness Class SN 4, 8, 10, or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Only for gravity applications. Can be easily curved. Alternative installation techniques possible, for example pipe cracking and slip lining. Can be welded to form an end load resistant system. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings/repair complicated. Smaller diameters available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
PP (Stiffness Class SN 4, 8, 10, or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Only for gravity applications.
GRP	AS 3571.1	✓	✓	✓	–	Alternative installation techniques possible, for example slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic conditions or tidal zones.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
GRP	AS 3571.2	–	–	–	✓	Alternative installation techniques possible, for example slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
VC	BS EN 295	✓	–	✓	–	Gravity applications only. Has benefits for particularly aggressive industrial wastes. Not recommended for active seismic (earthquake) zones, or unstable ground.
RRRC (rubber ring joint reinforced concrete)	AS/NZS 4058	✓	–	✓	–	Requires protection from hydrogen sulphide attack in sewer applications, by plastic lining or selection of appropriate cement additives.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
CLS (SCL) (concrete lined welded steel)	NZS 4442 AS 1579	–	✓	–	✓	Cement mortar lined, PE coating below ground or heavy duty coating above ground High mechanical strength and toughness. Available in long lengths. RRJ and welded joints available. Custom made, specially configured steel fittings can be made to order. Can be welded to form a system that will resist end load and joint permeation. UV resistant/vandal proof/impact resistant (where PE coated). Cathodic protection (CP) can be applied to electrically continuous pipelines to provide enhanced corrosion protection. PE lined and coated – RRJ As above for CLS (SCL). Suitable for conveying soft water. Corrosion resistant under all conditions. General notes Standard Portland cement mortar not resistant to H2S attack, at any high points or discharge points in the main. High alumina cement has improved resistance. Welded joints require skilled installers and special equipment. Welded joints require reinstatement of protection systems on site. Special design required for welded installations parallel, and adjacent to high voltage (> 66 kV) transmission lines. Cathodic protection requires regular monitoring and maintenance. Seal coating may be required over cement mortar linings, when conveying soft water, or in low flow extremities of reticulation mains, to prevent potentially high PH. Suitable for high load applications such as railway crossings and major roads. Large diameters are available. Suitable for aerial or suspended pipeline applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
DI (ductile iron pipe)	AS/NZS 2280 AS 3681	–	✓	–	✓	Fatigue analysis not normally required (pressure sewer applications). High mechanical strength and toughness. Ease of jointing. UV resistant/vandal proof/impact resistant. Well established methods of repair. Suitable for high pressure and above ground pipelines. Restrained joint systems available. Sufficient ring stiffness to not rely on side support, for structural adequacy for the usual water supply installation depths. Elevated PH may occur when conveying soft water, or in low flow extremities of reticulation mains. PE sleeving is required, and must be carefully applied and repaired when damaged. Standard Portland cement mortar not resistant to H2S attack, at any high points or discharge points in the main. (Wastewater applications. High alumina cement has improved resistance.) Not suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
Corrugated aluminium pipe	AS/NZS 2041	✓	–	–	–	Generally of short length (for culverts and so on). Joints need consideration in fine soils with high water tables. Invert may need lining to extend life.
Corrugated steel pipe	AS/NZS 2041 NZS 4405 NZS 4406	✓	–	–	–	Generally only for short length (culverts and so on). Joints need consideration in fine soils and high water tables. Invert may need lining to extend life.
ABS	AS/NZS 3518 AS/NZS 3690 AS/NZS 3879	–	✓	–	✓	Specific design for dynamic stresses (fatigue required for pressure sewer applications).

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1260	✓	–	✓	–	Gravity applications only.
PVC-U	AS/NZS 1254	✓	–	–	–	Gravity stormwater applications only.

Table A2 – Acceptable fitting materials and Standards

Fittings Materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1254	✓	–	–	–	Gravity stormwater applications only.
PE	AS/NZS 4129	✓	✓	✓	✓	PE pressure fittings, including mechanical compression, butt fusion or electrofusion, as approved by the TA.
Access covers and grates	AS 3996	✓	–	✓	–	
Ductile iron	AS/NZS 2280	–	✓	–	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Ductile iron unrestrained mechanical couplings	AS/NZS 4998	–	✓	–	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Plastic or metallic tapping bands	AS/NZS 4793	–	✓	–	✓	Generally for pressure applications. Tapping bands used on flexible pipes shall be AS/NZS 4793 Type F – that is, 'full circle design'. Ductile iron tapping bands shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Fire hydrants	NZS/BS 750	–	✓	–	✓	Generally pressure applications.
Resilient seated gate valves	AS 2638.2	–	✓	–	✓	Generally pressure applications.
PE (Stiffness Class SN 4, 8, 10 or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Gravity applications only.
PP (Stiffness Class SN 4, 8, 10 or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Gravity applications only.

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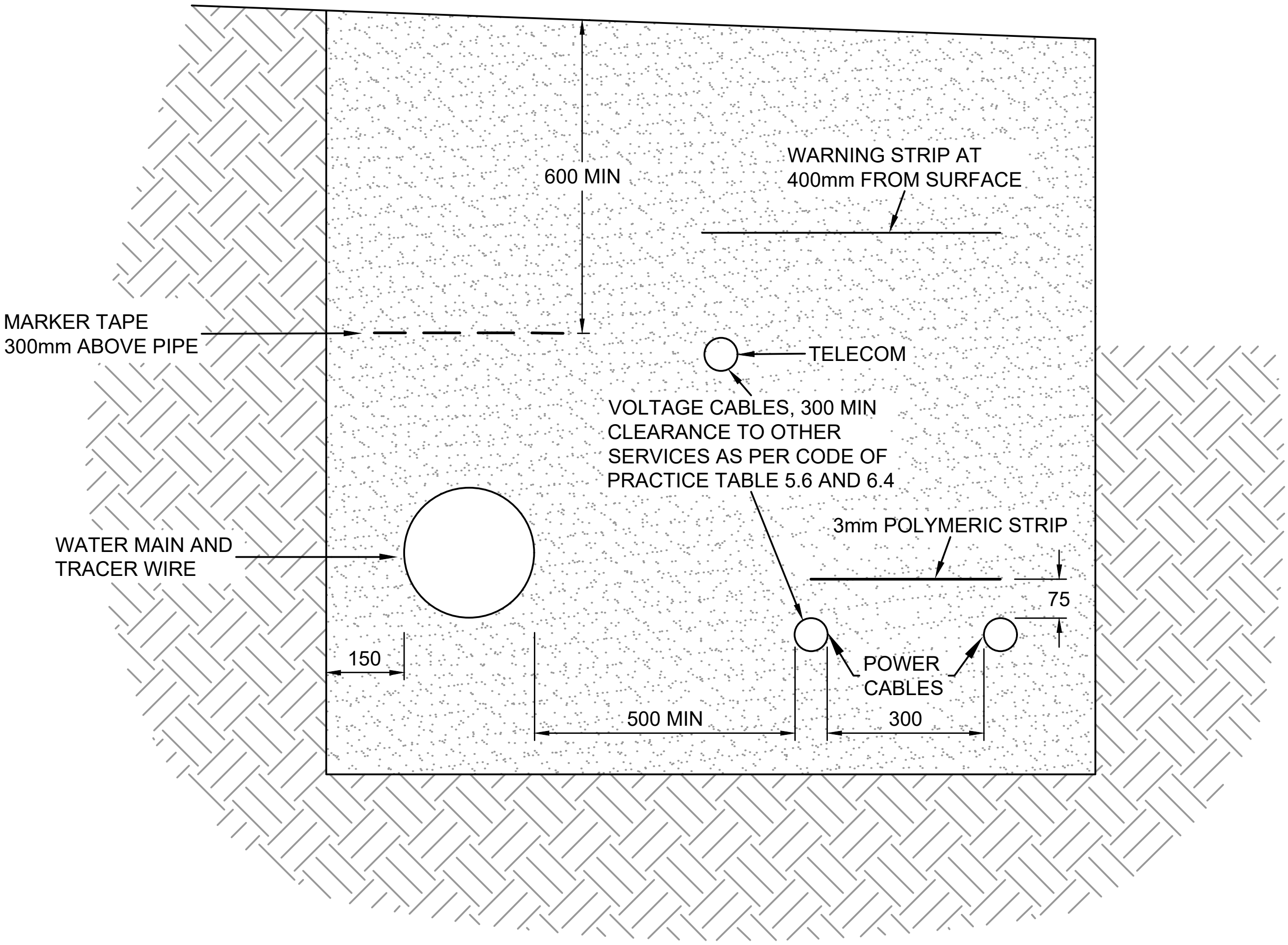
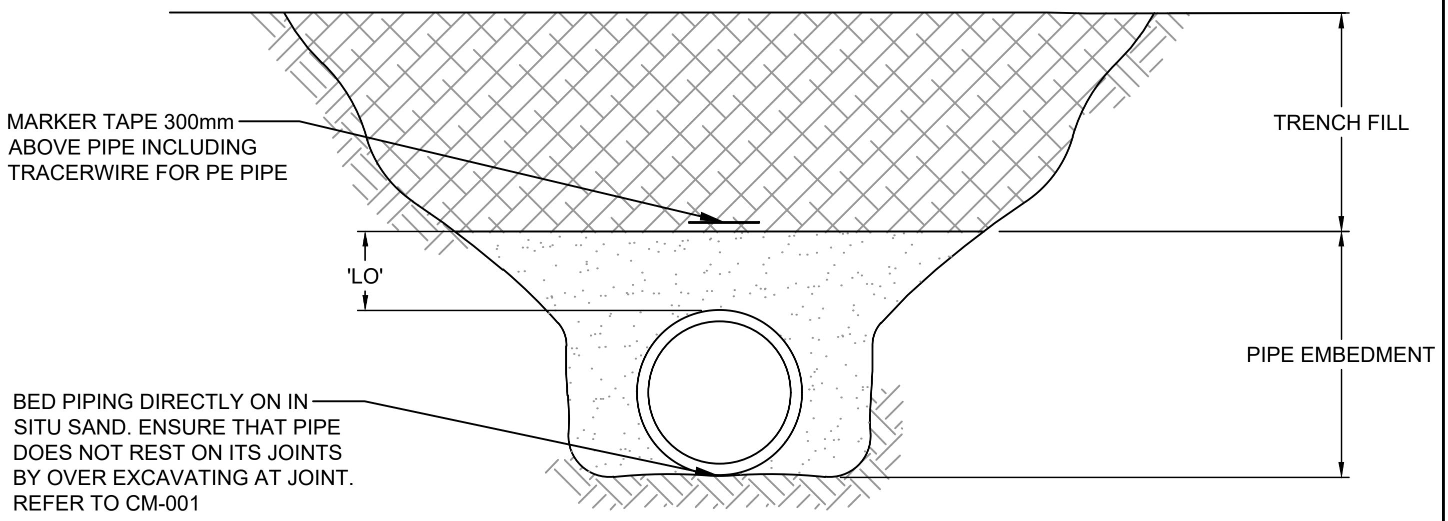
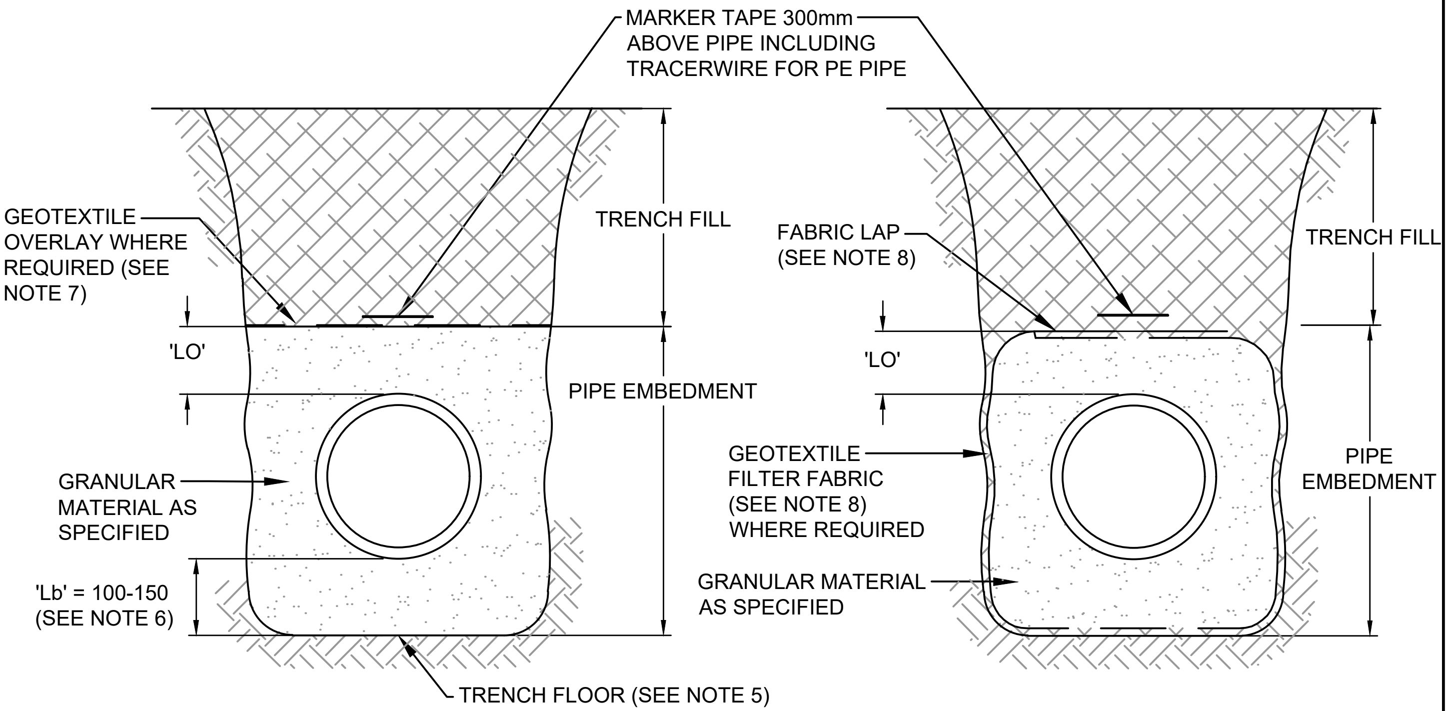


TRENCH DETAILS & UNDERGROUND UTILITIES IN VERGE

NOTE
SEPARATION FROM WATERMAIN DEFINED IN COP TABLE 6.4 (VARIES WITH PIPE SIZE)



TRENCH IN SAND STRATA



TYPE 3 SUPPORT

FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)

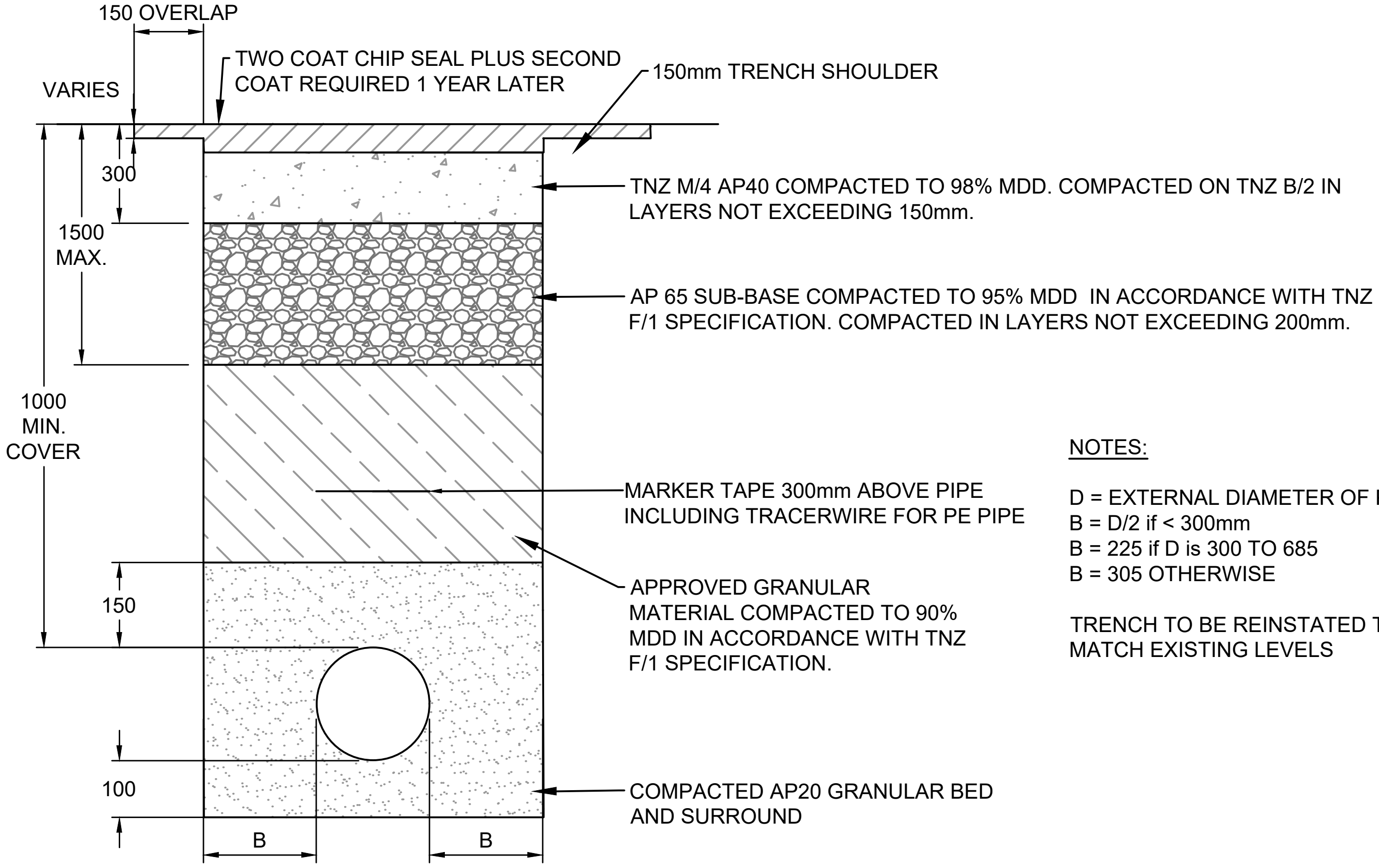
TYPE 4 SUPPORT

WITH GEOTEXTILE FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH CM-001
3. PIPE CLASSIFICATION
   a. RIGID PIPES: VC, RC, STEEL AND CL
   b. FLEXIBLE PIPES: PVC, GRP AND PE
4. PLACEMENT OF EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATION.
5. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPE SETTLEMENT. WHEN EXCAVATED, REPLACE WITH GRANULAR MATERIAL AS SPECIFIED FOR BEDDING OR ADOPT TYPE 1,2,3 OR 4 SUPPORT AS REQUIRED.
6. ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS AND FLANGES) DO NOT TOUCH TRENCH FLOOR - SEE CM-001
7. TYPE 4 SUPPORT TO BE USED WHERE MIGRATORY NATIVE SOILS (SANDS AND CLAYS) ARE ENCOUNTERED ADJACENT TO THE EMBEDMENT ZONE AND SINGLE SIZED AGGREGATE IS USED.
8. GEOTEXTILE OVERLAY IS REQUIRED FOR COARSE AGGREGATE EMBEDMENT >5mm. LAY GEOTEXTILE FILTER FABRIC AGAINST TRENCH FLOOR AND WALLS SUCH THAT IT FULLY ENCASES THE EMBEDMENT
   - PRESS FILTER FABRIC INTO VOIDS BEFORE INSTALLING EMBEDMENT TO PREVENT FABRIC TEARING
   - PROVIDE A MINIMUM OF 250 OVERLAP AT ALL FILTER FABRIC JOINTS
9. IN SOME AREAS LOCAL PRACTICE MAY ALLOW USE OF SELECTED EXCAVATED MATERIAL AS PIPE EMBEDMENT.
10. IN UNSUITABLE GROUND CONDITIONS SPECIFIC DESIGN IS REQUIRED REFER TO WSA 03 & WSA 04 DRAWINGS FOR GUIDANCE.
11. CONCRETE PIPES SHOULD BE BASED ON FIGURES 11 TO 13 IN ASNZS 3725.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Standard Pipe Embedment	NOT TO SCALE Drawing No. B1-2

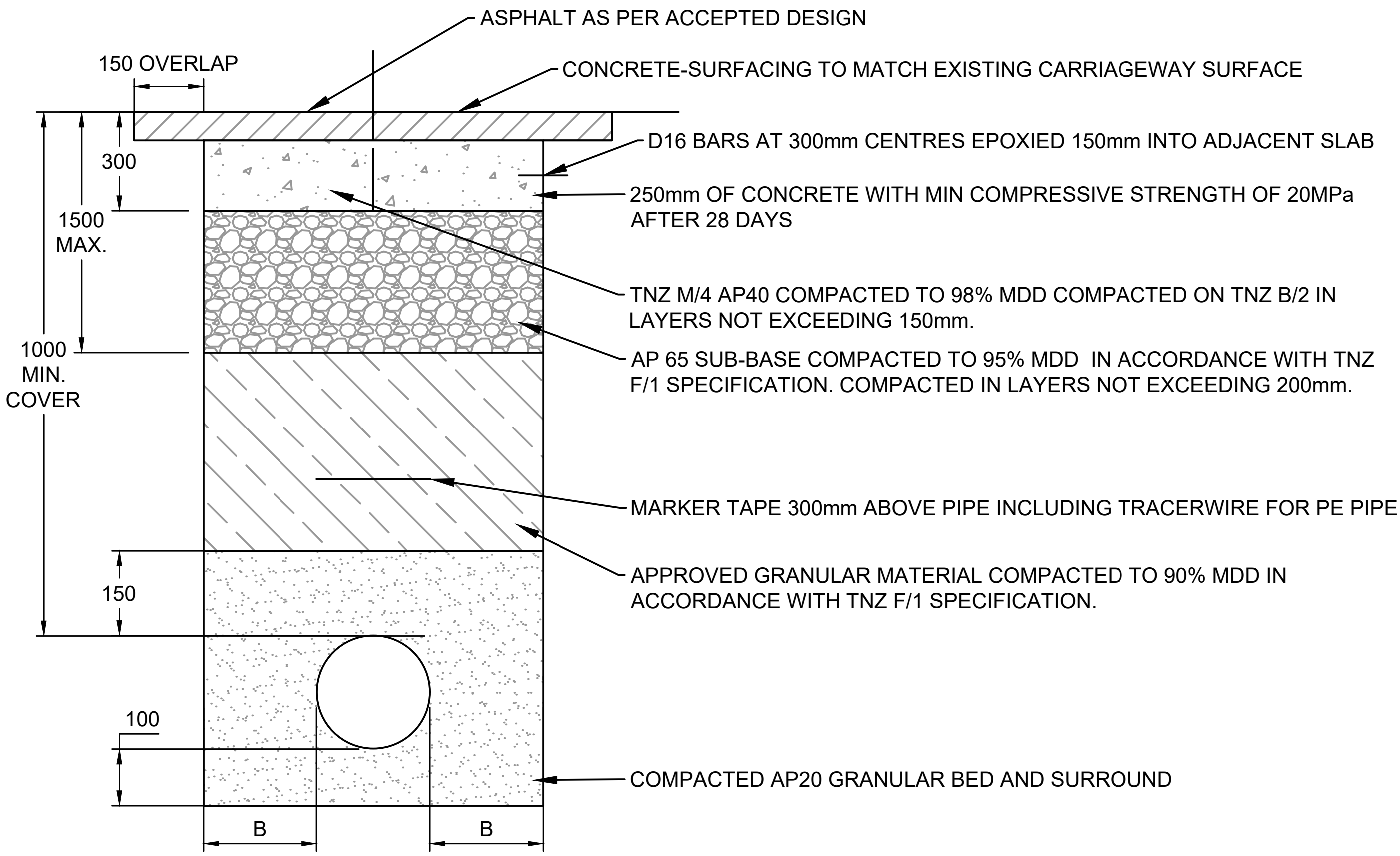


NOTES:

D = EXTERNAL DIAMETER OF PIPE
B = D/2 if < 300mm
B = 225 if D is 300 TO 685
B = 305 OTHERWISE

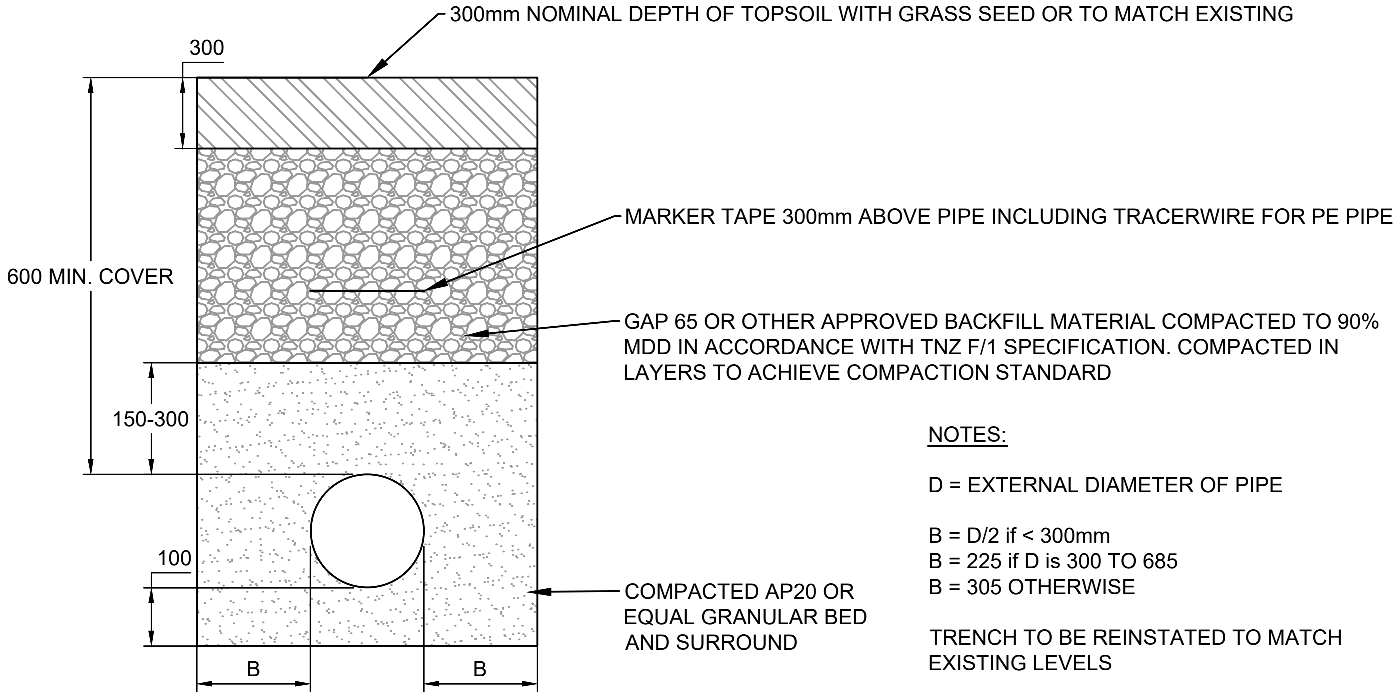
TRENCH TO BE REINSTATED TO MATCH EXISTING LEVELS

CHIPSEAL CARRIAGEWAY CROSS SECTION



ASPHALT/CONCRETE CARRIAGEWAY CROSS SECTION

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Pipe Bedding & Backfill for Carriageways	NOT TO SCALE Drawing No. B1-3



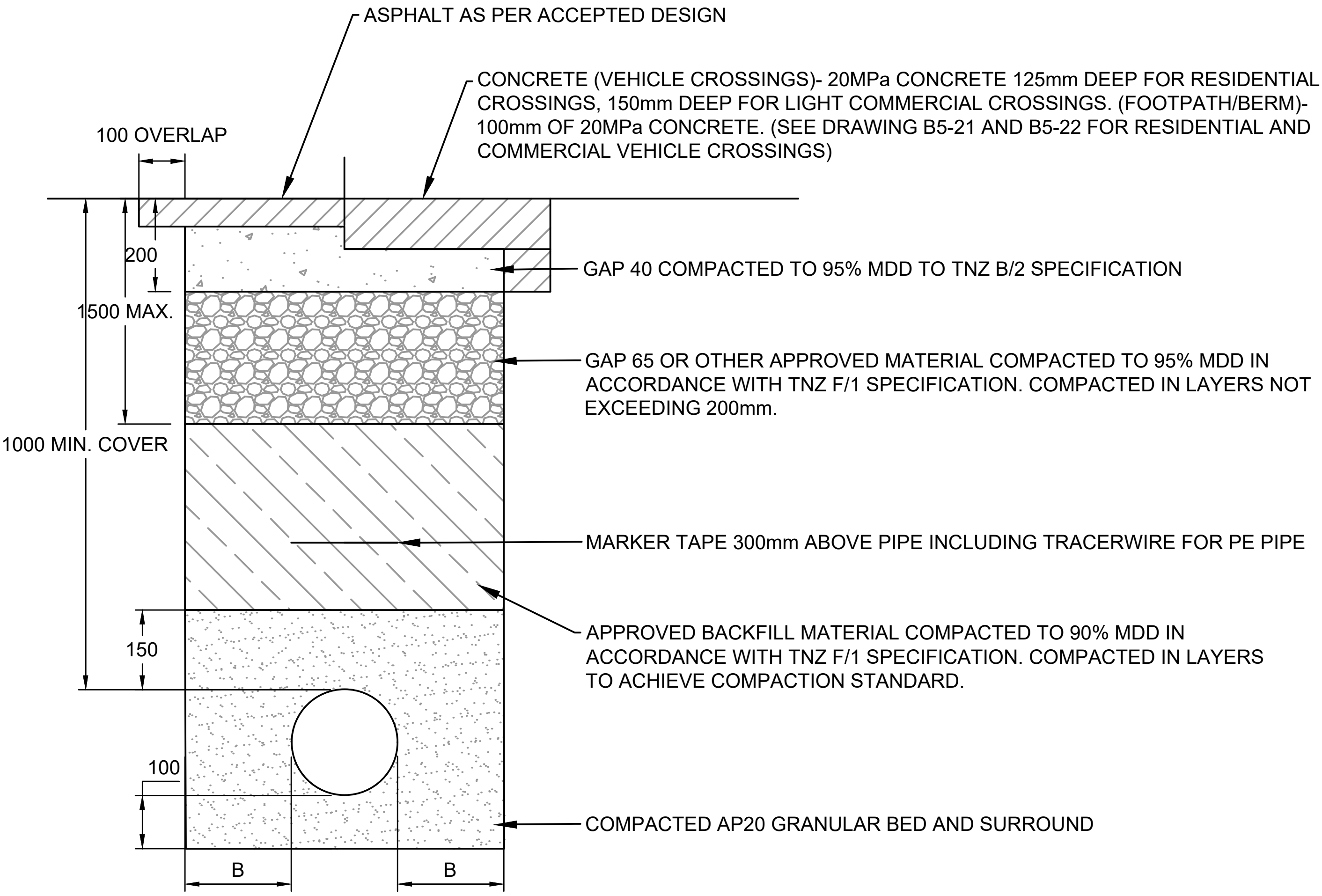
NOTES:

D = EXTERNAL DIAMETER OF PIPE

B = D/2 if < 300mm
B = 225 if D is 300 TO 685
B = 305 OTHERWISE

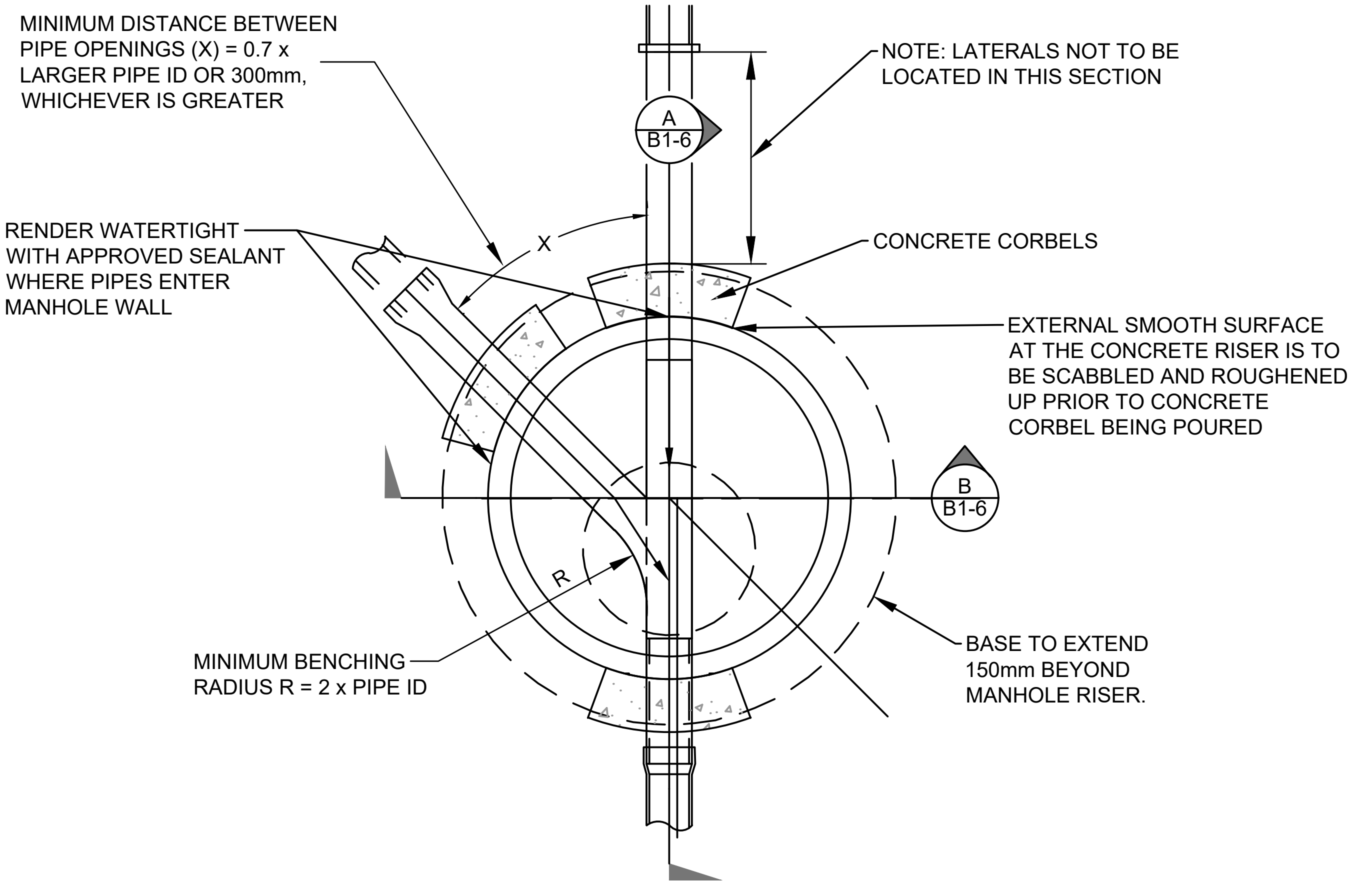
TRENCH TO BE REINSTATED TO MATCH EXISTING LEVELS

BERM/NON TRAFFICABLE CROSS SECTION



VEHICLE CROSSING CROSS SECTION

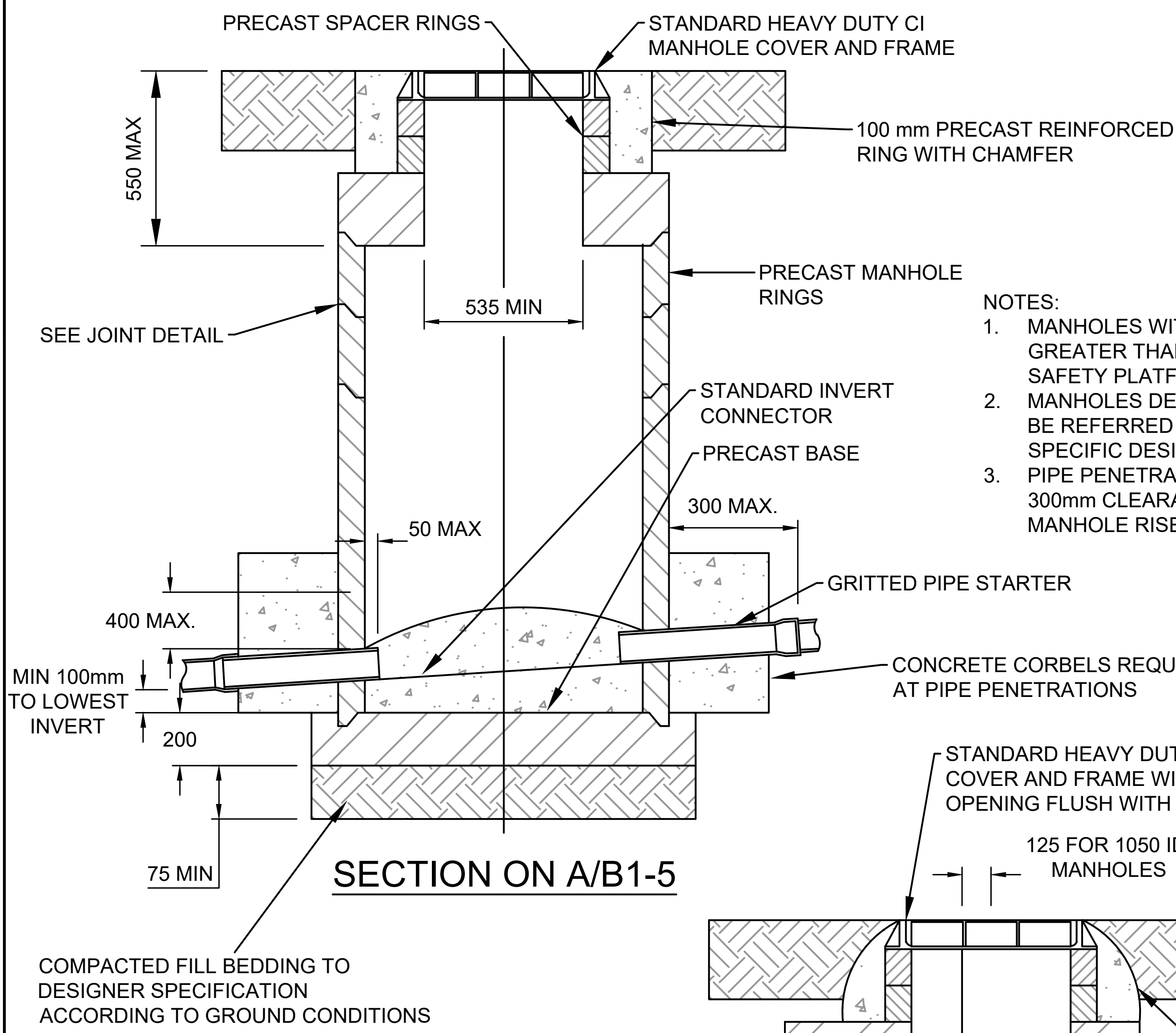
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Pipe Bedding & Backfill for Vehicle Crossings & Non Trafficable	NOT TO SCALE Drawing No. B1-4



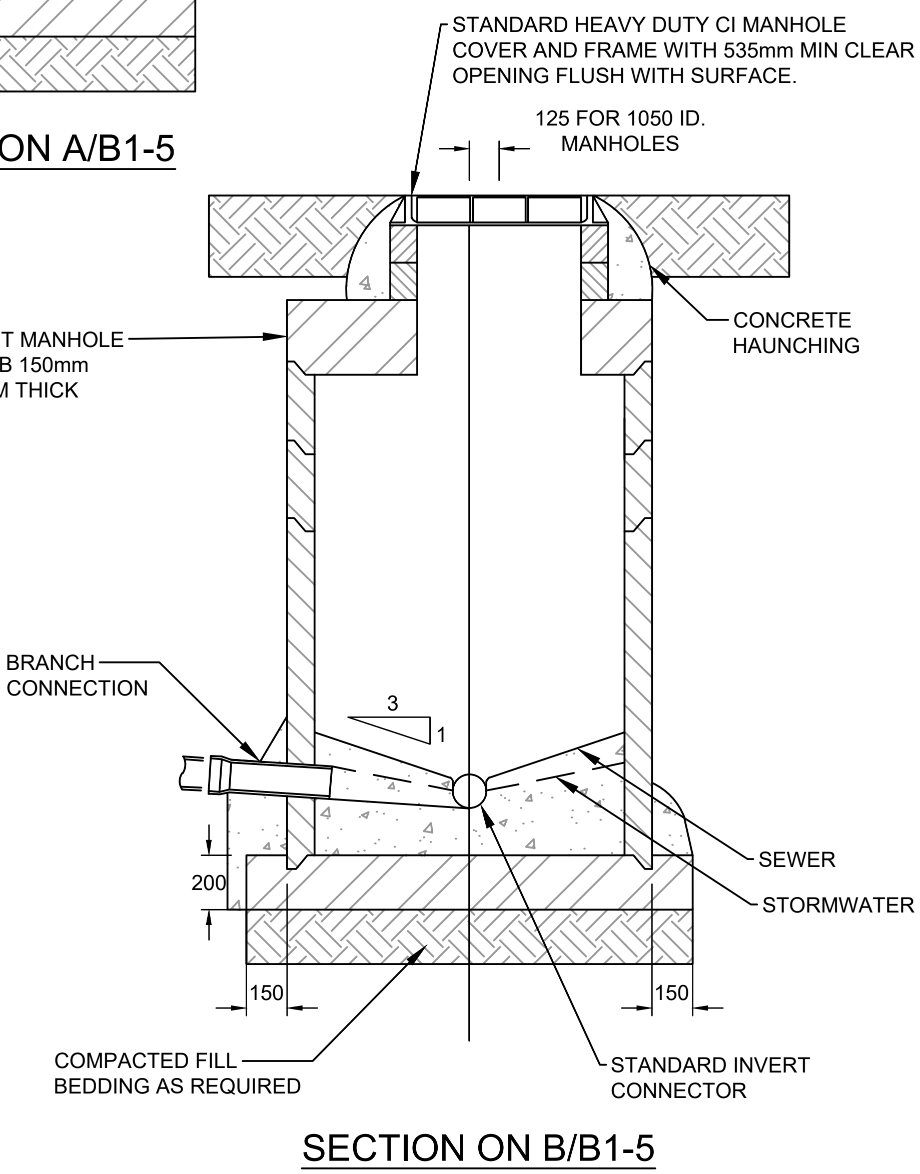
PLAN

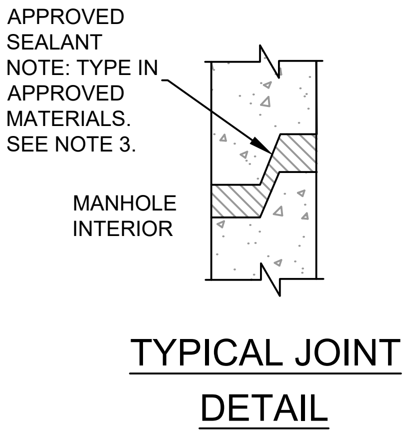
NOTES
1. ALL IN SITU CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 20MPa @ 28 DAYS.
2. ALL PRECAST MANHOLE UNITS (SHOWN SHADED IN DRAWING B1-6) TO BE STANDARD MANUFACTURED UNITS. (IE. HUMES OR SIMILAR APPROVED)
3. ALL BRANCHES SHALL BE CONSTRUCTED SUCH THAT THEY CAN BE READILY ACCESSED BY CCTV CAMERA. THE CORBALS DETAIL (IE. CROSS SECTION) SHALL NOT BE COMPROMISED. IF REQUIRED, THE "STRAIGHT THROUGH" CHANNEL SHALL BE OFFSET FROM THE MANHOLE CENTRELINE AND THE BRANCH CHANNELLING LEFT STRAIGHT FOR A SUFFICIENT LENGTH TO ACHIEVE THE DESIRED RESULT.
4. ACCESS OPENING TO BE LOCATED OVER THE DOWNSTREAM SIDE OF THE MANHOLE.
5. IF A DEVIATION IS SOUGHT FROM THE REQUIREMENTS IN THE DETAIL ABOVE, JUSTIFIABLE CALCULATIONS MUST BE GIVEN AND BE TO COUNCIL'S SATISFACTION.
6. >75° DEFLECTION SHALL REQUIRE SPECIFIC DESIGN FOR MANHOLE RISERS FOR ANY DIAMETER OF PIPE >375mm.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Manhole Detail A - Typical Plan View	NOT TO SCALE Drawing No. B1-5



NOTES:
1. MANHOLES WITH DEPTH TO INVERT GREATER THAN 6m SHALL HAVE A SAFETY PLATFORM INSTALLED
2. MANHOLES DEEPER THAN 4m SHALL BE REFERRED TO THE ENGINEER FOR SPECIFIC DESIGN
3. PIPE PENETRATIONS TO BE MINIMUM 300mm CLEARANCE FROM THE MANHOLE RISER JOINT





QLDC LDSC 2025
Standard Details

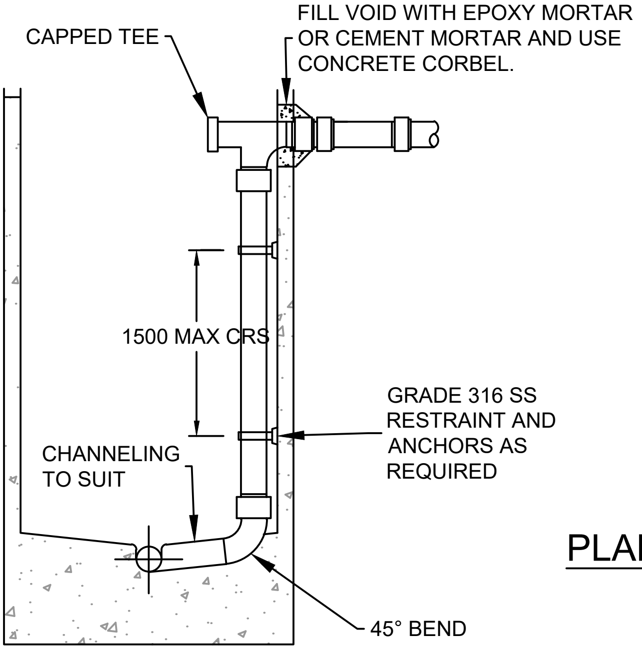
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

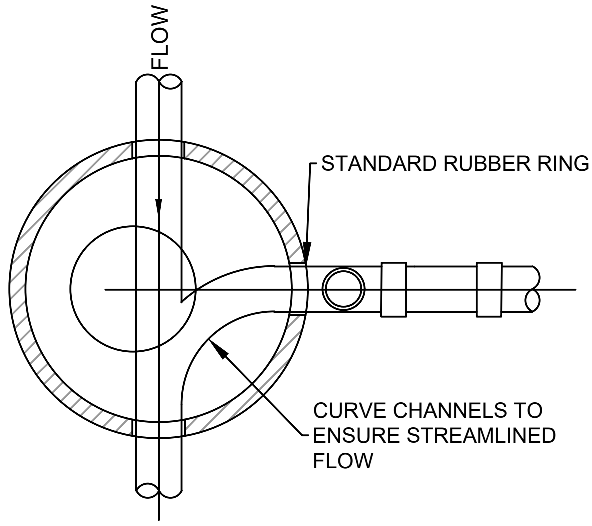
Drawing Title:
Manhole Detail B - Typical Cross Section

NOT TO SCALE

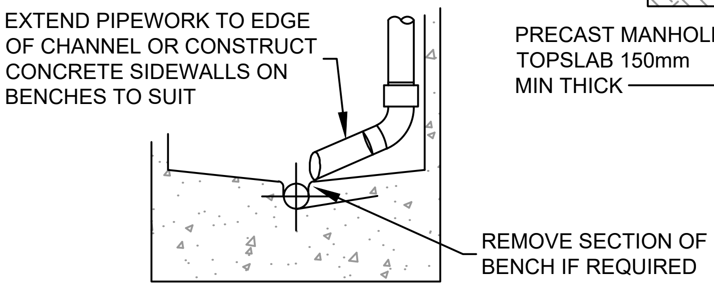
Drawing No.
B1-6



SECTION - INTERNAL DROP MANHOLE

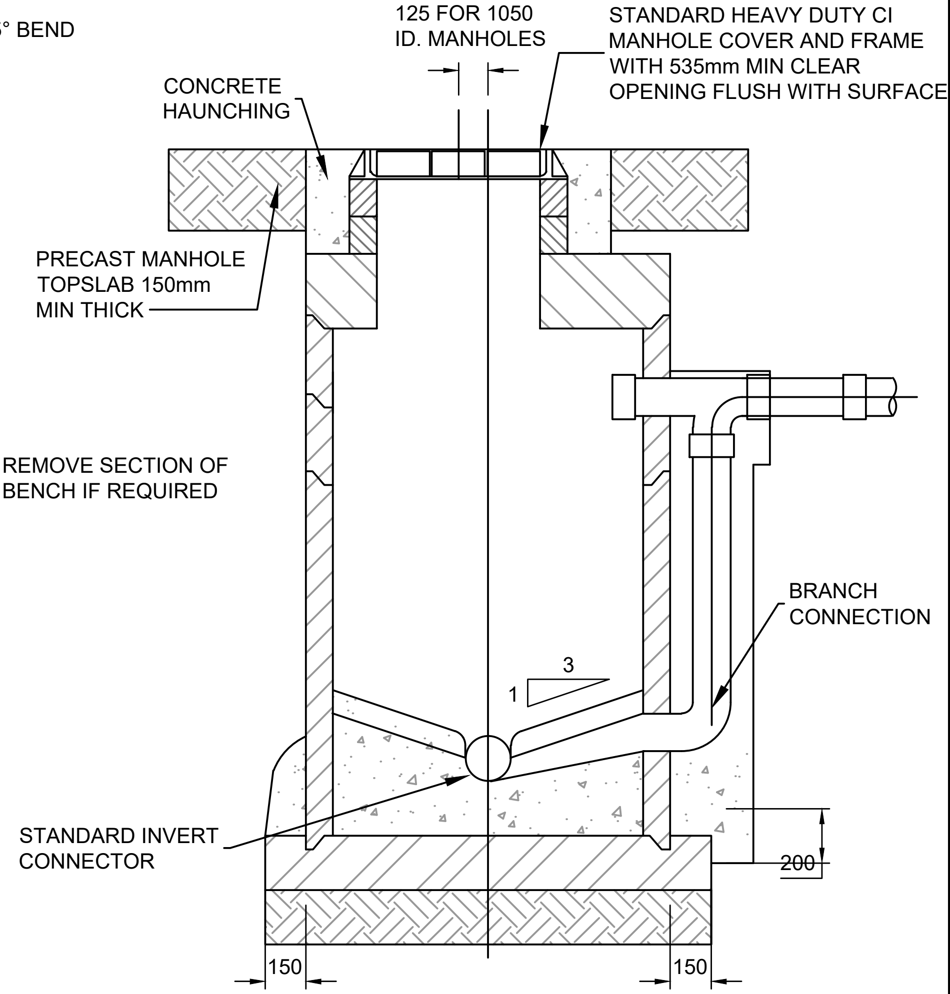


PLAN - EXTERNAL DROP MANHOLE

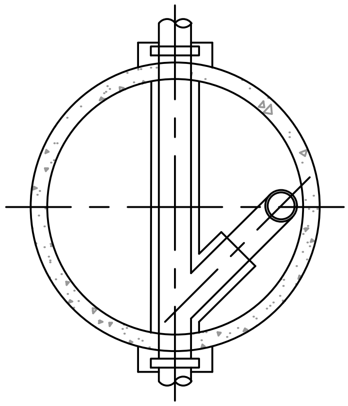


INTERNAL DROP POST CONSTRUCTION INSTALLATION DETAIL

(WHERE AUTHORISED BY TERRITORIAL AUTHORITY)



SECTION - EXTERNAL DROP MANHOLE



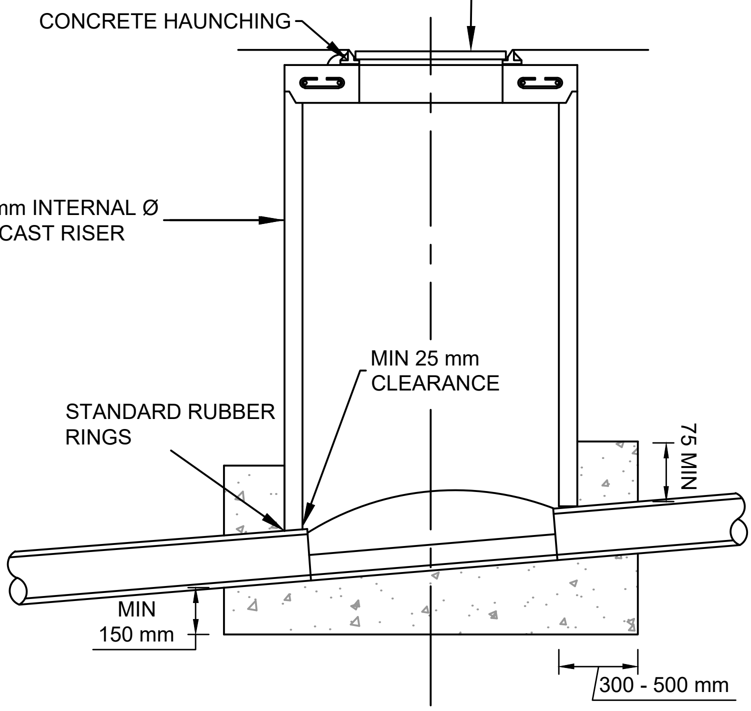
PLAN - TYPICAL INTERNAL DROP

SUITABLE FOR INSITU AND PRECAST MH (WHERE AUTHORISED BY TERRITORIAL AUTHORITY)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. MANHOLES WITH DEPTH TO INVERT GREATER THAN 6m SHALL HAVE A SAFETY PLATFORM INSTALLED.
3. MANHOLES DEEPER THAN 4m SHALL BE REFERRED TO THE ENGINEER FOR SPECIFIC DESIGN.
4. MINIMUM DN 1200 MH TO BE USED WITH INTERNAL DROP STRUCTURES.
5. INTERNAL DROP NOT NORMALLY USED IN STORMWATER APPLICATIONS.
6. ALL CAST IN-SITU BENCHING AND HAUNCHING TO BE 30MPa CONCRETE UNLESS OTHERWISE SPECIFIED BY TA.

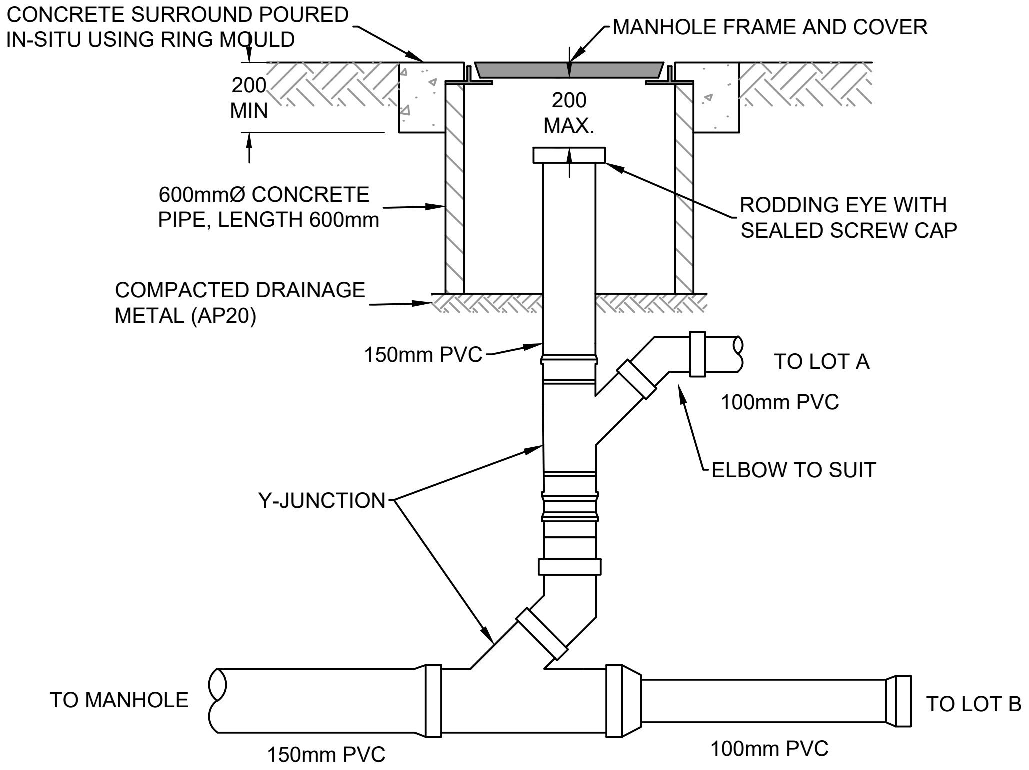
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: External and Internal Drop Manhole	NOT TO SCALE Drawing No. B1-7



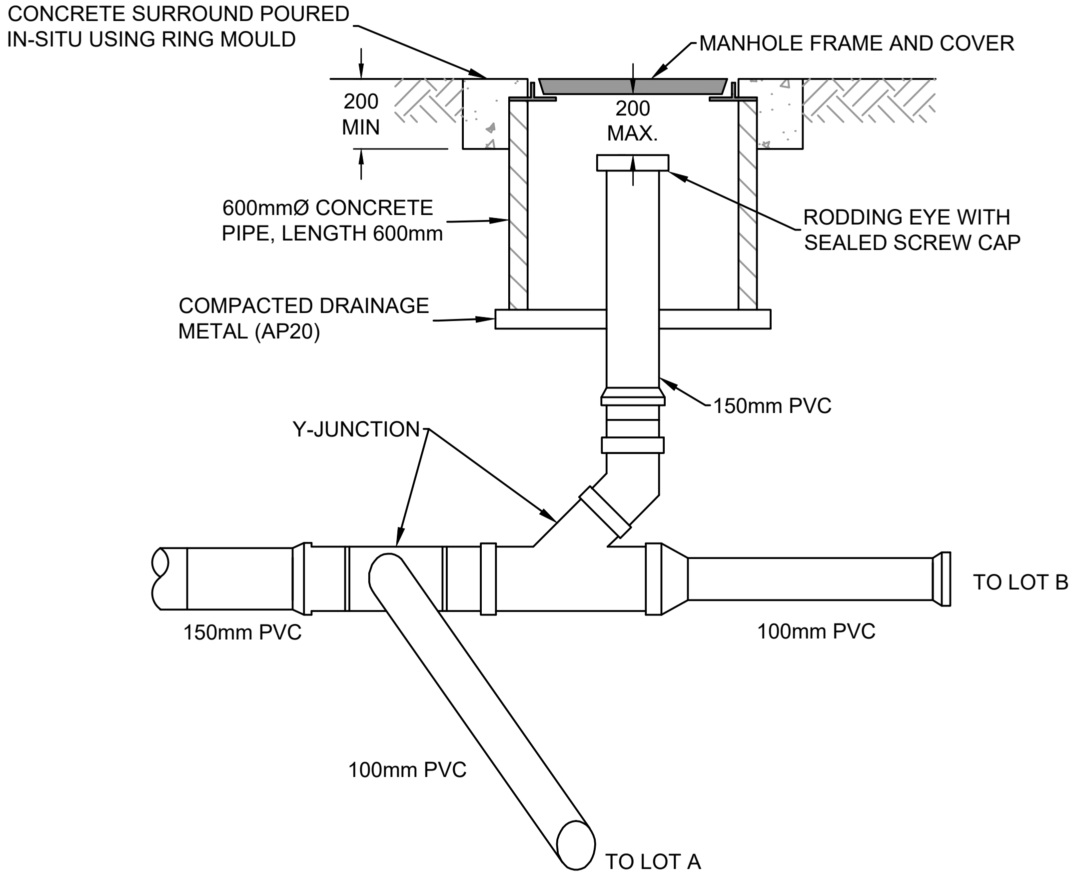
(DEPTH NOT TO EXCEED 1.2m)

MINI MANHOLE

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CAST IN-SITU BENCHING AND HAUNCHING TO BE 30MPa CONCRETE UNLESS OTHERWISE SPECIFIED BY TA.



LATERAL OFF RODDING EYE STANDPIPE



LATERAL OFF 150mm CONNECTION TO MANHOLE

QLDC LDSC 2025
Standard Details

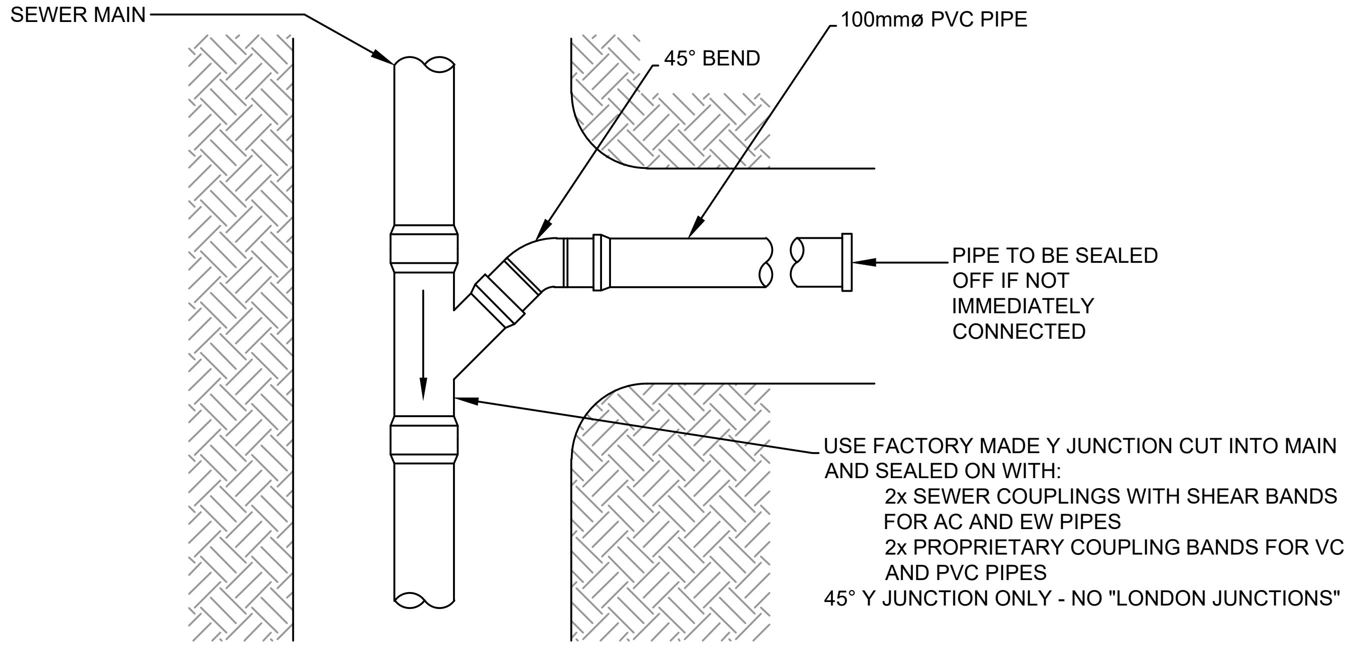
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

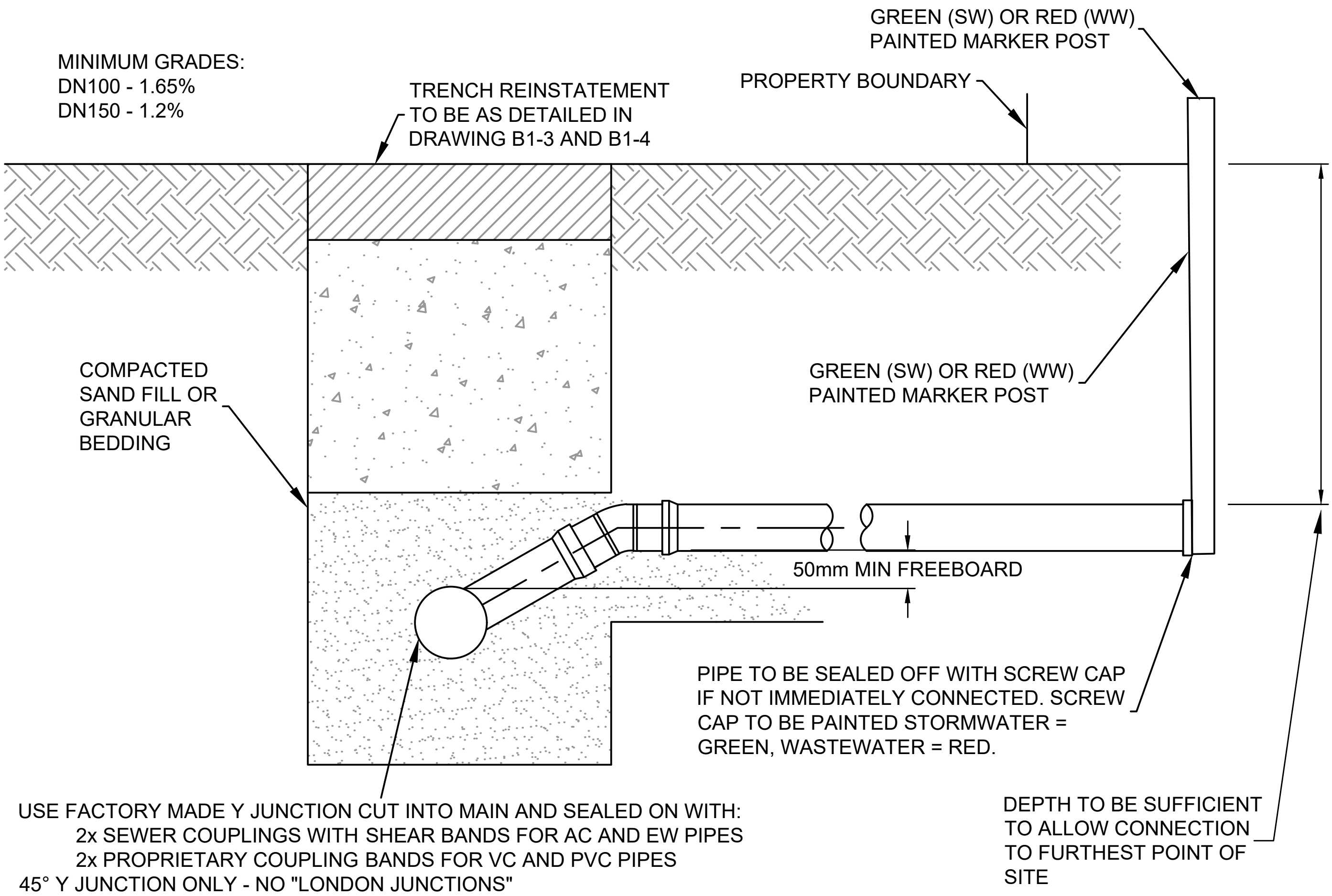
Drawing Title:
Lateral Connections For Two Properties

NOT TO SCALE

Drawing No.
B1-9



PLAN VIEW



STANDARD CONNECTION

DEPTH TO INVERT LESS THAN 2.5m

NOTES:

1. ALL CONNECTIONS SHALL HAVE NO ACCESS FITTINGS ON LINE, NO CHANGE OF DIRECTION, OR CHANGE OF GRADE WITHIN 3m OF MAIN CONNECTION.

QLDC LDSC 2025
Standard Details

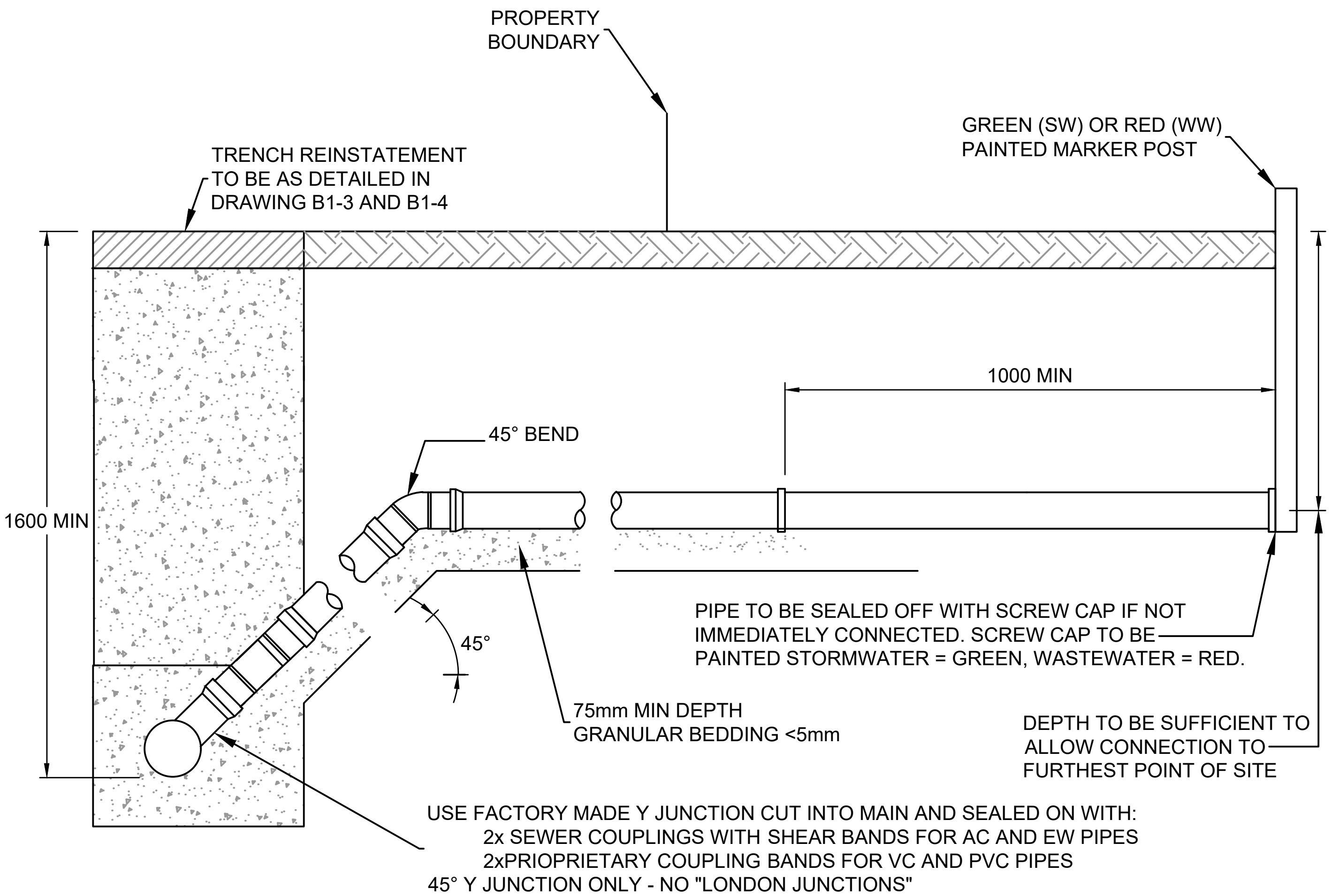
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

Drawing Title:
Domestic Drainage (Standard Connection) Detail

NOT TO SCALE

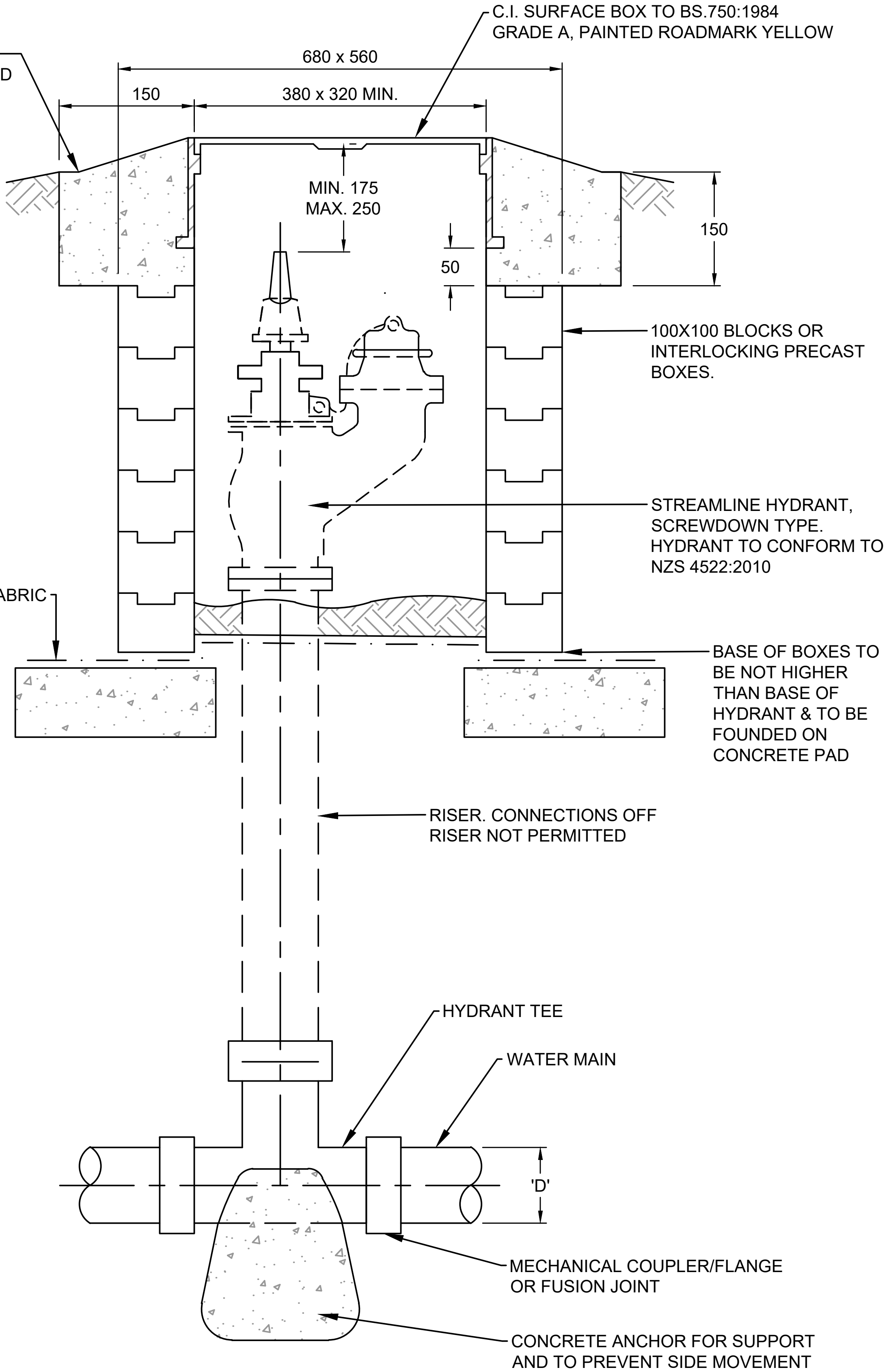
Drawing No.
B1-10



DEEP CONNECTION

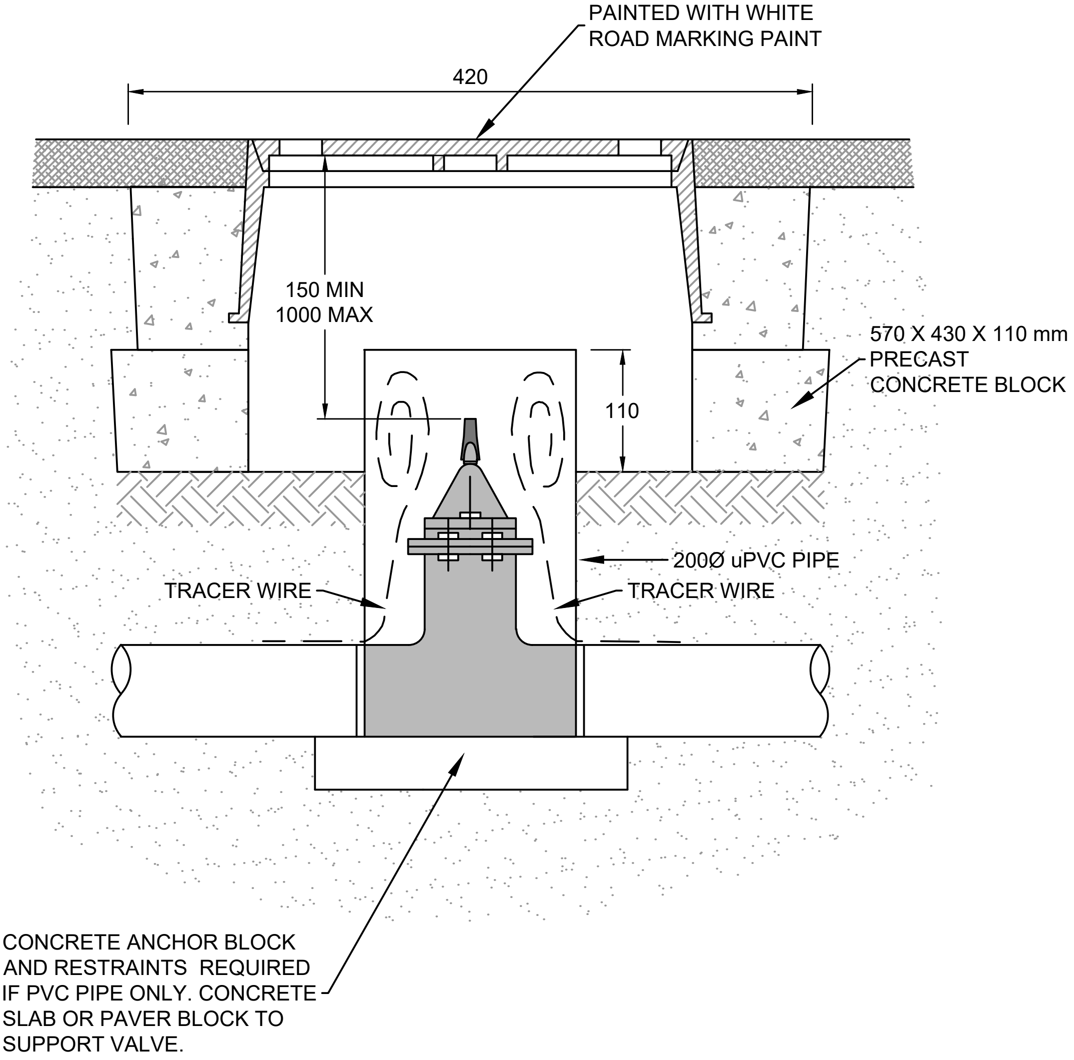
DEPTH TO INVERT MORE THAN 2.5m

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Domestic Drainage (Deep Connection) Detail	NOT TO SCALE Drawing No. B1-11

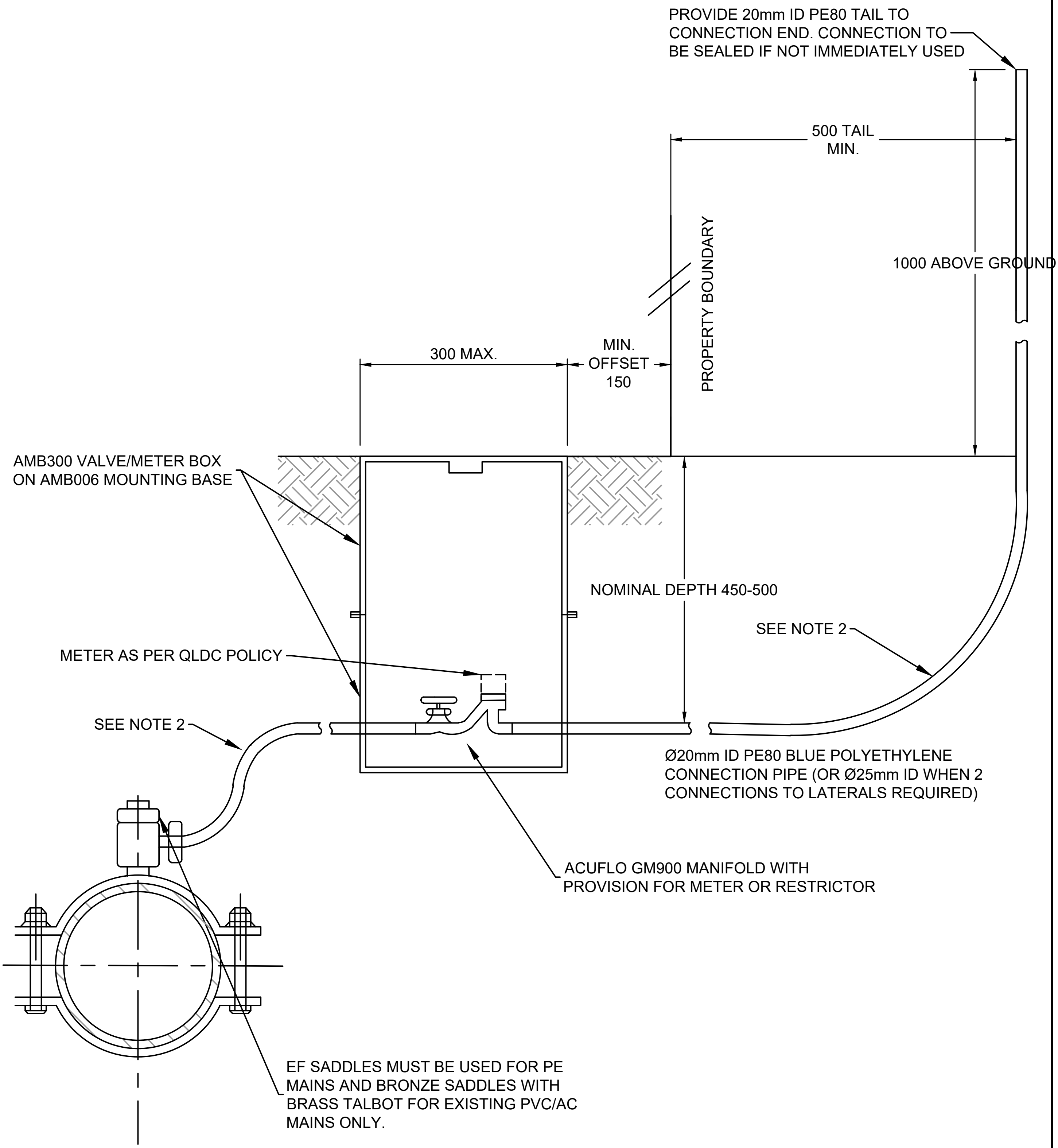


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. WHERE MAINS ARE CONSTRUCTED IN PVC, USE STANDARD CAST IRON HYDRANT TEE AND STEP MECHANICAL COUPLER.
3. FROST PLUG TO BE INSTALLED.
4. ALL FIRE HYDRANTS SHALL BE INSTALLED ON SUPPLY PIPES THAT HAVE A MINIMUM COVER OF 1000mm TO ALLOW FOR SUITABLE CLEARANCES, IF REQUIRED LOCALISED LOWERING OF THE SUPPLY PIPES CAN BE ACHIEVED BY TAPERING DOWN FROM 5m EITHER SIDE OF THE FIRE HYDRANT.



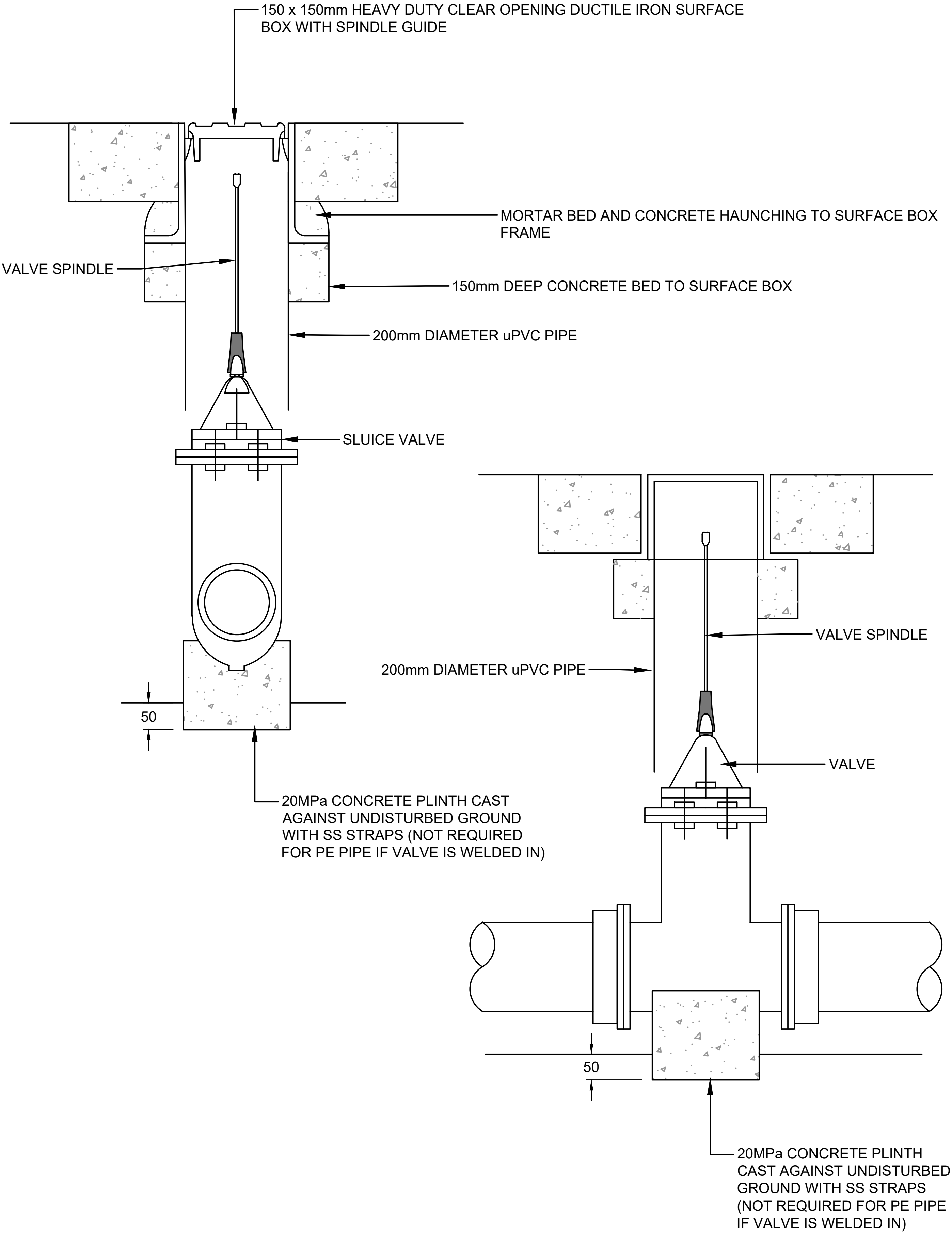
NOTES:
1. CONCRETE SURROUNDS 370x480x90H Ø200 HOLE FITS CAST IRON VALVE BOX 225x235
2. FIRE HYDRANT CONCRETE SURROUND 570x430x110H FITS 405x255 SV OR FH CAST IRON BOX



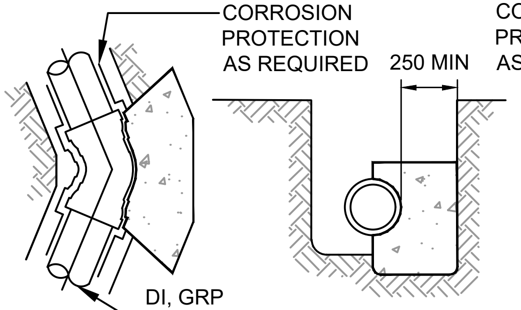
NOTES:

1. OPTION OF USING 50 mm BRASS TALBOT INSTEAD OF ELBOW OFF MAIN.
2. OPTION OF A CONTINUOUS PIPE LAID IN ACCORDANCE WITH MANUFACTURE MINIMUM BEND RADIUS, AND IF THIS CANNOT BE ACHIEVED THEN ELECTRO FUSION (EF) ELBOWS ARE TO BE USED.
3. WHEN THERE IS NO OPTION BUT TO INSTALL A TOBY BOX IN A TRAFFICABLE AREA THEN A TRAFFICABLE CAST BOX WITH CAST IRON LID IS REQUIRED. REFER TO DRAWING B2-2 FOR DETAILS.
4. 25mm ID CONNECTIONS REQUIRE 2 x ACUFLO BOXES OR 500mm JUMBO BOX WITH BASES.
5. AN ACUFLO GM900 MANIFOLD WITH BLANK CAP AND SCREW-IN DUAL CHECK VALVE SHALL BE INSTALLED ON EACH CONNECTION AND POSITIONED INSIDE AN AMB035 (LID-LESS BOX/BASE COMBINATION) WITH A AMB300 (300mm WITH LID) BOX POSITIONED ABOVE TO GIVE REQUIRED DEPTH (450mm) NEAR THE PROPERTY BOUNDARY AND ALSO BE CLEAR OF ANY VEHICULAR MOVEMENTS.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Service Connection	NOT TO SCALE Drawing No. B2-3



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Sluice Valve Detail	NOT TO SCALE Drawing No. B2-4

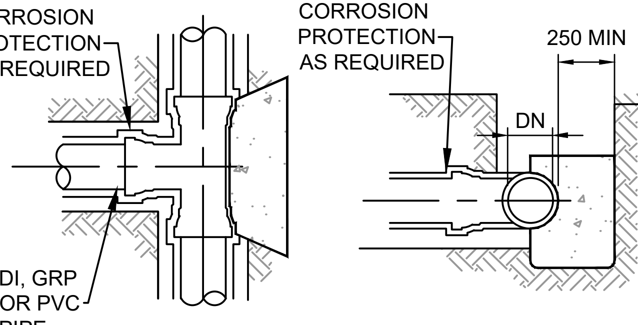


PLAN

ELEVATION

THRUST BLOCK FOR BENDS

(FOR HORIZONTAL THRUST)

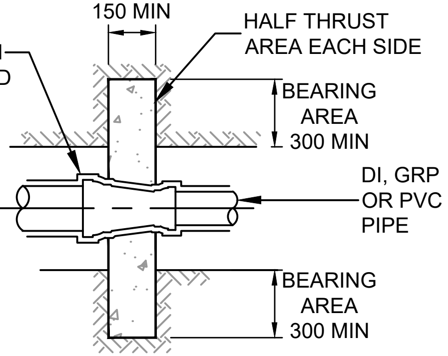


PLAN

ELEVATION

THRUST BLOCK FOR TEES

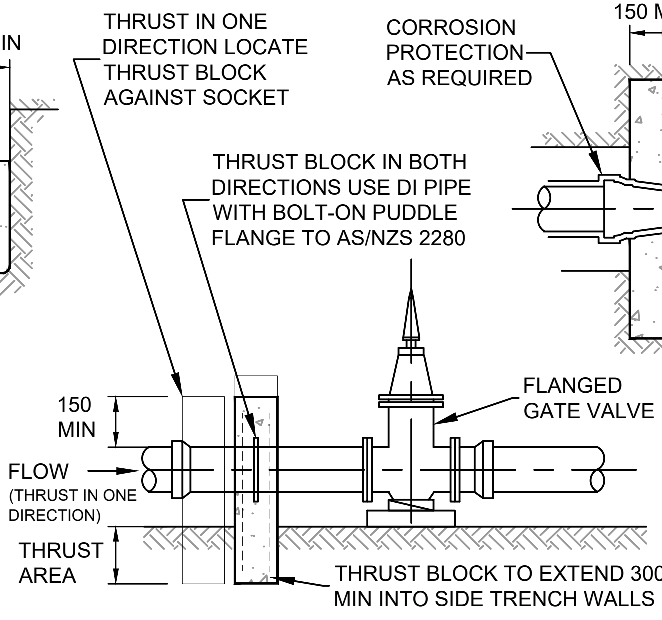
(FOR HORIZONTAL THRUST)



PLAN

TAPER THRUST BLOCK

(FOR HORIZONTAL THRUST)



ELEVATION

CONCRETE THRUST BLOCK FOR FLANGED VALVES

MINIMUM THRUST AREA FOR BLOCKS IN SQUARE METRES (m^2) DESIGN PRESSURE 1000 kPa (NOM. 100m HEAD)

SOIL CLASSIFICATION AND ALLOWABLE HORIZONTAL BEARING PRESSURE OF GROUND. (SEE NOTE 1) / FOR HORIZONTAL THRUST ON TRENCH WALLS WHERE THE COVER OVER PIPES IS 450 OR GREATER	90° & 60° HORIZONTAL BENDS			45° & 30° HORIZONTAL BENDS			22.5° HORIZONTAL BENDS			11.25° HORIZONTAL BENDS			TEES AND DEAD ENDS		
	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK
PBH kPa	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
NOMINAL DIAMETER OF FITTING (DN)															
100	0.32	N	N	N	N	N	N	N	N	N	N	N	.023	N	N
150	0.68	0.34	N	0.37	N	N	0.19	N	N	N	N	N	0.48	0.24	N
200	1.07	0.54	0.27	0.58	0.29	N	0.30	N	N	N	N	N	0.76	0.38	0.19
225	1.46	0.73	0.37	0.79	0.40	0.20	0.40	0.20	N	0.20	N	N	1.03	0.52	0.26
250	1.64	0.82	0.41	0.88	0.44	0.22	0.45	0.23	N	0.23	N	N	1.16	0.58	0.29
300	2.59	1.30	0.65	1.40	0.70	0.35	0.72	0.36	N	0.36	N	N	1.83	0.92	0.46
375	3.95	1.98	0.99	2.14	1.07	0.53	1.09	0.55	0.27	0.55	0.27	N	2.79	1.40	0.70
450	5.60	2.80	1.40	3.03	1.51	0.76	1.54	0.77	0.39	0.78	0.39	0.19	3.96	1.98	0.99
500	6.16	3.08	1.54	3.34	1.67	0.83	1.70	0.85	0.43	0.85	0.43	0.21	4.36	2.18	1.09
600	9.69	4.84	2.42	5.24	2.62	1.31	2.67	1.34	0.67	1.34	0.67	0.34	6.85	3.43	1.71
750	14.40	7.20	3.60	7.79	3.90	1.95	3.97	1.99	0.99	2.00	1.00	0.50	10.18	5.09	2.54

N' DENOTES NOMINAL THRUST AREA - (SEE NOTES 4 & 5)

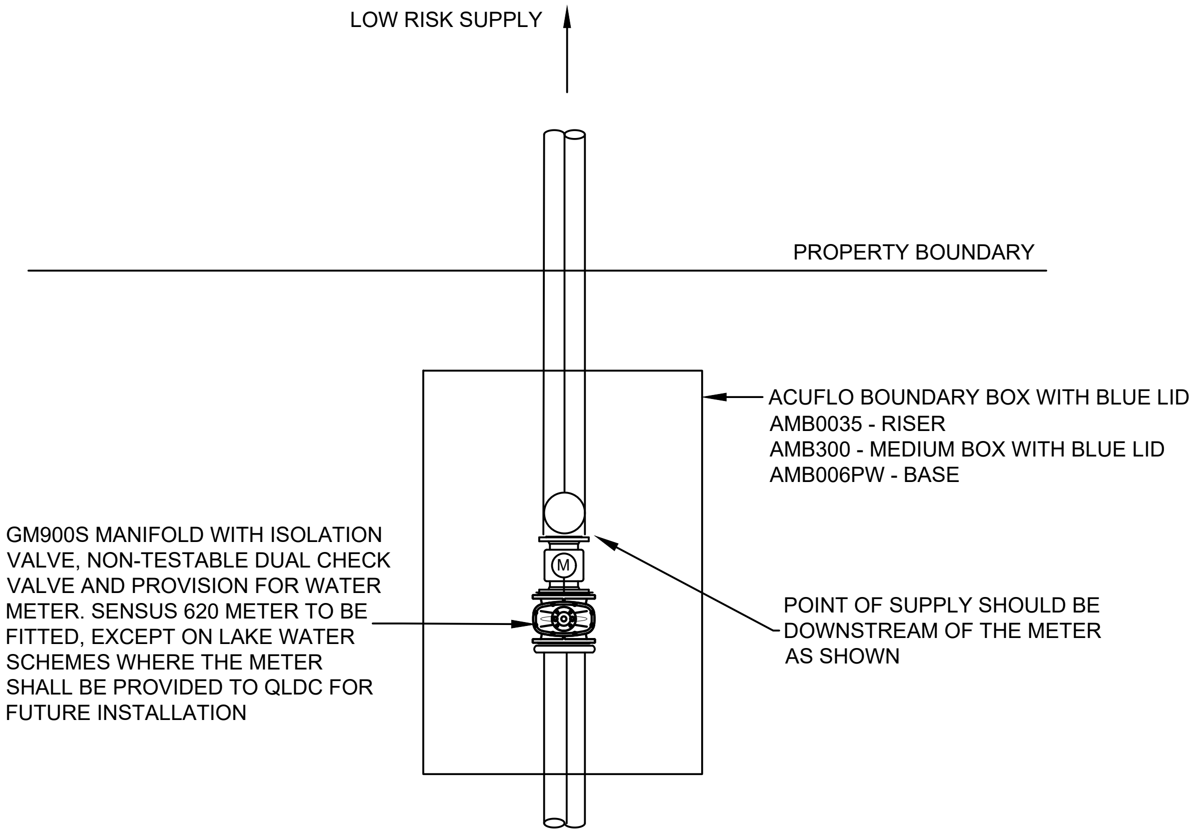
PBH - ALLOWABLE HORIZONTAL BEARING PRESSURE

NOTES:

1. SOIL CLASSIFICATIONS USED IN THIS TABLE ARE EXPLAINED IN APPENDIX G OF WSA 03.
2. CAST THE THRUST AREA OF ALL THRUST BLOCKS AGAINST A CLEAN FACE OF UNDISTURBED NATURAL SOIL. THRUST BLOCKS NOT TO INTERFERE WITH OTHER SERVICES.
3. DO NOT USE STANDARD THRUST BLOCKS IN:
   - VERY SOFT, SOFT OR FIRM CLAY;
   - LOOSE CLEAN SAND;
   - UNCOMPACTED FILL OR REFUSE;

   A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN IS REQUIRED FOR THESE SOILS.
3. THE NOMINAL THRUST AREA 'N' TO BE ACHIEVED BY POURING CONCRETE THE FULL LENGTH OF THE FITTING AND EXTENDING FROM THE FLOOR OF THE TRENCH TO ABOVE THE FITTING (SEE NOTE 5).
4. FOR SYSTEM TEST PRESSURES OTHER THAN 1000 kPa REDUCE OR INCREASE THE MINIMUM THRUST AREA BY THE RATIO OF THE APPLICABLE PRESSURES EXCEPT WHERE:
   - THRUST AREA IS <0.18m^2, AND
   - 'N' APPEARS IN THE TABLE AND THE APPLICABLE PRESSURE IS ABOVE 1000 kPa CALCULATE THE AREA.
5. FINISH THRUST BLOCKS APPROXIMATELY 100 mm ABOVE THE TOP OF THE FITTING OR BEARING PAD AND EXTEND TO THE FLOOR OF THE TRENCH OR DEEPER IF NECESSARY TO ACHIEVE THE REQUIRED THRUST AREA. MAXIMUM ENCASEMENT TO BE 180°.
6. THE MINIMUM THRUST AREA FOR TAPER THRUST BLOCKS TO BE EQUAL TO THE DIFFERENCE BETWEEN THE THRUST AREAS FOR DEAD-ENDS OF EQUIVALENT DIAMETER TO THOSE EACH SIDE OF TAPER.
7. FOR DOWNWARD VERTICAL THRUST, THE ALLOWABLE BEARING PRESSURES FOR VARIOUS SOILS MAY BE TAKEN AS TWICE THAT FOR HORIZONTAL THRUST SHOWN.
8. WHEN POURING CONCRETE AGAINST FITTINGS PLACE A MEMBRANE OF POLYETHYLENE, PVC OR FELT BETWEEN THE FITTING AND CONCRETE TO PREVENT DAMAGE TO THE FITTING. JOINTS TO BE CLEAR OF CONCRETE.
9. CONCRETE TO BE KEPT CLEAR OF BOLTS & FLANGES OR GIBAULT JOINTS TO ALLOW FITTINGS TO BE REMOVED WITHOUT INTERFERING WITH ANCHOR BLOCK.
10. THE USE OF THRUST BLOCKS IS GENERALLY NOT REQUIRED FOR PE PIPE. THRUST BLOCKS MAY BE REQUIRED IN CASES WHERE SPECIAL GASKETED MECHANICAL FITTINGS ARE USED.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Thrust Block Details	NOT TO SCALE Drawing No. B2-5



DETAIL 1

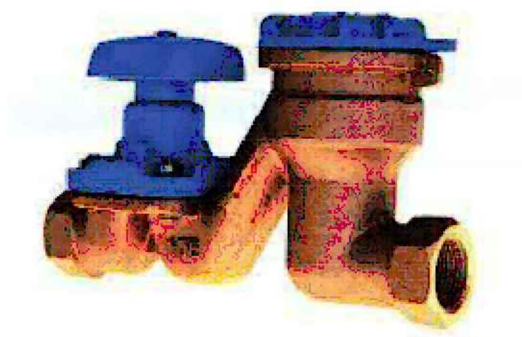


IMAGE OF GM900S MANIFOLD

(EXCLUDING BOX, BASE, RISER AND LID)

NOTES

GENERAL

1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
6. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
7. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

LOW RISK ONLY

1. LOW RISK WITH ID>25mm MUST BE SAME CONFIGURATION AS DETAIL 3.

QLDC LDSC 20202 Standard Details Revision: 0000B Rev Date: 17/05/2022	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Very Low Risk, Potable Supply Only for connections up to 25mm ID only	NOT TO SCALE Drawing No. B2-6

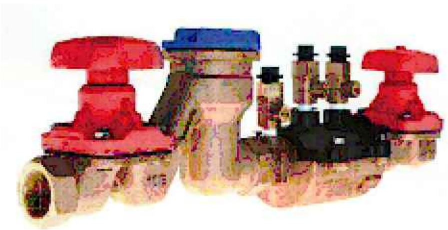
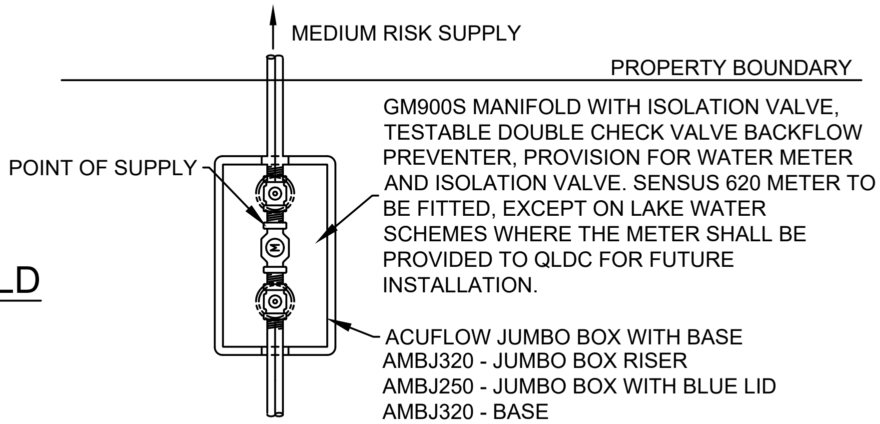


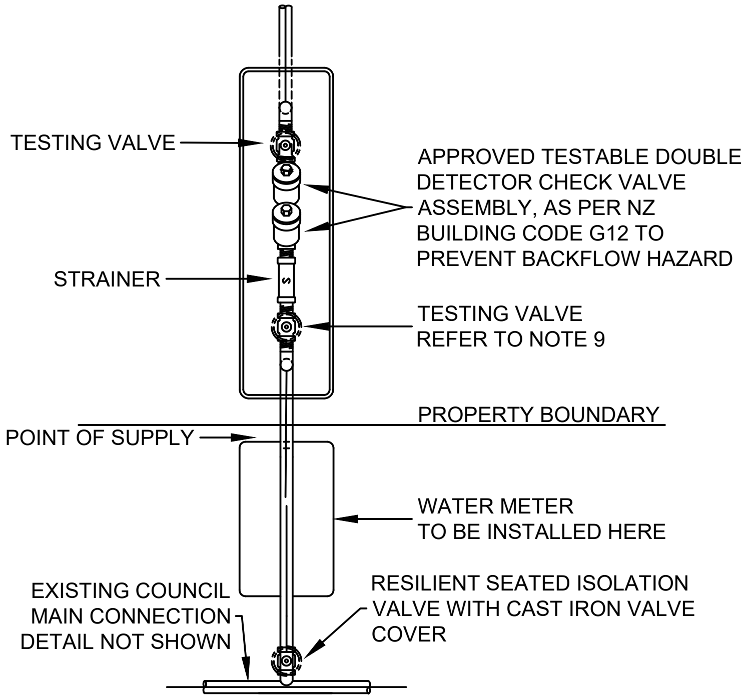
IMAGE OF GM900STR MANIFOLD

(EXCLUDING BOX, BASE, RISER AND LID)



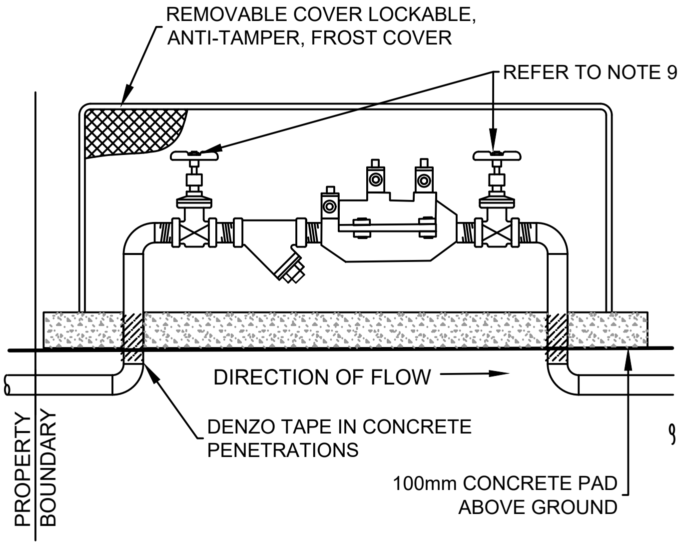
DETAIL 2 MEDIUM RISK - POTABLE WATER SUPPLY ONLY

FOR CONNECTIONS UP TO 25mm ID



DETAIL 3 MEDIUM RISK - POTABLE WATER SUPPLY ONLY

FOR CONNECTIONS GREATER THAN 25mm ID



SIDE ELEVATION FOR DETAIL 3

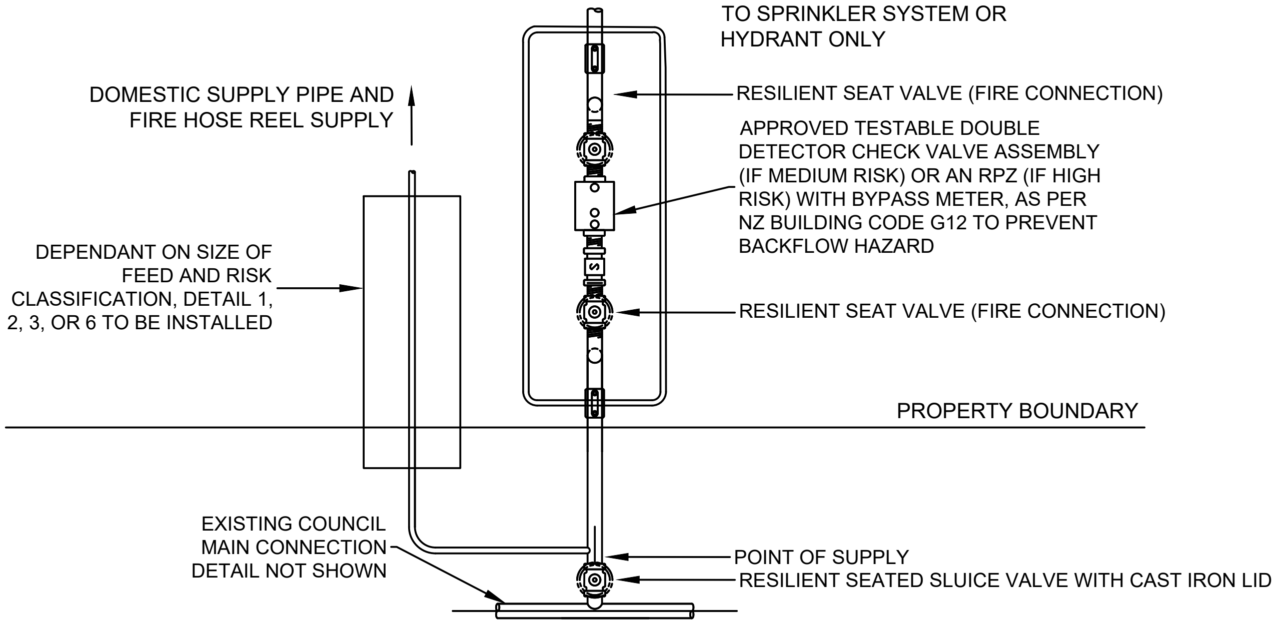
NOTES

GENERAL

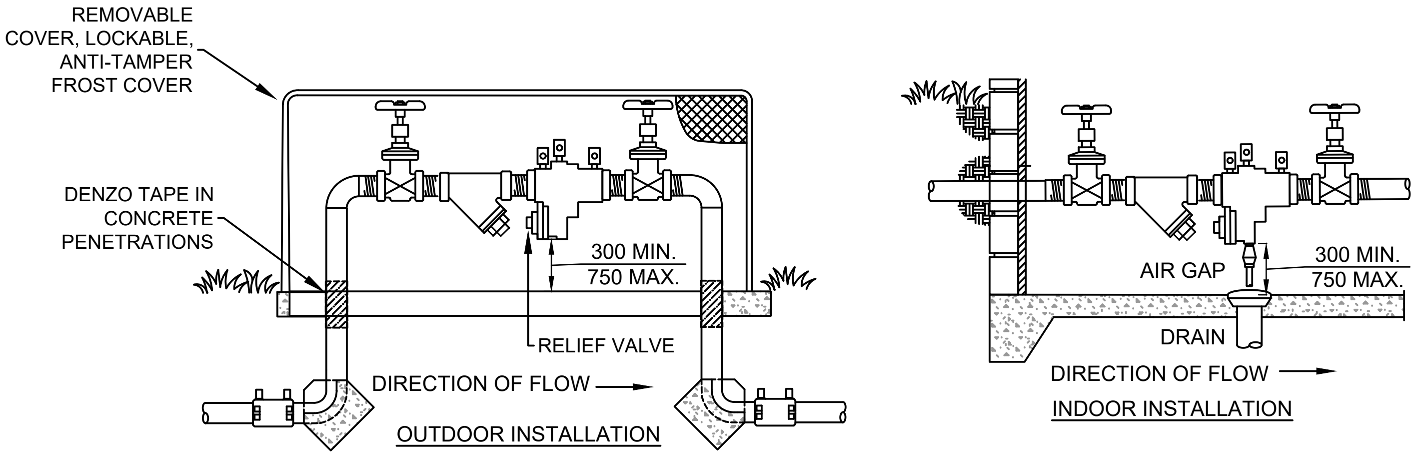
1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W. EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILIENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATIONS A BESPOKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.



DETAIL 4 FIRE SUPPLY WITH POTABLE WATER



SIDE ELEVATION FOR DETAIL 4 & 5 FIRE SUPPLY ONLY

NOTES

GENERAL

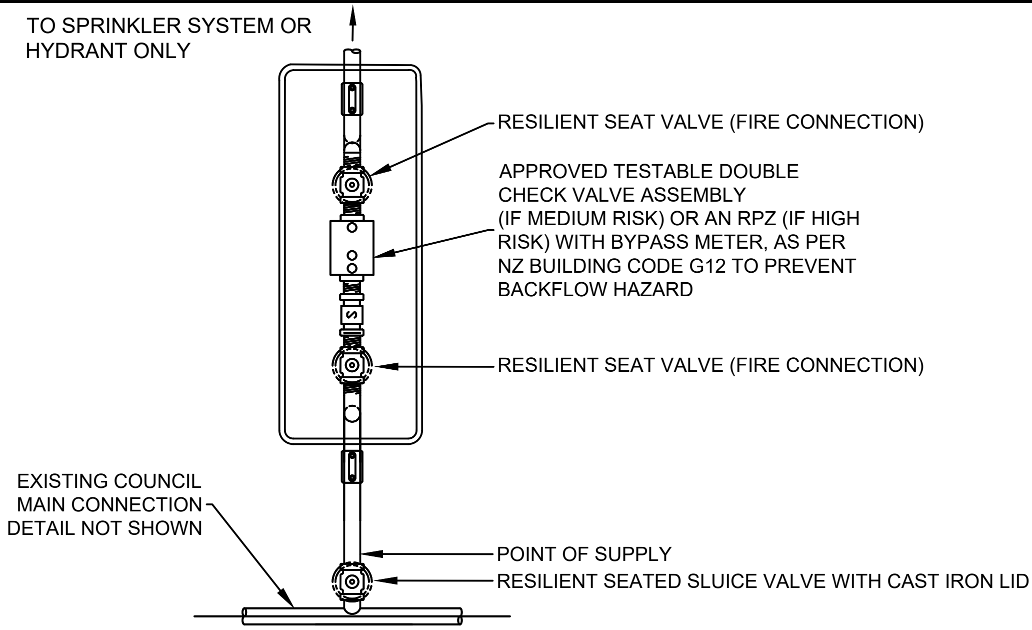
1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W. EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2). FOR LARGER INSTALLATION A BES[POKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.

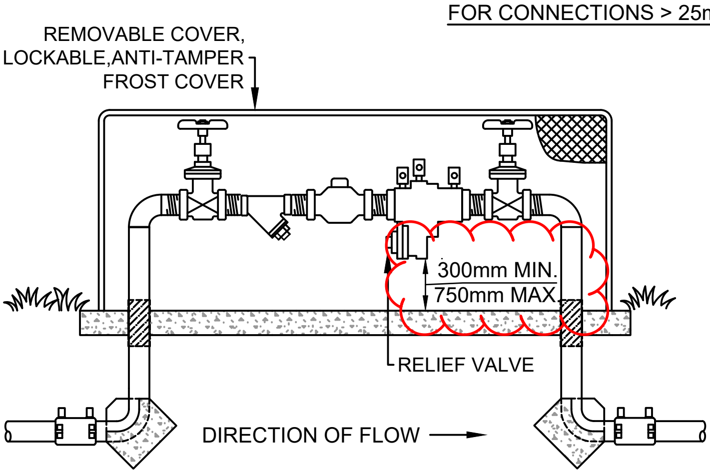
FIRE SUPPLY

1. ALL FIRE SUPPLY BFPS SHALL BE ABOVE GROUND.
2. FIRE SUPPLY CAN BE HIGH RISK (IF CHEMICALS/GLYCOL IS USED) OR MEDIUM RISK (IF NOT CHEMICALS/GLYCOL ARE USED).

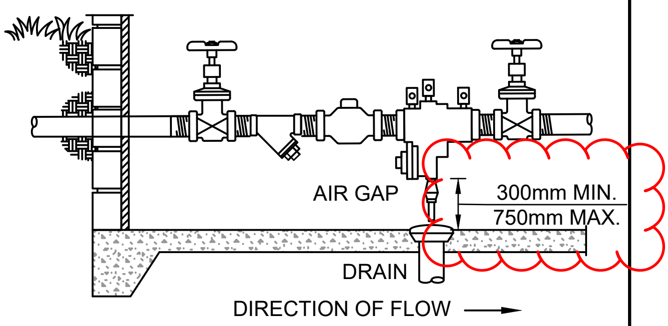


DETAIL 5 FIRE SUPPLY TO SPRINKLER SYSTEM OR HYDRANTS ONLY

FOR CONNECTIONS > 25mm (NOT TO SCALE)



OUTDOOR INSTALLATION



INDOOR INSTALLATION

NOTES

GENERAL

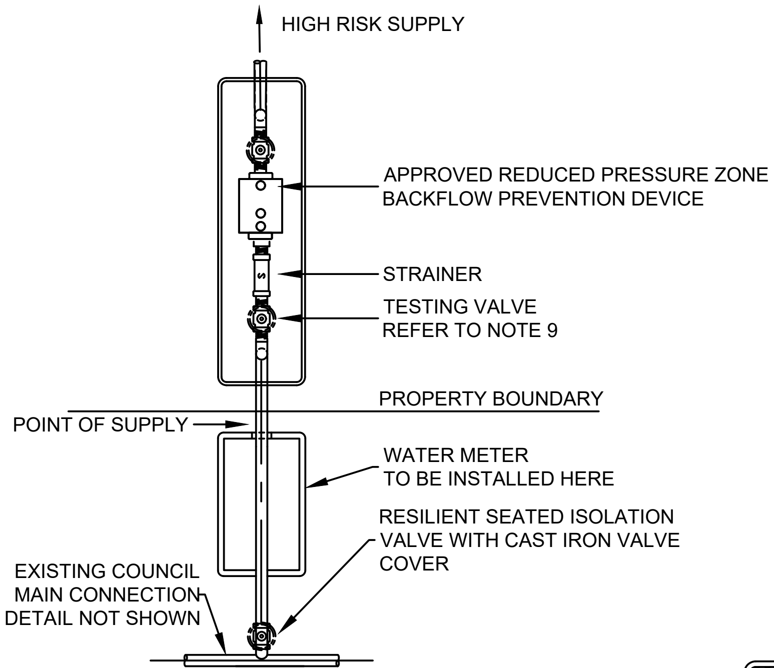
1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATION A BESPOKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.

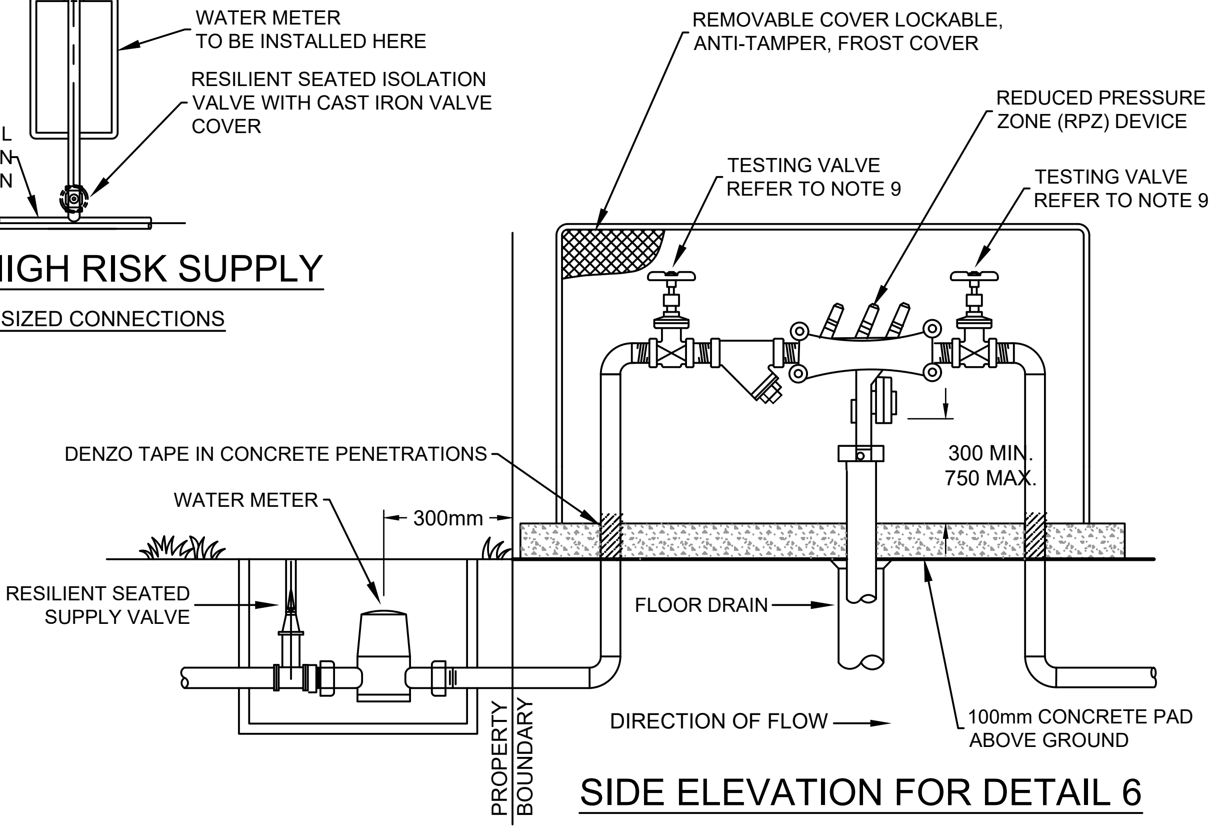
FIRE SUPPLY

1. ALL FIRE SUPPLY BFPS SHALL BE ABOVE GROUND.
2. FIRE SUPPLY CAN BE HIGH RISK (IF CHEMICALS/GLYCOL IS USED) OR MEDIUM RISK (IF NOT CHEMICALS/GLYCOL ARE USED).



DETAIL 6 HIGH RISK SUPPLY

FOR ANY SIZED CONNECTIONS



SIDE ELEVATION FOR DETAIL 6

NOTES

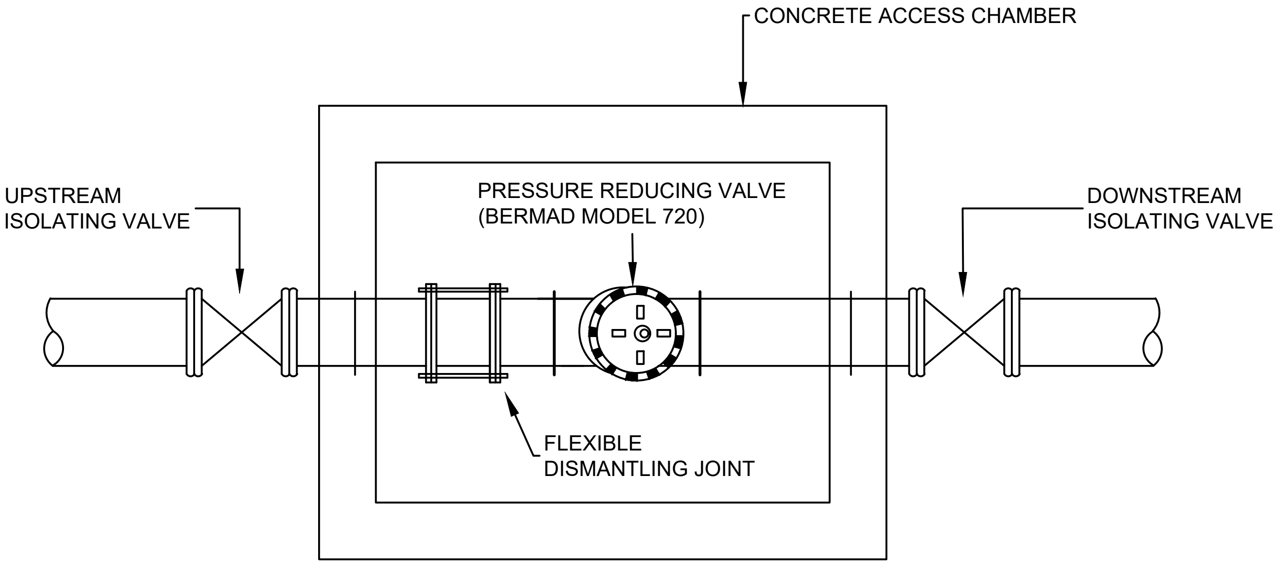
GENERAL

1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

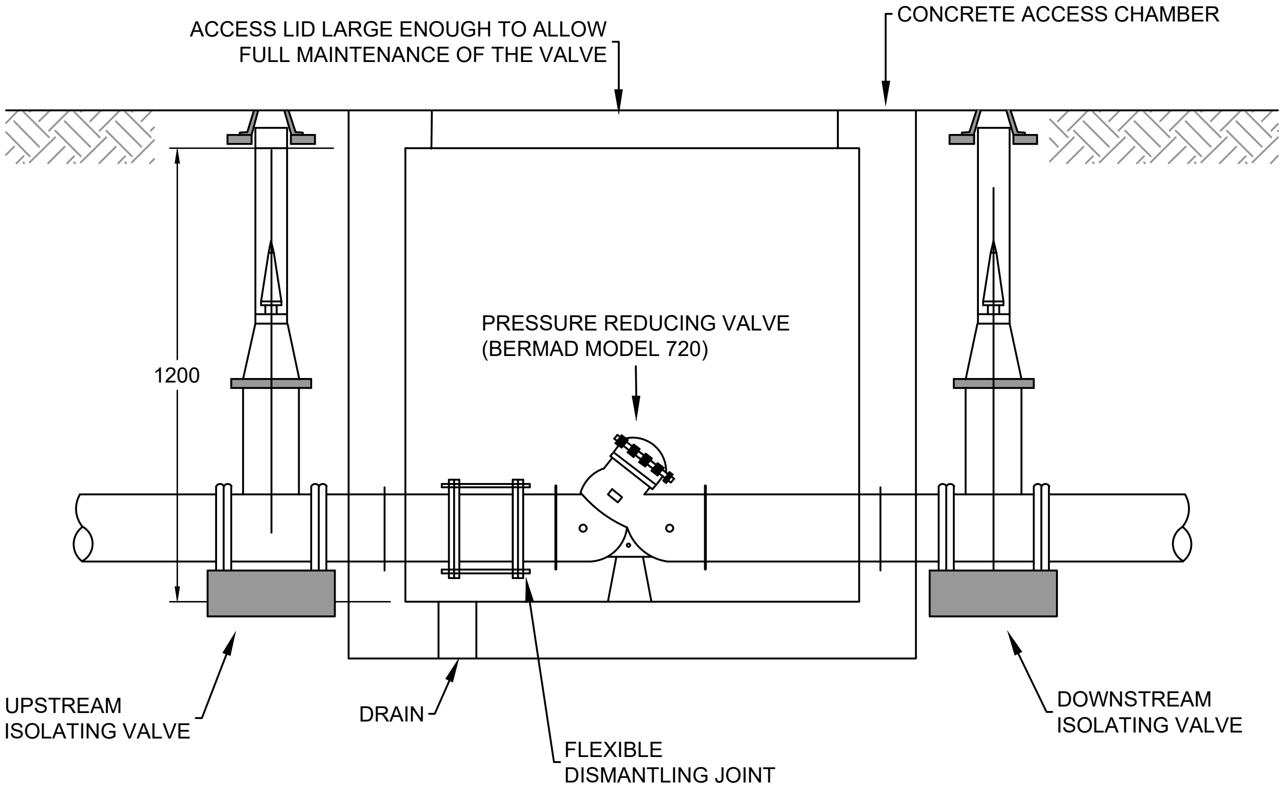
MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION
11. MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
12. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATION A BESPOKE ENCLOSURE WILL BE REQUIRED.
13. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.
14. FOR DETAIL 6, IF PIPE ID >50mm, CONFIGURATION MUST BE APPROVED BY TA TO CONFIRM THE VALVE AND METER LAYOUT.

QLDC LDSC 20202 Standard Details Revision: 0000B Rev Date: 17/05/2022	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: High Risk, Potable Supply Only for all connection sizes, no fire supply	NOT TO SCALE Drawing No. B2-10



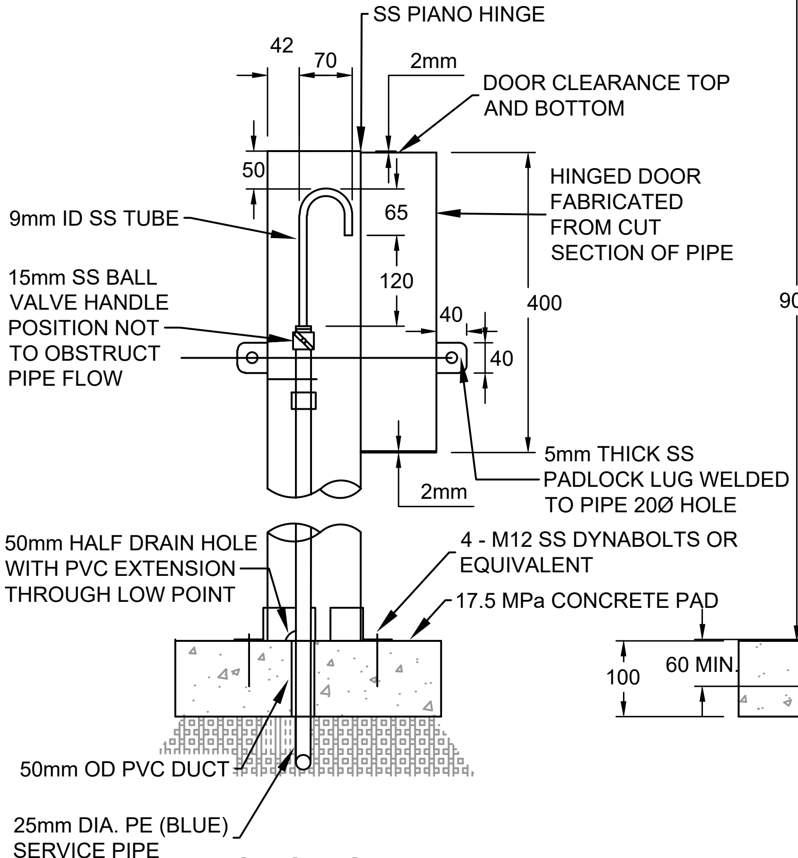
PLAN



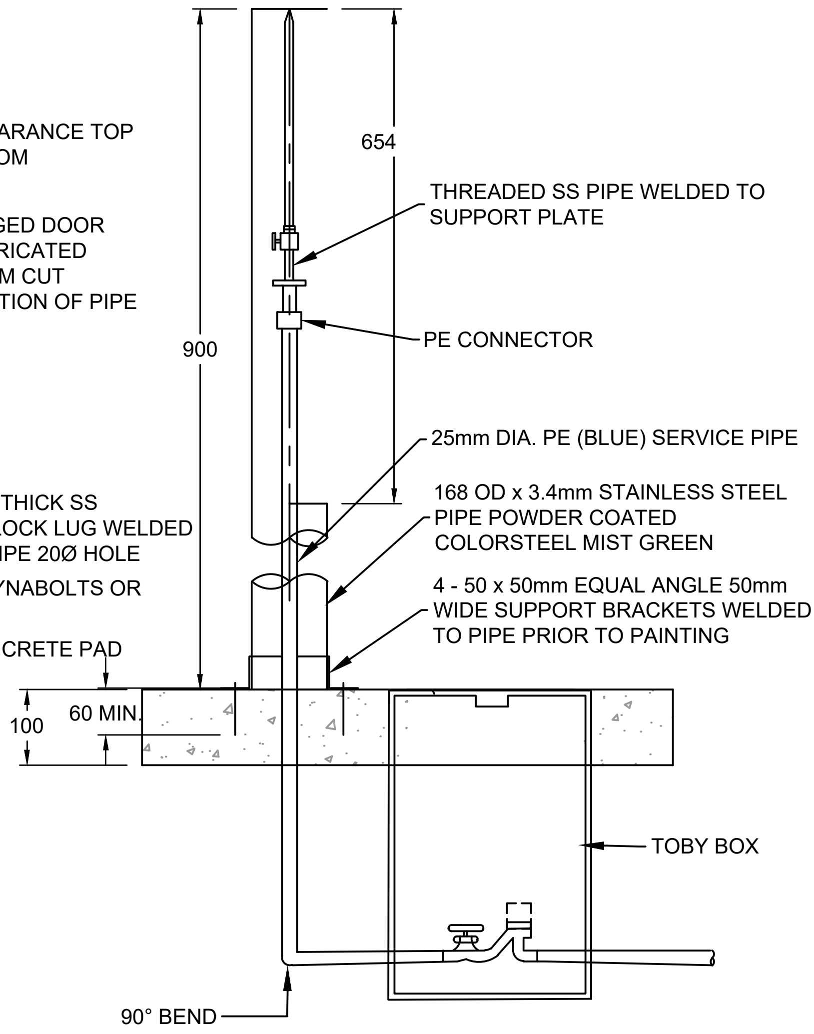
SECTION

NOTES:

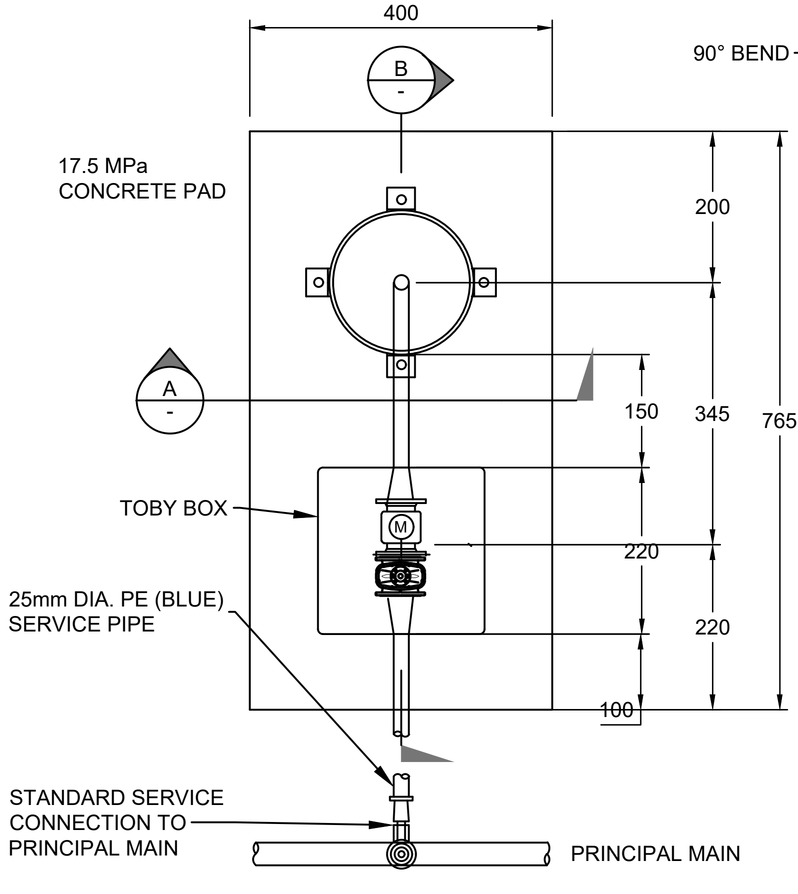
1. CONSIDERATION NEEDS TO BE GIVEN FOR UPSTREAM FILTER AND PRESSURE RELIEF VALVE WHEN DESIGNING THE INSTALLATION OF THESE VALVES.
2. CONSIDERATION NEEDS TO BE GIVEN FOR DRAINAGE WITHIN THE VALVE CHAMBER.



SECTION A



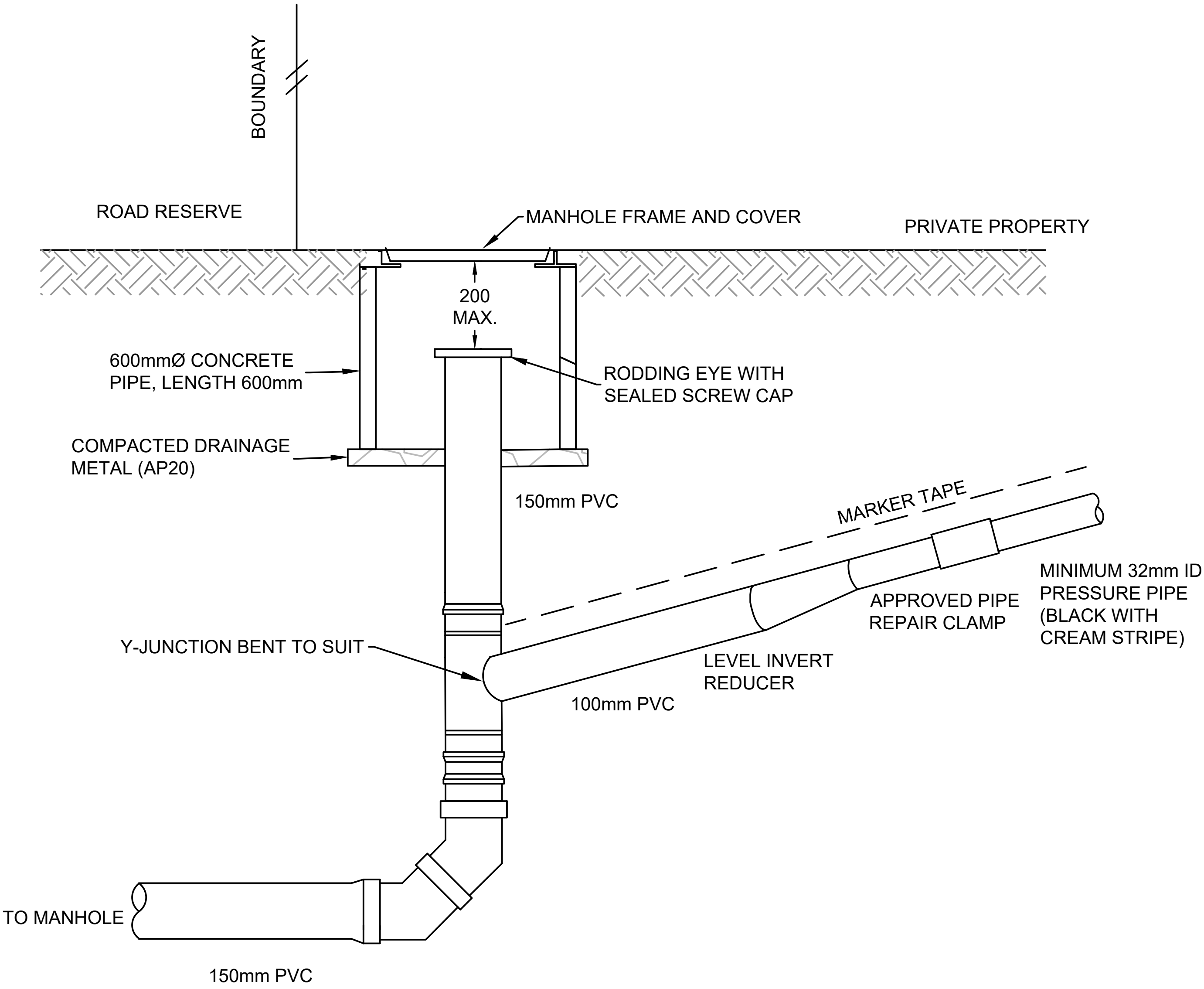
SECTION B



PLAN

NOTES

1. THIS ARRANGEMENT IS TO BE USED FOR ALL SAMPLING POINTS IN THE DISTRIBUTION NETWORK.
2. ALL PE CONNECTORS TO BE EITHER PUSHLOK, PLASSON, PHILMAC OR SIMILAR APPROVED.
3. ON SLOPING GROUND INSTALL DOOR OPENING ON UPHILL SIDE.
4. ALL WELDS TO BE 4mm FILLET.
5. SAMPLING POINTS TO BE ADDED TO END OF NETWORKS, IN AREAS WHERE ACCESIBLE



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

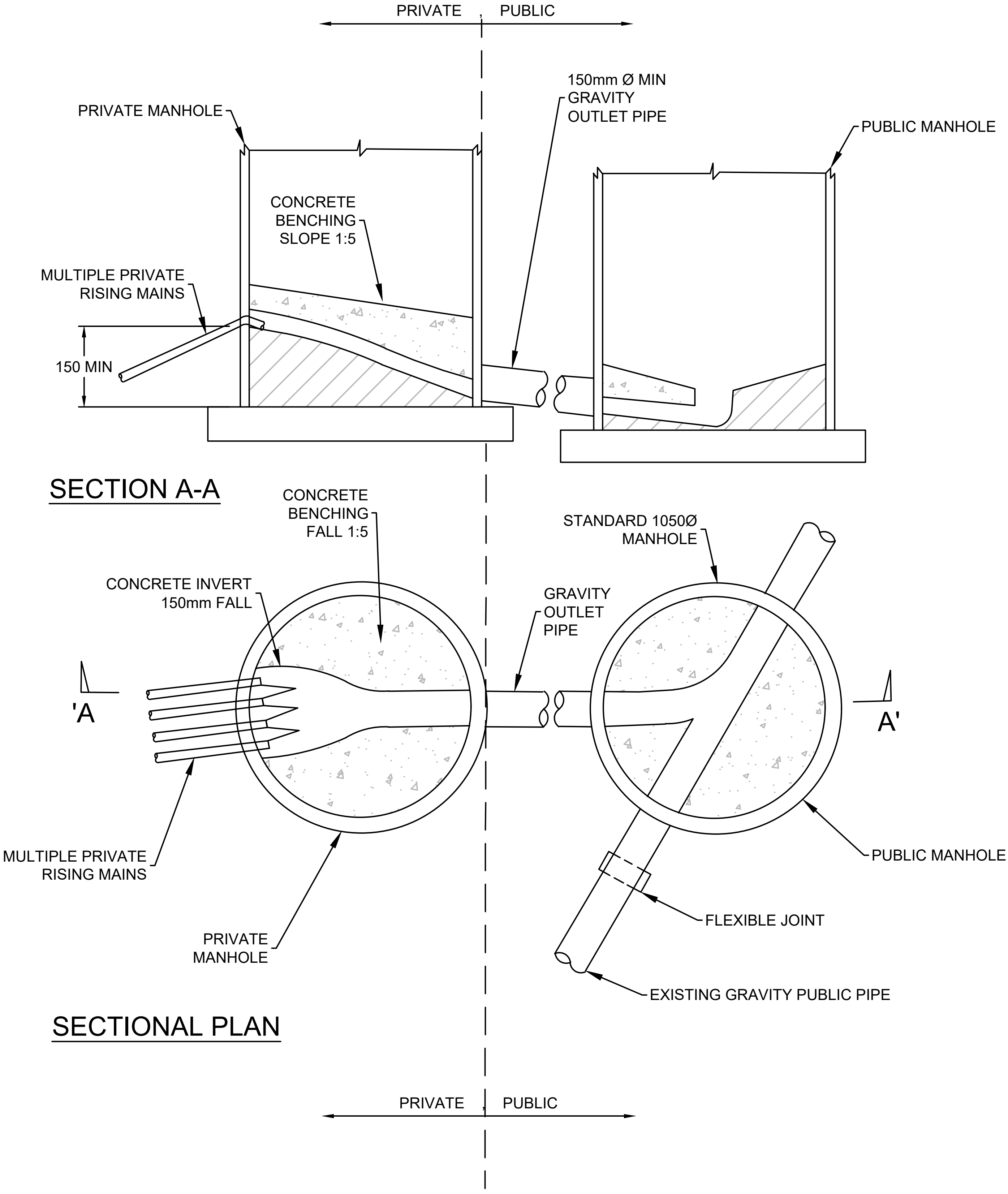
Drawing Title:

Private Pressure Sewer Main Connection to Sewer Lateral

NOT TO SCALE

Drawing No.

B3-1



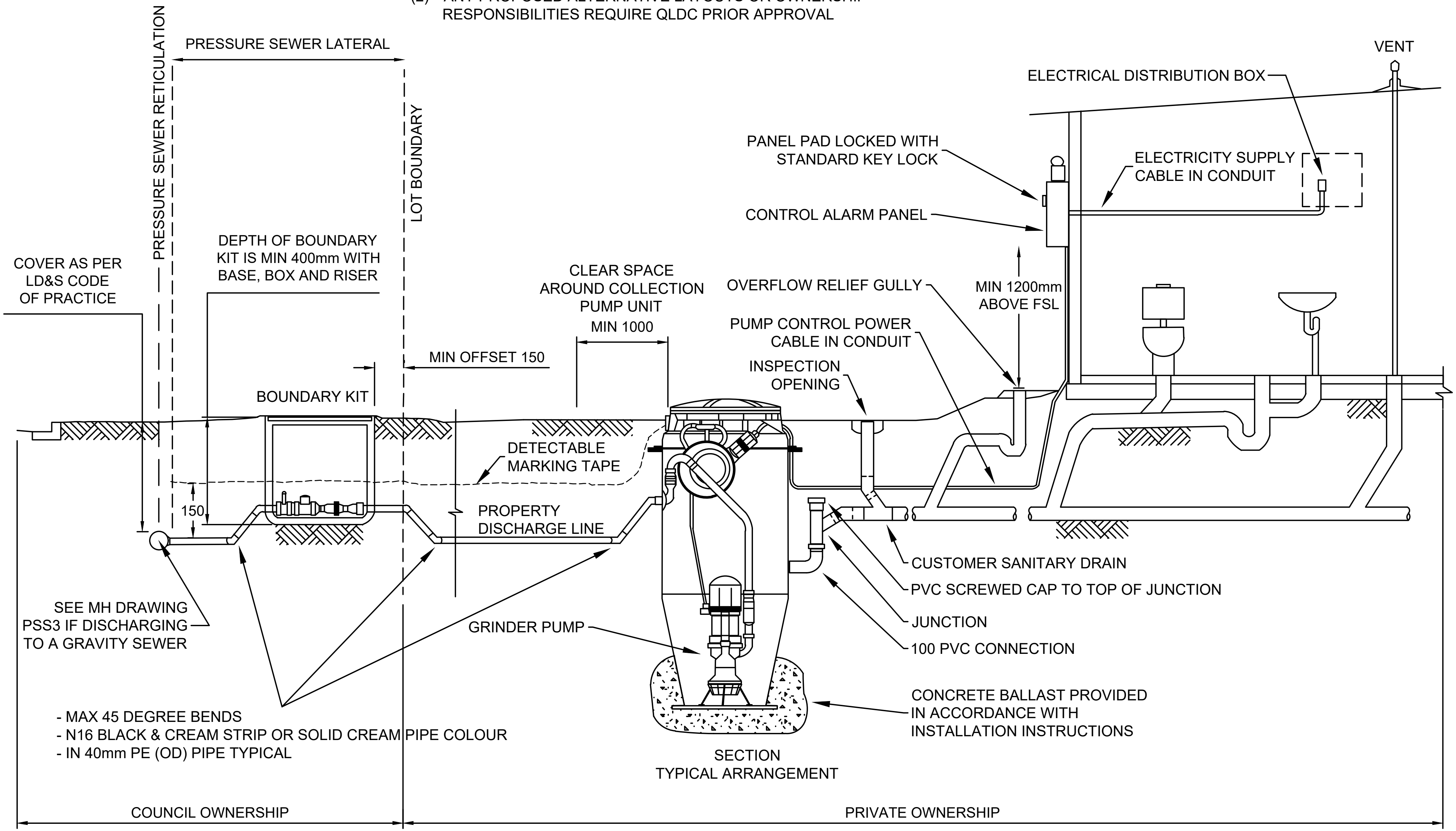
NOTES

1. ALL CONCRETE TO BE 17.5 MPa
2. A SINGLE PRIVATE MAIN CONNECTION TO THE PUBLIC SEWER SHALL BE MADE VIA A PRIVATE SHALLOW MANHOLE WITH A PUBLIC 150mm MIN GRAVITY PIPE FEED TO THE PUBLIC SEWER MANHOLE.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Rising Main Connection Private	NOT TO SCALE Drawing No. B3-2

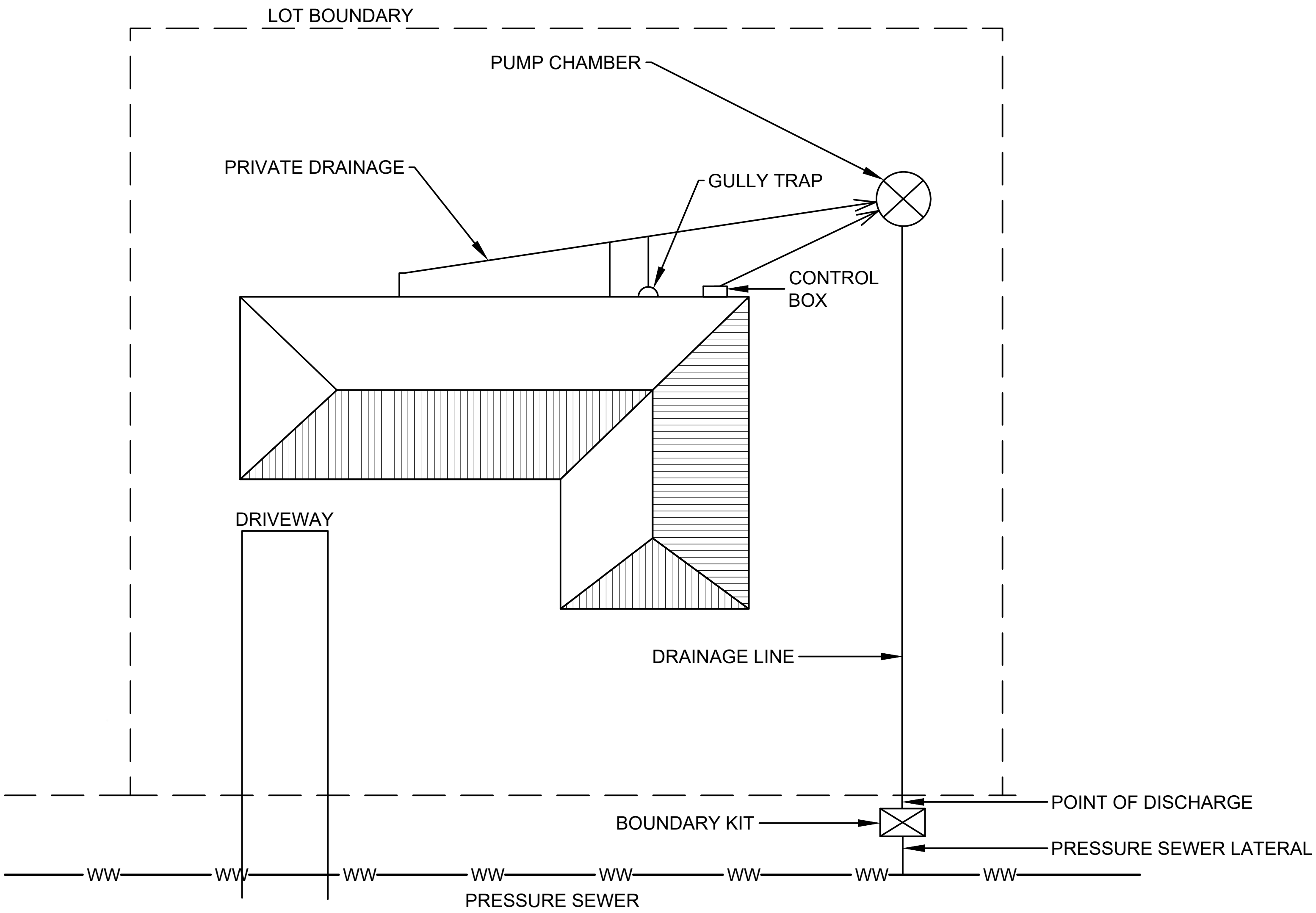
NOTES:

(1) ALL DIMENSIONS IN MM
(2) ANY PROPOSED ALTERNATIVE LAYOUTS OR OWNERSHIP RESPONSIBILITIES REQUIRE QLDC PRIOR APPROVAL

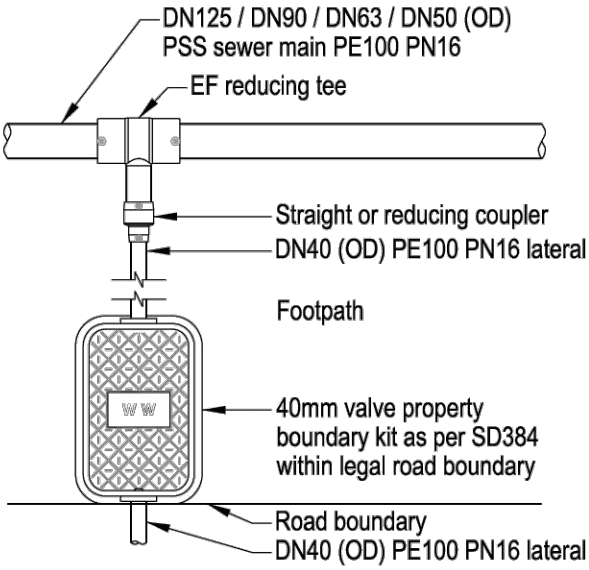


SECTION
TYPICAL ARRANGEMENT

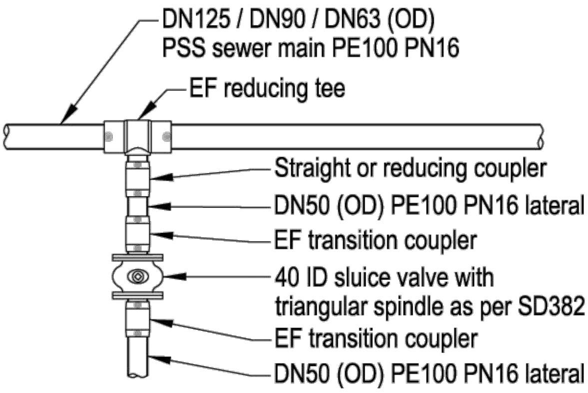
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: QLDC Pressure Sewer System Standard Detail Typical Layout Drawing for Low Pressure Systems 2 - 4 lots	NOT TO SCALE Drawing No. B3-3



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: QLDC Pressure Sewer - Typical On-Property Layout	NOT TO SCALE Drawing No. B3-4



A MAIN / DN40 (OD) PSS DWELLING CONNECTION DETAILS



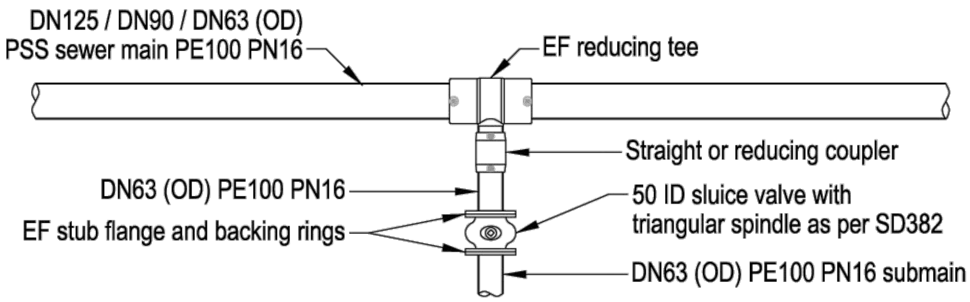
B MAIN / DN50 (OD) PSS SUBMAIN CONNECTION DETAILS

PE Tee and Reducer Summary

DN40 PSS Dwelling Connections			
Main	*Tee*	*Reducer*	*Reducer*
DN125	125/90	+ 90/50	+ 50/40
DN90	90/50	+ 50/40	
DN63	63/50	+ 50/40	
DN50 PSS Submain Connections			
Main	*Tee*	*Reducer*	*Valve*
DN125	125/90	+ 90/50	+ 40 ID Sluice valve
DN90	90/50	- - -	+ 40 ID Sluice valve
DN63	63/50	- - -	+ 40 ID Sluice valve

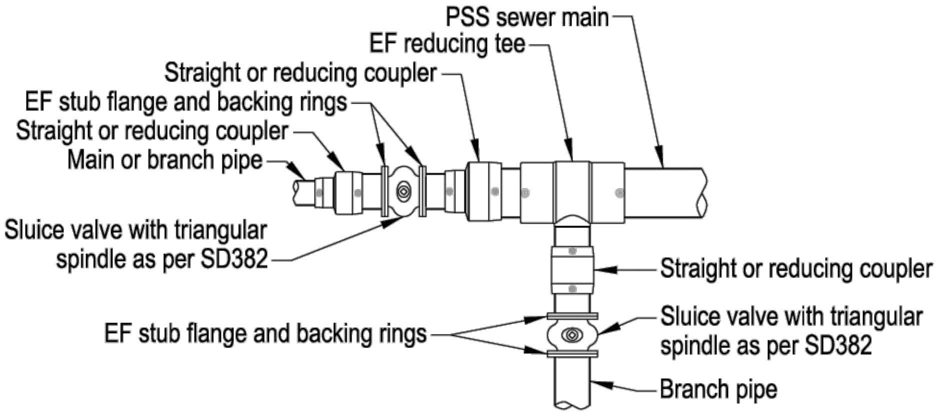
NOTES:

1. Saddles or self tapping joints may be used on pipes with an outside diameter (OD) of 90mm or greater.
2. Self-Tapping joints on branch pipes shall be at a depth of not less than 600mm.
3. For pipes less than DN90 (OD), only Electrofusion Tee joints shall be used.
4. Saddle joints **shall not** be used on pipes that are supplied in coils.
5. No brass fittings are to be used in any part of a pressure sewer system.
6. Mechanical couplers shall only be used on polyethylene pressure pipe DN90 (OD) or less for approved emergency repairs.



C MAIN / DN63 (OD) PSS SUBMAIN CONNECTION DETAILS

PE Tee and Reducer Summary			
DN63 PSS Submain Connections			
Main	*Tee*	*Reducer*	*Valve*
DN125	125/90	+ 90/63	+ 50 ID Sluice valve
DN90	90/63	- - -	+ 50 ID Sluice valve
DN63	63/63	- - -	+ 50 ID Sluice valve

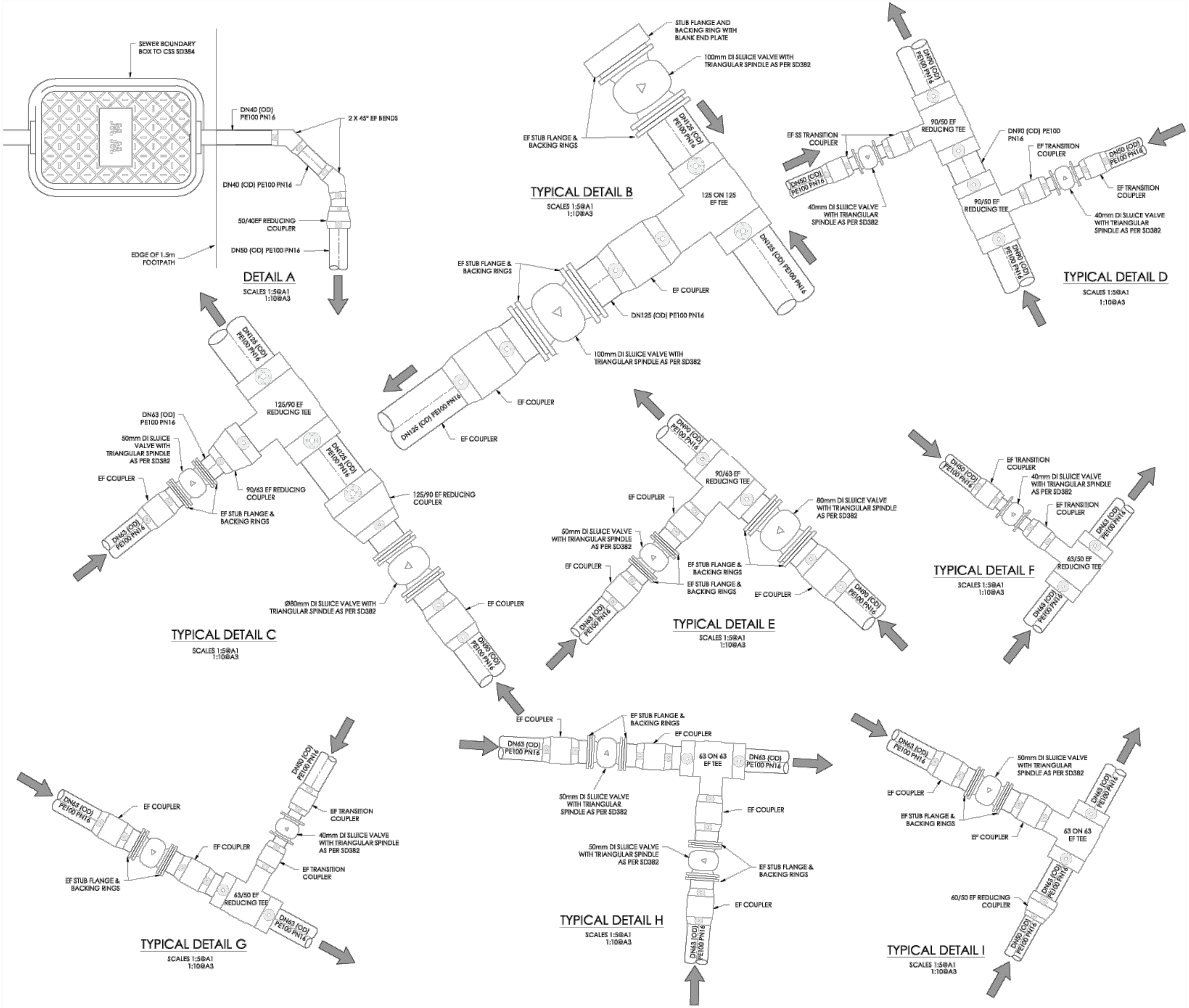


D ISOLATION VALVE CONNECTION DETAILS

PE Pipe / Sluice Valve Sizing	
PE Pipe	*Valve Size*
DN125	100 ID
DN90	75 ID
DN63	50 ID
DN50	40 ID

NOTES:

1. Saddles or self tapping joints may be used on pipes with an outside diameter (OD) of 90mm or greater.
2. Self-Tapping joints on branch pipes shall be at a depth of not less than 600mm.
3. For pipes less than DN90 (OD), only Electrofusion Tee joints shall be used.
4. Saddle joints **shall not** be used on pipes that are supplied in coils.
5. No brass fittings are to be used in any part of a pressure sewer system.
6. Mechanical couplers shall only be used on polyethylene pressure pipe DN90 (OD) or less for approved emergency repairs.



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

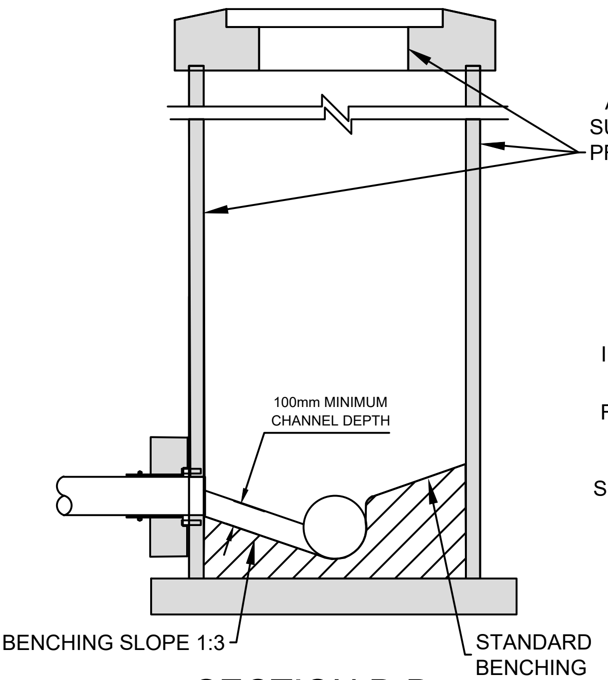
QUEENSTOWN LAKES DISTRICT COUNCIL

Drawing Title:

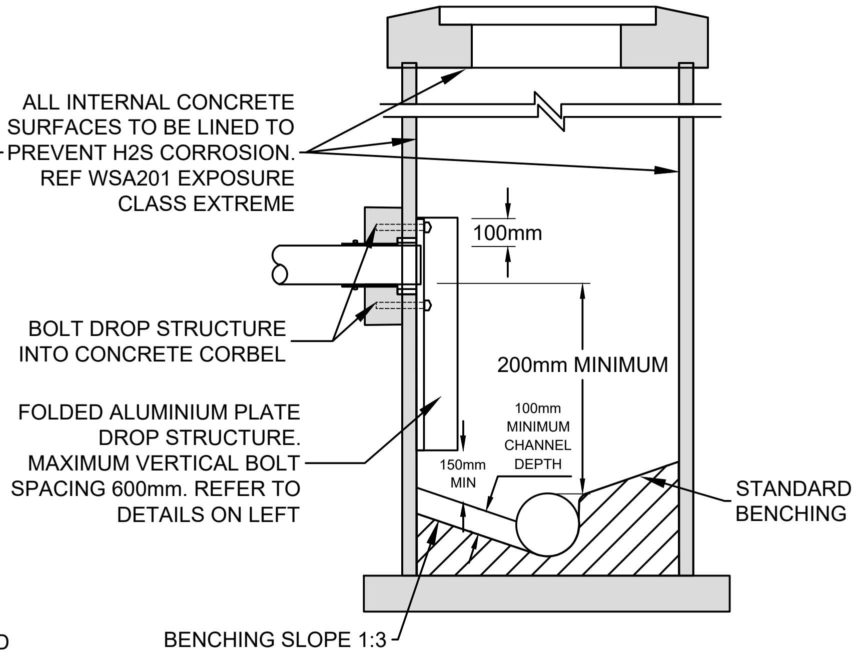
Sewer Details

NOT TO SCALE

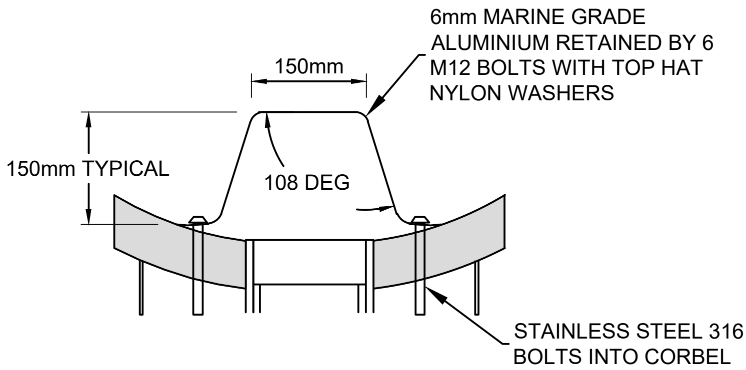
Drawing No.
B3-7



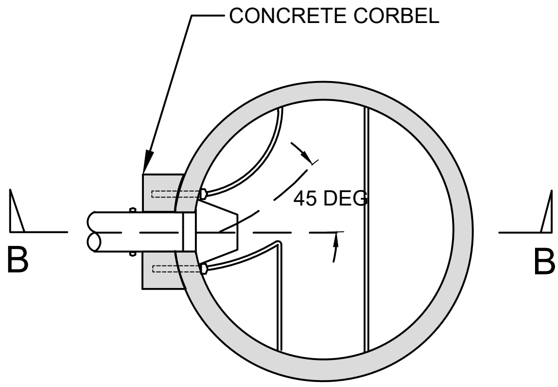
SECTION B-B
SHALLOW CIRCULAR PRECAST MANHOLE



SECTION B-B
DROP INSTALLATION CIRCULAR PRECAST MANHOLE



ALUMINIUM STRUCTURE



PLAN

NOTES

1. DROP STRUCTURES OVER DN180 REQUIRE SPECIAL DESIGN

2. MANHOLES AND PIPE LAYING TO BE CONSTRUCTED AS DETAILED ON PLANS LD&S: APPENDIX B DRAWINGS B1-5 TO B1-7.

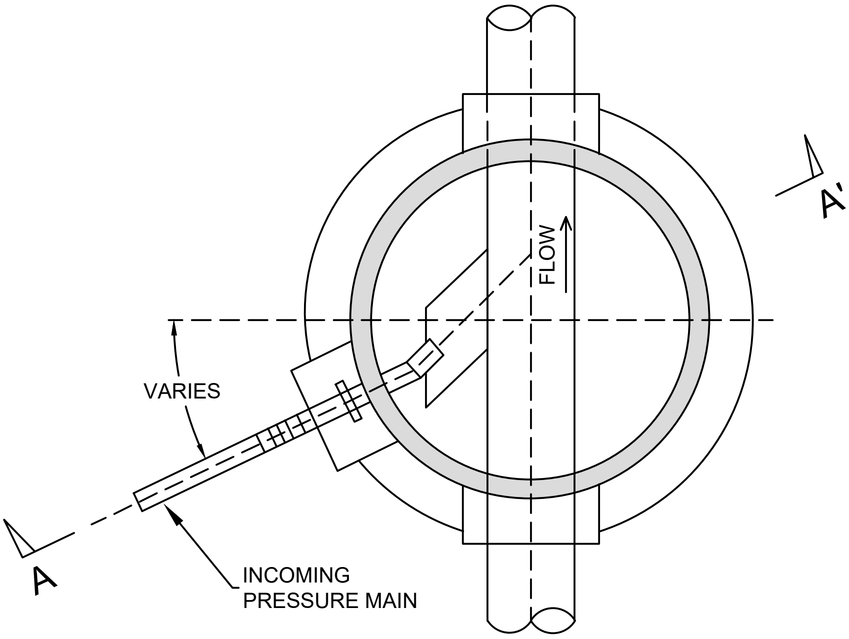
3. CHANNELLING IN NEW MANHOLES SHALL BE VERTICAL TO TOP OF MAIN SEWER AND BENCHING GRADED AT 1 IN 3 AS APPLICABLE

4. BENCHING AND CHANNELLING IN EXISTING MANHOLES SHALL BE REFORMED IN EASY CURVES

5. OPENING FOR MANHOLE STARTER AND CORBELL SHALL BE CLEAR OF ANY JOINT IN PRECAST MANHOLE BY AT LEAST 300mm

6. FOR PIPES LARGER THAN DN180, SPECIFIC DESIGN OF CONCRETE CORBEL AND CONCRETE DROP STRUCTURE TO BE APPROVED BY QLDC.

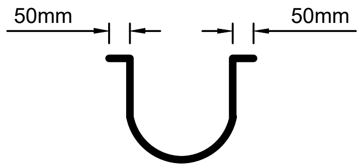
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Pressure Sewer Discharge into Manholes for DN90 - DN180 Pipes	NOT TO SCALE Drawing No. B3-8



PLAN

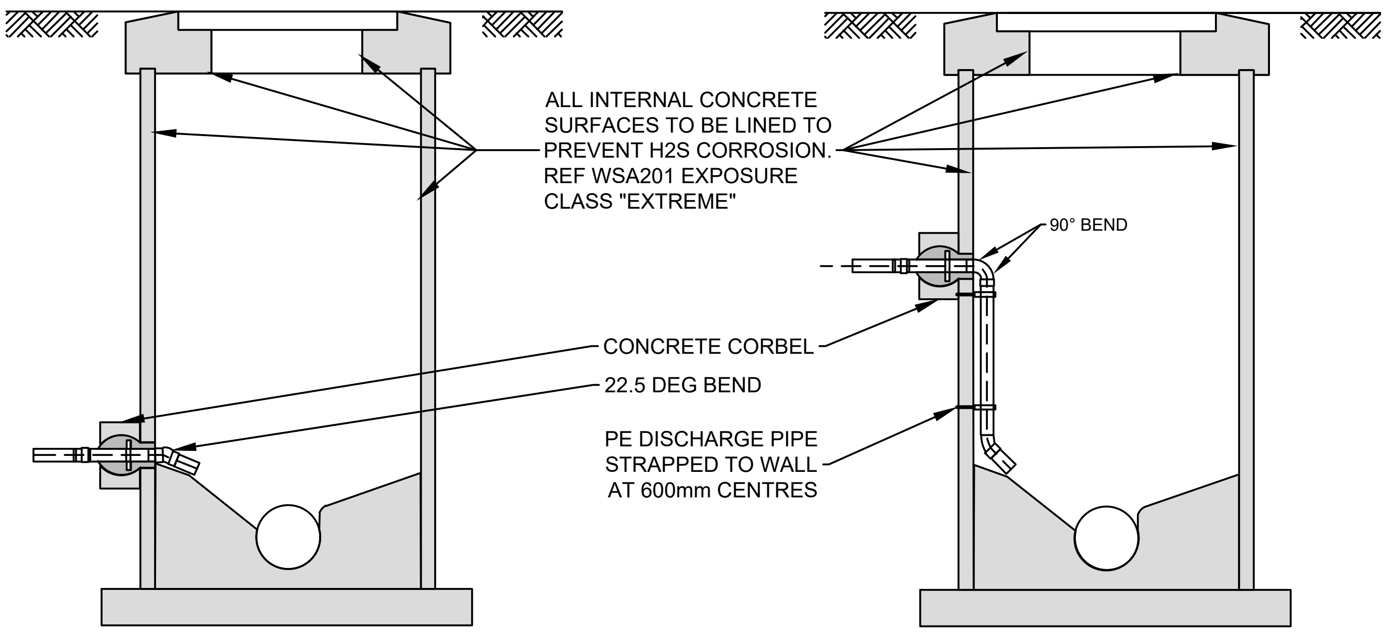
NOTES

1. ALL INTERNAL CONCRETE SURFACES TO BE LINED TO PREVENT H2S CORROSION.



STRAP DETAIL

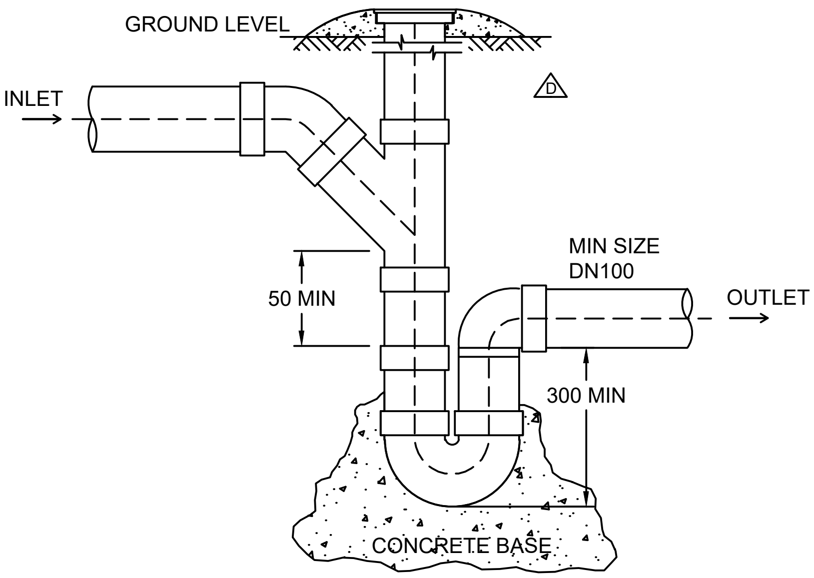
2. 25MM WIDE x 1.25MM 316 STAINLESS STEEL STRAP FIXED TO MANHOLE WALL WITH 2x M12 x 100MM 316SS THREADED STUDS. EPOXY ANCHOR WITH 50MM EMBEDMENT DEPTH



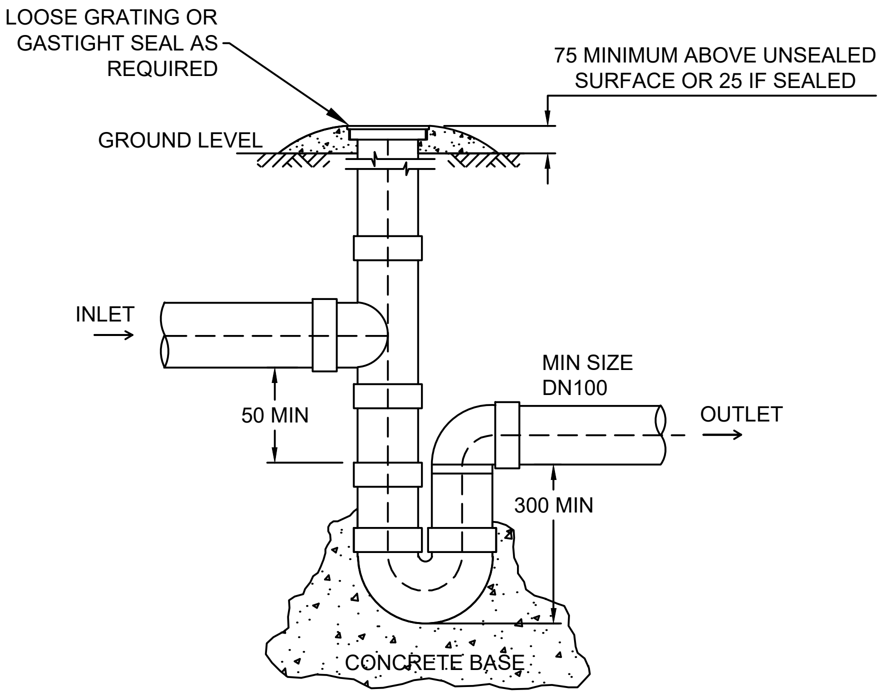
SECTION A-A'
FOR SHALLOW MANHOLES

SECTION A-A'
IF DROP STRUCTURE IS REQUIRED

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Pressure Sewer Discharge into Manholes for up to DN63 Pipes	NOT TO SCALE Drawing No. B3-9



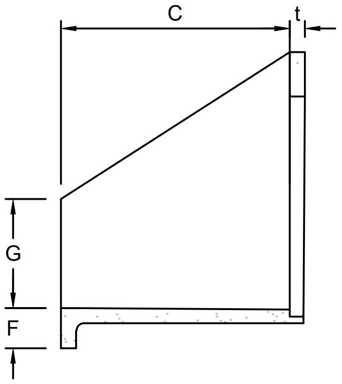
SECTION
PUMPED DISCHARGE



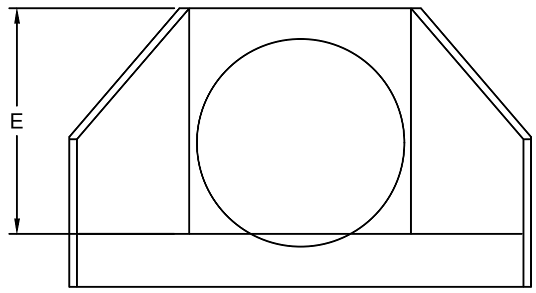
SECTION
GRAVITY DISCHARGE

<u>GUIDELINES</u>

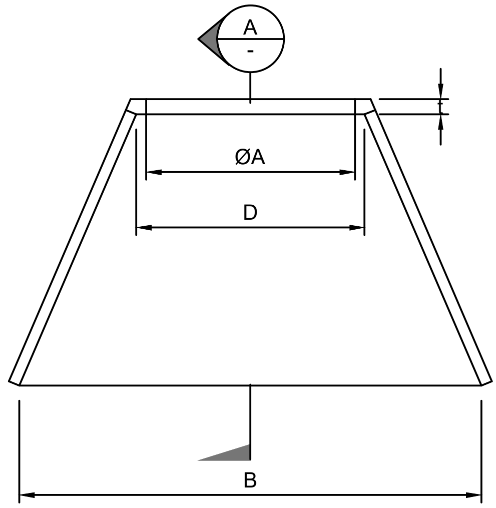
1. LOCATED IMMEDIATELY DOWNSTREAM OF ANY PRE-TREATMENT FIXTURE.
2. THE TRADE WASTE SAMPLING POINT SHALL BE POSITIONED AT ANY POSITION AS DIRECTED BY THE TRADE WASTE SECTION.
3. SAMPLING POINTS ARE TO BE PURPOSE MADE TO PROVIDE A MINIMUM DEPTH OF WATER OF 300MM.
4. MINIMUM SIZE OF SAMPLING POINT SHALL BE DN100.
5. SAMPLE POINTS SHALL NOT BE USED AS A RELIEF DISCONNECTOR GULLY.
6. IN THE CASE A BUSINESS IS REQUIRED TO BE MONITORED, DISCHARGES FROM ALL PROCESS AREAS / OR TREATMENT FACILITIES ARE TO BE DIRECTED THROUGH A SINGLE MONITORING POINT WHICH INCLUDES AN INDUSTRIAL WASTE SAMPLING POINT.
7. MINIMUM OF 50MM VERTICAL DIFFERENCE BETWEEN INLET INVERT LEVEL TO TOP OF WATER SEAL.
8. ALL MEASUREMENTS SHOWN ARE IN MILLIMETRES.
9. ALL ASSOCIATED PLUMBING WORK IS TO COMPLY WITH WATER SERVICES LICENSING (PLUMBERS LICENSING AND PLUMBING STANDARDS) REGULATIONS 2000 AND LATEST VERSIONS OF AS/NZS 3500.1 AND AS/NZS 3500.2.
10. SEALED TRADE WASTE SAMPLING POINTS MUST HAVE A MINIMUM OF A DN50MM VENT TO ATMOSPHERE
11. AIR ADMITTANCE VALVES ARE NOT TO BE USED



CROSS SECTION A



FRONT ELEVATION

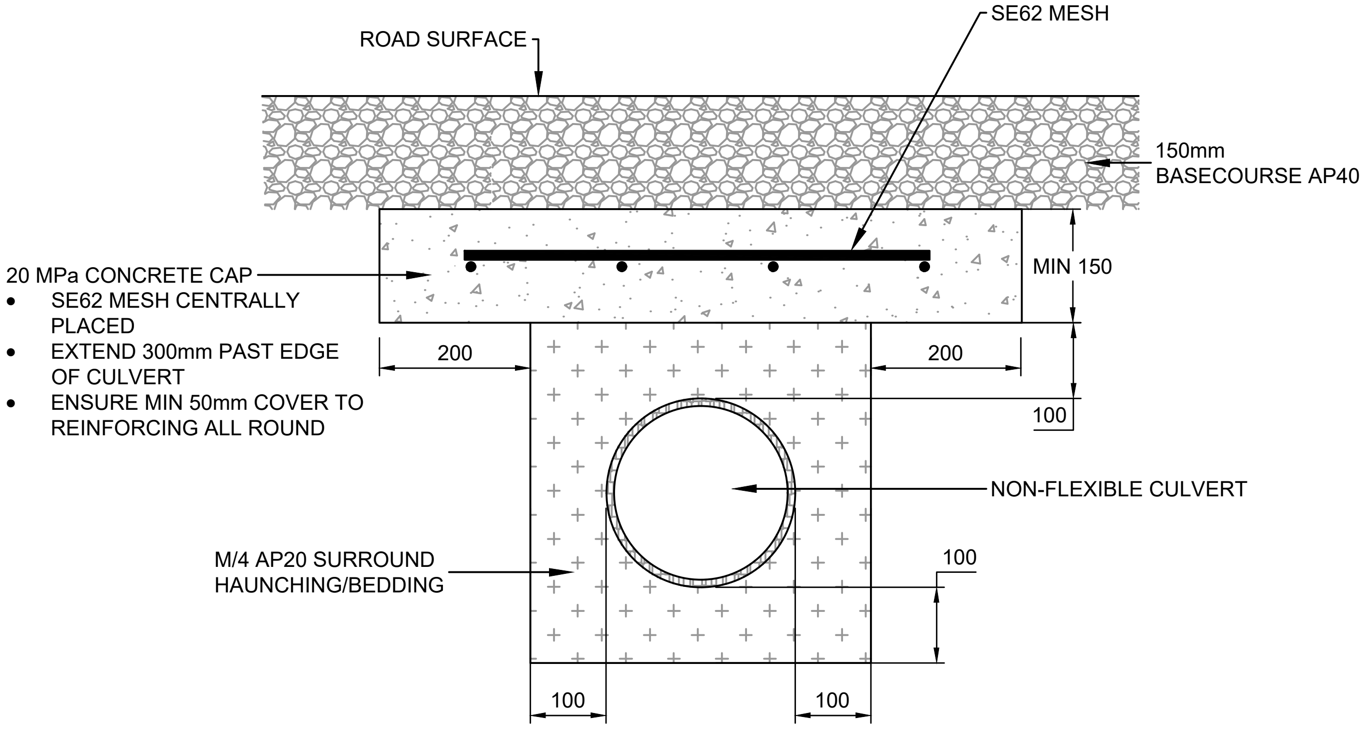


PLAN VIEW

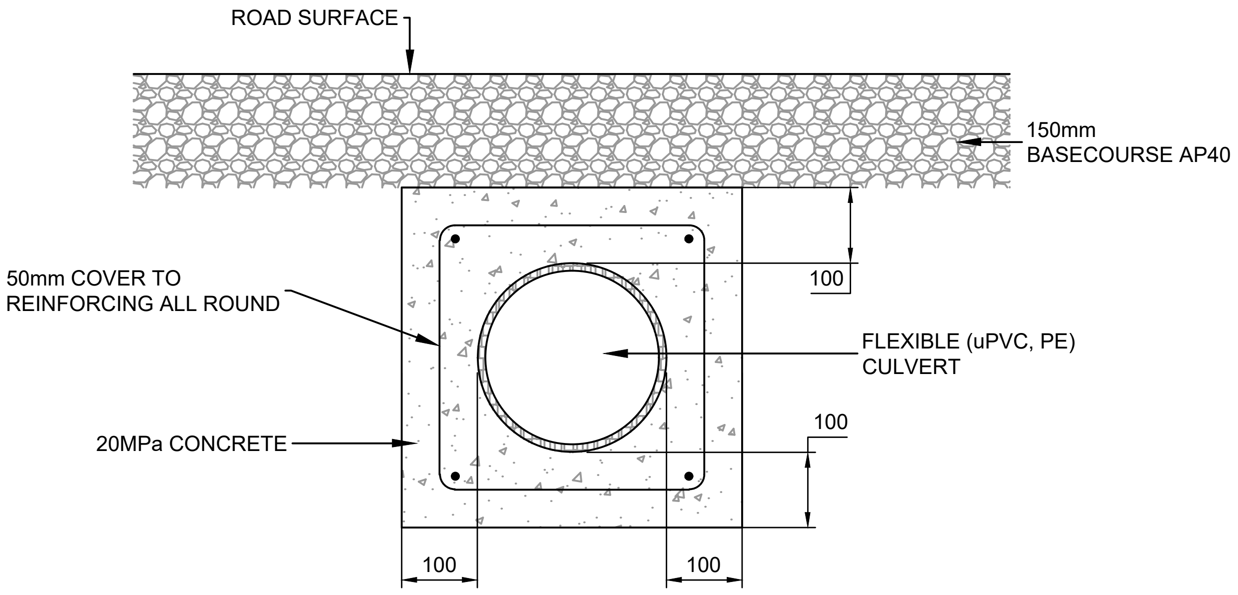
TABLE 1

PIPE DIA.	PRINCIPAL DIMENSIONS (mm)							
	A	B	C	D	E	F	G	t
150-300	190-390	1000	600	460	520	200	160	50
300-600	370-700	1900	1100	750	900	280	500	80
600-1050	720-1225	3000	100	1270	1675	345	600	100
1200-1350	1380-1540	4100	2400	1600	1975	425	750	125
1600-1800	1727-2040	4900	2400	2150	2265	450	750	150

NOTES:
1. REINFORCED FLOOR AND WALLS WITH
   150 TO 375 - 665 MESH (668 OR SIMILAR)
   450 TO 600 - 663 MESH OR EQUIVALENT OR 10Ø RODS @ 250 CRS
   675 TO 900 - 12Ø RODS @ 250 CRS
   1050 TO 1350 - 12Ø RODS @ 150 CRS
2. ALL REINFORCEMENT SHALL BE PLACED CENTRAL IN WALLS & FLOOR AND SHALL BE CONTINUOUS BETWEEN WALL AND FLOOR.
3. LAPS IN STRUCTURAL GRADE BARS TO BE 300mm MINIMUM.
4. THERE SHALL BE AT LEAST TWO BARS WHETHER MESH OR MILD STEEL, OVER THE TOP OF THE PIPE.
5. CONCRETE COMPRESSIVE STRENGTH IS TO BE 20MPa @ 28 DAYS.
6. BAFFLES ARE TO BE CONSTRUCTED AS SHOWN WHEN OUTLET VELOCITIES AND SOIL CONDITIONS DICTATE. IN EXTREME CASES SPECIFIC DESIGN MAY BE REQUIRED.
7. INLETS EXCEEDING 450mmØ TO HAVE ANTI-VERMIN SCREENS FITTED, EXCEPT WHEN THE PIPE IS LESS THAN 20m LONG.
8. TABLE 1 IS FOR FORMING INLET AND OUTLET STRUCTURES OUTSIDE MANUFACTURERS SPECIFICATIONS.

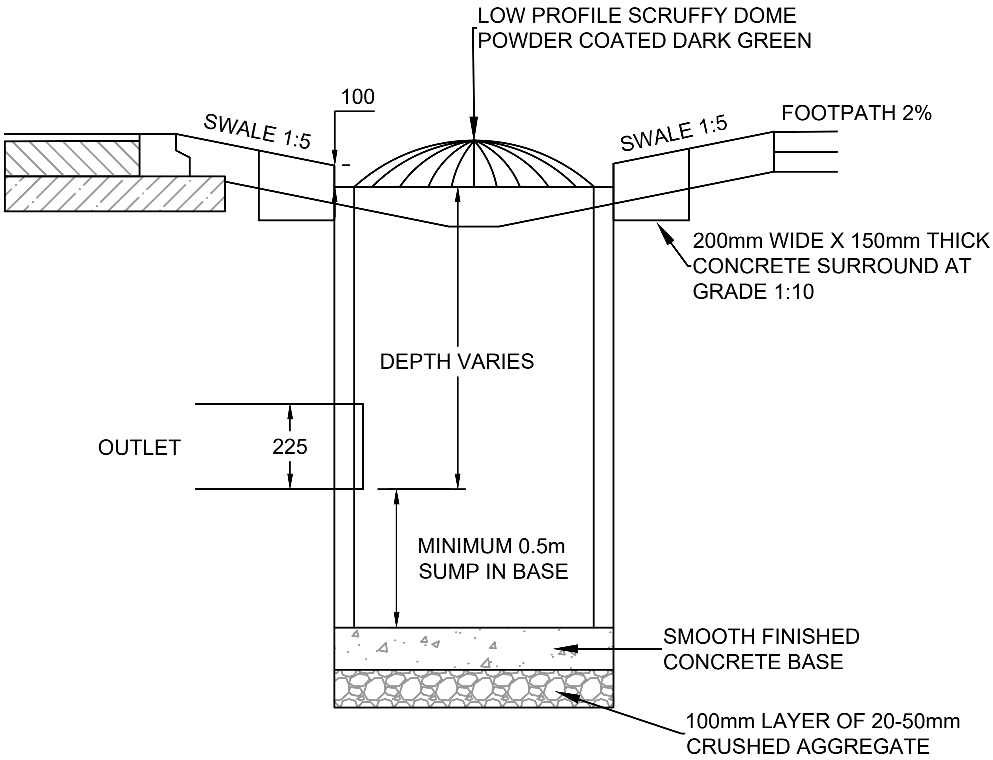


CONCRETE CAPPING DETAIL

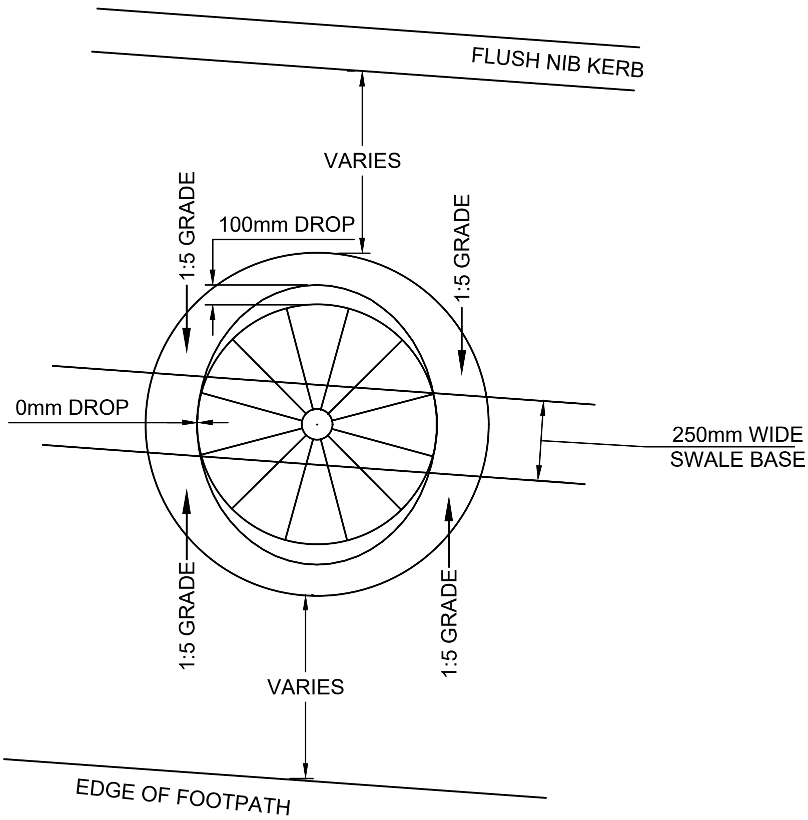


CONCRETE ENCASING DETAIL

NOTES:
1. WHERE COVER IS REDUCED FROM REQUIREMENTS, PIPE LOADING CAPACITY SHALL FIRST BE CHECKED AS PER AS/NZS 2566.1 REQUIREMENTS TO DETERMINE IF CONCRETE CAPPING OR ENCASING IS REQUIRED. IF PIPE LOADING CAPACITY IS ACCEPTABLE, JUSTIFICATION TO BE SUBMITTED TO QLDC FOR APPROVAL. IF PIPE LOADING CAPACITY IS EXCEEDED, CONCRETE CAPPING OR ENCASING IS REQUIRED.
2. FOR NON-FLEXIBLE PIPE DIAMETERS GREATER THAN 450mm OR FLEXIBLE PIPE DIAMETERS GREATER THAN 300mm SPECIAL DESIGN APPLIES.
3. WITH FLEXIBLE PIPES PROTECTION TO BE USED UNLESS OTHERWISE SPECIFIED.
4. PIPES IN TRAFFICABLE AREAS WITH LESS THAN 1.0 m COVER SHALL BE CONCRETE CAPPED, AND PIPES WITH LESS 0.6 m COVER SHALL BE CONCRETE ENCASED. THE CONCRETE ENCASEMENT SHALL BE REINFORCED CONCRETE AND STRUCTURALLY DESIGNED FOR REQUIRED DESIGN LOAD BY A STRUCTURAL ENGINEER.

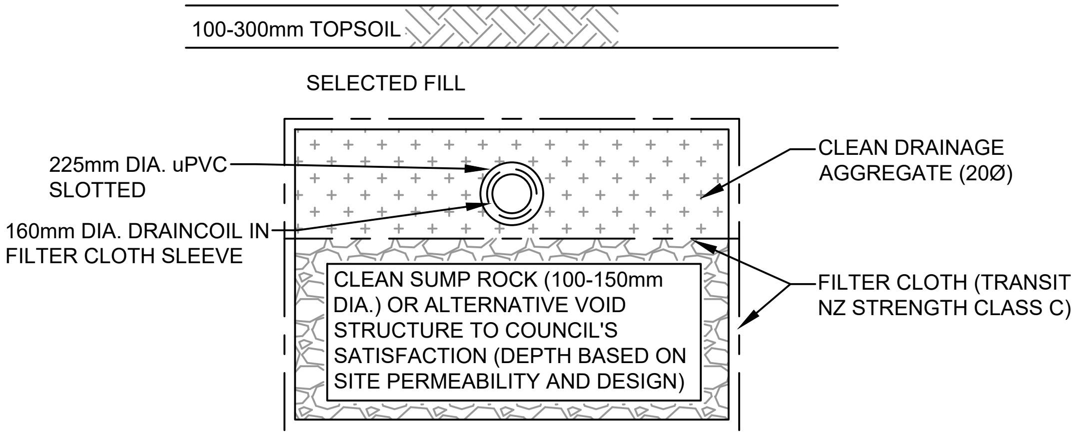


SIDE ELEVATION



PLAN

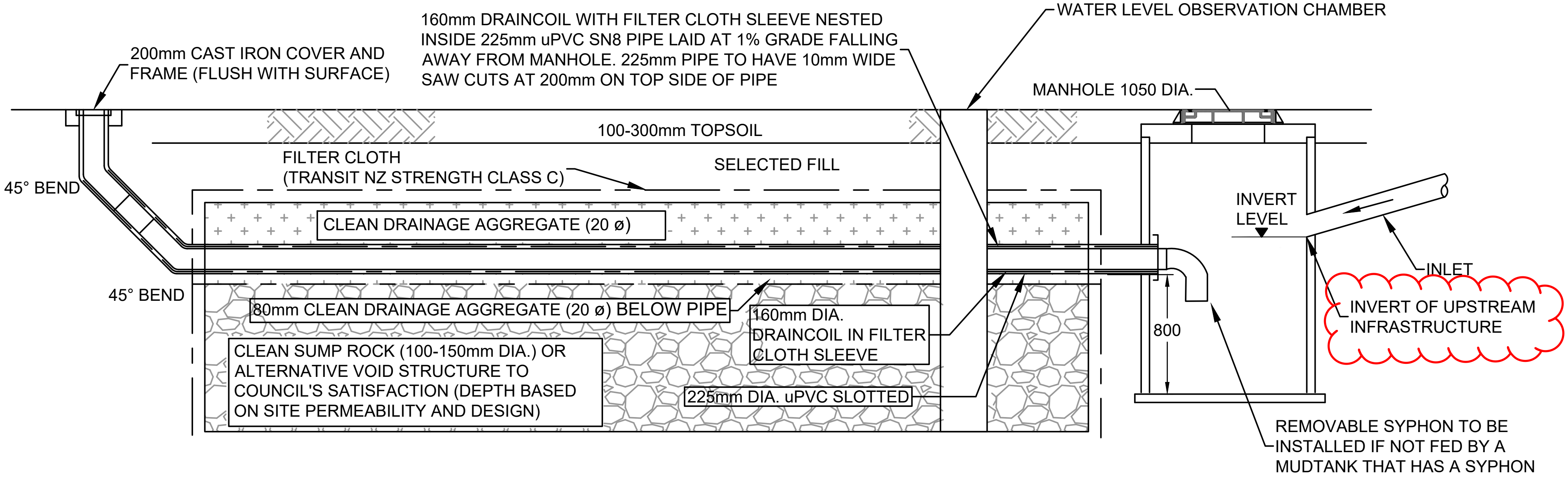
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Scruffy Dome Detail	NOT TO SCALE Drawing No. B4-3



STORMWATER SOAKAGE PIT TYPICAL SECTION END ELEVATION (ROAD CONNECTIONS)

NOTES:

1. DRAINCOIL IS TO BE REMOVABLE FROM WITHIN THE 225mm PIPE, ENABLING CLEANING/REPLACEMENT OF THE PIPE AND FILTER SLEEVE AS REQUIRED. CLEANING EYE ALLOWS FOR FLUSHING FROM EITHER END OF THE SYSTEM.
2. SOAKPIT DIMENSIONS TO BE DETERMINED BASED ON GROUND CONDITIONS AND SPECIFIC DESIGN.



STORMWATER SOAKAGE PIT TYPICAL SECTION SIDE ELEVATION (ROAD CONNECTIONS)

QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

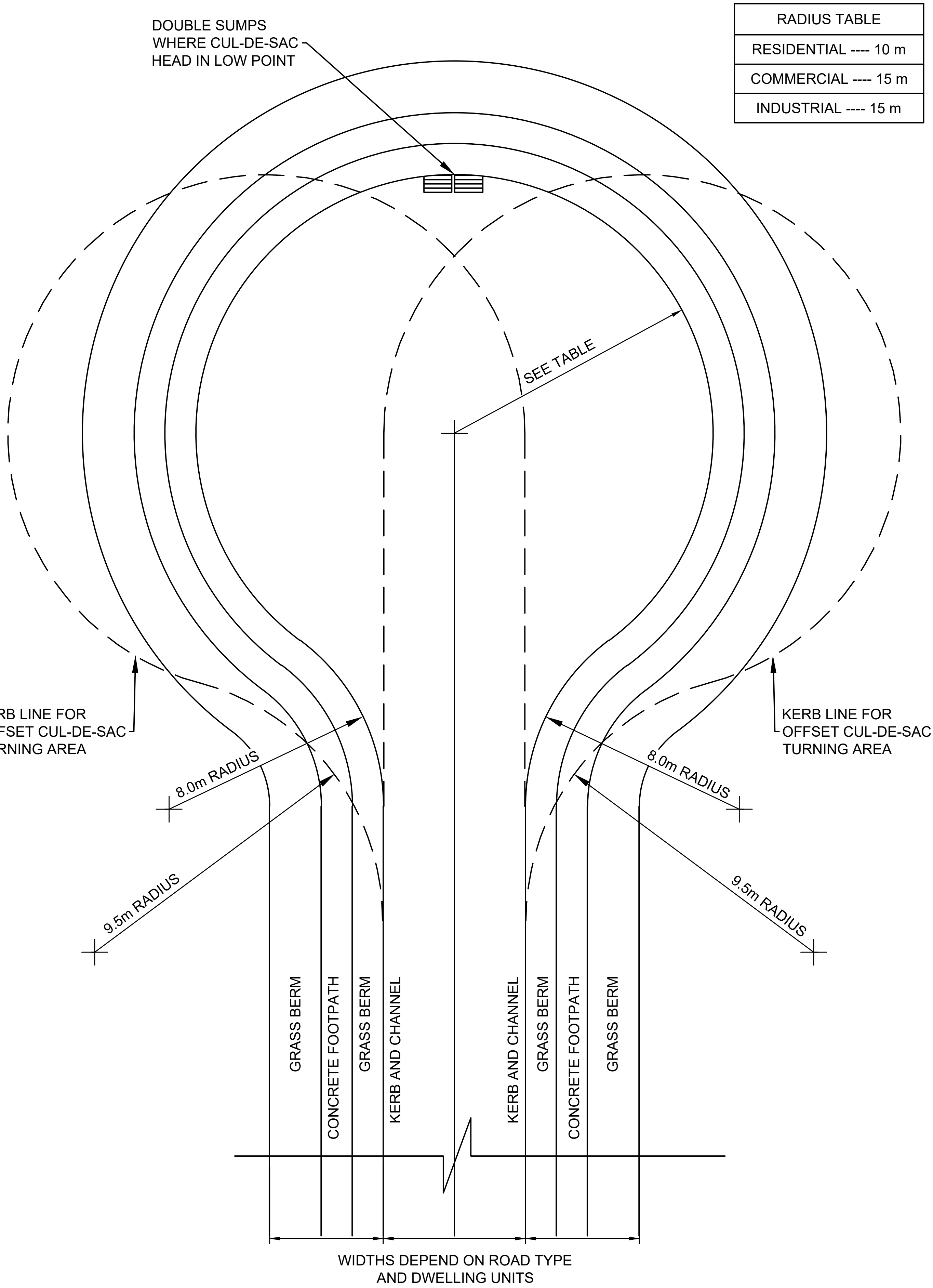
Drawing Title:

Soak Pit

NOT TO SCALE

Drawing No.

B4-4



QLDC LDSC 2025
Standard Details

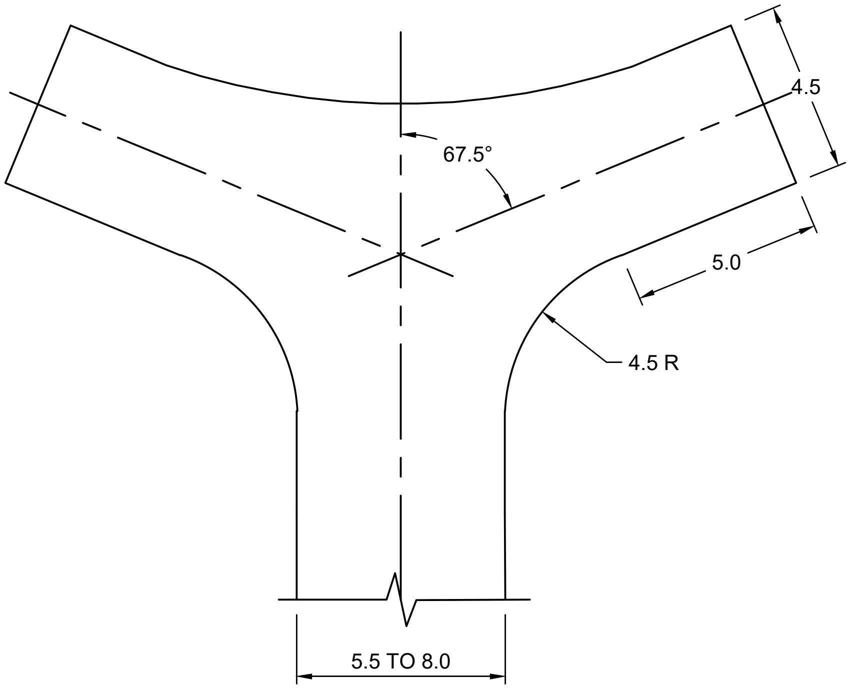
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

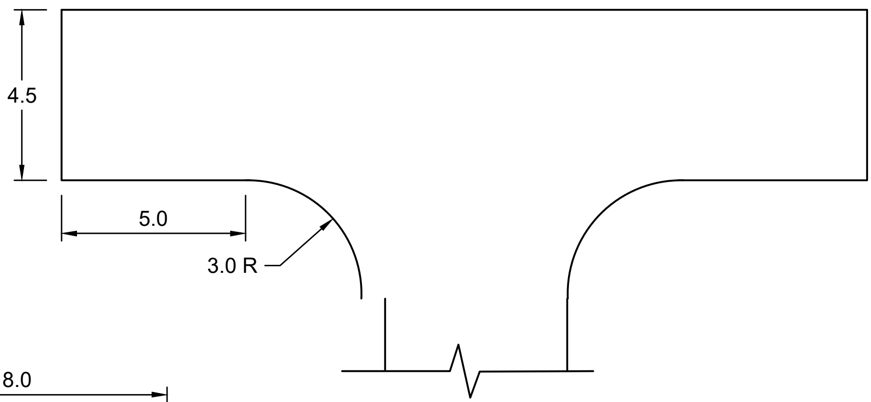
Drawing Title:
Dimensions of No-Exit Road Turning Areas

NOT TO SCALE

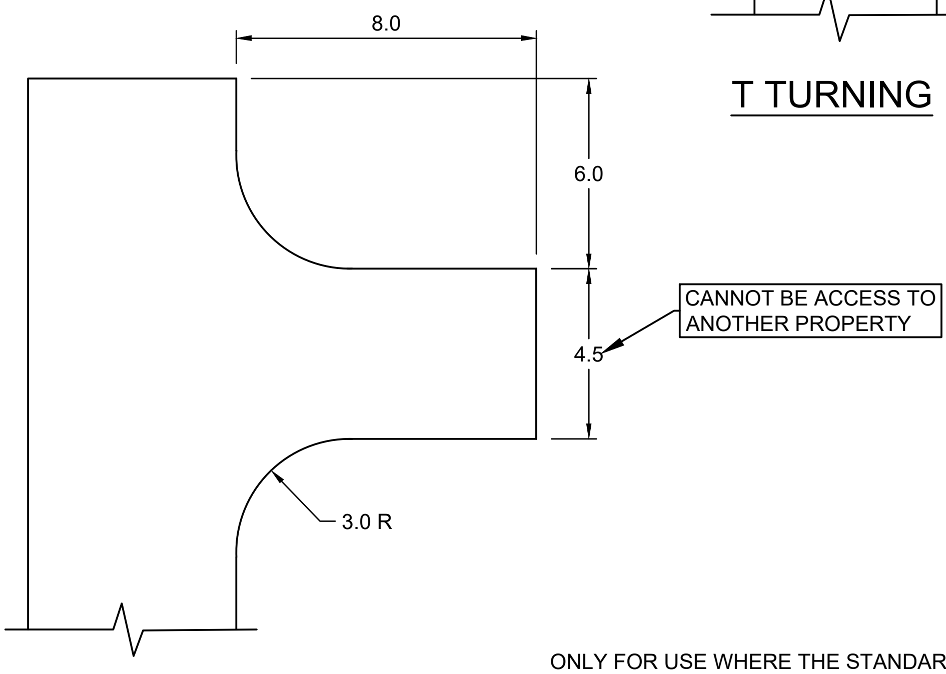
Drawing No.
B5-1



Y TURNING



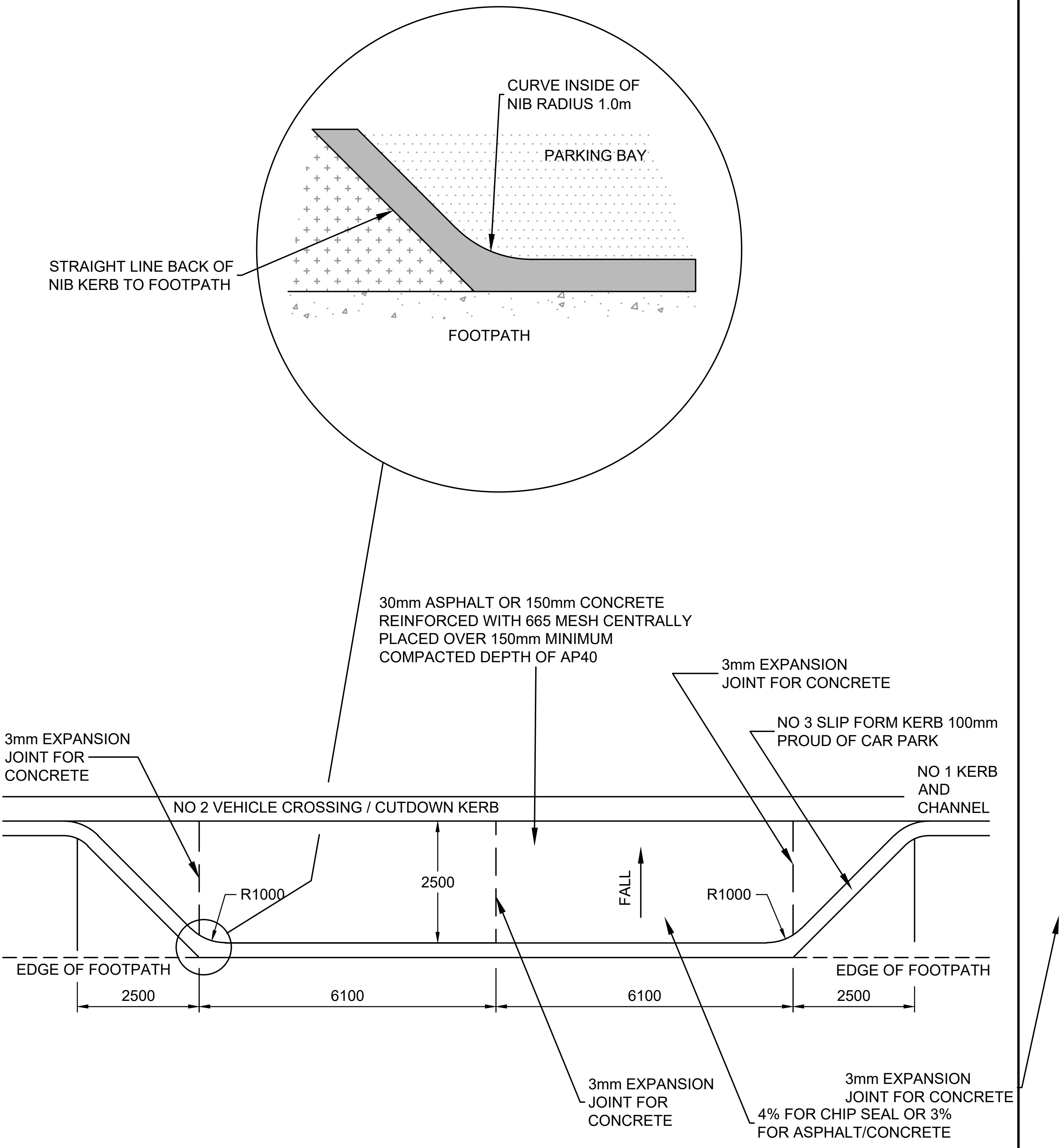
T TURNING



L TURNING

ONLY FOR USE WHERE THE STANDARD CIRCULAR HEAD IS UNSUITABLE OR WHERE APPROVED BY COUNCIL.

ALL DIMENSIONS ARE IN METRES.



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

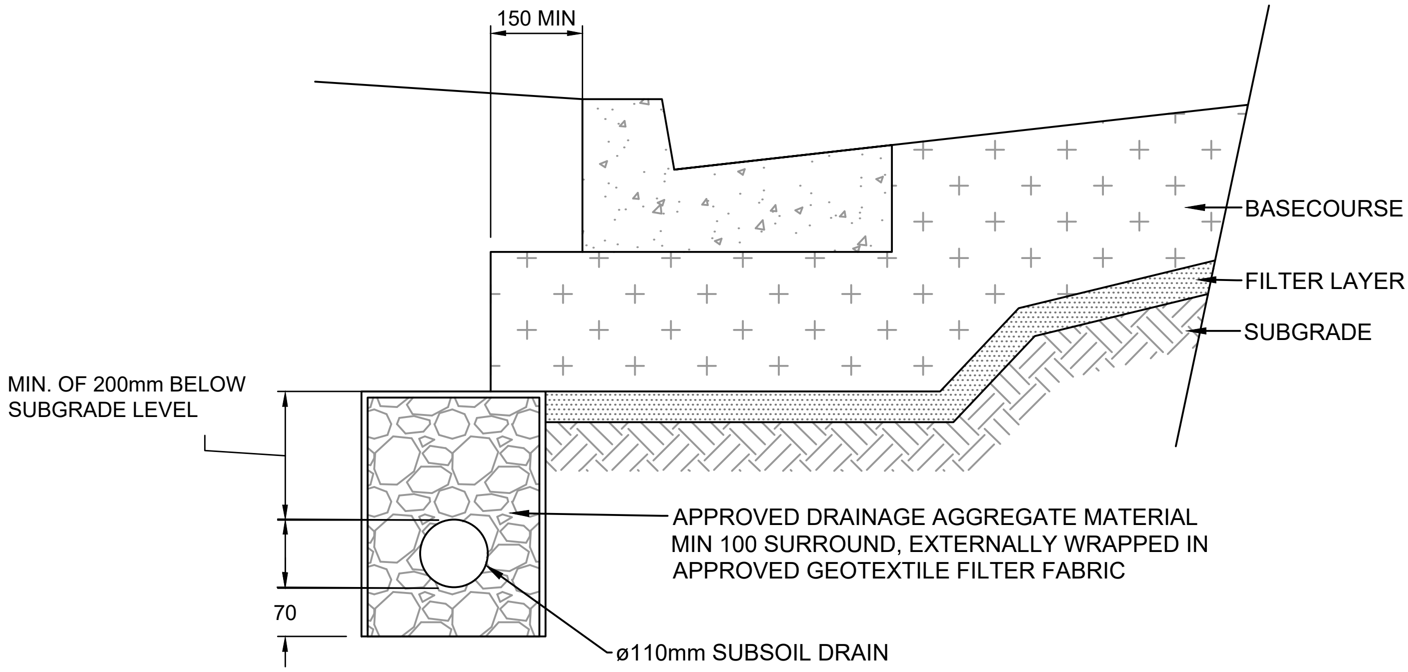
Drawing Title:

Parking Bay

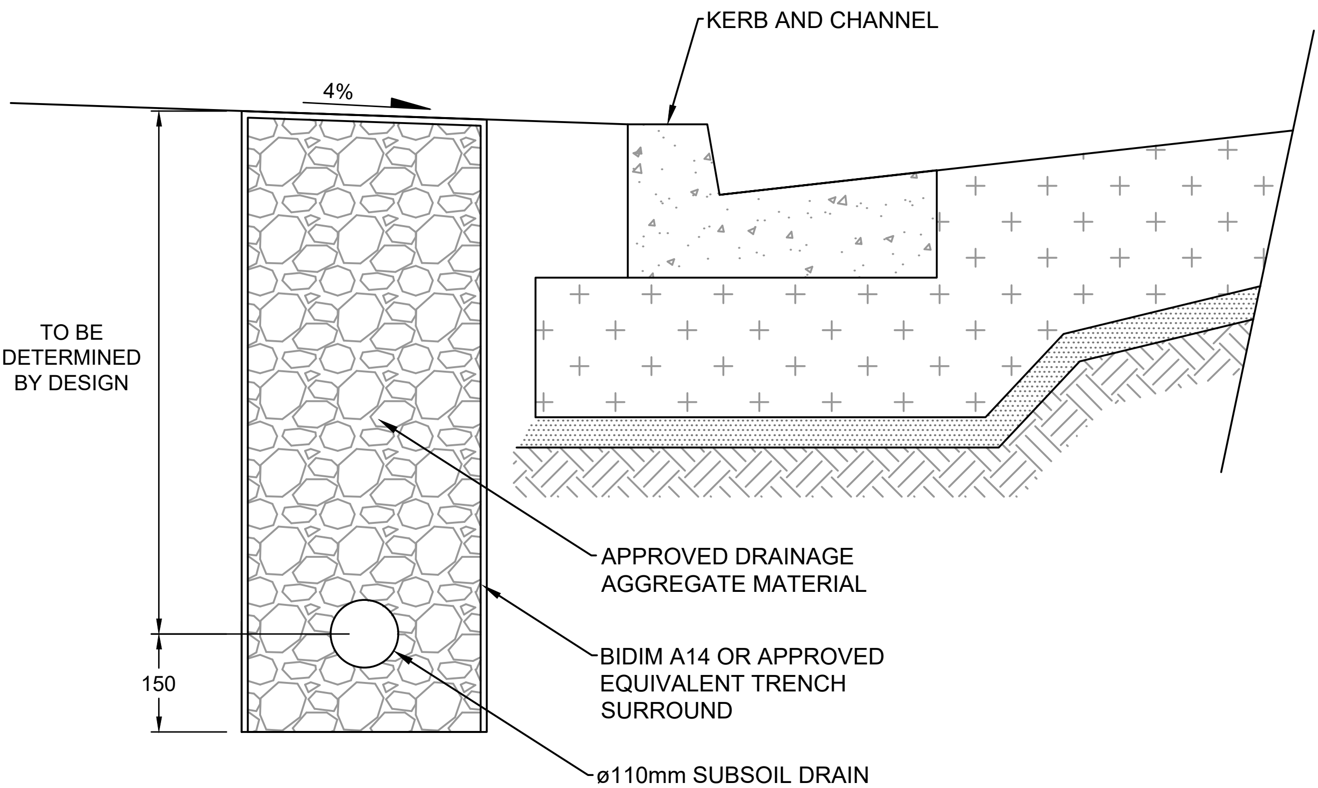
NOT TO SCALE

Drawing No.

B5-3



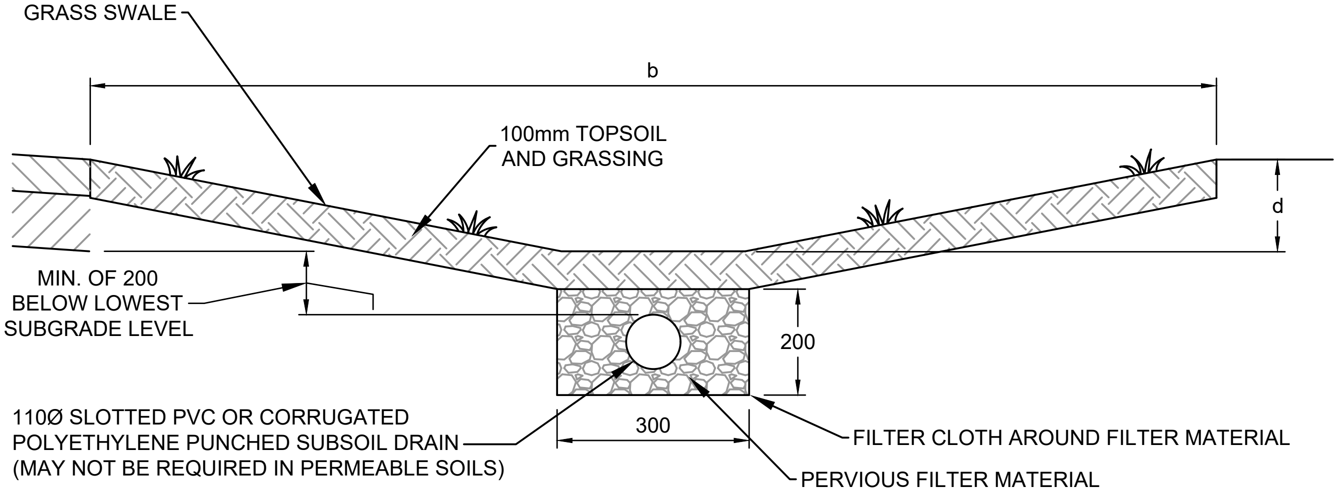
UNDER KERB DRAINAGE



SURFACE WATER CUT-OFF DRAIN

ALL DIMENSIONS ARE IN MILLIMETRES

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Subsoil Drains - Roadside	NOT TO SCALE Drawing No. B5-4

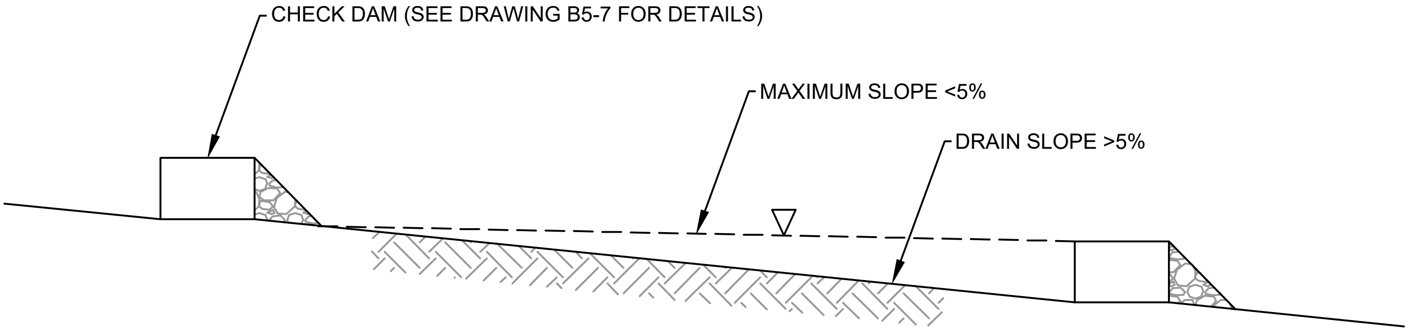


SWALE CROSS SECTION

NOTES:

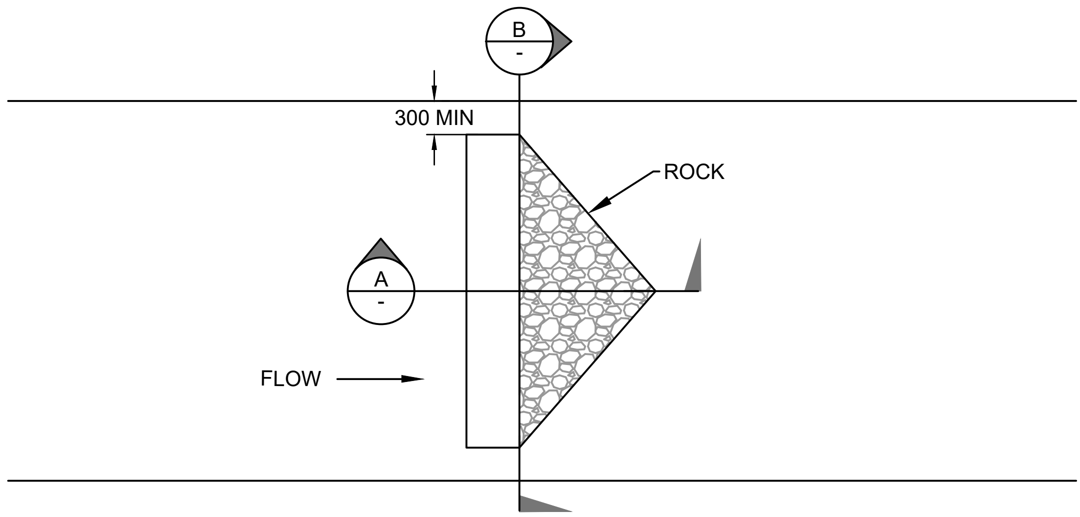
1. EFFECTIVE CATCHMENT AREA DRAINED = IMPERVIOUS AREA + 0.72 x PERVIOUS AREA.
2. MAXIMUM SWALE SLOPE UP TO 5%. STEEPER SWALES REQUIRE CHECK DAMS (SEE DRAWING B5-6 AND DRAWING B5-7).
3. DIMENSIONS 'b' AND 'd' TO BE SIZED FOR CONVEYANCE OF 5% AEP EVENT.
4. EXISTING GROUND IS REGRADED, COMPACTED, TOPSOILED (100mm DEPTH), AND GRASSED.
5. SIDE SLOPES NO STEEPER THAN 1v:4h IF PLANTED (NOT MOWN).
6. SIDE SLOPES NO STEEPER THAN 1v:5h IF GRASSED (MOWN).

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Swale Detail	NOT TO SCALE Drawing No. B5-5

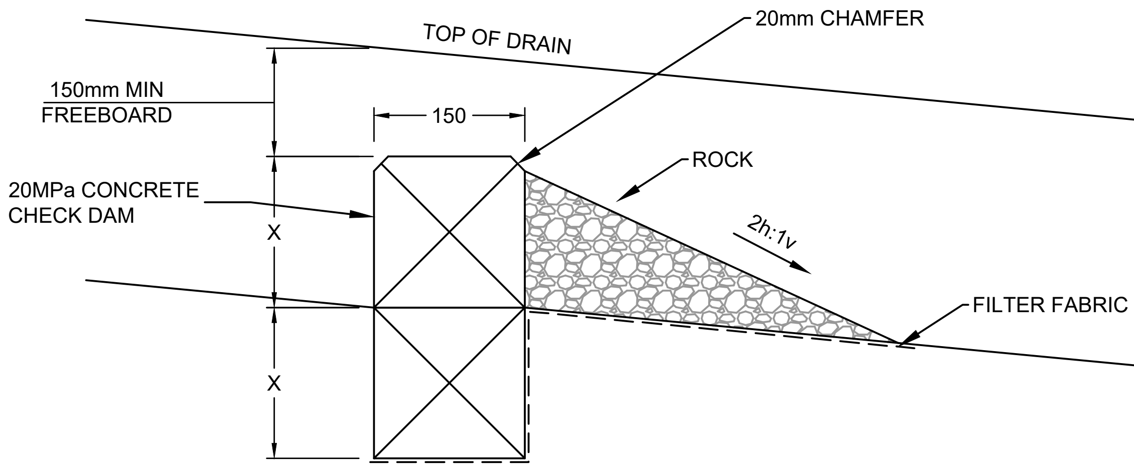


LOCATION OF CHECK DAMS IN SWALES

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Swale Detail (When Check Dams Required)	NOT TO SCALE Drawing No. B5-6

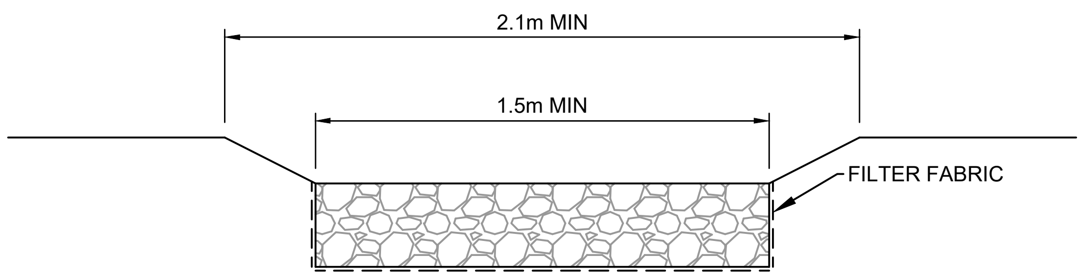


TYPICAL PLAN



ELEVATION A

ROCK TO BE SCORIA GRADED CLEAN (SGC) 75-70 OR EQUIVALENT.
FILTER FABRIC TO BE BIDIM A14 OR EQUIVALENT.



ELEVATION B

QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

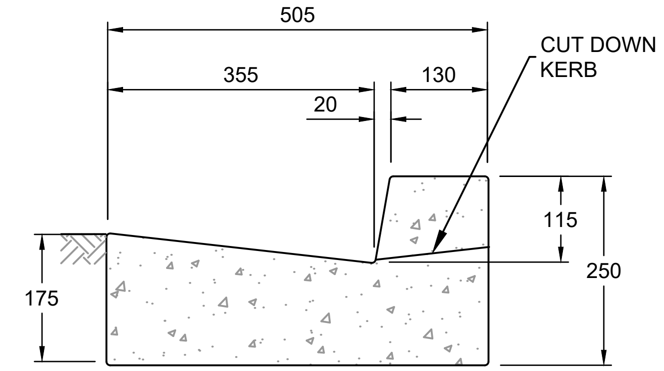
Drawing Title:

Typical Check Dam Detail

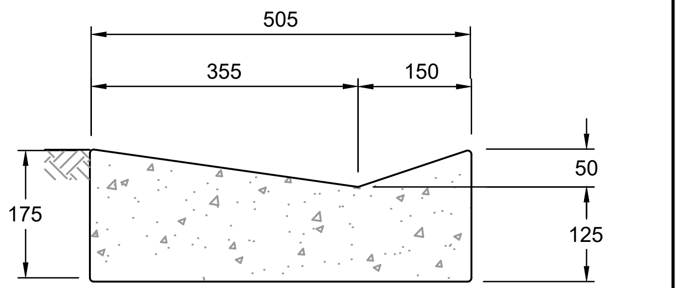
NOT TO SCALE

Drawing No.

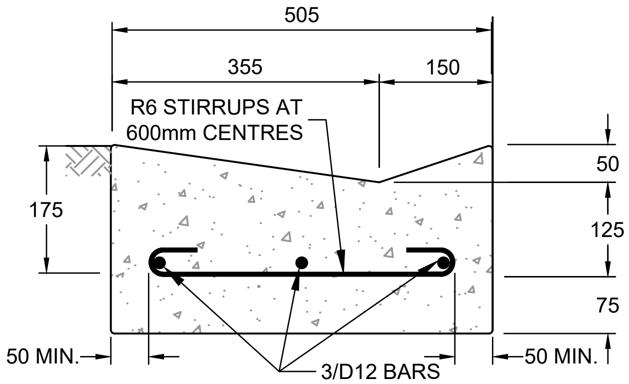
B5-7



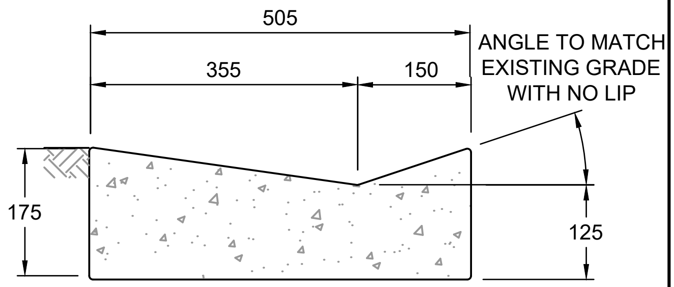
No. 1a KERB & CHANNEL



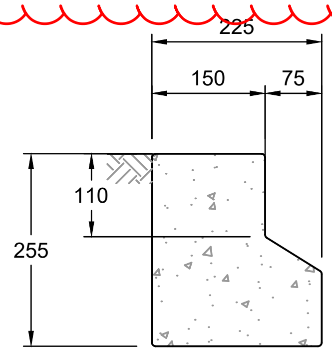
No. 2 VEHICLE CROSSING



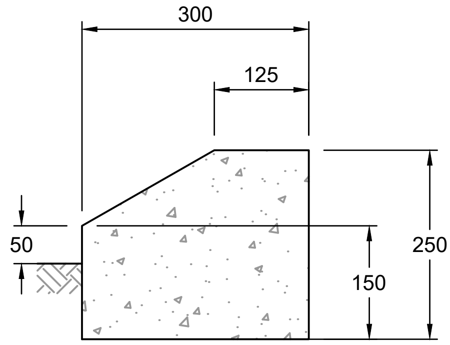
No. 2A COMMERCIAL VEHICLE CROSSING



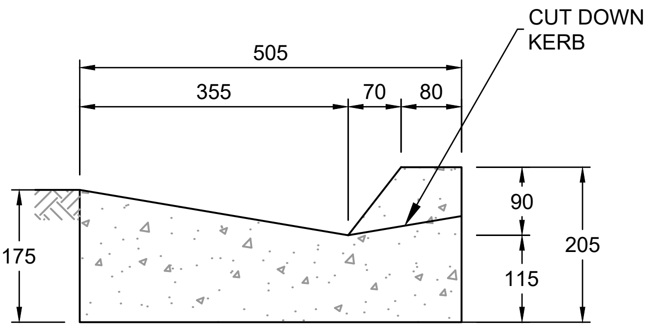
No. 2B CYCLIST/PRAM DROP DOWN



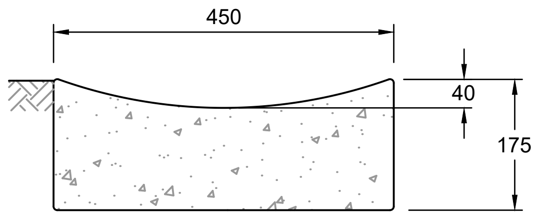
No. 3 SLIP FORM KERB



No. 5 MOUNTABLE KERB



No. 8 MOUNTABLE KERB & CHANNEL



No. 16 DISH CHANNEL

NOTE: KERB AND CHANNELS TO HAVE 200mm MIN. DEPTH OF COMPACTED AP40 BASECOURSE OR GAP65 SUBBASE UNDER THEM

QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

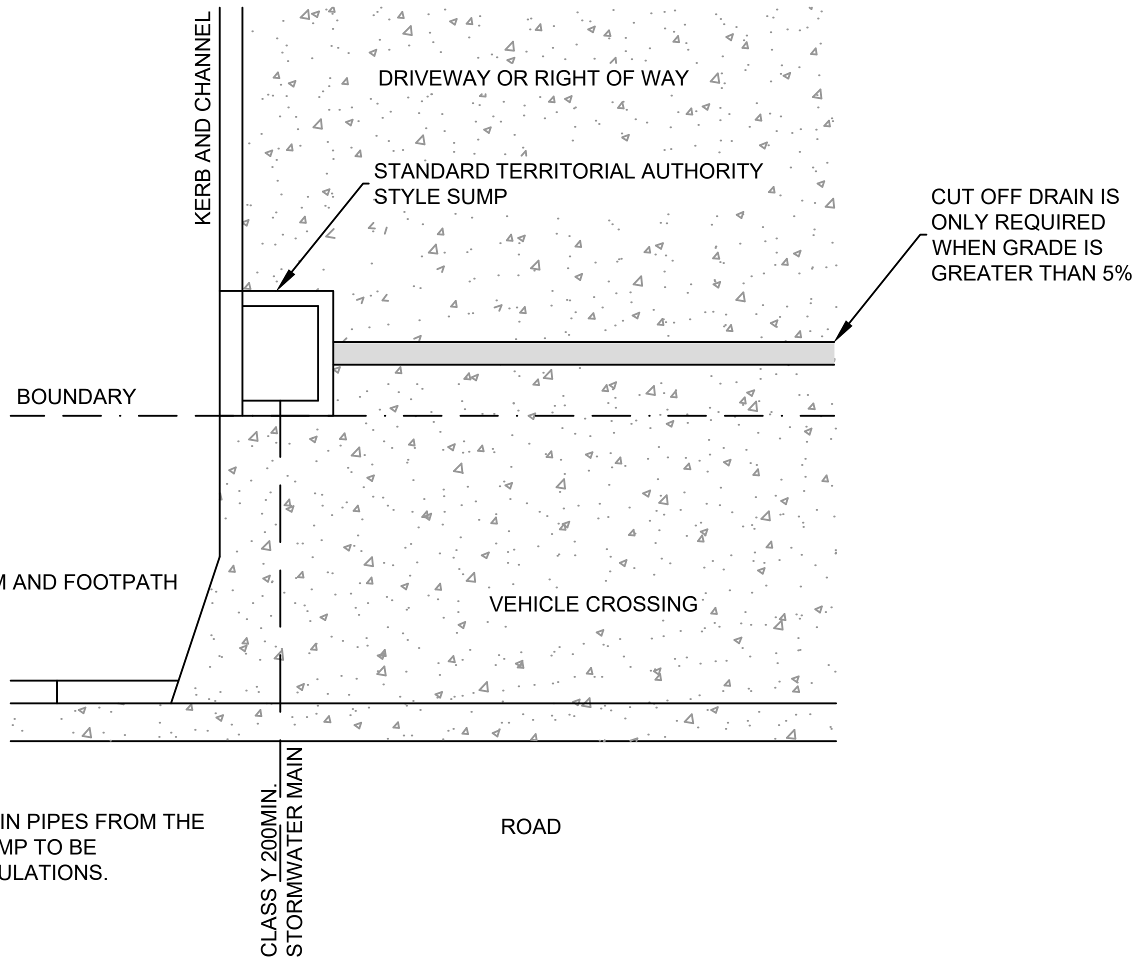
Drawing Title:

Kerbs and Dished Channels

NOT TO SCALE

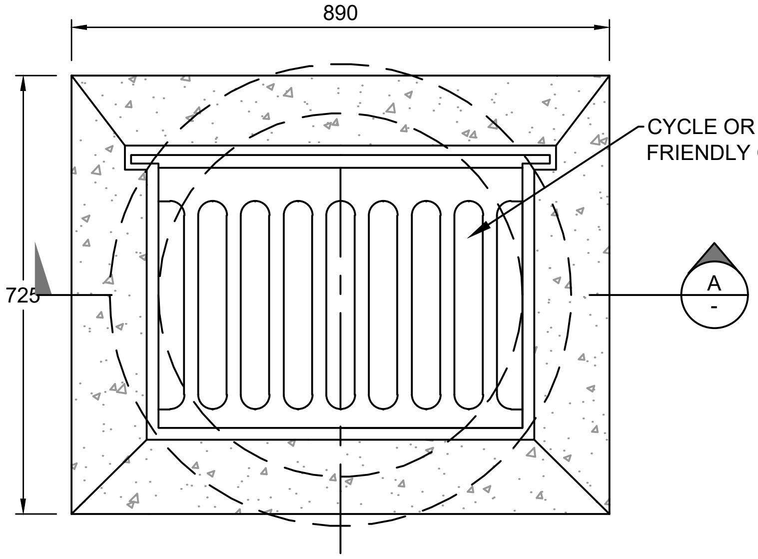
Drawing No.

B5-8

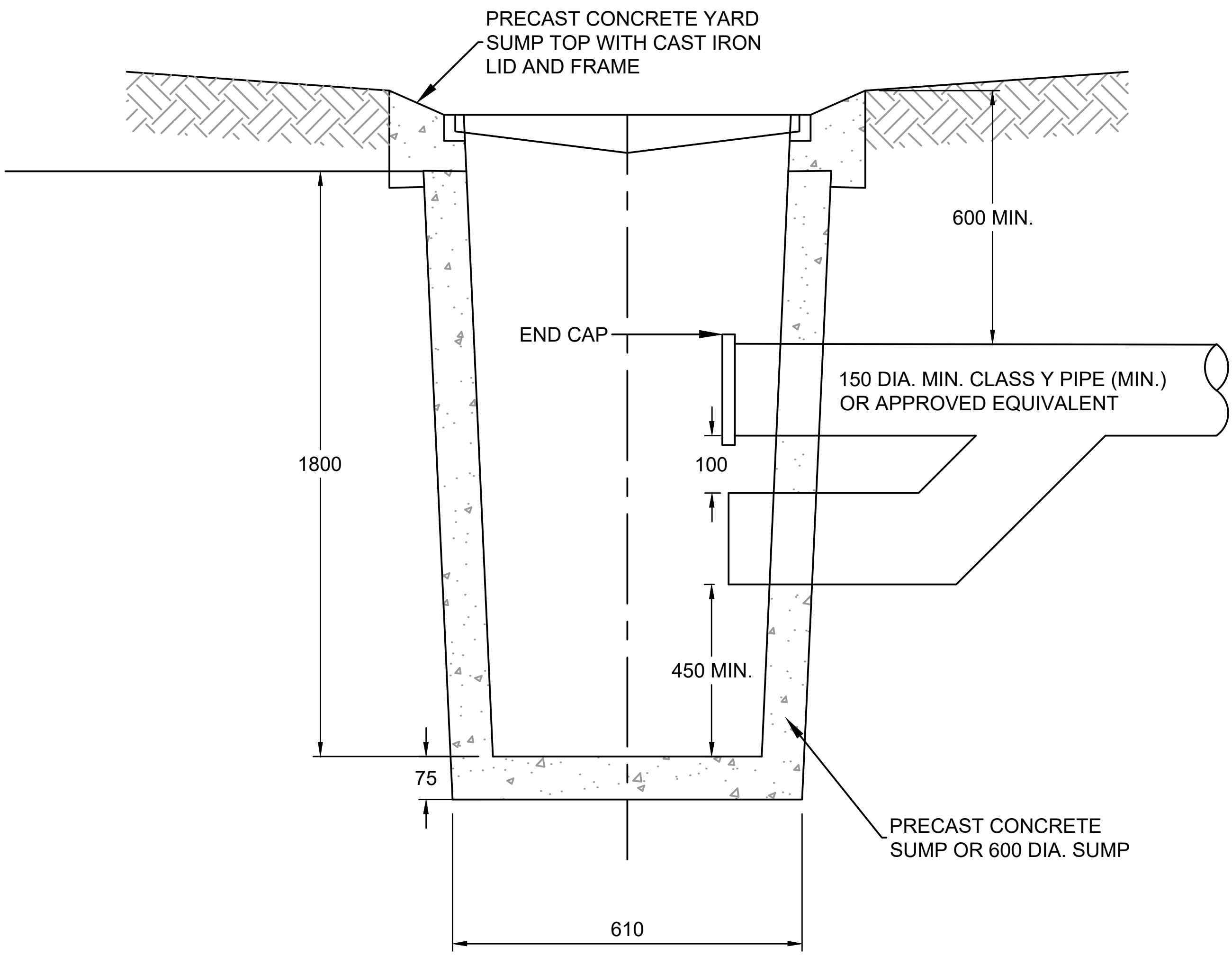


NOTES:

1. USE OF SINGLE OR TWIN PIPES FROM THE PROPERTY TO THE SUMP TO BE DETERMINED BY CALCULATIONS.

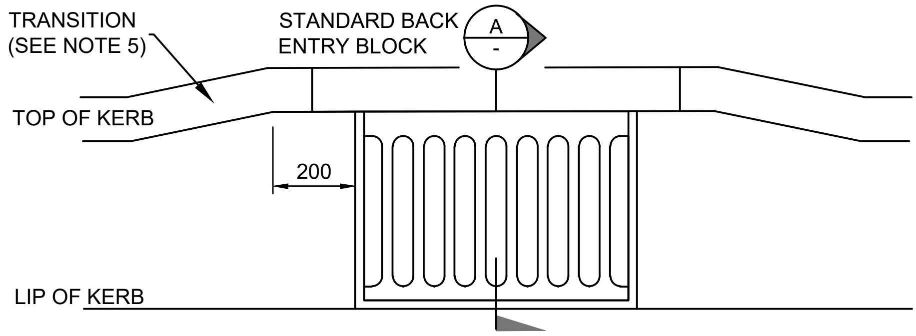


PLAN

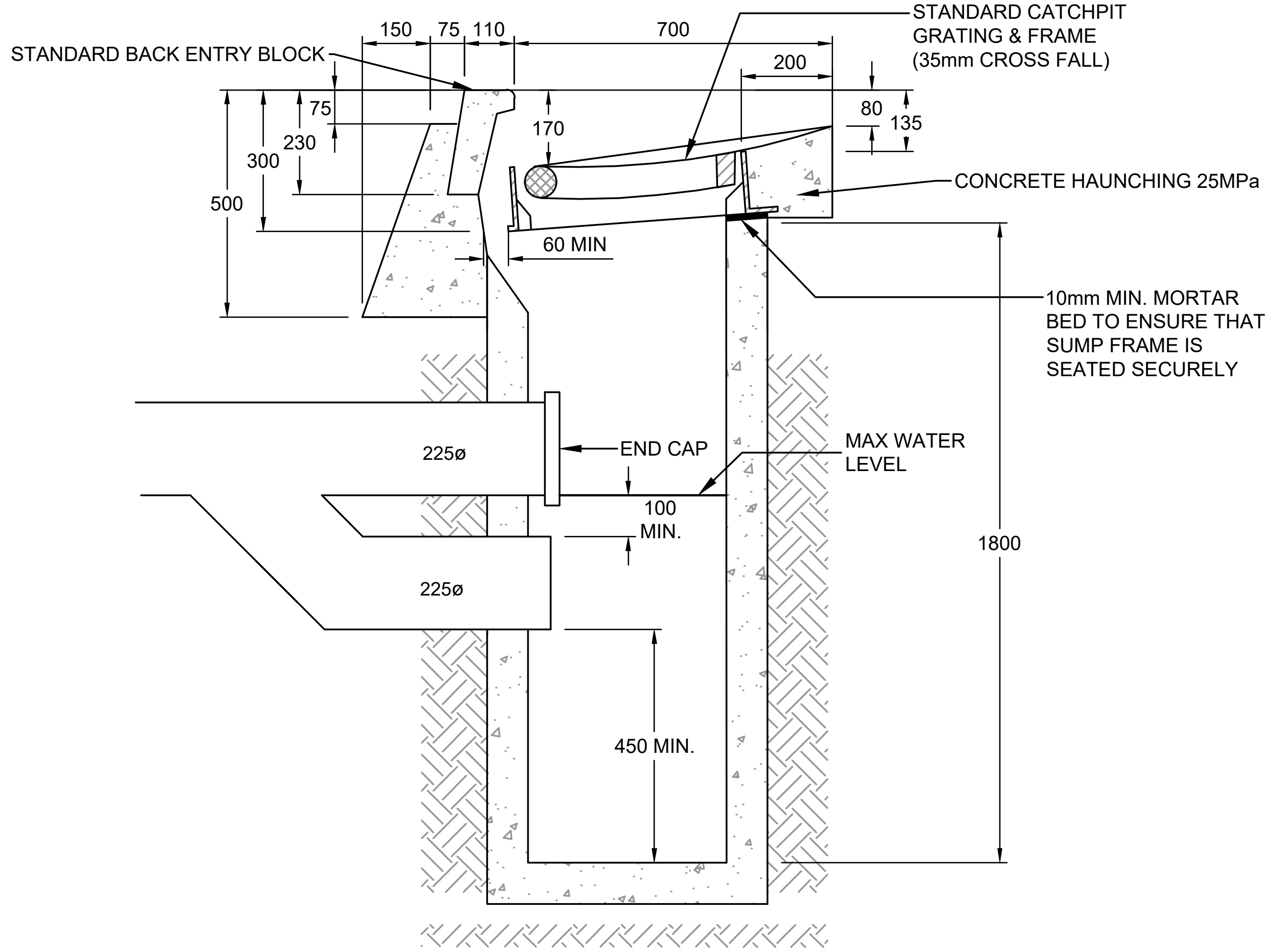


SECTION A

NOTE:
1. SUMP OUTLET MAY BE 150 DIA. IN PRIVATE PROPERTY
2. ALL DIMENSIONS ARE IN MILLIMETRES



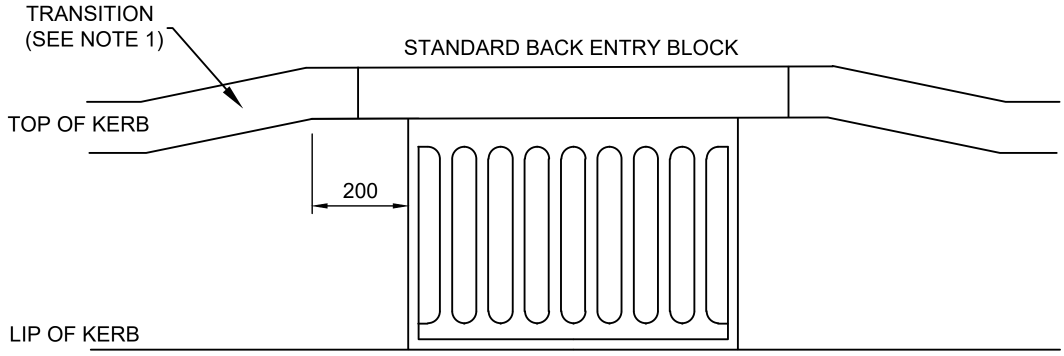
STANDARD SUMP IN CHANNEL



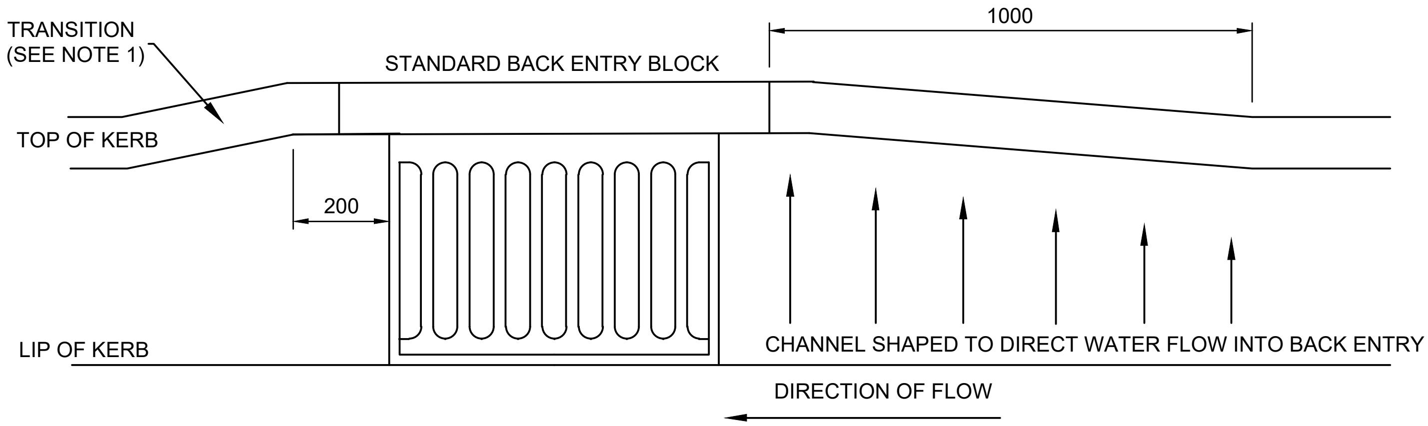
SECTION A

NOTE:

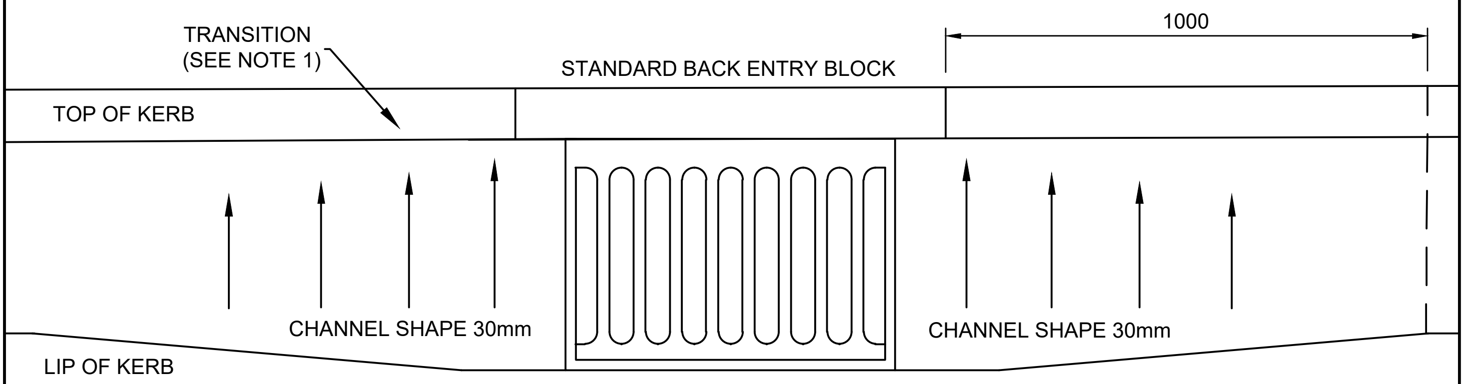
1. ROAD SUMPS TO BE PLACED AT 90m (MAX.) INTERVALS.
2. DOUBLE SUMPS TO BE INSTALLED IN PLACE OF SINGLE SUMPS:
   A. UNDER VERTICAL CURVES IN ROADS
   B. ON ALL ROADS WITH VERTICAL GRADIENTS EXCEEDING 10%. SPECIFIC DESIGN REQUIRED WHERE GRADIENT EXCEEDS 12%.
3. SUMP LEADS TO INTERSECT SIDE OR BACKWALL OF SUMP BOX AT 90°.
4. SITE-SPECIFIC DESIGN REQUIRED TO REDUCE SYPHON FROM 225ø DOWN TO 150ø.
5. WHERE GRADIENTS EXCEED 10%, CHANNEL TRANSITION INTO DOUBLE MUDTANK TO BE 800mm AND CHANNEL TO BE FORMED DIRECTLY INTO BACK ENTRY.
6. TO BE USED WHERE BACK OF KERB IS NOT DIRECTLY ADJACENT TO THE FOOTPATH.
7. ALL SUMPS SHOULD BE 1800mm DEPTH.
8. A MINIMUM SEDIMENT STORAGE DEPTH OF 450mm IS TO BE PROVIDED (TO INVERT OF PIPE).
9. REDUCED COVER WHERE THE LEADS LEAVE THE MUD SUMP IS ACCEPTABLE. THIS SHOULD NOT REDUCE BELOW A MINIMUM OF 600mm COVER TO PIPE.
10. THE LENGTH OF PIPE WITH REDUCED COVER SHOULD BE MINIMISED AND AVOID EXTENDING INTO THE WHEEL TRACKS AS FAR AS POSSIBLE.



STANDARD ROAD SUMP



ROAD SUMP IN HILLSIDE CHANNEL

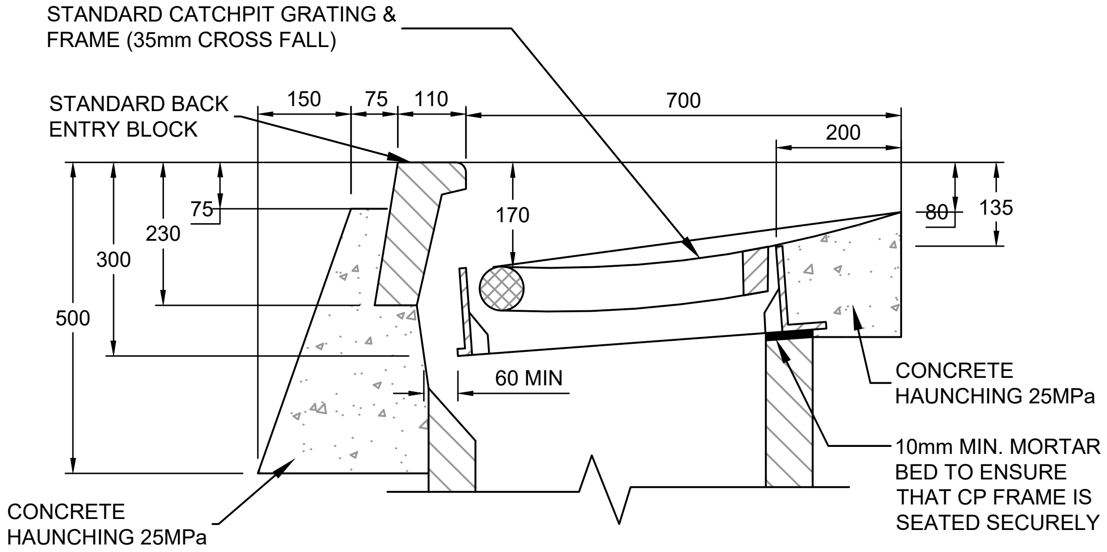


ROAD SUMP DETAIL WHERE NO VERGE

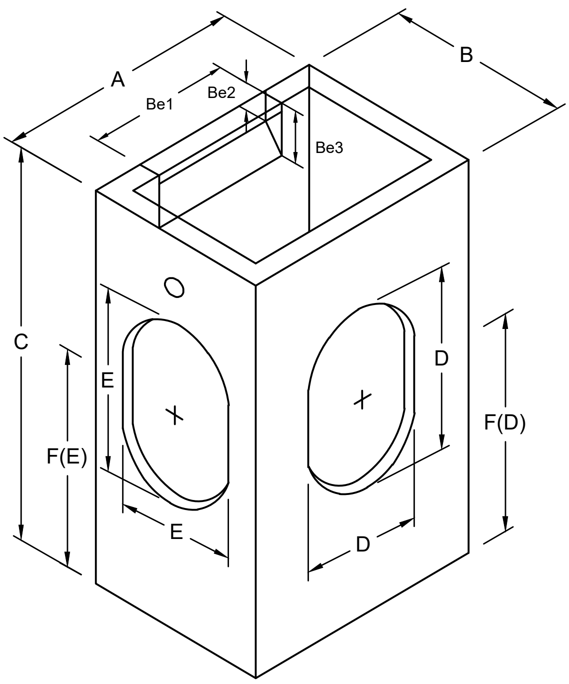
(BACK OF KERB AGAINST FOOTPATH)

NOTE:

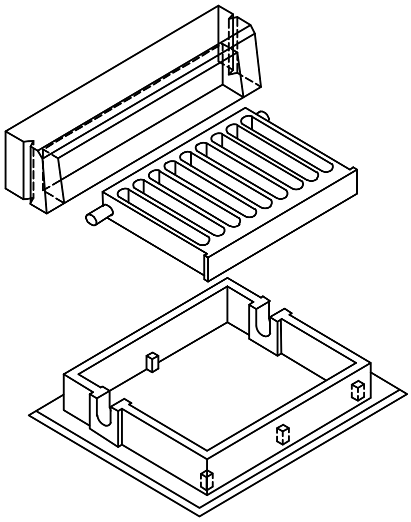
1. WHERE GRADIENTS EXCEED 10%, CHANNEL TRANSITION INTO DOUBLE MUDTANK TO BE 800MM AND CHANNEL TO BE FORMED DIRECTLY INTO BACK ENTRY.

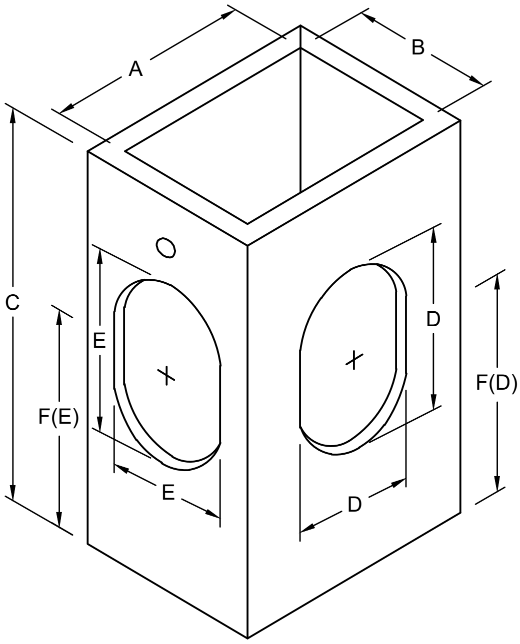


SECTION THROUGH GRATE



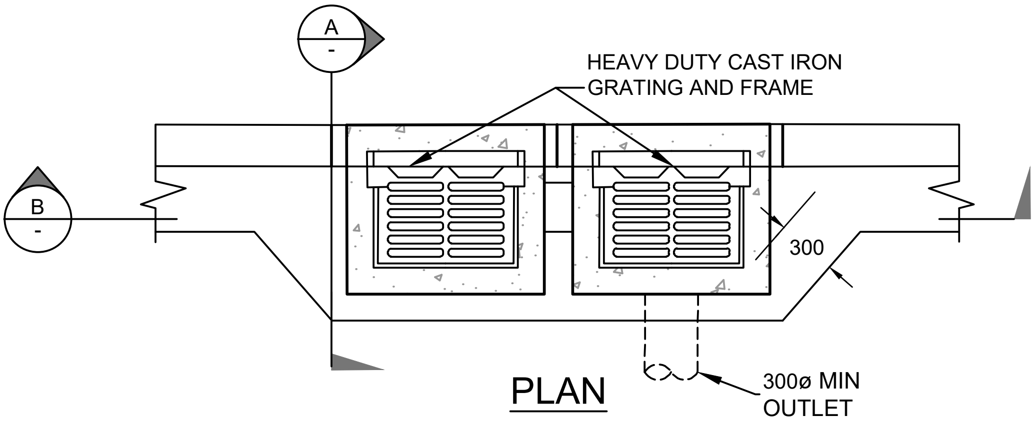
BACK ENTRY SUMP ISOMETRIC VIEW



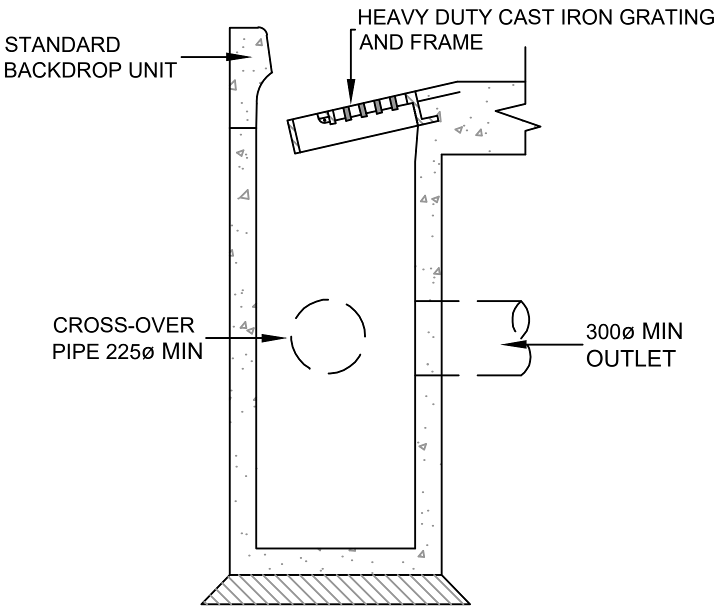


NOTES:
1. DIMENSIONS PER MANUFACTURER'S SPECIFICATIONS.
2. ALL SUMPS SHALL BE A MINIMUM OF 1800 DEPTH.

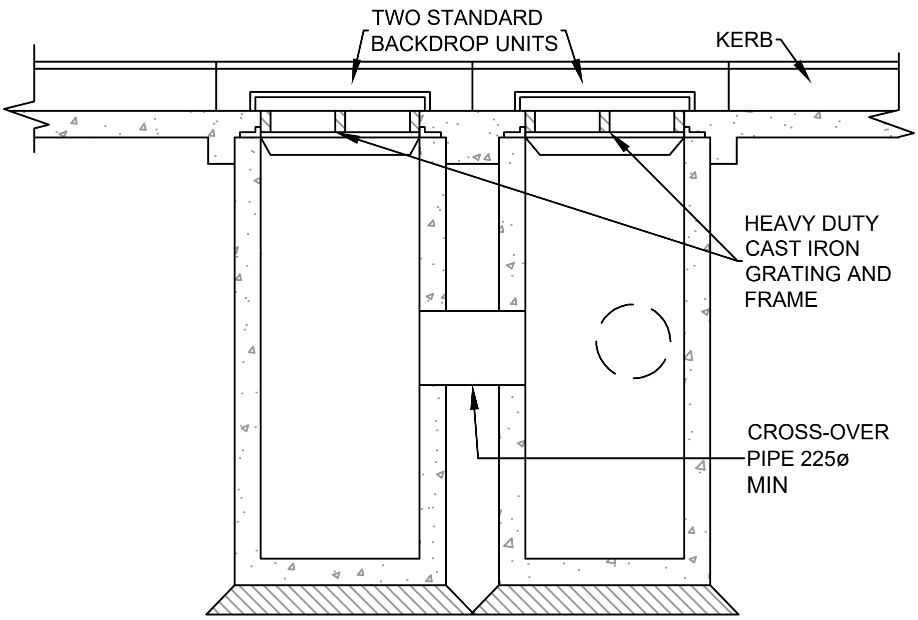
FLAT TOP SUMP ISOMETRIC VIEW



PLAN

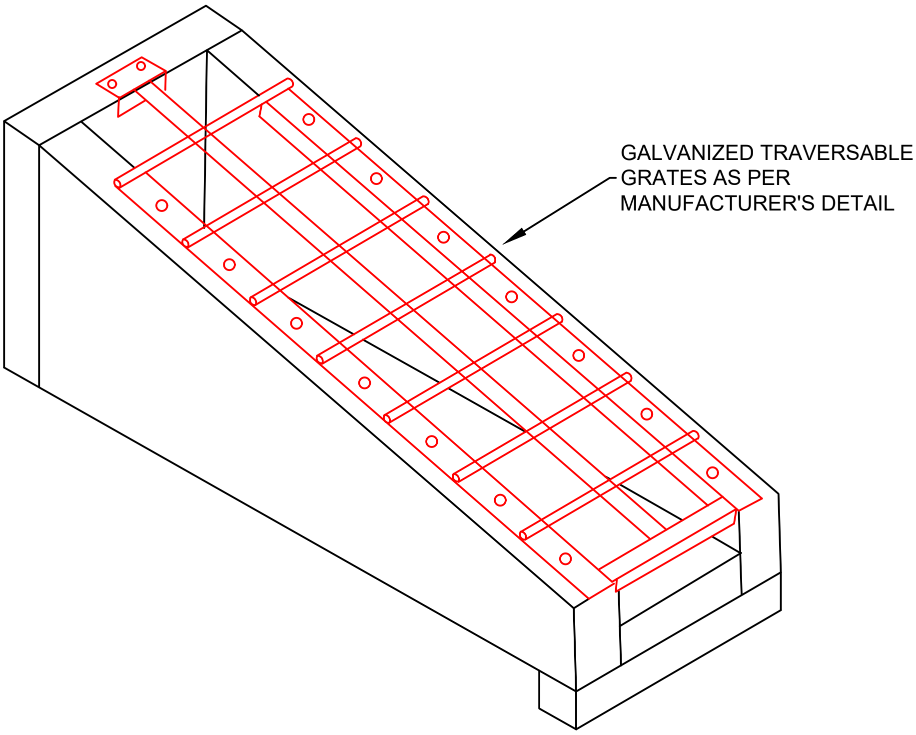


SECTION A



SECTION B

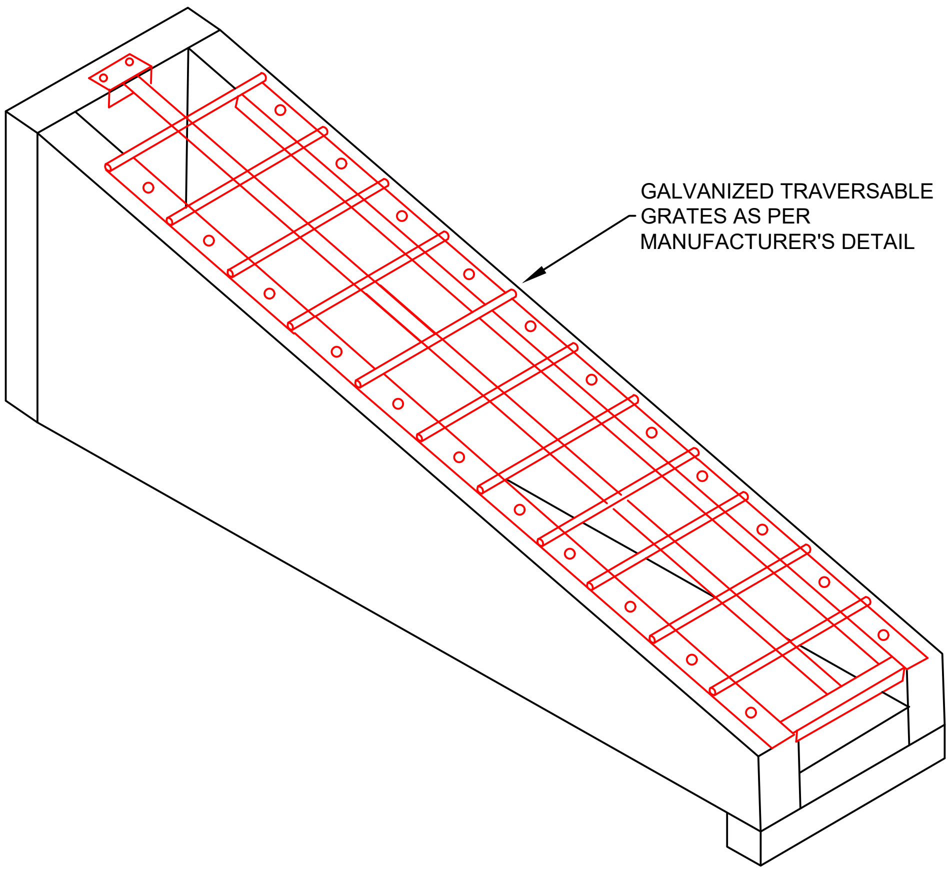
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Double Back-Entry Sump for Road Low Points and Alternative	NOT TO SCALE Drawing No. B5-14



ISOMETRIC VIEW

NOTES:

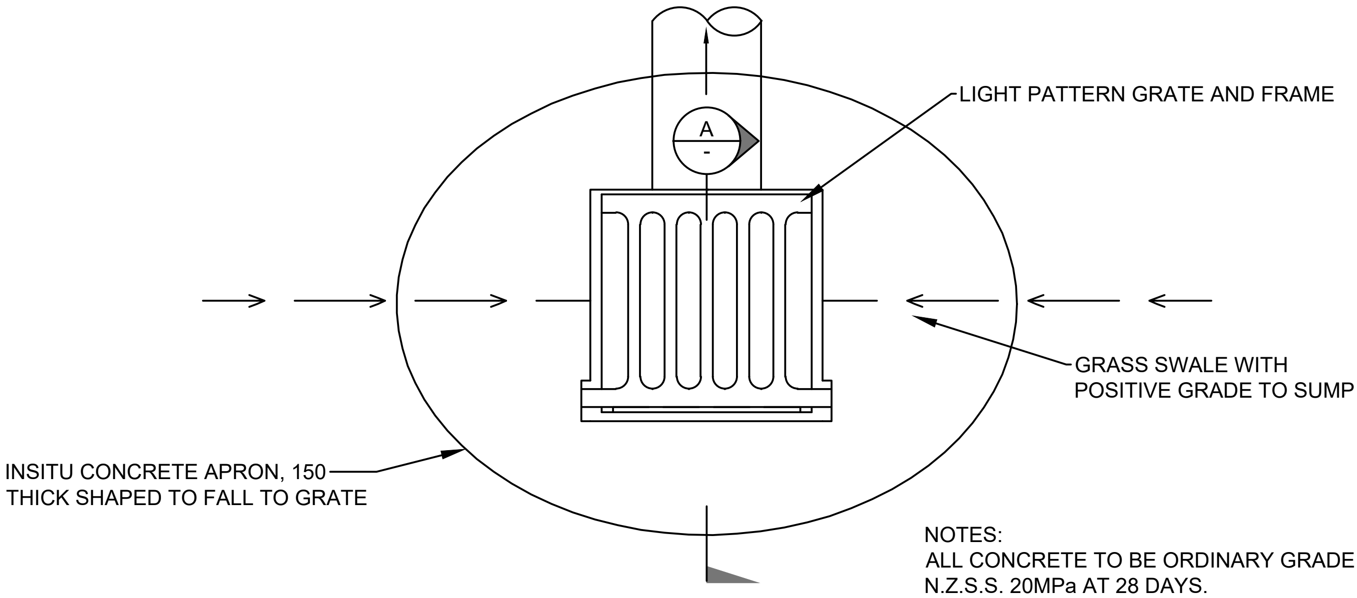
1. IT IS RECOMMENDED THAT THE GRATES ARE SOURCED FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL TO ENSURE THE GRATE AND HEADWALL ARE COMPATIBLE. OTHERWISE GUIDANCE SHOULD BE SOUGHT FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL ON THE REQUIRED DIMENSIONS FOR ANY GRATES NOT SUPPLIED BY THEM.
2. THE CLEAR WIDTH BETWEEN SIDE WALLS OF PRECAST CULVERT HEADWALLS SHALL NOT EXCEED 600mm WHEN USING THIS GRATE.
3. MATERIAL SPECIFICATIONS FOR THE FOLLOWING ITEMS:
   STEEL GALVANIZED ANGLES - AS/NZS 3679.1:1996 HOT ROLLED BARS AND SECTIONS REINFORCING BARS - AS/NZS 4671:2001
   STEEL REINFORCING MATERIALS GALVANIZING - AS/NZS 4680:2006 HOT DIP GALVANIZING (ZINC) COATINGS ON FABRICATED FERROUS ARTICLES



ISOMETRIC VIEW

NOTES:

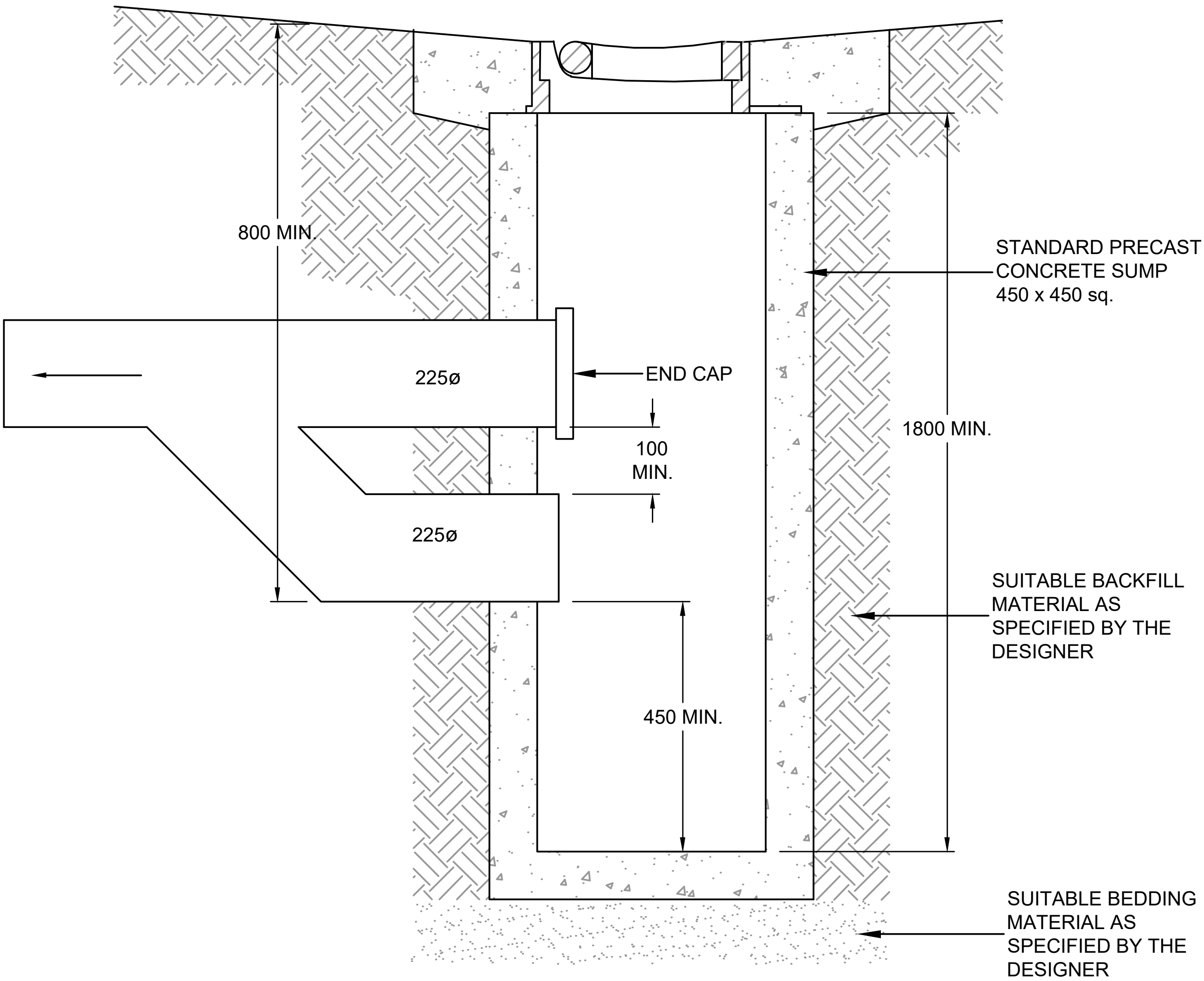
1. IT IS RECOMMENDED THAT THE GRATES ARE SOURCED FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL TO ENSURE THE GRATE AND HEADWALL ARE COMPATIBLE. OTHERWISE GUIDANCE SHOULD BE SOUGHT FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL ON THE REQUIRED DIMENSIONS FOR ANY GRATES NOT SUPPLIED BY THEM.
2. THE CLEAR WIDTH BETWEEN SIDE WALLS OF PRECAST CULVERT HEADWALLS SHALL NOT EXCEED 600mm WHEN USING THIS GRATE.
3. MATERIAL SPECIFICATIONS FOR THE FOLLOWING ITEMS:
   STEEL GALVANIZING ANGLES - AS/NZS 3679.1:1996 HOT ROLLED BARS AND SECTIONS REINFORCING BARS - AS/NZS 4671:2001 STEEL REINFORCING MATERIALS GALVANIZING - AS/NZS 4680:2006 HOT DIP GALVANIZING (ZINC) COATINGS ON FABRICATED FERROUS ARTICLES.



PLAN

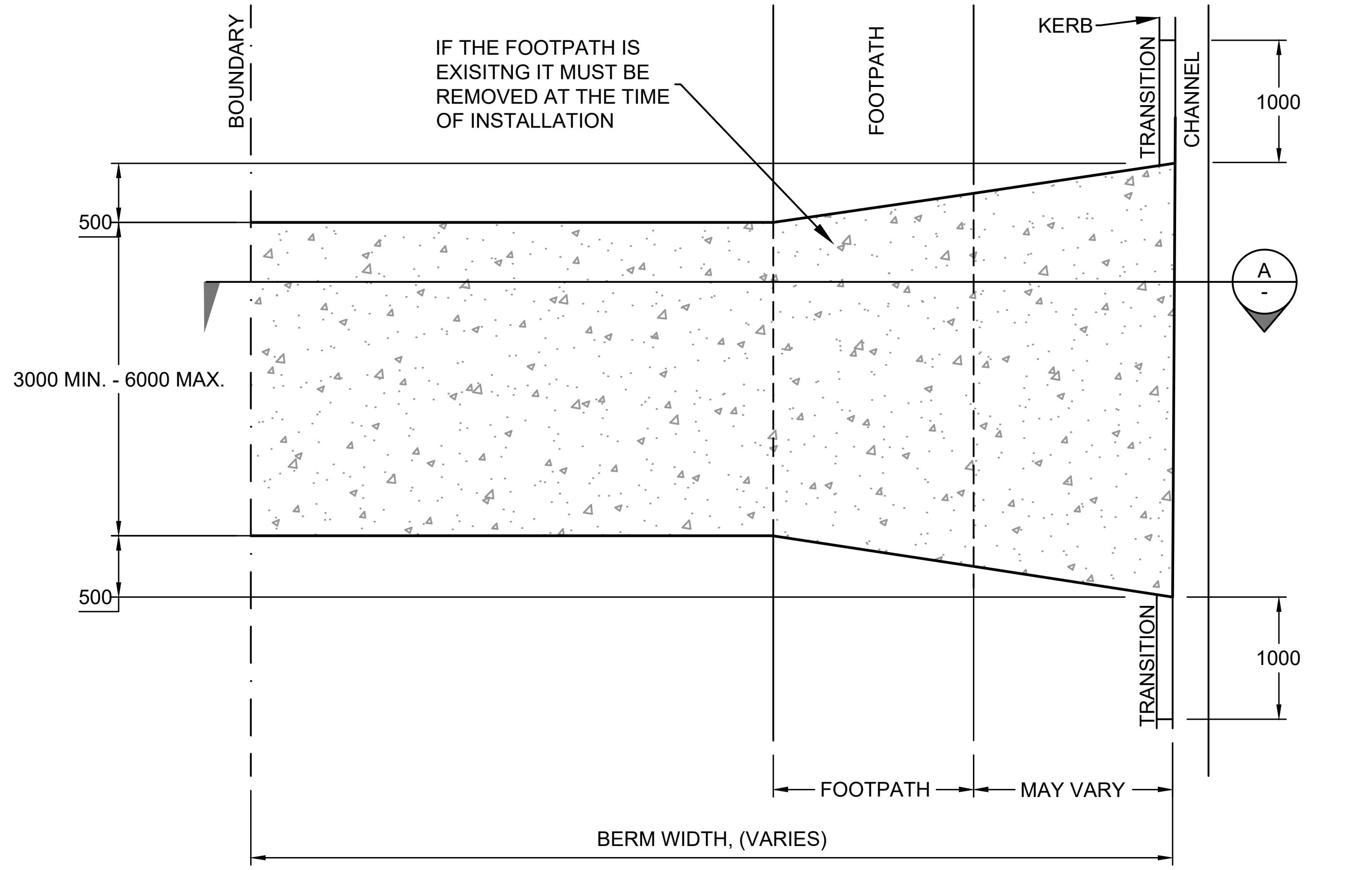
NOTES:
ALL CONCRETE TO BE ORDINARY GRADE N.Z.S.S. 20MPa AT 28 DAYS.

ALL PIPES TO BE FINISHED FLUSH WITH INSIDE WALL OF SUMP.

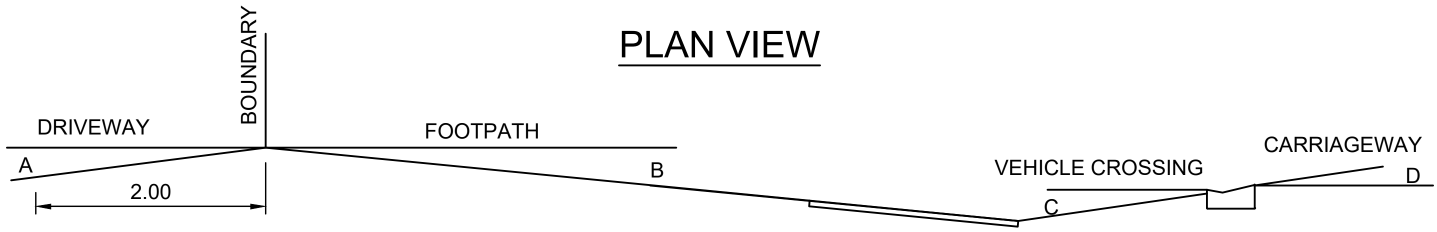


SECTION A

NOTES:
1. ALL SUMPS SHOULD BE 1800mm DEPTH.
2. A MINIMUM SEDIMENT STORAGE DEPTH OF 450mm IS TO BE PROVIDED (TO INVERT OF PIPE).

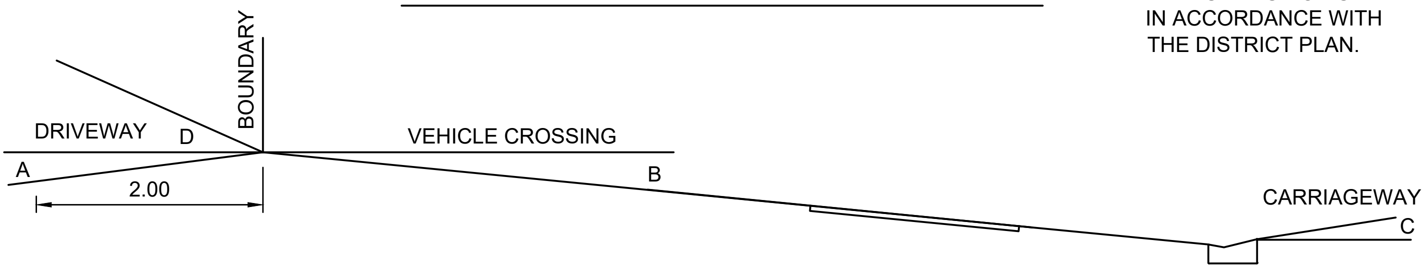


PLAN VIEW



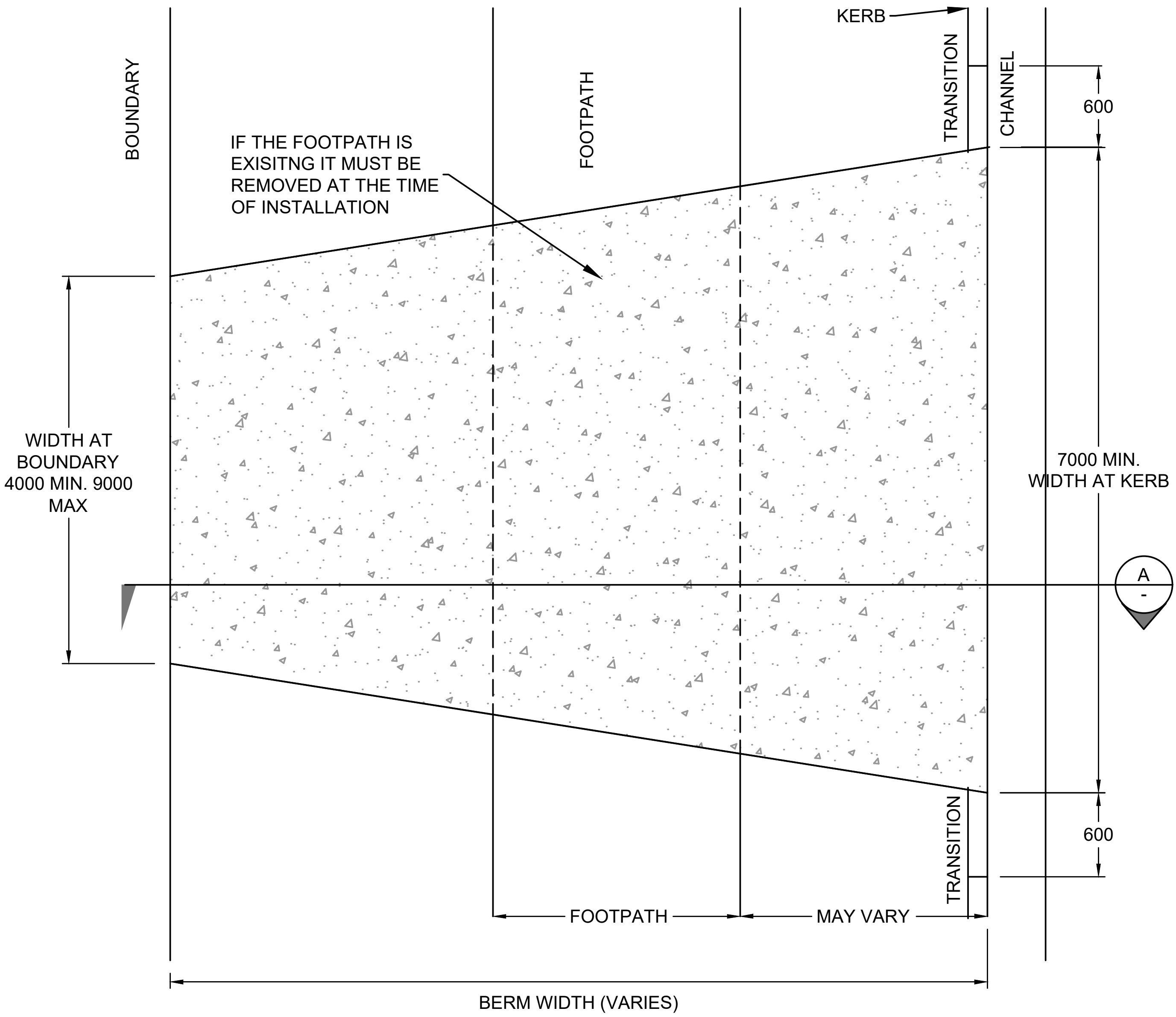
SECTION A: LOW LEVEL FOOTPATH

MAX. CHANGE OF GRADE IN ACCORDANCE WITH THE DISTRICT PLAN.

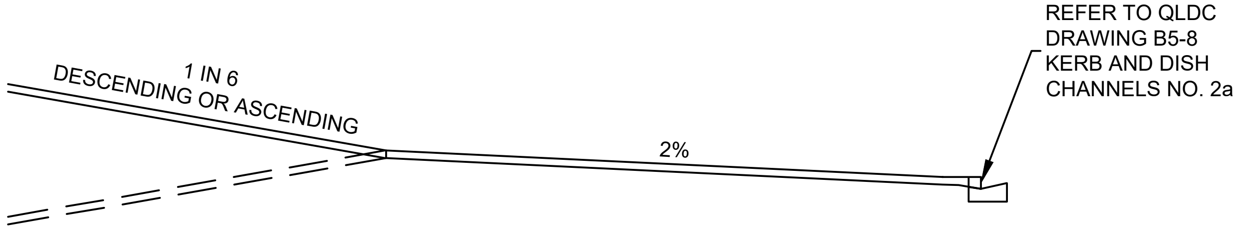


SECTION A: STANDARD FOOTPATH

NOTES:
1. DESIGN OF ALL RESIDENTIAL CROSSINGS TO COMPLY WITH DISTRICT PLAN REQUIREMENTS.
2. CROSSING CONCRETE TO BE 125mm THICK REINFORCED WITH STRUCTURAL MESH, CENTRALLY PLACED.
3. SURFACING TO BE CONCRETE WITH A MINIMUM CRUSHING STRENGTH OF 20MPa AT 28 DAYS, OR 30mm DG7 ASPHALT (NZTA M10 Notes TABLE N3.3), OR 2 COAT SEAL.
4. BASECOURSE TO BE A MINIMUM 150mm COMPACTED DEPTH OF M4 AP40 CRUSHED GRAVEL, OR 150mm M4 AP40 FOR 2 COAT SEAL.
5. SUBGRADE TO BE TRIMMED AND COMPACTED TO ACHIEVE A MINIMUM CBR VALUE = 7.
6. MAXIMUM LONGITUDINAL GRADIENTS SHALL BE IN ACCORDANCE WITH THE DISTRICT PLAN.
7. A, B, C AND D REFER TO THE GRADIENTS EXPRESSED EITHER AS A PERCENTAGE OR IN DEGREES.
8. LOW SLUNG CARS WITH GROUND EFFECT FEATURES MAY NOT MEET THE CRITERIA ASSUMED IN THIS DESIGN GUIDE.



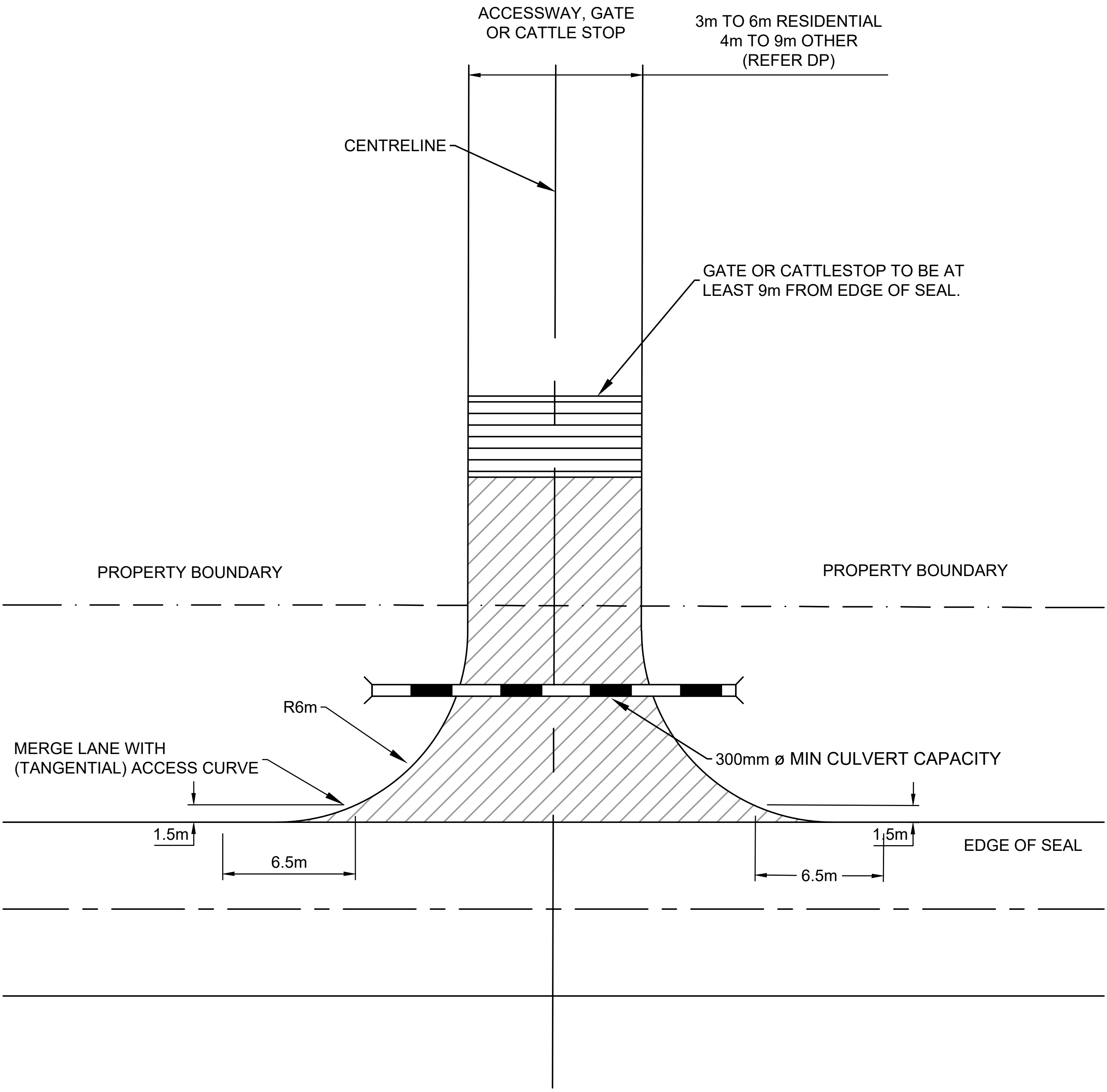
PLAN



SECTION A

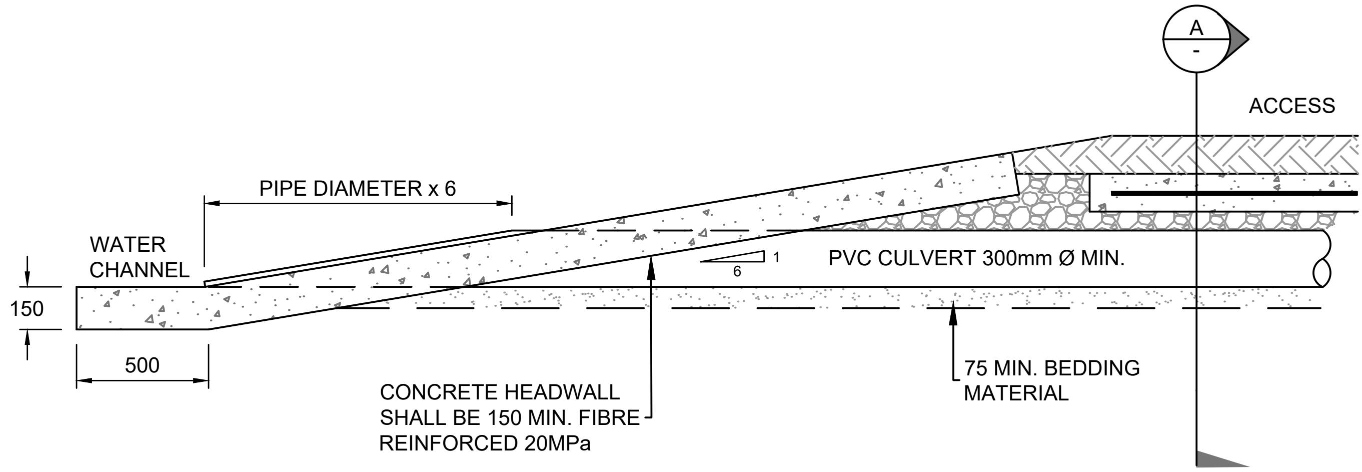
NOTES:

1. THE CONCRETE SHALL BE 150mm THICK AND REINFORCED WITH STRUCTURAL MESH, CENTRALLY PLACED.
2. THE CONCRETE SHALL HAVE A MINIMUM CRUSHING STRENGTH OF 30 MPa AT 28 DAYS AND SHALL COMPLY WITH NZS 3124.
3. CHANNEL CROSSING TO BE HEAVY DUTY, REINFORCED WITH 3 D12 BARS.
4. SUB-GRADE TO BE TRIMMED AND COMPACTED TO ACHIEVE A MIN. CBR VALUE OF > 7.
5. DESIGN OF ALL COMMERCIAL CROSSINGS TO COMPLY WITH THE DISTRICT PLAN.
6. MAXIMUM LONGITUDINAL GRADIENTS SHALL BE IN ACCORDANCE WITH THE DISTRICT PLAN.
7. ONLY CONCRETE IS PERMITTED (ASPHALT NOT PERMITTED).

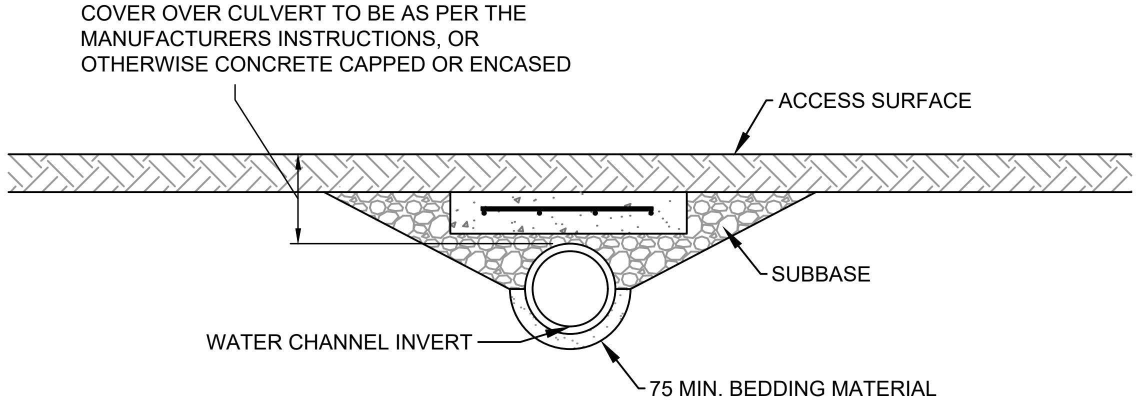


NOTES:

1. CROSSING TO BE MINIMUM 4.5m WIDE AT ENTRANCEWAY & INCORPORATE MIN. 6m RADIUS.
2. PAVEMENT CONSTRUCTION TO BE 150mm COMPACTED DEPTH M/4 AP40 BASECOURSE ON 200mm COMPACTED DEPTH OF AP65 SUBBASE ON COMPACTED SUB-GRADE WITH CBR > 7 (FOR ACCESSWAY INTERNAL TO SITE AS WELL AS LINKING SITE AND LEGAL ROAD).
3. WHERE THE CROSSING INTERCEPTS EXISTING SIDE DRAINAGE, A MIN. 300mm ø CULVERT IS TO BE INSTALLED.
4. IF THE APPLIED SURFACE IS CHIP SEAL A SECOND COAT SEAL IS REQUIRED TO BE PROGRAMMED AND CONSTRUCTED WITHIN 12 MONTHS FROM CONSTRUCTION OF THE FIRST COAT OR IN THE NEXT SUMMER SEASON, WHICHEVER COMES FIRST.
5. CULVERT TO BE FINISHED WITH CONCRETE HEADWALLS AS PER DRAWING B5-24: NON-PRECAST HEADWALL DETAIL OR DRAWING B5-16: TRAVERSABLE GRATES FOR PRECAST HEADWALLS 250mm TO 450mm CULVERTS.
6. MINIMUM DEPTH OF 450mm TO TOP OF CULVERT IS REQUIRED OR CONCRETE CAPPED/ENCASED IF THE ROAD DEPTH CANNOT BE ACHIEVED OR AS AGREED WITH THE T.A.



LONGITUDINAL ELEVATION: HEADWALL

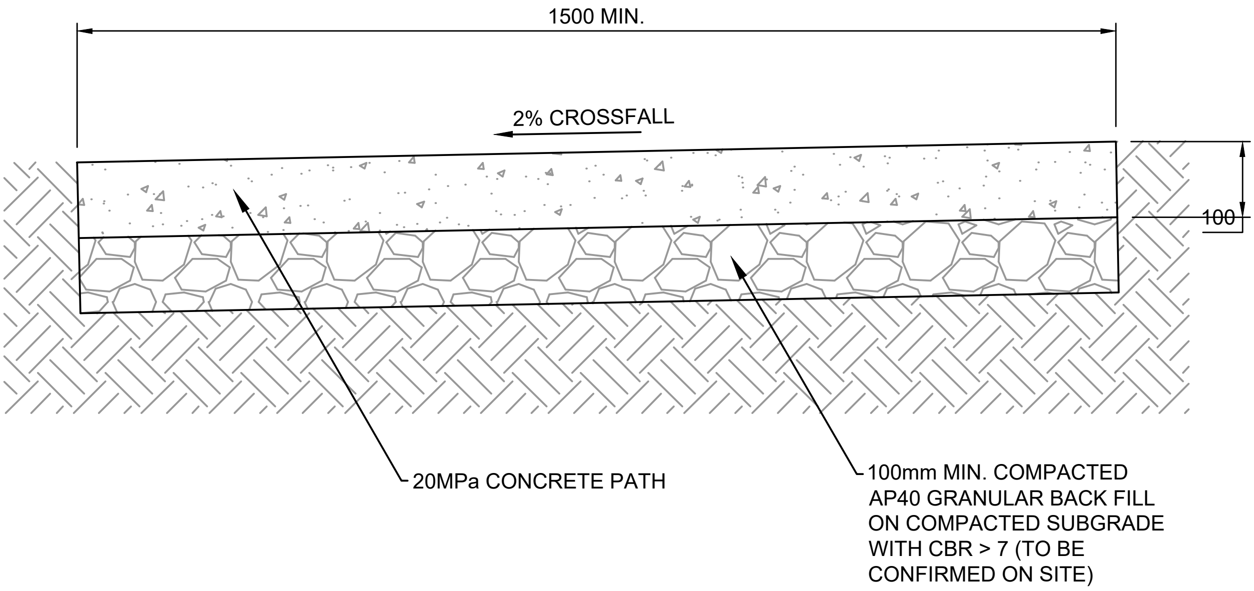


SECTION A: ACCESS PIPE BEDDING

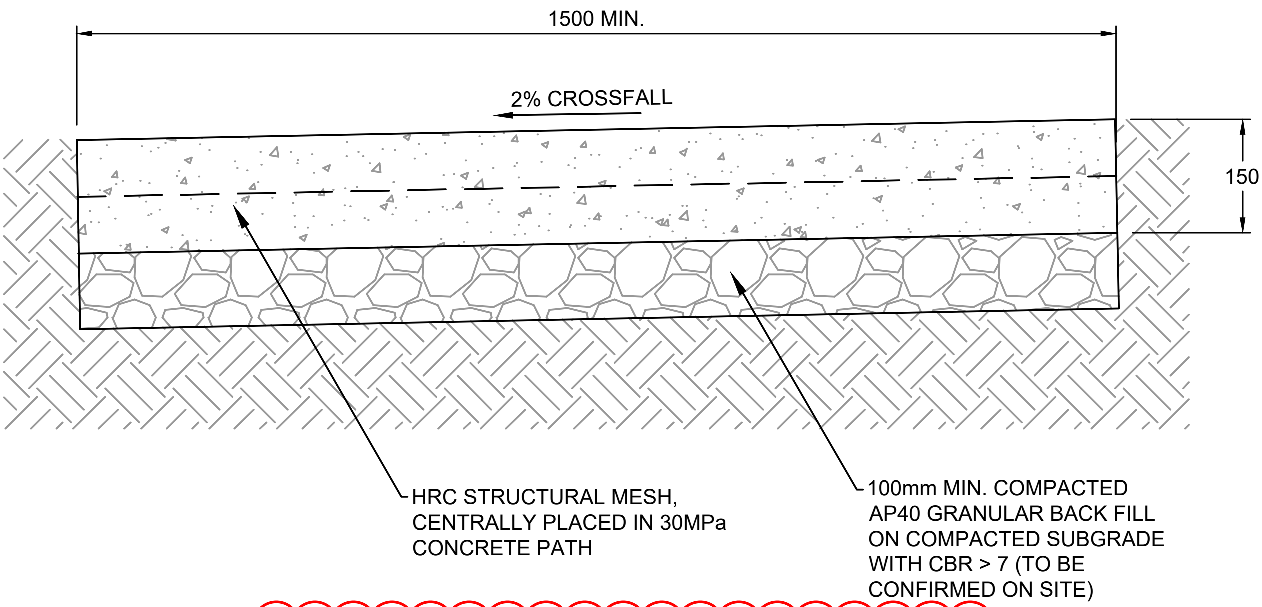
NOTES:

1. WHERE THE ACCESS INTERCEPTS EXISTING SIDE DRAINAGE / WATER TABLE, A 300mm MIN. DIAMETER (OR MIN. DIAMETER OF UPSTREM CULVERT, WHICHEVER IS THE GREATER) CULVERT IS TO BE INSTALLED.
2. PIPE TO SN8 PVC OR CONCRETE WITH APPROPRIATE BEDDING.
3. COVER OVER CULVERT TO BE AS PER THE MANUFACTURERS INSTRUCTIONS, OR OTHERWISE CONCRETE CAPPED OR ENCASED IF AN APPROPRIATE DEPTH CANNOT BE ACHIEVED.
4. CULVERT ENDS TO BE MITRED TO A GRADIENT OF 1V:6H.
5. CONSTRUCT CONCRETE HEADWALL AND APRON AROUND PIPE ENDS AND CHANNEL INVERT.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Non-Precast Headwall Detail for Culvert Under Access	NOT TO SCALE Drawing No. B5-21



CONCRETE FOOTPATH



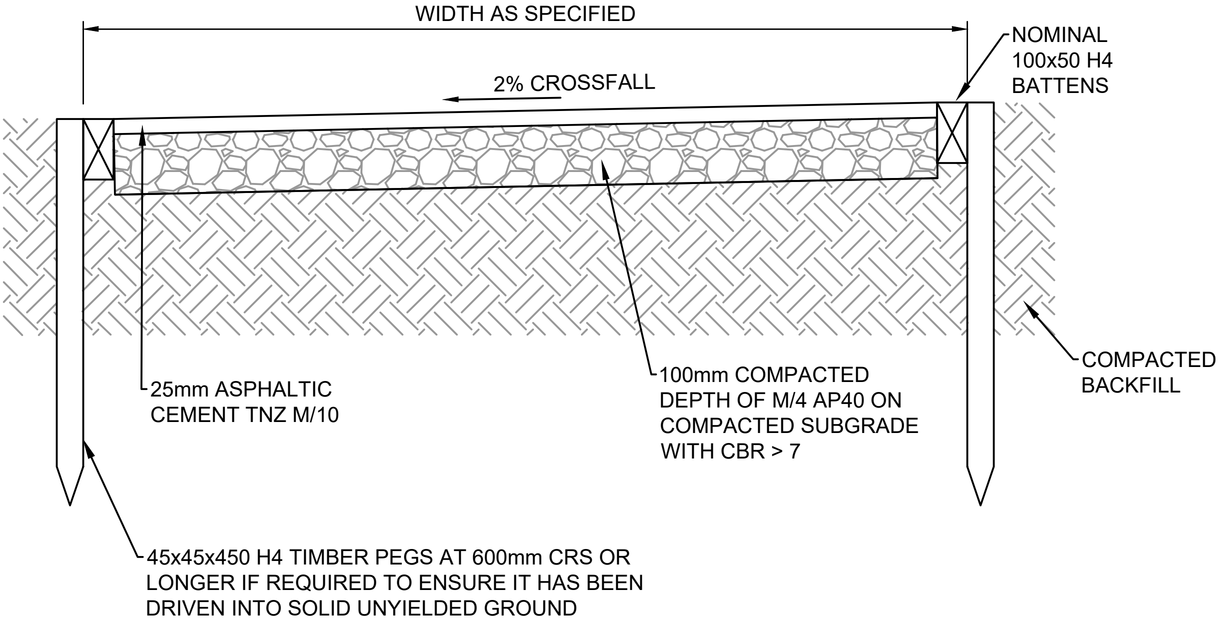
HEAVY DUTY CONCRETE FOOTPATH

TO BE USED FOR COMMERCIAL OR RESIDENTAIL CROSSINGS

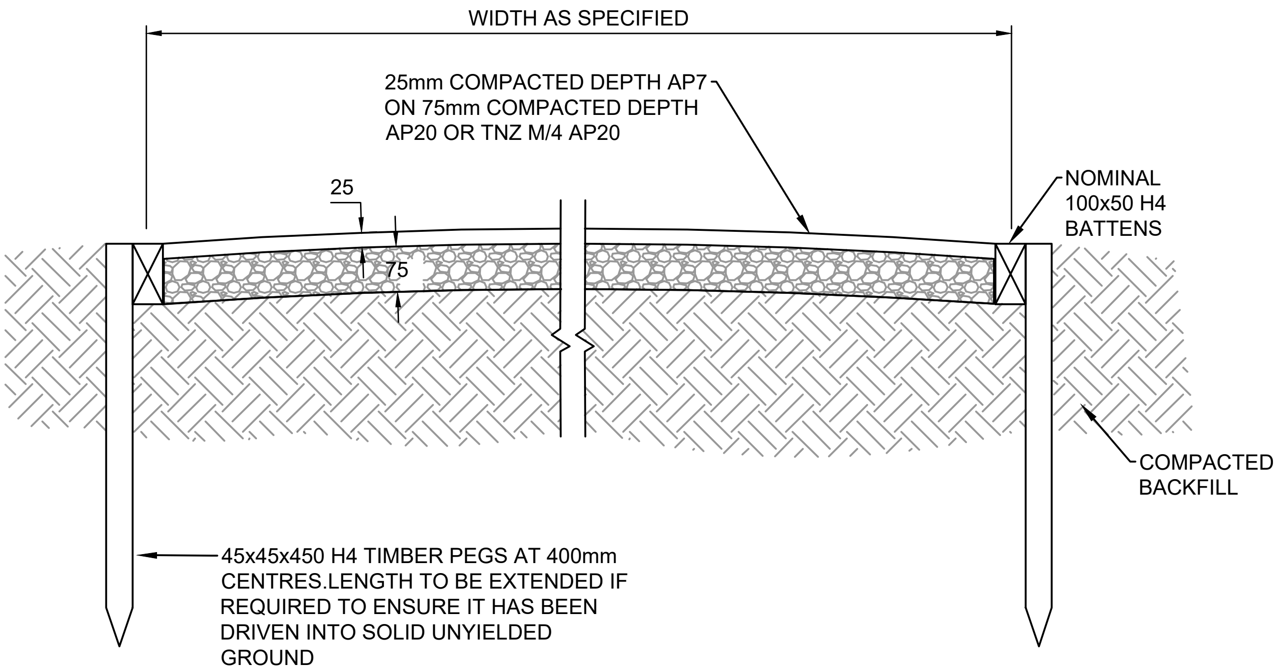
NOTES:

1. BRUSHED CONCRETE SURFACE TO BE USED FOR VESTED ROADS

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Heavy Duty Footpath	NOT TO SCALE Drawing No. B5-22



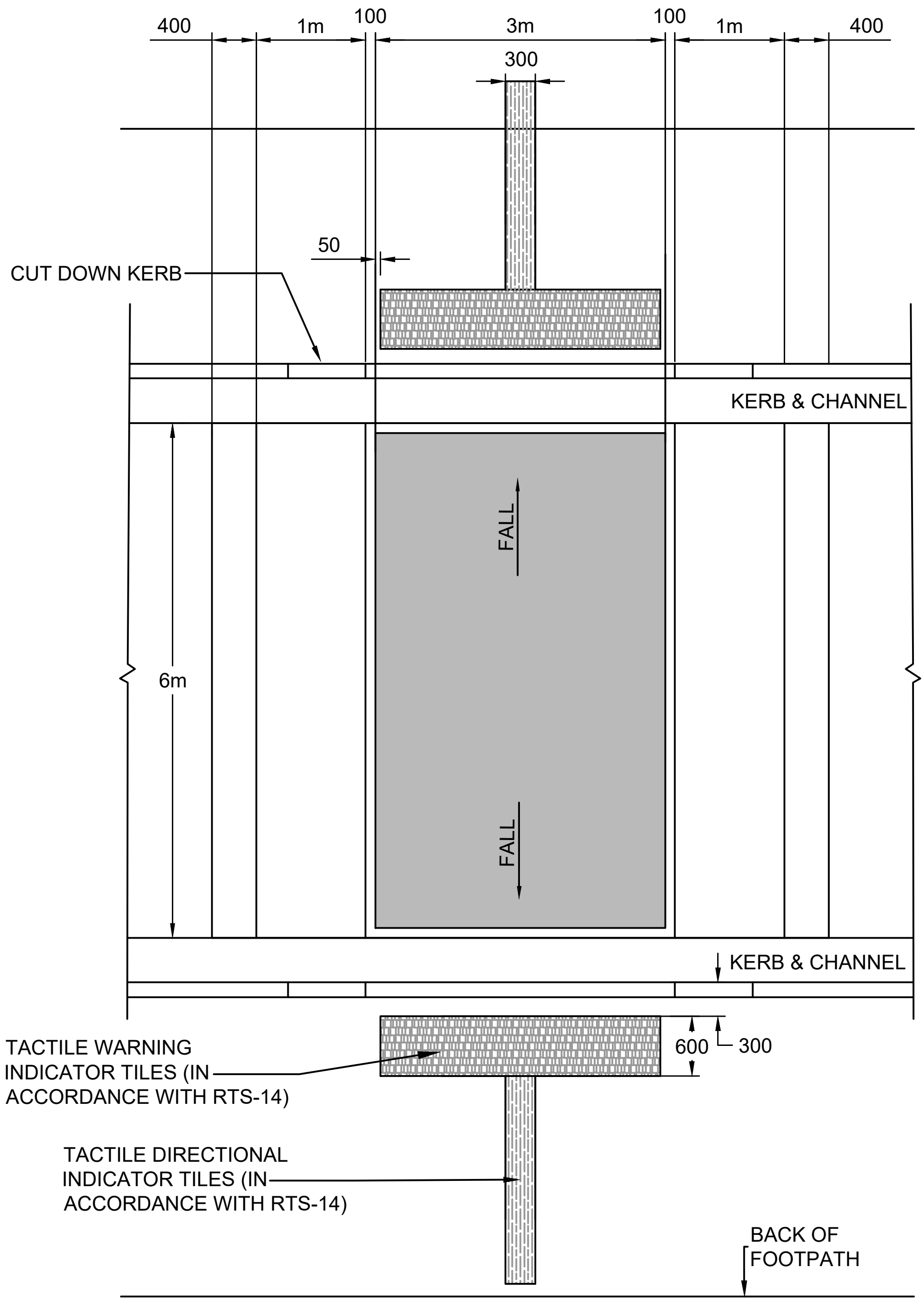
ASPHALT FOOTPATH



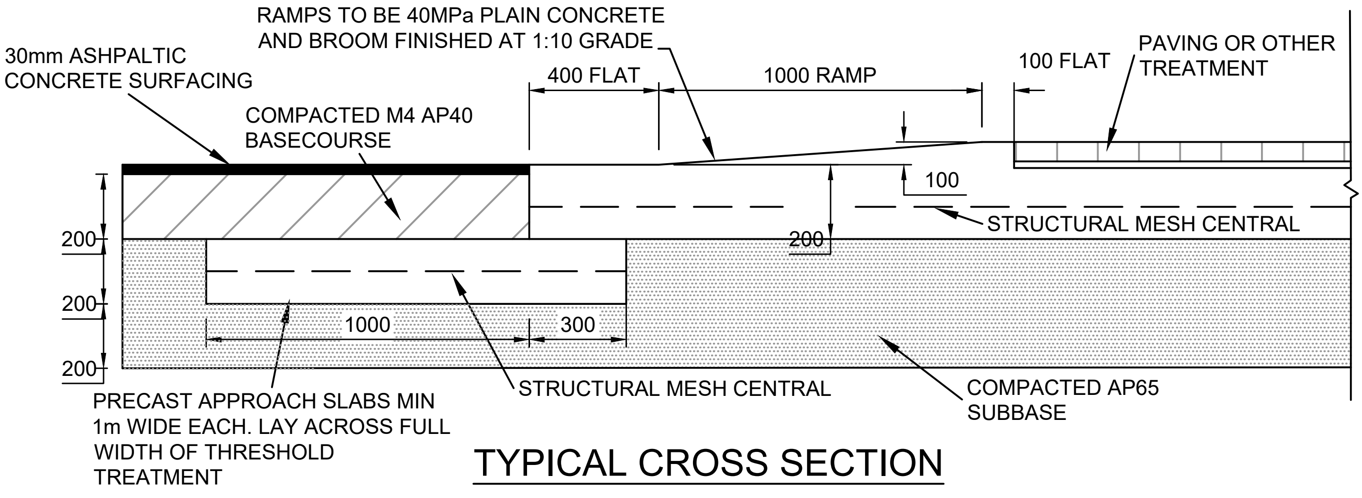
GRITTED FOOTPATH

NOTES:
1. RE. MIN. CBR OF 7 REQUIRED AND SUBBASE OF 75mm.
2. CROSSFALLS TO BE NOMINALLY 3% (CROWNED OR CONTINUOUS CROSSFALLS AS SPECIFIED).
3. SUBGRADE & METALCOURSE TO BE TREATED WITH APPROVED SOIL STERILANT.
4. PEGS CAN BE CUT OFF AT AN ANGLE, FLUSH WITH BOXING ON SIDE AND MINIMUM 5mm DOWN ON THE OTHER.
5. TRACKS AND TRAILS TO BE DESIGNED AND BUILT AS PER THE QLDC TRACKS AND TRAILS DESIGN GUIDE.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Footpath - Asphalt & Gritted Detail	NOT TO SCALE Drawing No. B5-23



PLAN



TYPICAL CROSS SECTION

QLDC LDSC 2025
Standard Details

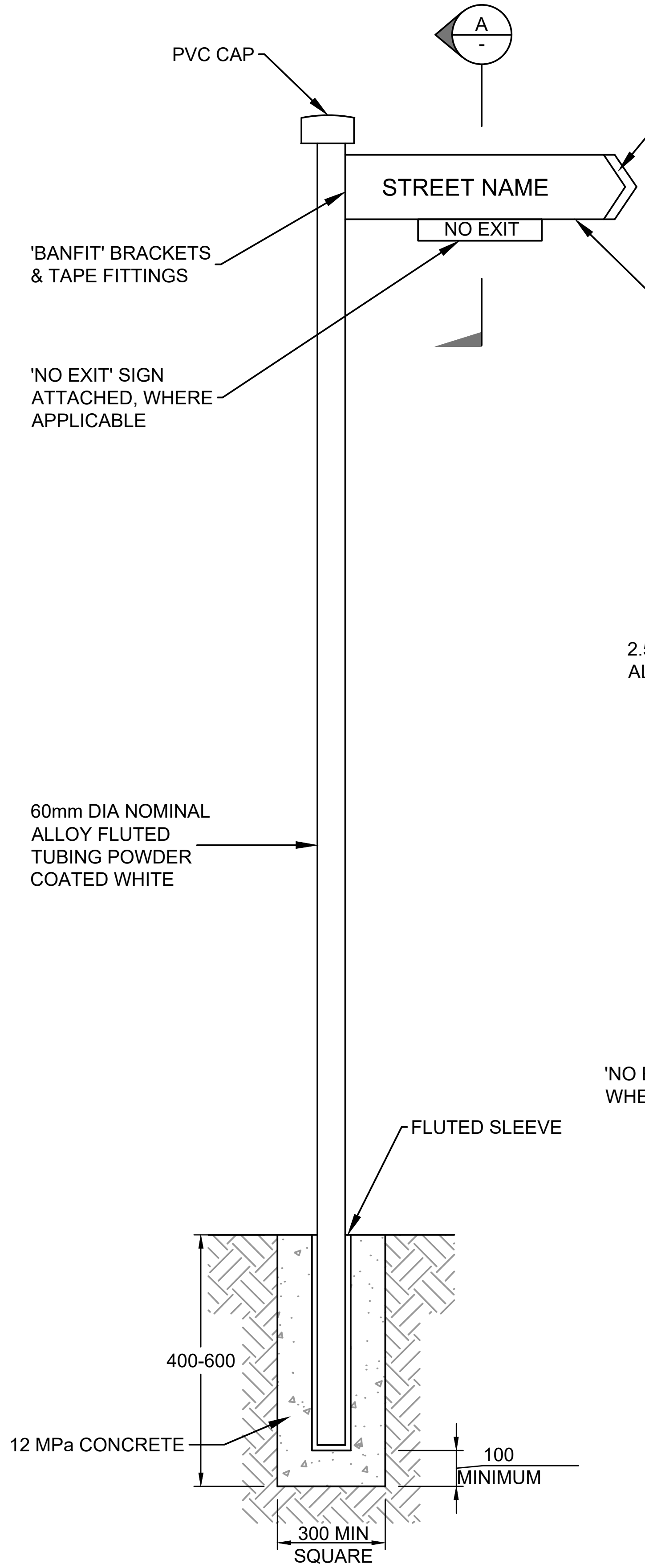
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

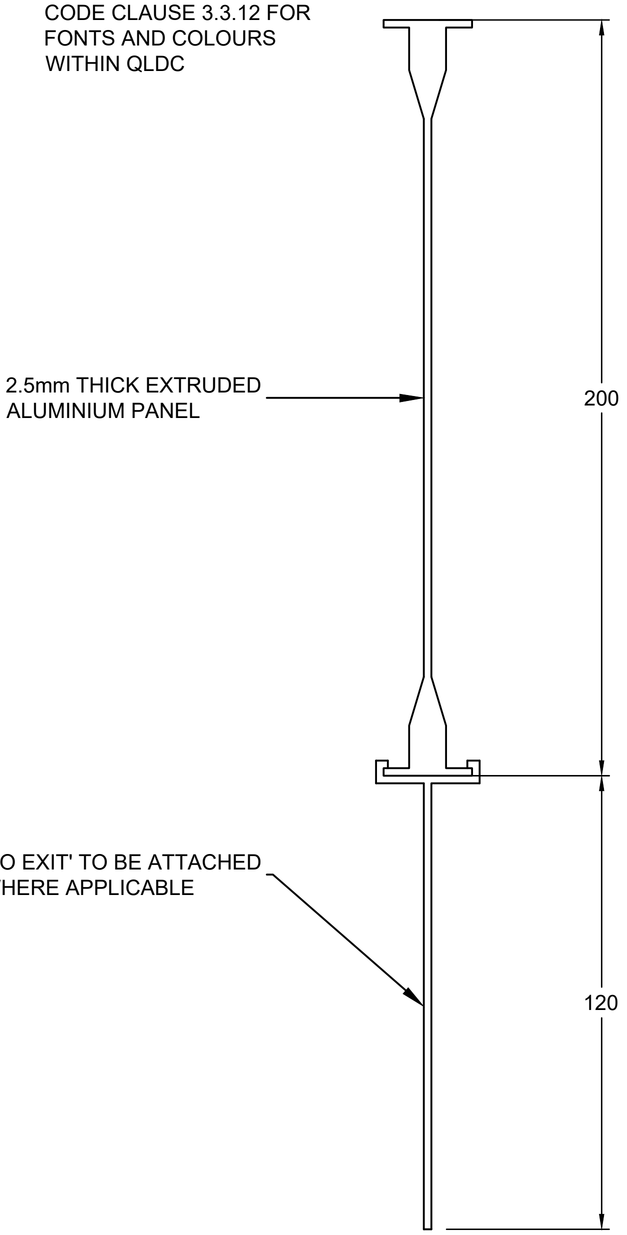
Drawing Title:
Pedestrian Crossing Detail

NOT TO SCALE

Drawing No.
B5-24



STREET NAME AND POST



SECTION A

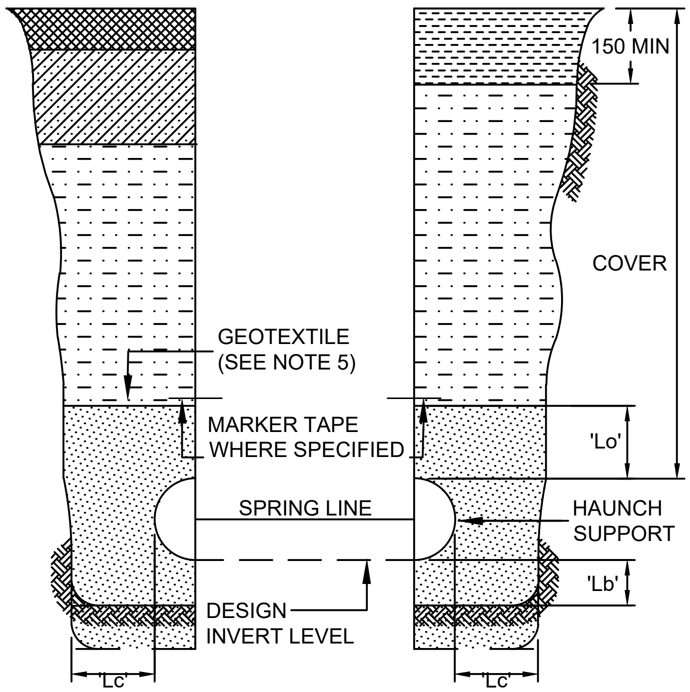
NOTE:
WHERE POLES ARE SUPPORTING MORE THAN 3 SIGNS, SPECIFIC APPROVAL OF BASE UNIT DESIGN IS REQUIRED.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Street Sign: Pole Mount	NOT TO SCALE Drawing No. B6-1

MATERIAL		ZONE	
ROAD SURFACE	NON ROAD SURFACES		
ROAD SURFACE LAYER	TO MATCH EXISTING	SURFACE COURSE	
TO MATCH EXISTING ROAD BASE OR TO TERRITORIAL AUTHORITY REQUIREMENTS	TRENCH FILL MATERIALS TO BE SIMILAR WITH SNZ HB 2002 APPENDIX L OR TO TERRITORIAL AUTHORITY REQUIREMENTS OR INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE	ROAD BASE	
TRENCH FILL MATERIALS TO BE SIMILAR WITH SNZ HB 2002 APPENDIX L OR TO TERRITORIAL AUTHORITY REQUIREMENTS OR INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE		TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)	
EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND TERRITORIAL AUTHORITY (SEE NOTE 4)		OVERLAY	EMBEDMENT
		SIDE SUPPORT	EMBEDMENT
BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING		BEDDING	EMBEDMENT
		OVER-EXCAVATION	

VEHICULAR LOADING

'Lo' - 100 mm MIN. NON TRAFFICABLE
'Lb' - 300 mm MIN. TRAFFICABLE
- REFER TO CM - 002



ZONE		MATERIAL
TOPSOIL OR PAVEMENT		ORIGINAL OR IMPORTED MATERIAL TO MATCH EXISTING
TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)		INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE
EMBEDMENT	OVERLAY	EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND TERRITORIAL AUTHORITY (SEE NOTE 4)
EMBEDMENT	SIDE SUPPORT	
EMBEDMENT	BEDDING	BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING
OVER-EXCAVATION		

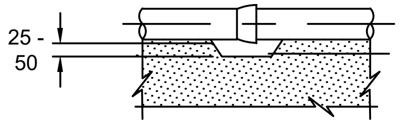
NO VEHICULAR LOADING

INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLE LOADING OCCURS SUCH AS RESERVES AND FOOTWAYS

SPRING LINE TRENCH CLEARANCE

NOMINAL DIAMETER DN	MINIMUM CLEARANCE 'Lc'
≤150	100
>150 - ≤300	150
>300 - ≤450	200
>450 - ≤900	300
>900 - ≤1500	350

TRENCH WIDTH TO BE SUFFICIENT TO SAFELY LAY PIPE AND COMPACT THE SIDE SUPPORT ZONE



PROVIDE POCKETS IN BEDDING AT JOINTS PRIOR TO LAYING PIPES. FILL VOID DURING COMPLETION OF EMBEDMENT

PIPE JOINT BEDDING POCKETS

FOR JOINT PROJECTIONS (SOCKETS, FLANGES, AND SO ON)

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. SPECIFY SPECIAL BEDDING TO SUIT THE CONDITIONS IF THE TRENCH FLOOR HAS:
   - IRREGULAR OUTCROPS OF ROCK OR
   - BEEN DISTURBED BY UNCONTROLLED GROUND WATER.
3. COMPACT AND EVENLY GRADE FINISHED TRENCH FLOOR.
4. EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENT OF DESIGN DRAWINGS OR SPECIFICATIONS.
5. USE GEOTEXTILE FILTER FABRIC WHERE SPECIFIED.
6. SIDES OF EXCAVATION TO BE KEPT VERTICAL TO AT LEAST 150 ABOVE THE PIPE.

STANDARDS NEW ZEALAND PAERANGA AOTEAROA

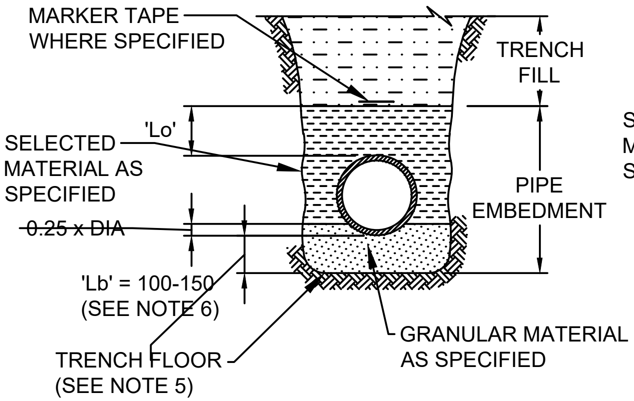
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT

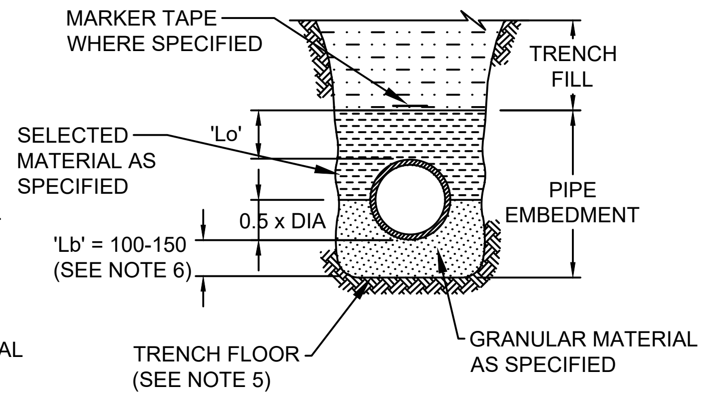
NOT TO SCALE

B7-1



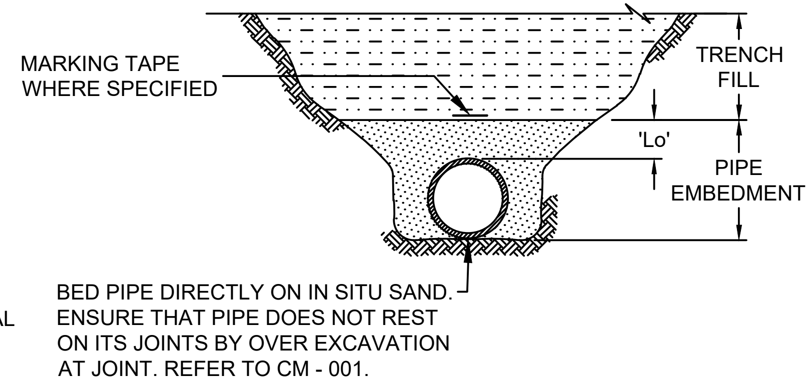
TYPE 1 SUPPORT

(SEE NOTE 9)

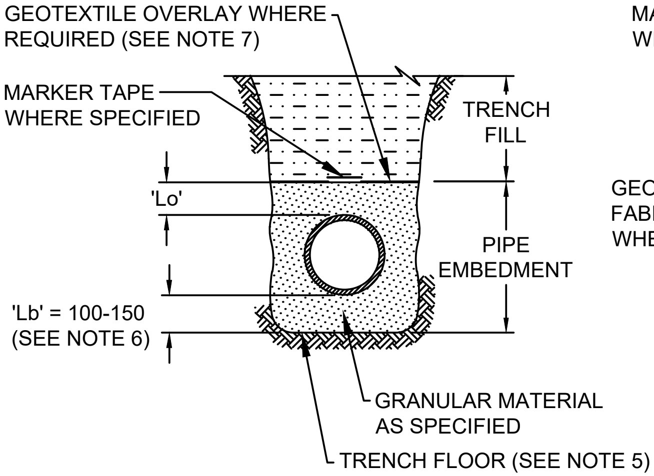


TYPE 2 SUPPORT

FOR RIGID PIPES ONLY (SEE NOTE 3)
(SEE NOTE 9)

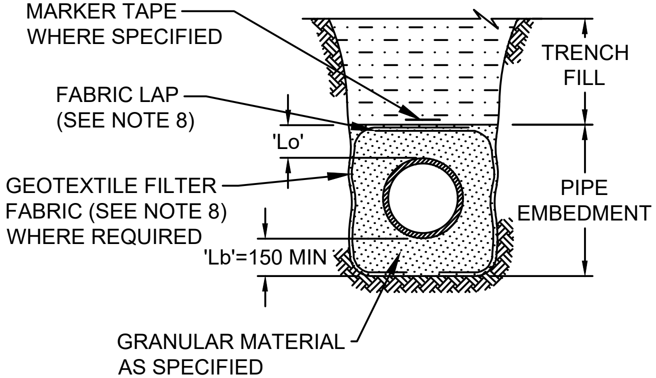


TRENCH IN SAND STRATA



TYPE 3 SUPPORT

FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)



TYPE 4 SUPPORT

WITH GEOTEXTILE FOR FLEXIBLE
AND RIGID PIPES (SEE NOTE 3)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH CM - 001.
3. PIPE CLASSIFICATION:
   (a) RIGID PIPES: VC, RC, STEEL AND DI
   (b) FLEXIBLE PIPES: PVC, GRP, AND PE.
4. PLACEMENT OF EMBEDMENT, TRENCHFILL, & COMPACTION TO MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS.
5. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPELINE SETTLEMENT. WHEN EXCAVATED, REPLACE WITH GRANULAR MATERIAL AS SPECIFIED FOR BEDDING OR ADOPT TYPE 1, 2, 3, OR 4 SUPPORT AS REQUIRED.
6. ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS, FLANGES) DO NOT TOUCH TRENCH FLOOR -SEE CM-001.
7. TYPE 4 SUPPORT TO BE USED WHERE MIGRATORY NATIVE SOILS (SANDS & CLAYS) ARE ENCOUNTERED ADJACENT TO THE EMBEDMENT ZONE AND SINGLE SIZE AGGREGATE IS USED.
8. GEOTEXTILE OVERLAY IS REQUIRED FOR COARSE AGGREGATE EMBEDMENT > 5mm. LAY GEOTEXTILE FILTER FABRIC AGAINST TRENCH FLOOR AND WALLS SUCH THAT IT FULLY ENCASES THE EMBEDMENT.
   - PRESS FILTER FABRIC INTO THE VOIDS BEFORE INSTALLING EMBEDMENT TO PREVENT FABRIC TEARING.
   - PROVIDE A MINIMUM OF 250 OVERLAP AT ALL FILTER FABRIC JOINTS.
9. IN SOME AREAS LOCAL PRACTICE MAY ALLOW USE OF SELECTED EXCAVATED MATERIAL AS PIPE EMBEDMENT.
10. IN UNSUITABLE GROUND CONDITIONS SPECIFIC DESIGN IS REQUIRED. SEE WSA 03 & WSA 04 DRAWINGS FOR GUIDANCE.
11. CONCRETE PIPES SHOULD BE BASED ON FIGURES 11 - 13 IN AS/NZS 3725.

EMBEDMENT TYPES TO BE SPECIFIED IN DESIGN DRAWINGS

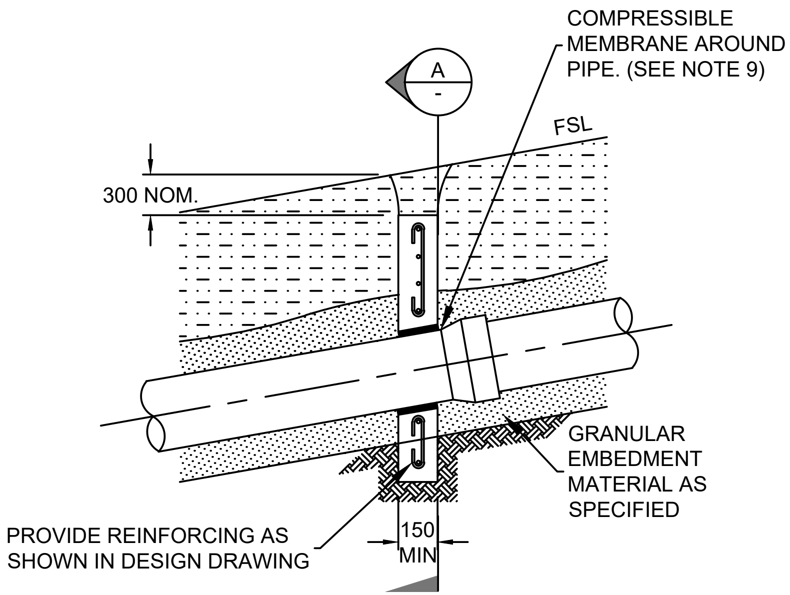
STANDARDS NEW ZEALAND
PAEREWA AOTEAROA
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

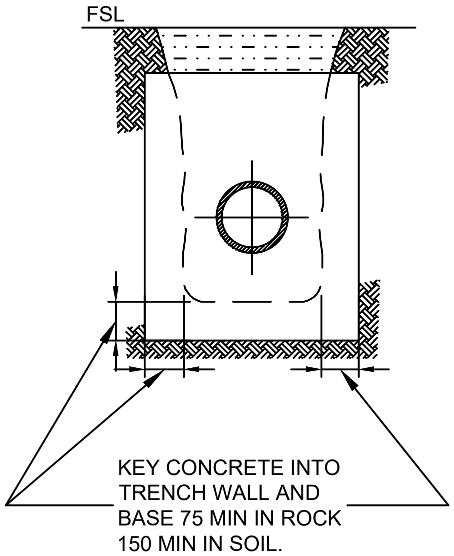
NOT TO SCALE

EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT

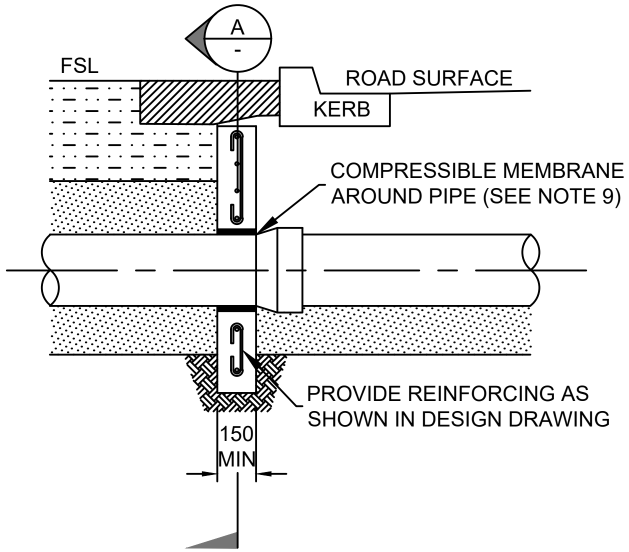
B7-2



CONCRETE BULKHEAD DETAIL



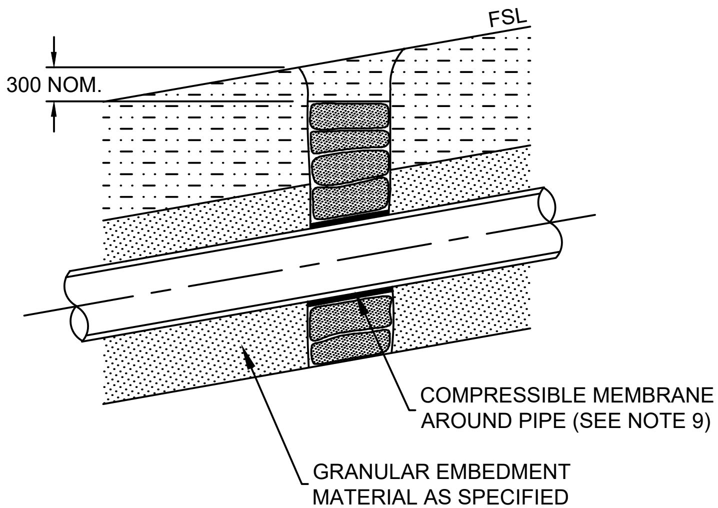
SECTION A



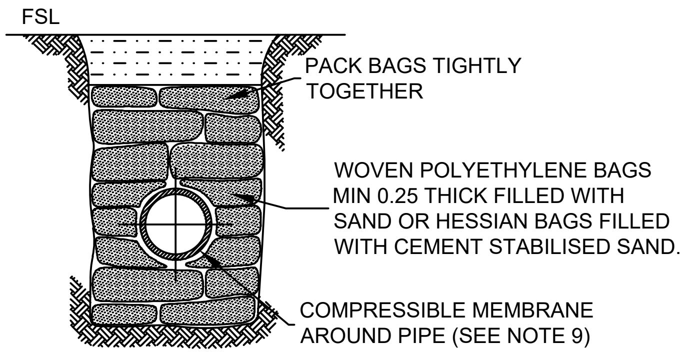
TYPICAL ROAD CROSSING BULKHEAD

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. CONSTRUCT CONCRETE BULKHEADS AND TRENCH STOPS AT LOCATIONS SPECIFIED IN DESIGN DRAWINGS.
3. CONSTRUCT BULKHEAD ADJACENT TO KERB AND GUTTER SHOULDER OF SEALED ROADS.
4. BULKHEAD AT A RETAINING WALL TO BE UNDER THE WALL.
5. KEY CONCRETE BULKHEADS INTO SIDES AND BOTTOM OF TRENCH AGAINST A BEARING SURFACE OF UNDISTURBED SOIL.
6. CONCRETE TO BE 17.5 MPA.
7. DO NOT DEFORM PIPES DURING PLACEMENT OF CONCRETE OR BAGS.
8. SEAL BAGS TO PREVENT LEAKAGE OF CONTAINED MATERIAL.
9. COMPRESSIBLE MEMBRANE AROUND PIPE TO BE 10 THICK POLYSTYRENE FOR BULKHEADS ADJACENT TO KERBS AND 3 THICK RUBBER FOR BULKHEADS AND TRENCHSTOPS ON SLOPES.
10. FOR SLOPES >35% REFER TO TERRITORIAL AUTHORITY FOR REQUIREMENTS.



TRENCH STOP DETAIL

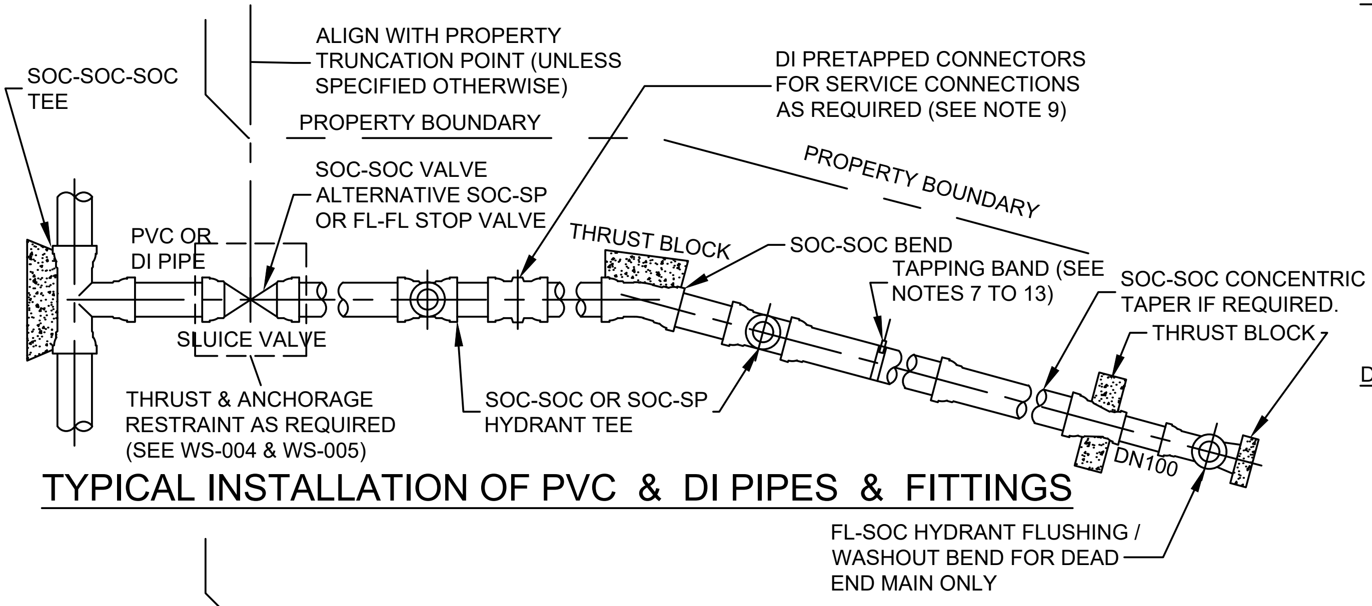


SECTION B

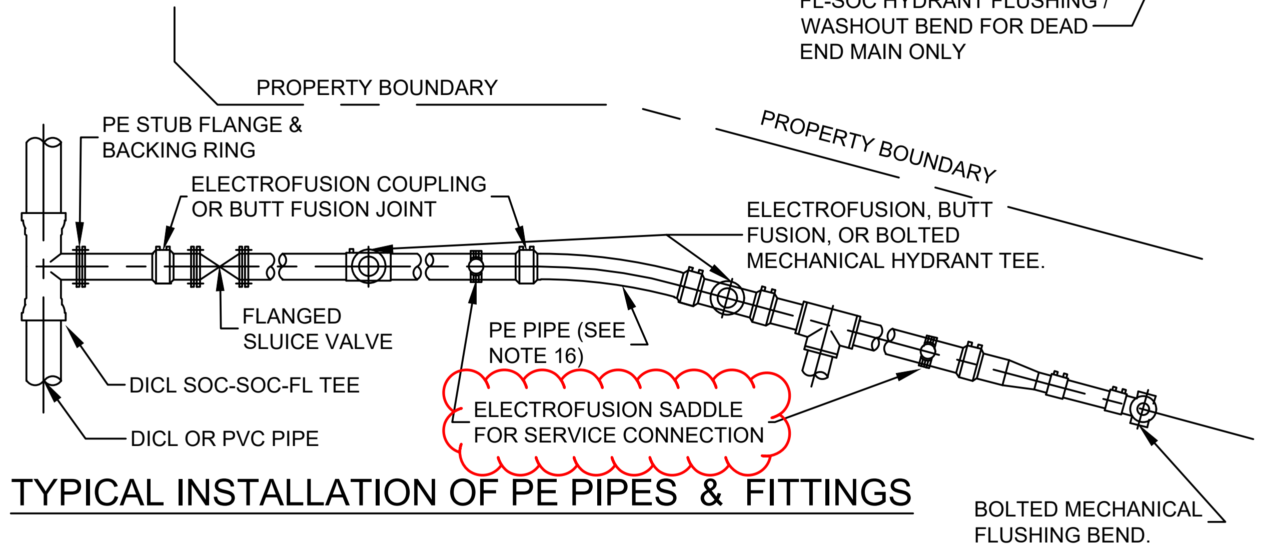
STANDARDS NEW ZEALAND PAEREWA AOTEAROA

ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

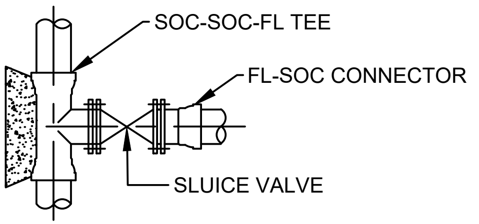
NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
BULKHEADS & TRENCH STOP STANDARD DETAILS	B7-3



TYPICAL INSTALLATION OF PVC & DI PIPES & FITTINGS



TYPICAL INSTALLATION OF PE PIPES & FITTINGS



TYPICAL VALVE CONNECTION DIRECT TO NEW MAIN

NOTE-
1. ALL DIMENSIONS IN MILLIMETRES.
2. INSTALL PIPEWORK PARALLEL TO PROPERTY BOUNDARIES.
3. STAINLESS STEEL AND NYLON COATED (TO AS/NZS 4158)TAPPING BANDS DO NOT REQUIRE ADDITIONAL CORROSION PROTECTION.
4. WRAP BOLTED CONNECTIONS USING OTHER THAN NYLON COATED FITTINGS AND STAINLESS STEEL BOLTS WITH A PETROLATUM TAPE SYSTEM.
5. WHERE MAINS ARE 300 OR LARGER BYPASSES SHOULD BE INSTALLED FOR ALL MANUAL SLUICE VALVES.
6. ALL VALVES AND FITTINGS SHALL BE COATED WITH A THERMAL BONDED POLYMERIC COATING APPLIED IN ACCORDANCE WITH AS/NZS 4158.

DI & PVC PIPE
7. DUCTILE IRON FITTINGS MAY BE USED WITH DI & PVC PIPE.
8. FITTINGS SHALL BE NYLON COATED AND LINED OR CEMENT LINED WITH A BITUMINOUS EXTERNAL COATING. DO NOT USE PVC FITTINGS WITH DI PIPE.
9. USE PRE TAPPED CONNECTORS ON DN 100 & DN 150 NEW MAIN INSTALLATIONS (UNLESS SPECIFIED OTHERWISE BY THE TERRITORIAL AUTHORITY.
10. USE TAPPING BANDS FOR CONNECTIONS TO EXISTING MAINS AND NEW MAINS >DN 150.
11. ELECTRICALLY ISOLATE COPPER SERVICES FROM DICL PIPE.

PVC PIPE
12. TAPPING BANDS ON PVC PIPE TO BE FULL CIRCLE CLAMPING.
13. WHERE PVC FITTINGS ARE USED, A PROTECTIVE MEMBRANE IS REQUIRED BETWEEN FITTING AND THRUST BLOCK. PVC FITTINGS TO BE USED ONLY ON PVC PIPE. DI SPIGOTS NOT TO BE INSERTED INTO PVC SOCKETS.
14. MAXIMUM SIZE OF DRILLED HOLES FOR SERVICE CONNECTIONS IN PVC PIPE TO BE 30% DN OR 50 (LOWER VALUE TO BE USED) LARGER HOLES CAN BE USED FOR UNDER PRESSURE TAPPING.

DI PIPE
15. DIRECT TAPPING OF >DN 200 DICL MAY BE AUTHORISED BY TERRITORIAL AUTHORITY.

PE PIPE
16. PE PIPE MAY BE COLD BENT TO MINIMUM RADIUS OF 25 X (OD)STAKES OR OTHER SOURCES OF POINT LOADS SHALL NOT BE USED TO ASSIST IN BENDING THE PIPE.
17. MAKE ALLOWANCE DURING CONSTRUCTION FOR EXPANSION AND CONTRACTION OF PE PIPE DUE TO TEMPERATURE CHANGES.
18. BUTT WELDING IN ACCORDANCE WITH WSA-01 (POLYETHYLENE CODE) BUTT WELDING IN TRENCHES IS NOT PERMITTED.
19. ALL MECHANICAL COUPLINGS TO BE SELF-RESTRAINING.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

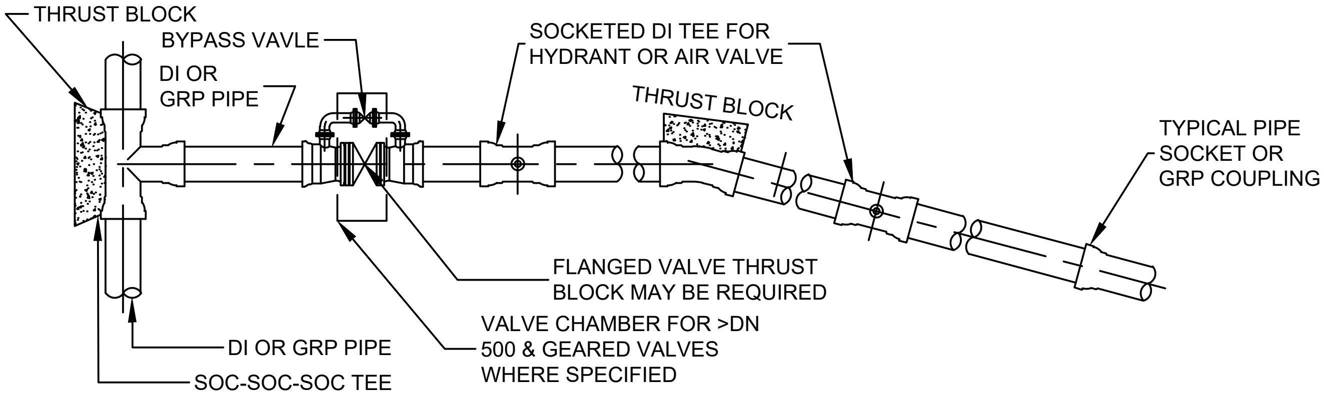
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

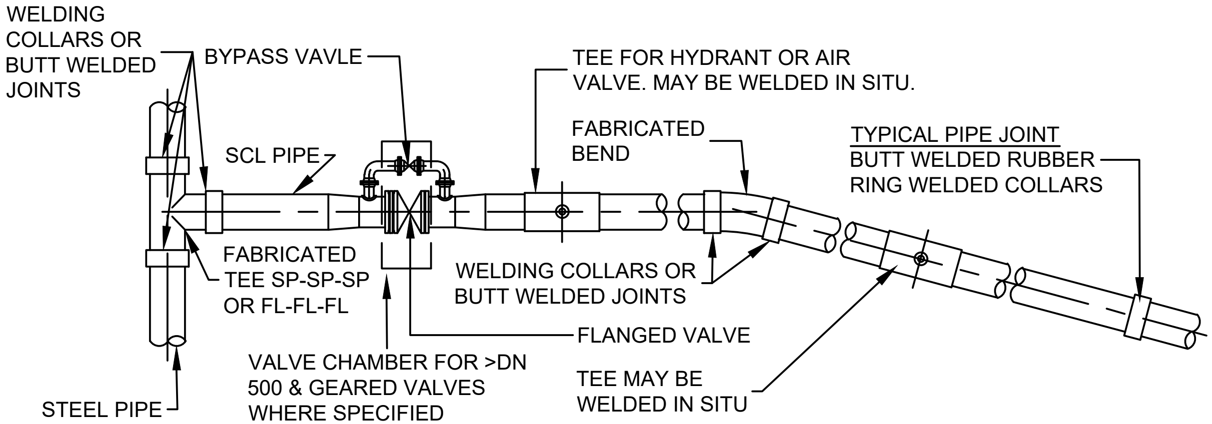
NOT TO SCALE

TYPICAL MAINS CONSTRUCTION - RETICULATION MAIN ARRANGEMENTS

B7-4

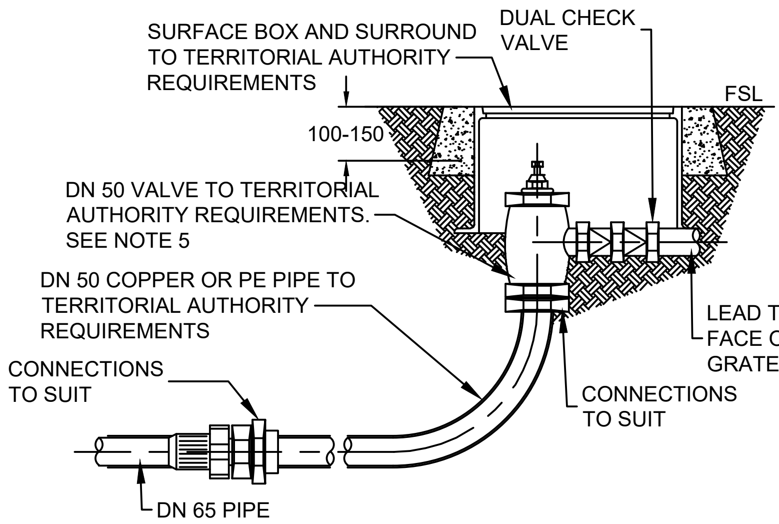


TYPICAL INSTALLATION OF DI AND GRP MAINS



TYPICAL INSTALLATION OF STEEL MAINS

THRUST BLOCKS REQUIRED WHERE NON-RESTRAINING RUBBER RING JOINTS USED



FLUSHING POINT

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. WHERE POSSIBLE USE A SINGLE LENGTH OF PE PIPE.
3. THRUST BLOCKS TO BE IN ACCORDANCE WITH TERRITORIAL AUTHORITY REQUIREMENTS.
4. PVC PIPE MAY BE USED AS SHROUD PIPE, CUT AS REQUIRED TO CLEAR HYDRANT FLANGE.
5. FIT THE FLUSHING POINT VALVE IN SUCH A WAY AS TO PREVENT MOVEMENT OR ROTATION OF THE VALVE BODY. PROVIDE A SUITABLE PLUG OR CAP TO KEEP OUT DIRT AND GRAVEL.
6. PROVIDE CORROSION PROTECTION FOR ALL NON COATED METALLIC SURFACES IN ACCORDANCE WITH TERRITORIAL AUTHORITY REQUIREMENTS.
7. SERVICE CONNECTIONS NOT PERMITTED ON DISTRIBUTION MAINS WITHOUT TERRITORIAL AUTHORITY APPROVAL.

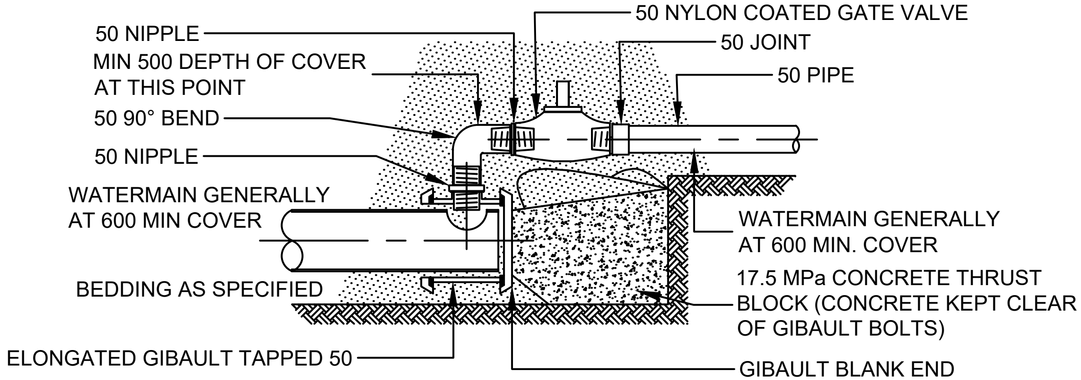
STANDARDS NEW ZEALAND
PAEREWA AOTEAROA
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

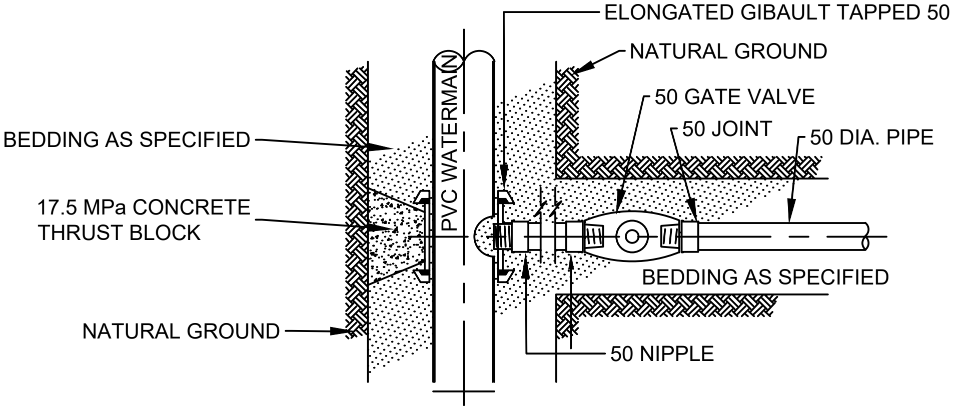
NOT TO SCALE

TYPICAL MAINS CONSTRUCTION - DISTRIBUTION AND TRANSFER MAINS

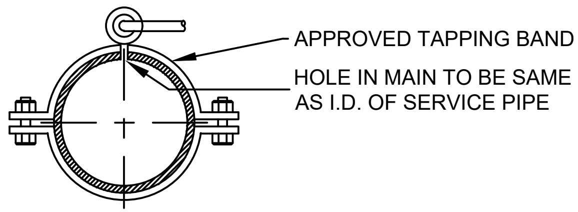
B7-5



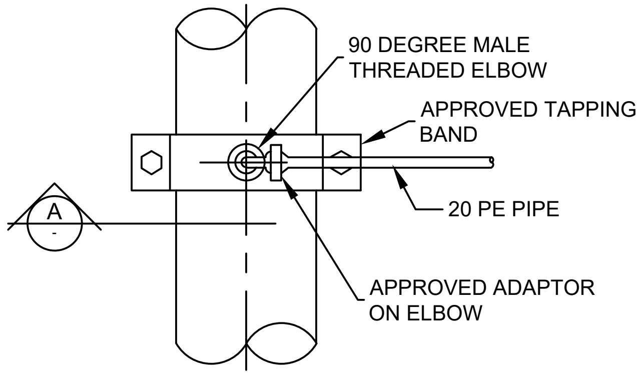
STRAIGHT LINE CONNECTION - METHOD 1 - ELEVATION



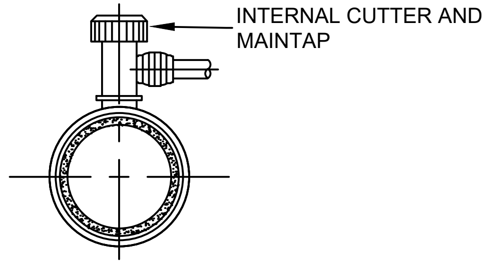
90° CONNECTION - PLAN
RIDER MAIN CONNECTIONS



SECTION A



PLAN
STANDARD TAPPING METHODS



ELECTROFUSION TAPPING SADDLE
PE PIPE

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. USE METAL GATE VALVE ON 20 CONNECTIONS WHERE REQUIRED BY T.A. OR WHERE SHUTTING DOWN MAIN TO REPAIR SERVICE WOULD CAUSE SIGNIFICANT INTERRUPTION TO SUPPLY.
3. USE PROPRIETARY IN LINE METAL VALVES APPROVED BY T.A. WHEN MAIN IS TAPPED UNDER PRESSURE.
4. WHERE POSSIBLE, LAY SERVICE CONNECTIONS AND RIDER CONNECTIONS TO PRINCIPAL MAIN. WHERE NOT POSSIBLE INSTALL METALLIC TAPE ON TOP OF CONNECTION.
5. RIDER MAINS AND SERVICE CONNECTIONS TO PRINCIPAL MAIN USE ELONGATED GIBAULT, PROPRIETARY TEE (RIDER MAIN ONLY) OR APPROVED PROPRIETARY TAPPING BANDS.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	PROPERTY SERVICES - CONNECTION TO AN EXISTING PVC MAIN	B7-6

MINIMUM BLOCK VOLUME FOR ANCHORAGE

VERTICAL BENDS

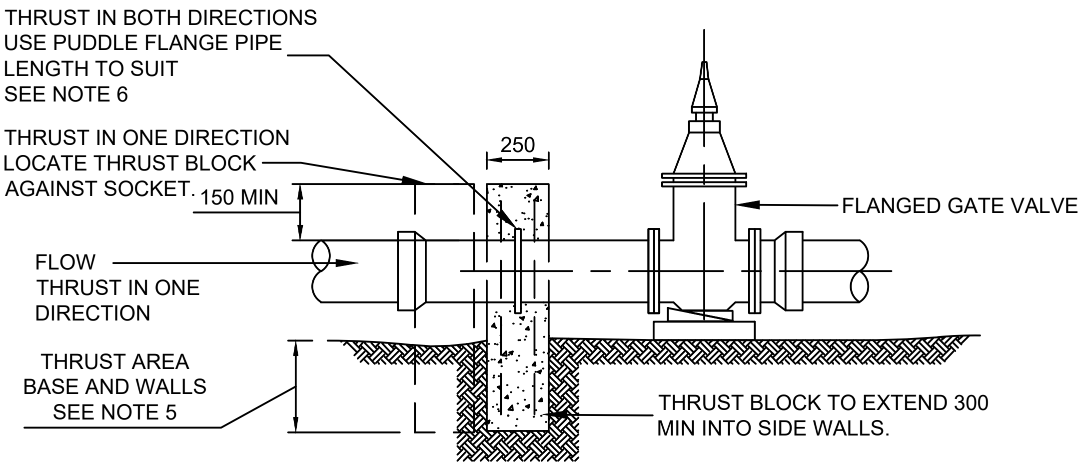
FOR TEST PRESSURE OF 1000kPa (SEE NOTE 2)

PIPE DN	CONCRETE VOLUME M^3		
	11.25° BEND	22.25° BEND	45° BEND
100	N	N	0.3
150	N	0.3	0.6
200	0.2	0.5	1.1
225	0.3	0.6	1.4
250	0.3	0.7	2.5
300	0.4	1.1	3.8
375	0.7	1.8	5.8
450	DETAILED DESIGN REQUIRED (ALTERNATIVE METHODS TO BE CONSIDERED)		
500			
600			
750			

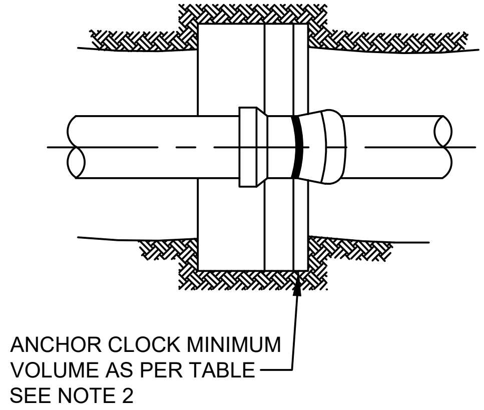
'N' - NO ADDITIONAL RESTRAINT REQUIRED (COMPACTED TRENCHFILL SUFFICIENT)

ANCHOR BLOCK CONSTRUCTION NOTES:

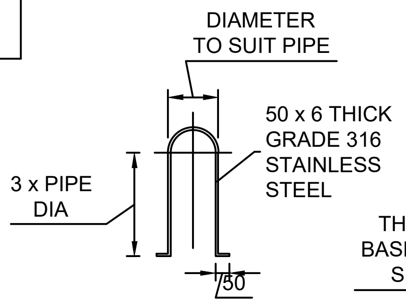
- LOCATE ANCHOR BLOCK CENTRALLY AROUND BEND.
- KEY ANCHOR BLOCK INTO BASE OF TRENCH A MINIMUM DEPTH OF 250.
- POUR CONCRETE AGAINST A SOLID EXCAVATION FACE.
- USE GRADE 17.5 MPa CONCRETE.
- KEEP CONCRETE CLEAR OF ALL BOLTS, NUTS, AND PIPE JOINTS.



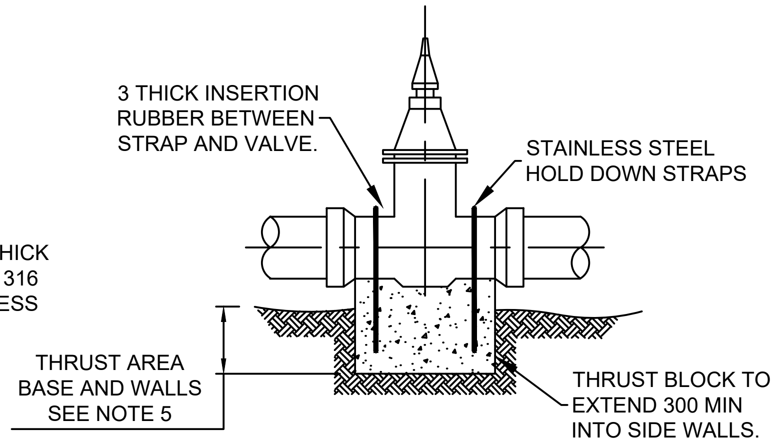
FLANGED VALVES



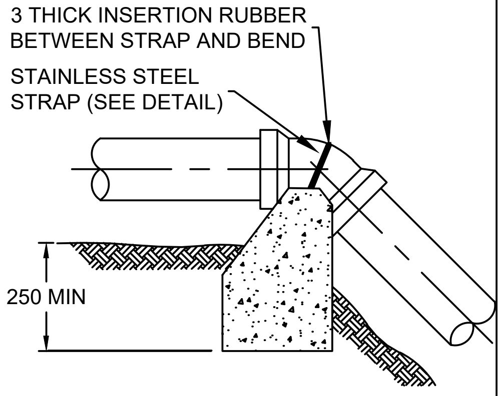
PLAN



TYPICAL SS STRAP



SOCKETED VALVES



ELEVATION VERTICAL BENDS

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES, UNLESS SHOWN OTHERWISE.
2. ANCHOR BLOCKS IN THE TABLE ARE DESIGNED FOR A TEST PRESSURE OF 1000 kPa (100 m HEAD)ADJUST CONCRETE VOLUME TO SUIT ACTUAL TEST PRESSURE.
3. WHERE DI PIPES AND FITTINGS WITH RESTRAINED JOINTS ARE USED THRUST BLOCKS ARE NOT REQUIRED.
4. THRUST BLOCK REINFORCEMENT AS SPECIFIED IN DESIGN DRAWINGS.
5. WHERE SPECIFIED PROVIDE CONCRETE THRUST BLOCKS FOR SOC-SOC VALVES. THRUST AREA TO BE AS FOR DEAD ENDS AS SHOWN IN WS-004.
6. INSTALL PUDDLE FLANGES ON CLASS K12 DICL PIPE.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

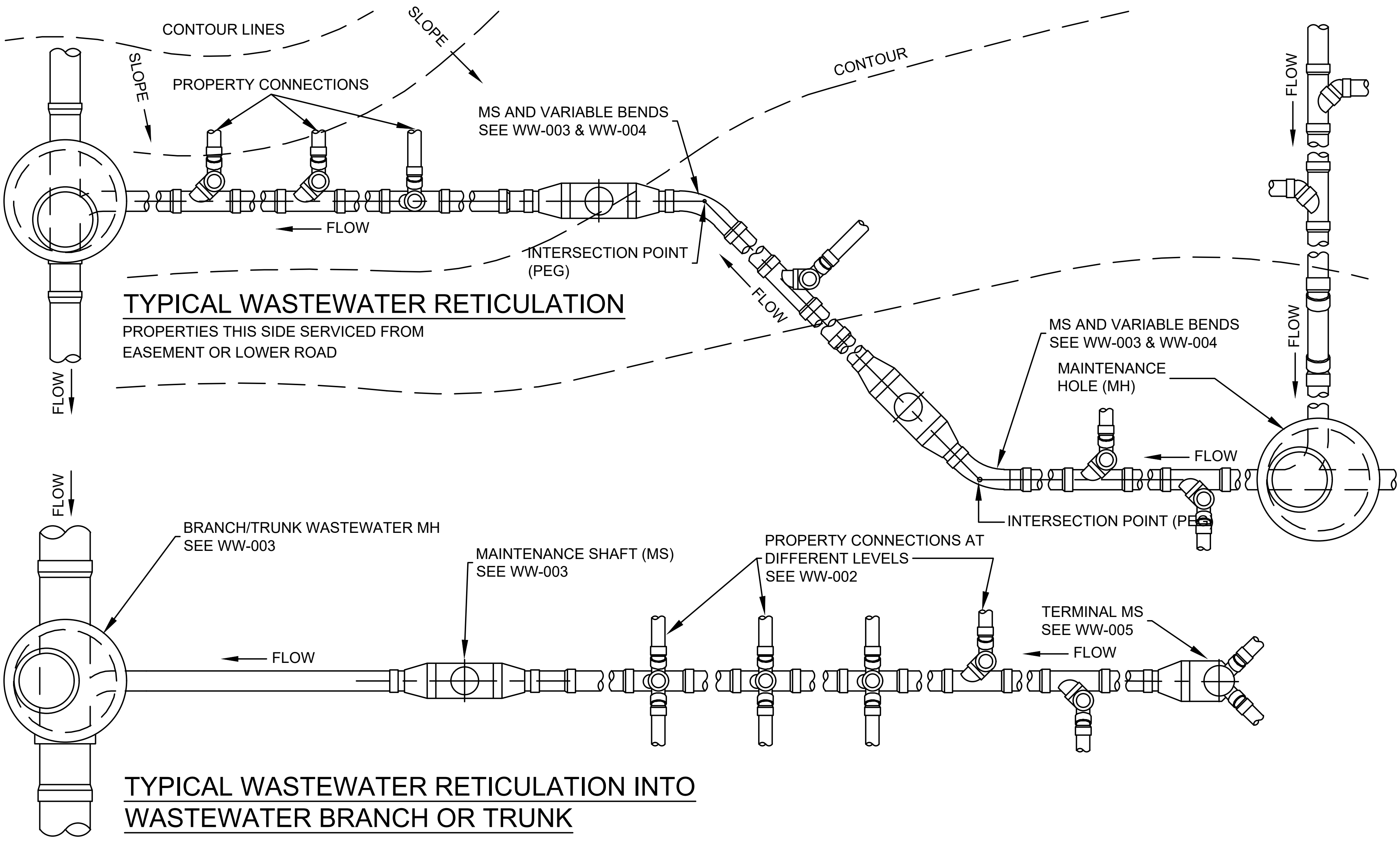
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

THRUST AND ANCHOR BLOCKS - GATE VALVES AND VERTICAL BENDS IF REQUIRED

NOT TO SCALE

B7-7



TYPICAL WASTEWATER RETICULATION

PROPERTIES THIS SIDE SERVICED FROM
EASEMENT OR LOWER ROAD

TYPICAL WASTEWATER RETICULATION INTO WASTEWATER BRANCH OR TRUNK

NOTE:

1. GRADE WASTEWATER EVENLY BETWEEN MH/MS TO LEVELS SHOWN IN DESIGN DRAWINGS.
2. LAY PIPES AND FITTINGS WITH SOCKETS UPSTREAM WHEREVER PRACTICABLE.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

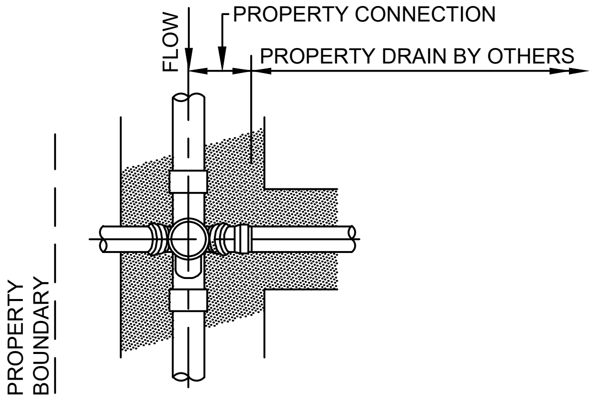
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

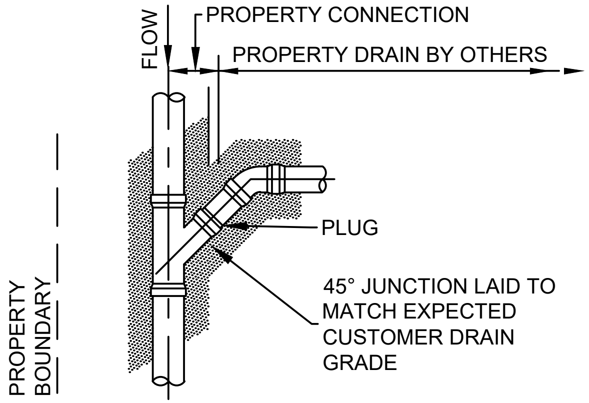
PIPELAYING - TYPICAL ARRANGEMENTS

NOT TO SCALE

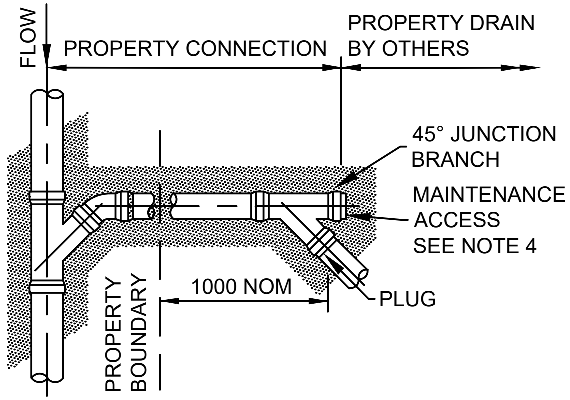
B7-8



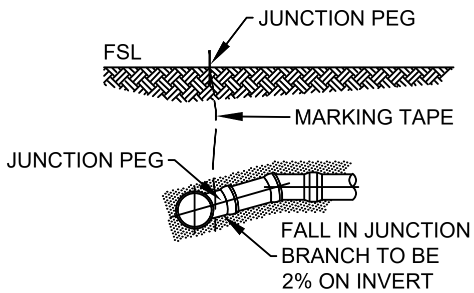
PLAN
WASTEWATER WITHIN PROPERTY



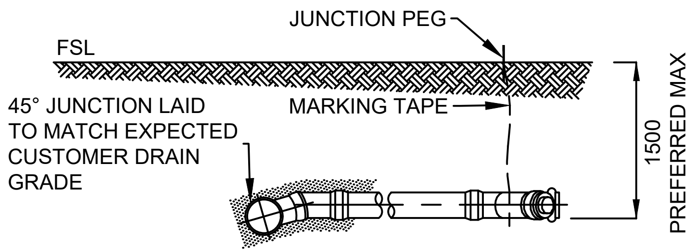
PLAN
WASTEWATER WITHIN PROPERTY



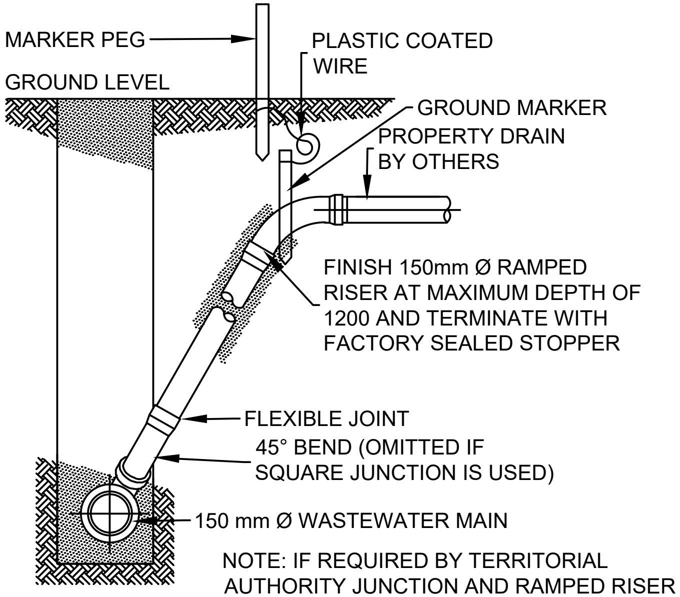
PLAN
WASTEWATER WITHIN PROPERTY



ELEVATION
STANDARD CONNECTION

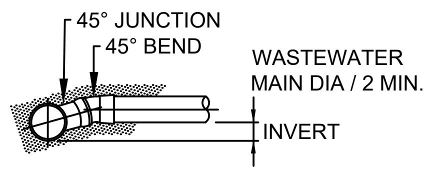


ELEVATION
EXTENDED CONNECTION
MAY ALSO BE INSTALLED AS A SLOPED CONNECTION



NOTE: IF REQUIRED BY TERRITORIAL AUTHORITY JUNCTION AND RAMPED RISER TO BE SURROUNDED BY MIN 150 mm THICKNESS OF 17.5 MPa CONCRETE DISCONTINUOUS AT PIPE JOINTS.

ELEVATION
Y JUNCTION RAMPED RISERS



MINIMUM LEVEL
STANDARD CONNECTION

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CONNECTION TYPES SHOWN IN THIS DRAWING ARE APPLICABLE TO VC, PVC.
3. LAY PROPERTY DRAIN CONNECTION AT DEPTH AS SHOWN IN DESIGN DRAWINGS.
4. PROVIDE RODDING POINTS WHERE REQUIRED BY TERRITORIAL AUTHORITY.
5. GRADE OF PROPERTY CONNECTION WASTEWATER PIPE TO BE NOT LESS THAN: DN 100 1.65%
   DN 150 1.2%

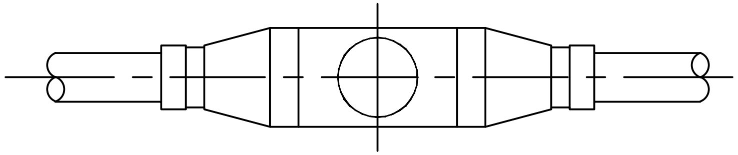
STANDARDS NEW ZEALAND
PAEREWA AOTEAROA
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

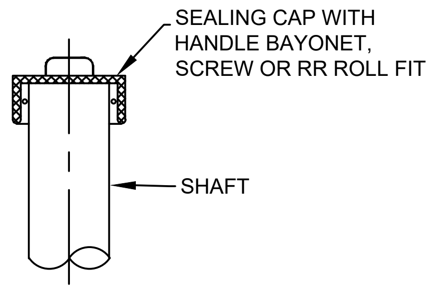
NOT TO SCALE

PROPERTY CONNECTION - BURIED INTERFACE METHOD

B7-9

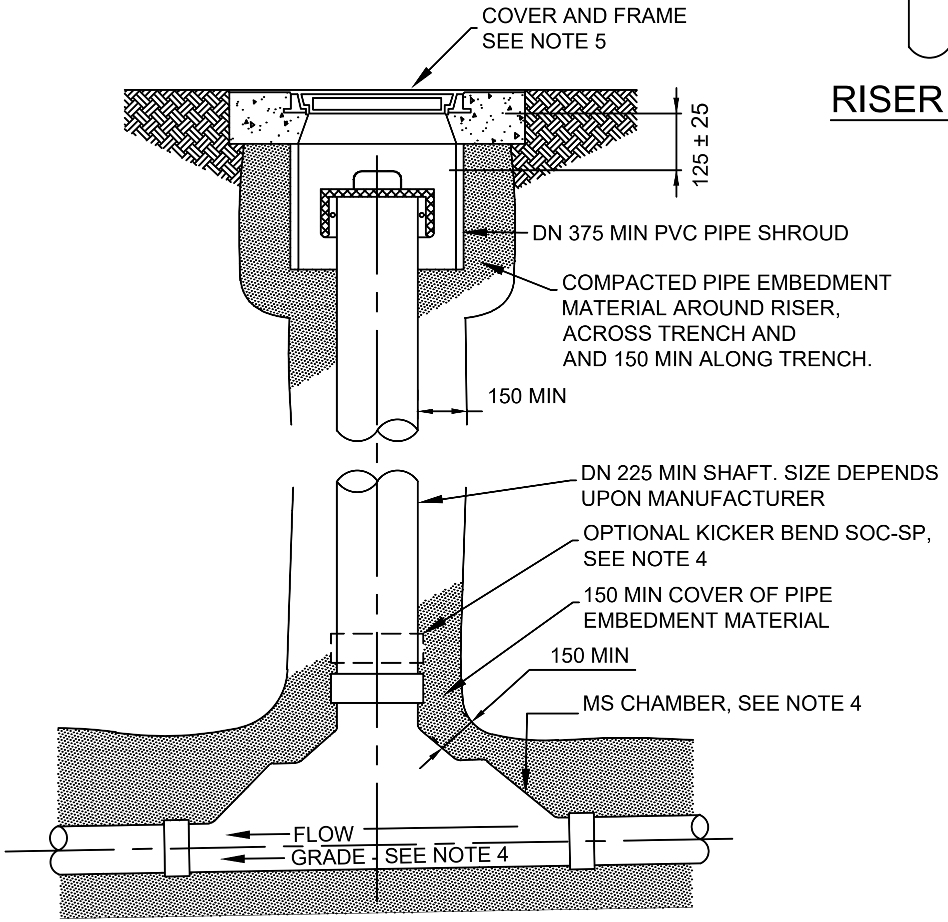


PLAN

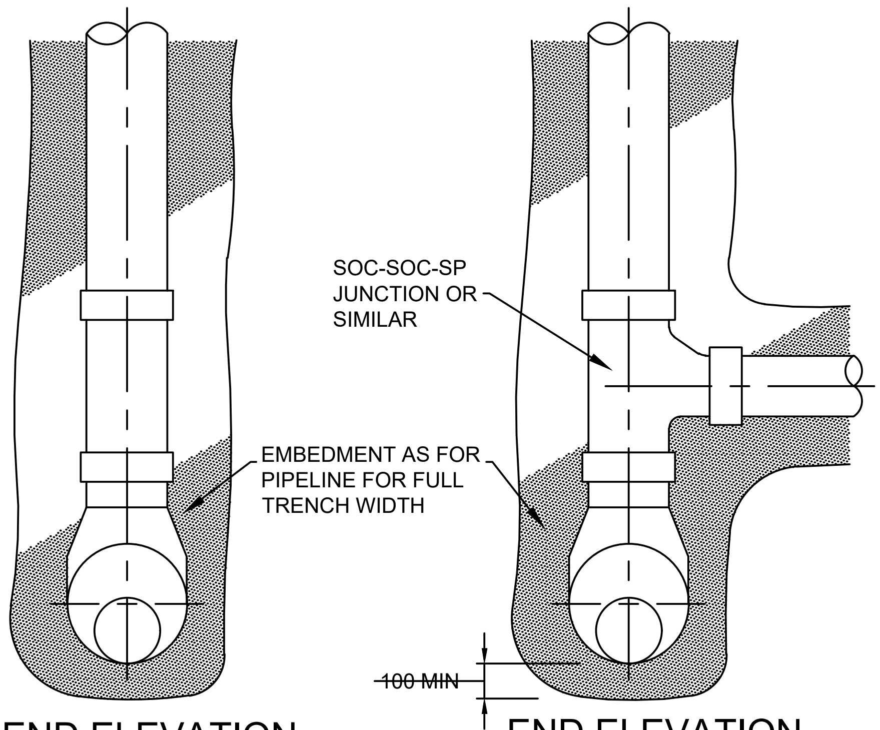


RISER SHAFT CAP

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. MS MAY BE MANUFACTURED USING VARIOUS MATERIALS AND JOINTING SYSTEMS AS AUTHORISED BY TERRITORIAL AUTHORITY.
3. MAXIMUM DEPTH TO INVERT 3000.
4. ADJUST MS TO PIPE GRADE BY TILTING MS CHAMBER. MAX DEVIATION FROM VERTICAL OF THE RISER TO BE 1:10 OR A MAXIMUM OF 300 AT SURFACE. USE KICKER BEND IF REQUIRED TO ADJUST RISER TO VERTICAL.
5. ACCESS COVER, FRAME, AND SUPPORT SLAB TO BE AS AUTHORISED BY TERRITORIAL AUTHORITY.



END ELEVATION
MAINTENANCE SHAFT



END ELEVATION
PLAIN RISER SHAFT

END ELEVATION
DROP JUNCTION

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

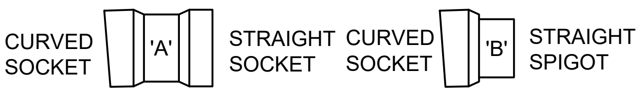
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

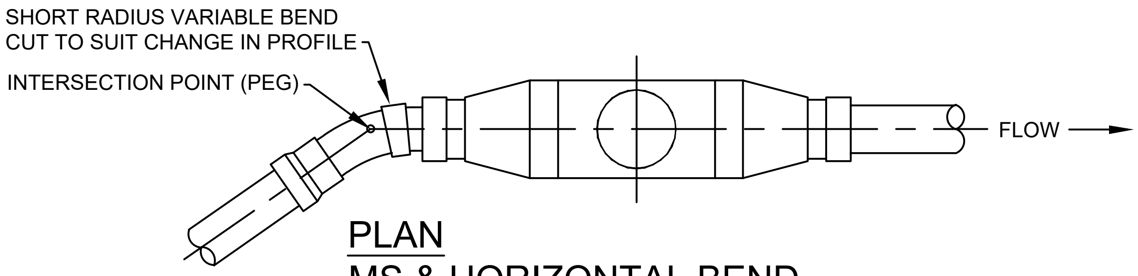
NOT TO SCALE

MAINTENANCE SHAFTS -
TYPICAL INSTALLATION

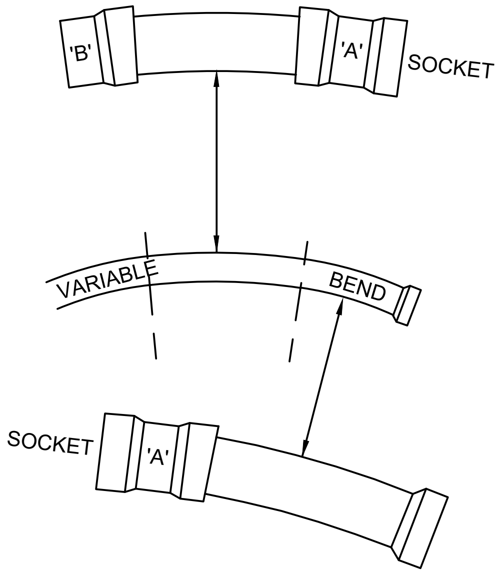
B7-10



LEGEND

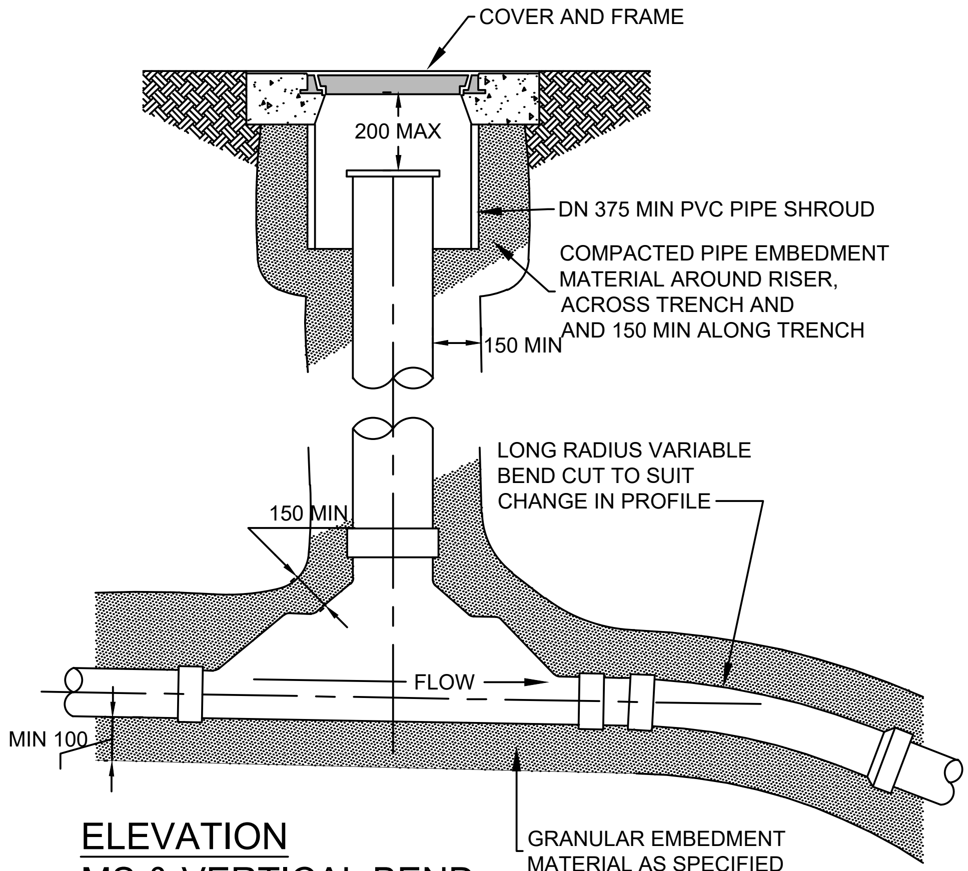


PLAN
MS & HORIZONTAL BEND



TYPICAL VARIABLE BENDS

ALL COMBINATIONS OF ENDS ACCEPTED



ELEVATION
MS & VERTICAL BEND

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. VARIABLE BEND CUT TO LENGTH TO ACHIEVE REQUIRED DEFLECTION.
3. RECORD DETAILS OF BEND LOCATIONS AND ANGLES ON WORK AS CONSTRUCTED DRAWINGS.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

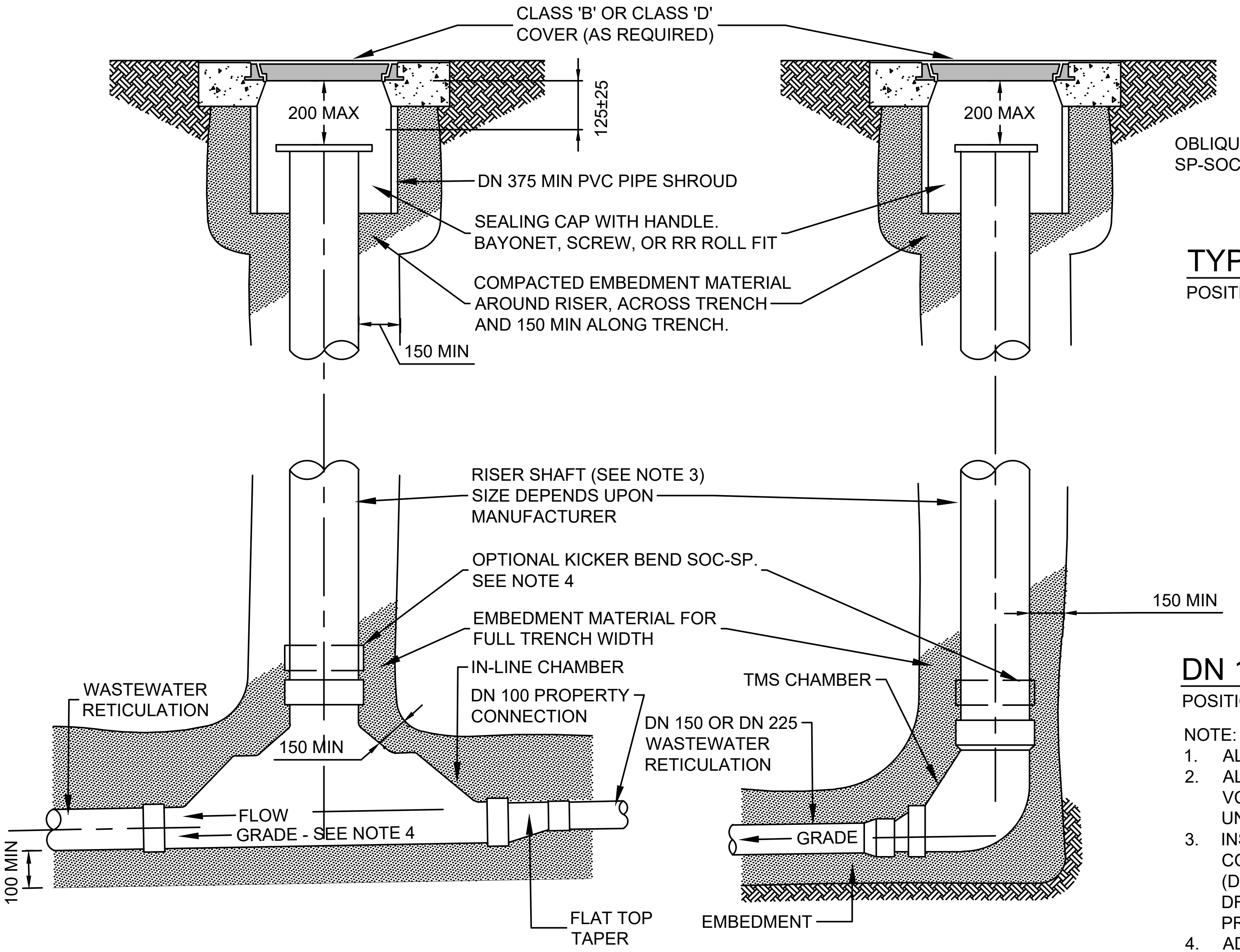
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

MAINTENANCE SHAFTS - MS AND VARIABLE BEND INSTALLATIONS

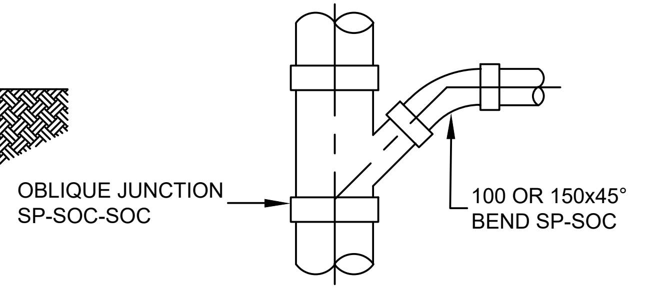
NOT TO SCALE

B7-11



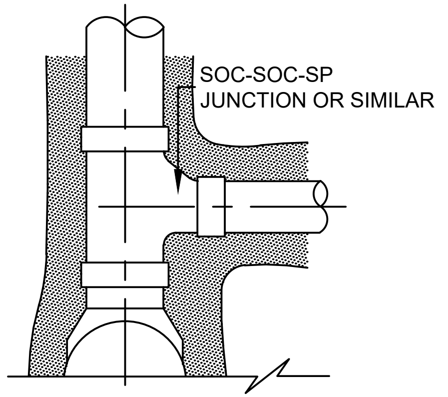
ELEVATION
TERMINAL MAINTENANCE SHAFT WITH PROPERTY CONNECTION AHEAD

ELEVATION
TERMINAL MAINTENANCE SHAFT



TYPICAL PROPERTY CONNECTIONS

POSITIONED IN RISER AS SPECIFIED



DN 150 RETICULATION INLETS

POSITIONED IN RISER AS SPECIFIED

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CONNECTION TYPES SHOWN ARE APPLICABLE TO VC, PVC (SOLVENT WELD) AND PVC (RUBBER RING) PIPES UNLESS OTHERWISE SHOWN.
3. INSTALL BRANCH CONNECTIONS AND PROPERTY CONNECTIONS (AS SHOWN ABOVE) IN RISER SHAFT (DROP JUNCTIONS) WHERE SHOWN IN DESIGN DRAWINGS. MAXIMUM OF 1 RETICULATION INLET OR 2 PROPERTY CONNECTIONS.
4. ADJUST MS TO PIPE GRADE BY TILTING CHAMBER. MAX DEVIATION FROM VERTICAL OF THE RISER TO BE 1:10 OR A MAXIMUM OF 300 AT SURFACE. USE KICKER BEND IF REQUIRED TO ADJUST RISER TO VERTICAL.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	MAINTENANCE SHAFTS - TMS AND CONNECTION INSTALLATION	B7-12

CONTENTS

1 PURPOSE

The purpose of this procedure is to:

> To verify the quality of worksmanship and materials used in the construction of Council infrastructure, demonstrating compliance with the Queenstown Lakes District Council (QLDC) Land Development and Subdivision Code of Practise, relevant AS/NZS standards, and industry best practice;

> For pressure pipes, provide confirmation that the pipeline is able to sustain a pressure greater than the design pressure without leakage;

> For non-pressure pipes and manholes, provide confirmation that the installation does not exceed allowable rates of infiltration/exfiltration;

> Provide confidence in the pipeline's structural integrity.

2 SCOPE

The scope of this procedure is to identify the appropriate test methodologies for different pipe and installation types for the purpose of confirming acceptability.

Disinfection protocols associated with water mains are covered in the QLDC Code of Practice Appendix D.

3 ROLES AND RESPONSIBILITIES

All contractors working on the Council network, or involved in the construction of infrastructure that will be vested to Council, must adhere to the requirements of the QLDC Land Development and Subdivision Code of Practice.

Only QLDC Approved Contractors shall undertake work on the network. Contractors shall ensure that appropriately trained and competent personnel are present to supervise all field testing activities.

Contractors shall be responsible for maintaining test equipment in good condition, and ensuring that any calibrations and safety certifications are current.

QLDC may audit the testing practices at their discretion to validate that the requirements of this document is being followed.

4 PIPELINE TESTING – NON-PRESSURE PIPES

Leakage testing is used to reveal locations of potential infiltration and exfiltration due to the inclusion of damaged pipes, seals, or incorrectly made joints in the pipeline at the completion of installation.

Leakage testing for acceptance of non-pressure pipelines shall be carried out by at least one of the following methods:

a) Low pressure air testing;
b) Hydrostatic testing

For pipeline test sections installed below the water table, and for submarine pipelines, the test pressure used for the hydrostatic test, and for the air test, shall be increased to maintain the required differential between internal and external pressure.

A pipeline failing to meet the requirements of the air tests may be retested using the hydrostatic test method.

4.1 LOW PRESSURE AIR TEST – PLASTIC PIPES

The test length shall be acceptable where the gauged pressure exceeds 18 kPa (or not more than 7 kPa less than the pressure at the start of the test) for the time interval shown in Table 1 after the shut-off of the air supply.

Table 1 is based on an air test pressure of 25 kPa (in excess of any external hydrostatic pressure due to groundwater) and, on this basis, air volume losses shall not exceed the greater of:

a) A rate of 0.0009 m3/(min x m2) of pipe wall area; and

b) A rate of 0.056 m3 /min, which is regarded as the lowest detectable individual air leak.

Column 2 and column 3 of Table 1 give the times and lengths up to which (b) prevails over (a).

In the case of concrete pipelines, it is recommended that pipelines be water soaked for a period of 24 hours prior to the air testing.

For safety reasons air test pressures in excess of 50 kPa should not be applied.

Table 1 Low pressure air and vacuum tests – Minimum time intervals for 7 kPa pressure change in pipline

DN	**Minimum time** (minutes)	**Maximum length for minimum time to apply** (metres)	**Test length** (metres)				
			50	**100**	**150**	**200**	**250**
			Minimum test duration (minutes)				
80	1.5	231	1.5	1.5	1.5	1.5	1.6
100	2	185	2	2	2	2	3
150	3	123	3	3	3	5	6
225	4	82	4	5	8	10	13
300	6	62	6	9	14	18	23
375	7	49	7	14	22	29	36
450	9	41	10	21	31	41	52
525	10	35	14	28	42	56	70
600	11	31	18	37	55	73	92
675	13	27	23	46	70	93	116
750	14	25	29	57	86	115	143
900	17	21	41	83	124	165	207
1000	19	19	51	102	153	204	255
1050	20	18.8	56	112	169	225	281
1200	23	15	73	147	220	294	367
1500	28	12	115	230	344	459	574

NOTE –

The time interval may be reduced for a proportionate reduction in the allowable pressure drop. Where there is no detectable change in pressure after 1 hour of testing, the section under test shall be deemed acceptable.

This table is based on the following equation:

$T = 1.02 D_i k L q$

where

T = time for a 7 kPa pressure drop, in seconds

D_i = pipeline internal diameter, in metres

q = allowable volume loss in cubic metre/minute/square metre taken as 0.0009 $m^3/min.m^2$

$k = 0.054DL$ but not less than 1

L = length of test section, in metres.

Columns 2 and 3 have been calculated with k = 1.0.

The appropriate air or vacuum test/pressure method for pipes larger than DN 750 should be established by reference to the specifier.

4.1.1 Low Pressure Air Test Procedure

The procedure shall be as follows:

(a) Pump in air slowly until a pressure of 25 +5,−0 kPa is reached. Where the pipeline is below the water table this pressure shall be increased to achieve a differential pressure of 25 kPa. In no circumstances should the actual pressure exceed 50 kPa;

NOTE – Rapid pressurisation may cause significant air temperature changes, which will effect the testing accuracy.

(b) Maintain the pressure for at least 3.0 minutes;

(c) Where no leaks are detected, shut off the air supply;

(d) Where the pipeline fails the test, repressurise to 25 +5,−0 kPa and check for leaks by pouring a concentrated solution of soft soap and water over accessible joints and fittings;

(e) Repair any defects, then repeat steps (a) to (c);

(f) With the air supply shut off, monitor the pressure for the time intervals given in table 1. The test length shall be acceptable where the pressure drops by 7 kPa, or less, over the required (tabulated) test period.

NOTE

1. The test length of pipeline should be restricted to pipeline sections between maintenance holes (the most convenient places for inserting test plugs or fixing temporary bulkheads). The method should not be used for test lengths in excess of 250 m and for pipe diameters larger than 1500 mm.
2. The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow-out. A relief valve, with a 50 kPa maximum setting, should be installed on all pressurising equipment.

4.2 LOW PRESSURE AIR TEST – CONCRETE PIPES

Concrete pipelines shall be tested in accordance with the CPAA Performance Testing of Non-Pressure Concrete Stormwater Pipes publication. The low-pressure air test can provide the criteria for acceptance of a pipeline but not for its rejection. The low-pressure air test shall be used for testing each pipe. If a length fails, the Contractor shall use a hydrostatic test. The following excerpts are from the CPAA publication.

The test is deemed acceptable where the gauged pressure drops from 10 kPa to 8 kPa in a time interval not exceeding that given in Table 22 after the shut-off of the air supply.

It is recommended that pipelines be water soaked for a period of 24 hours prior to the air testing.

Table 2 : Low pressure air tests minimum holding times at average 9 kPa pressure in pipeline (mins – secs)

DN	*Length of Test Section (metres)*									
	10	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100*
225	*0:11*	*0:22*	*0:33*	*0:44*	*0:55*	*1:06*	*1:17*	*1:28*	*1:38*	*1:41*
300	*0:19*	*0:39*	*0:58*	*1:18*	*1:37*	*1:57*	*2:14*	*2:14*	*2:14*	*2:14*
375	*0:31*	*1:01*	*1:31*	*2:02*	*2:32*	*2:50*	*2:50*	*2:50*	*3:12*	*3:33*
450	*0:44*	*1:28*	*2:11*	*2:55*	*3:22*	*3:22*	*3:22*	*4:06*	*4:36*	*5:07*
525	*1:00*	*1:59*	*2:59*	*3:55*	*3:55*	*4:11*	*4:53*	*5:34*	*6:16*	*6:58*
600	*1:18*	*2:35*	*3:53*	*4:29*	*4:29*	*5:28*	*6:22*	*7:17*	*8:11*	*9:06*

4.2.1 Low Pressure Air Test Procedure

The procedure shall be as follows:

(a) Pump in air slowly until a pressure just over 10 kPa is reached. Regulate the air supply to maintain pressure between 10 and 11 kPa, whilst check all plugs and fitting with soap solution to ensure there is no leakage. Where the pipeline is below the water table this pressure shall be increased to achieve a differential pressure of 10 kPa. In no circumstances should the actual pressure exceed 20 kPa;

NOTE – Rapid pressurisation may cause significant air temperature changes, which will affect the testing accuracy.

(b) Maintain the pressure for at least 15 minutes to allow air temperature to stabilise with the pipe walls;

(c) After stabilisation period, ensure pressure is at least 10 kPa before shutting off the air supply;

(d) Commence timing as pressure falls to 10kPa and measure time taken for pressure to drop by 2 kPa to 8 kPa;

(e) For the pipeline to pass, the time measured must be less than that given in Table 8 for the length and diameter of the pipe;

(f) Where the pipeline fails the test, either repeat after resoaking the pipe for 24 hours, or undertake a hydrostatic test instead.

NOTE

1. The method should not be used for test lengths exceeding 100 m and for pipe diameters larger than 600 mm.
2. The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow-out. A hydrostatic test should be used instead.

4.3 HYDROSTATIC TEST

The test length shall be acceptable where the specified allowable make up water is not exceeded. Where not specified, the allowable make up water shall be 0.5 L/hour per metre length per metre diameter.

4.3.1 Hydrostatic Test Procedure

The procedure shall be as follows:

(a) The test pressure shall be not less than 20 kPa, or 20 kPa above the groundwater pressure at the pipe soffit at its highest point, whichever is the greater, and not exceed 60 kPa at the lowest point of the section;

(b) Steeply graded pipelines shall be tested in stages where the maximum pressure, as stated above, will be exceeded if the whole section is tested in one length;

(c) The pressure shall be maintained for at least 2 hours by adding measured volumes of water where necessary;

(d) Any visible leaks detected shall be repaired and the pipeline shall be retested.

5 PIPELINE TESTING – PRESSURE PIPES

Hydrostatic pressure testing requires selecting an appropriate configuration of method, pressure, and length of test section. Test parameters and details shall be determined with due consideration to the following:

(a) Pipe material;

(b) Pipe diameter;

(c) Length of test section;

(d) Duration of the test;

(e) Magnitude of test pressure and rate of pressurisation;

(f) Presence of air in the pipeline;

(g) Time required for saturation of porous liners;

(h) Potential movement of pipeline thrust restraints;

(i) Design pressure for thrust and anchor supports;

(j) Accuracy of test equipment;

(k) Ambient temperature changes during testing;

(l) Presence of leaks in equipment used for testing or equipment attachment points (such as sealing plugs);

(m) Potential for leaks in the pipeline.

NOTE – It is advisable to begin testing early in the pipeline installation to confirm adequacy of laying procedures and, where appropriate, to increase the length tested progressively as experience is gained.

5.1 GENERAL TEST REQUIREMENTS

5.1.1 Selection of Test Pressure

The hydrostatic test pressure at any point in the pipeline shall be:

(a) Not less than the design pressure; and

(b) Not more than 25% above the rated pressure of any pipeline component.

NOTE – The design pressure is the maximum system pressure at a point in the pipeline, considering future developments, static pressure, dynamic pressure, and an allowance for short-term surge pressure (water hammer), as determined by analysis.

Compressed air testing shall not be permitted for pressure pipe.

In general, QLDC require that pipes are tested to their rated capacity i.e. a PN16 pipe would be tested at 16 bar.

5.1.2 Selection of Test Length

The pipeline length tested shall be either the whole, or a section (capable of being isolated), of the pipeline depending on the length and diameter, the availability of water, and the spacing between sectioning valves or blank ends.

The pipeline shall be divided into test sections such that:

(a) The hydrostatic test pressure at any point in the pipeline is:

(i) Shall be 1.25 times the rated pressure and no more, but not less than the design pressure at the highest point where pipe is tested on a sloped installation; and

(ii) (ii) Not more than 25% above the rated pressure of any pipeline component;

(b) Test sections shall not exceed 1000m and shall be limited to pipe of the same material. Consideration shall be given to the pressure loading time at the maximum filling rate (see C2.2.3) in determining the test length; and

(c) Water is available for the test together with facilities for its disposal, in accordance with regulatory requirements, after the test.

NOTE –

1. Where long lengths are to be tested, radio or other electronic means of communication between test operatives, to coordinate test procedures and thus minimise the test duration, is desirable.
2. Long test sections may incorporate a large number of mechanical (that is, flanged) joints, which should be checked for leakage. The longer the test section the harder it is to locate a leak, or discriminate between a leak and the other effects, such as the absorption of air into solution under pressure.
3. QLDC recommends that test sections are as short as possible to reduce the efforts during fault finding should a test length fail to pass the test. Test lengths of 250m to 500m are typically considered as practical.

5.1.3 Pre-Test Procedures

The pre-test procedures are as follows:

(a) All required temporary and permanent thrust blocks, or other pipeline thrust resisting methods, including integral joint-restraint systems, shall be in place, and all concrete shall be adequately cured (normally a minimum of 7 days);

(b) Blank flanges or caps shall be installed at the beginning and end of the test section. Testing shall not take place against closed valves. Mechanical ends that are not end load resistant shall be temporarily strutted or anchored, to withstand the test pressures without movement;

NOTE – Temporary supports should not be removed until the pipeline has been depressurised. All test personnel should be informed of the loading limits on temporary fittings and supports.

(c) Where practicable, all bolted joints shall be left exposed to allow for retensioning during or after testing;

(d) Compacted embedment and fill material shall be placed to leave all joints, service connections and ball valves exposed wherever possible;

(e) For PE pipelines, the pressurising time shall not exceed 45 minutes;

NOTE – The pressurising time affects the duration of the PE pipeline test.

(f) The test equipment shall be placed in position and checked for satisfactory operation;

(g) The pump shall be of adequate size to raise and maintain the test pressure;

NOTE – A pump that is too small may increase the test duration or where too large it may be difficult to control the pressure.

(h) Two calibrated test gauges shall be used to cross check gauge accuracy;

(i) Slowly fill the test length of pipeline with water, preferably from the lowest point, ensuring air is vented at the high point valves. Allow a period, in the range of minimum 3 hours to 24 hours (preferred), for the temperature of the test length and the test water to stabilise and for dissolved air to exit the system. The recommended rate of filling shall be based on a flow velocity of 0.05 m/s, calculated from the following equation:

$$Qf \leq 12.5\pi D2$$

where

Qf = filling rate, in litres per second

D = pipe diameter, in metres

NOTE – The slow rate of 0.05 m/s avoids air entrainment when the filling water is cascading through downward gradients along the pipeline.

The period of stabilisation will depend on pipe dimensions, length, material, longitudinal profile, and air exit points. For cement-mortar lined pipe, the pipeline shall be filled at least 24 hours before the commencement of the test, to allow the lining to become saturated.

NOTE – A firm foam swab may be used ahead of the fill water to assist air removal especially where the pipeline undulates. Extract the swab at a high-point wash-out.

Typical pressure test equipment and location are shown in figures 1 and 2.

5.1.4 Post Test Procedures

After testing, pipelines shall be depressurised slowly. All air venting facilities shall be open when emptying pipelines. The test water shall be drained to an approved waterway and all connection points shall be reinstated.

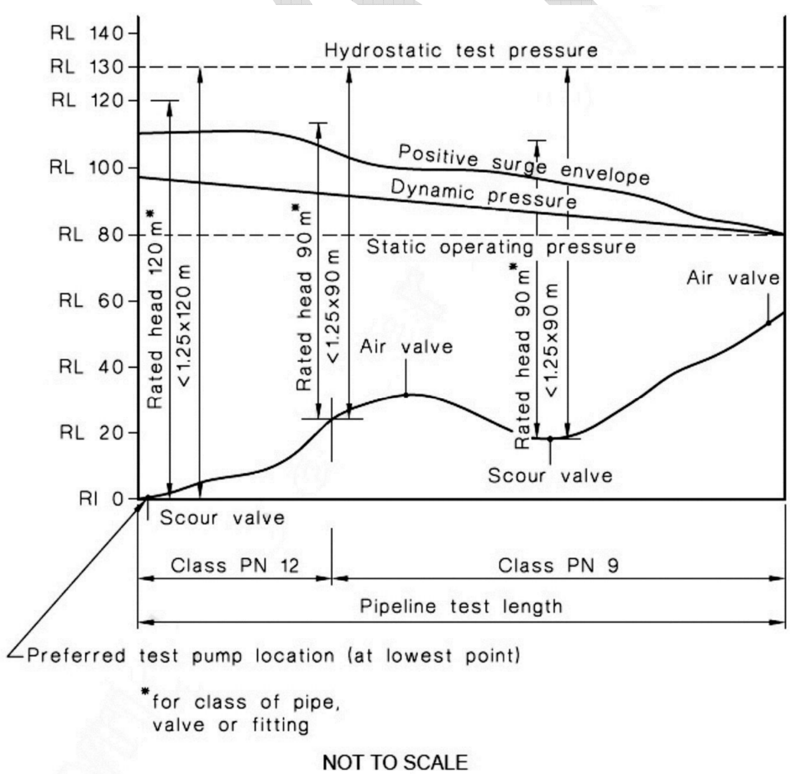


Figure 1 Typical pressure pipeline under typical field test

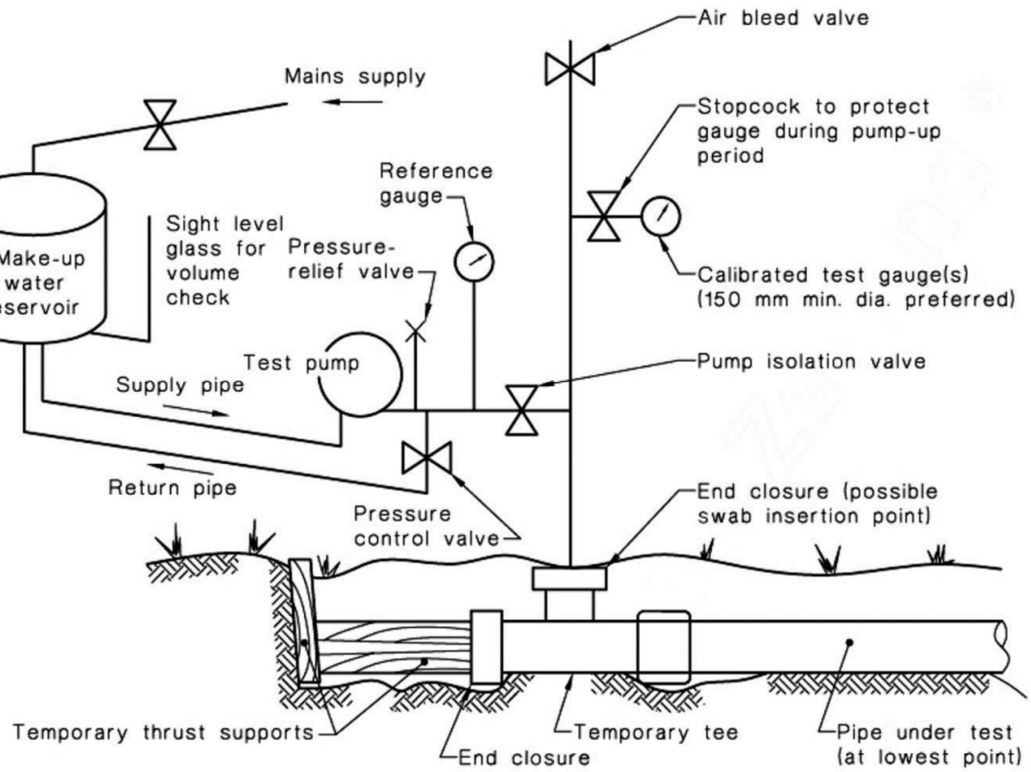


Figure 2 Typical field pressure test equipment layout

A pressure log of the test, recorded at 5 second intervals (or less), must be submitted in .xls or .csv format with the test report.

5.2 CONSTANT PRESSURE TEST (WATER LOSS METHOD) – NON-VISCOELASTIC PIPELINES

This test is applicable for PVC, DI, GRP, and steel pipelines.

5.2.1 Procedure

The procedure shall be as follows:

(a) Close all valves apart from the test pump input and pressurise the test length to the specified test pressure (STP) – (see 5.1.1);

(b) Apply and then maintain the test pressure by the addition of measured and recorded quantities of make-up water at regular intervals over a period, in the range of 1 hour to 12 hours. Note, that after the test section has been filled with water, it is often necessary to use a hand pump to complete the test as a motorised test pump can prove to be difficult to control when testing short lengths of relatively small diameter pipeline ;

(c) Where pressure measurements are not made at the lowest part of the test length, make an allowance for the static head, between the lowest point of the pipeline and the point of measurement,

The quantity of make-up water necessary to maintain the test pressure shall comply with the following equation:

$Q \leq 0.14LDH$

where

Q = allowable make-up water, in litres per hour

L = length of the test length, in kilometres

D = nominal diameter of the test length, in metres

H = average test head over length of pipeline under test, in metres

NOTE – The make-up water is not a leakage allowance, but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution. Normally the test should last for a minimum of 2 hours and be concluded within 5 to 8 hours. The make-up water requirement should reduce with time as air goes into solution. Where, after 12 hours the make-up water still exceeds the allowable limit, testing should cease and the cause of loss investigated.

5.2.2 Acceptance

The test length shall be acceptable where:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage;

(c) The quantity of make-up water necessary to maintain the test pressure complies with 5.2.1.

5.3 CONSTANT PRESSURE TEST (WATER LOSS METHOD) – VISCOELASTIC PIPELINES

This test is applicable to PE, PP, and ABS pressure pipelines. The test lengths may be several kilometres in length.

NOTE - This method is based on VAV P78, as outlined in AS/NZS 2566.2, Appendix A.

5.3.1 Procedure

The procedure shall be as follows:

(a) Purge the air from pipeline;

(b) Apply the specified test pressure (STP) (see C3.1) to the test length;

(c) Shut off main and allow pressure to settle for 12 hours (pressure will drop significantly);

(d) Re-apply and maintain test pressure for 5 hours by successively pumping a sufficient amount of water;

(e) Measure and record water volume (V1 in litres) required to maintain this pressure between Hour 2 and Hour 3;

(f) Measure and record water volume (V2 in litres) required to maintain this pressure between Hour 4 and Hour 5;

(g) Calculate:

$$0.55V1 + Q$$

where

Q is the allowable make-up volume obtained from 5.2.1.

5.3.2 Acceptance

The test length shall be acceptable where:

(a) The test length shall be acceptable where there is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage; and

(c) $V2 \leq 0.55\ V1 + Q$

5.4 PRESSURE REBOUND TEST (PE PIPES UP TO DN315)

This test is applicable to PE, PP, and ABS pressure pipelines up to and including DN315, where a short test time is required.

NOTE – This test is based on BS EN 805:2000, Appendix A (refer to AS/NZS 2566.2).

5.4.1 Pressure Measurement Rig

The test rig shall be a recently calibrated pressure transducer, data logger, and check pressure gauge that has a dial of at least 100 mm diameter and a pressure range that places the specified test pressure (STP) (see 5.1.1) in the range 35% to 70% of the gauge's full scale. The transducer and the check gauge shall read within ±5% of each other. If they do not agree within this tolerance, the equipment shall be recalibrated or replaced.

5.4.2 Procedure

The test procedure has the following three phases:

(a) A preliminary phase in which the pipeline is —

  (i) Depressurised and allowed to relax after the C3.3 pre-test procedure

  (ii) Pressurised quickly to the test pressure and maintained at this pressure for a period of time without further water being added

  (iii) The pressure is allowed to decay by viscoelastic creep, and

  (iv) Provided the pressure drop does not exceed a specified maximum, the pressure test can proceed to the second phase;

(b) A phase in which the volume of air remaining in the pipeline is assessed against an allowable maximum;

(c) The main test phase in which the pipeline is maintained at the test pressure for a period of time and decay due to viscoelastic creep commenced. The creep is interrupted by a rapid reduction of the pressure in the pipeline to a specified level. This rapid reduction in pressure results in contraction of the pipeline with an increase (rebound) in pressure. If, during the rebound period, the pressure versus time record shows a fall in pressure, the pipeline fails the test.

5.4.3 Preliminary Phase

The procedure shall be as follows:

(a) Reduce pressure to just above atmospheric at the highest point of the test length, and let stand for 60 minutes. Ensure no air enters the line;

(b) Raise the pressure smoothly to STP in less than 10 minutes. Hold the pressure at STP for 30 minutes by pumping continuously, or at short intervals as needed. Do not exceed STP;

(c) Inspect for leaks during the 30 minute period, then shut off pressure;

(d) Allow the pressure to decay for 60 minutes;

(e) Measure the pressure remaining at 60 minutes (P60);

(f) If P60 ≤ 70% of STP the test is failed. The cause shall be located and rectified. Steps (a) to (e) shall be repeated. If P60 > 70% of STP, proceed to the air volume assessment.

5.4.4 Air Volume Assessment

The procedure shall be as follows:

(a) Quickly (<5 mins) reduce pressure by ΔP (10% - 15% of STP)

(b) Measure water volume bled out (ΔV)

(c) Calculate $\Delta V_{max\ allowable}$ as follows:

$$\Delta V_{max\ allowable} = 1.2 \times V \times \Delta P(1/E_W + D/eE_R)$$

where

1.2	=	air allowance
V	=	pipe volume, in litres
ΔP	=	measured pressure drop, in kilopascals
D	=	pipe internal diameter, in metres
E_R	=	pipe material modulus, in kilopascals (see table 2)
E_W	=	bulk modulus of water, in kilopascals (se table 3)
e	=	pipe wall thickness, in metres

(d) If $\Delta V > \Delta V_{max}$ allowable the test has failed. The cause shall be located and rectified. The preliminary phase shall be repeated. If $\Delta V \leq \Delta V_{max}$ allowable, proceed to the main test phase.

NOTE – ΔV and ΔP should be measured as accurately as possible, especially where the test length volume is small.

5.4.5 Main Test Phase

Observe and record the pressure rise for 30 minutes.

In the event of failure, locate and repair leaks. If failure is marginal or doubtful, or if it is necessary to determine leakage rate, use a reference test (see 5.3).

NOTE – Figure 3 gives an example of a full pressure test with the main test phase extended to 90 minutes

Table 3 Pipe E material modulus for PE 80B and PE 100

Temp (°C)	**PE 80B – *E* Modulus** (kPa×10^3)			**PE 100 – *E* Modulus** (kPa×10^3)		
	1 h	**2 h**	**3 h**	**1 h**	**2 h**	**3 h**
5	740	700	680	990	930	900
10	670	630	610	900	850	820
15	600	570	550	820	780	750
20	550	520	510	750	710	680
25	510	490	470	690	650	630
30	470	450	430	640	610	600

Table 4 Bulk modulus E_w – Water

Temperature (°C)	**Bulk Modulus** (kPa×10^3)
5	2080
10	2110
15	2140
20	2170
25	2210
30	2230

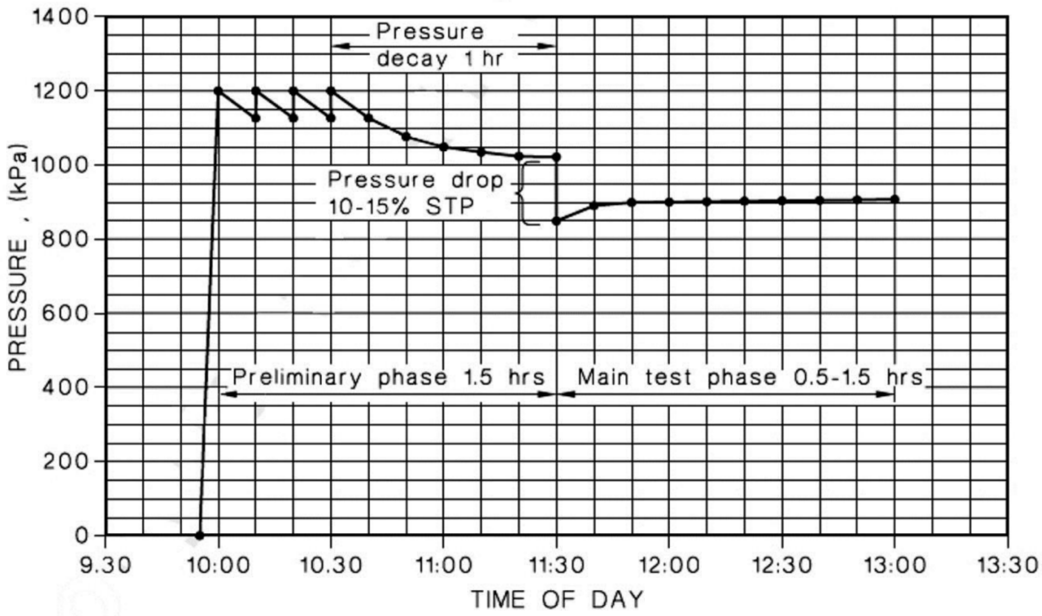


Figure 3 Typical successful modified rebound test for a PE pipeline

5.4.6 Acceptance

The test length shall be acceptable if:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage;

(c) The pressure rises or remains static in 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 90-minute period.

If the pressure drops by more than 20 kPa during the 90-minute extended period, the test fails.

Repetition of the main test phase shall only be done by carrying out the whole test procedure, including the relaxation period of 60 minutes described in 5.4.3.

5.5 VISUAL TEST FOR SMALL DIAMETER PRESSURE PIPELINES

This test is applicable for small pipelines of all materials (less than 200 m in length), and pipelines where pipeline joints have been left exposed for the test operation (such as coiled pipe).

5.5.1 Procedure

The procedure shall be as follows:

(a) The test pressure (see 5.1.1) shall be applied and the test section isolated by closing the high point air release valves and the pump feed valve;

(b) The test section shall be visually inspected for leakage at all joints, especially bolted joints, all fittings, service connections, and ball valves;

(c) Pressure gauges shall be checked to ensure that pressure has not fallen significantly indicating an undetected leak;

(d) Any detected leak shall be repaired and the section shall be retested;

(e) Where no leak is detected, high point air release valves shall be opened, the pipeline shall be depressurised to slowly drain the line into an approved waterway and all connection points shall be reinstated.

5.5.2 Acceptance

The test length shall be acceptable where:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage; and

(c) There is no pressure loss indicative of a leak.

6 MANHOLE TESTING

The type of test shall be selected according to the performance requirement of the system, the type of installation methodology, ground conditions and Health and Safety risk factors associated with the installation. All manhole tests shall include 300mm of the connecting pipework with the lid fitted into place.

6.1 HYDROSTATIC TEST (CONCRETE MANHOLES)

This test may be used for manholes up to 3.5m depth and relies on obtaining a proper seal from the pipeline plugs to withstand the hydrostatic pressure. The limitation on this test is the non-uniform pressure distribution and the low pressure at the top of the manhole will not sufficiently test the top seal of the lid. To test the top seal this test shall be supplemented with the visual check (smoke test) in section 6.4 or the low pressure air test as per section 6.2. The manhole shall be completely backfilled and interconnected pipework and manholes be vacated before starting the test.

6.1.1 Procedure

Ensure that there is no entry into the connecting trench or any connected manhole associated with the manhole being tested. The manhole shall not be pressurised beyond the static pressure alone and the lid shall remain open.

The procedure shall be as follows:

(a) Seal openings using properly sized or inflatable plugs;

(b) Completely fill the manhole to the top of the lid frame with water;

(c) Allow the filled manhole to soak for minimum 4 hours;

(d) Top up any water loss to the top of the lid frame during the soak period;

(e) Measure the water loss over every 1 hour for 8 hours;

(f) Empty the manhole and allow to stand for 1 hour before completing a visual inspection for groundwater infiltration.

6.1.2 Acceptance

The test shall be acceptable where:

(a) The average quantity of make-up shall not be more than 0.3 litres per 1m diameter per 1m depth per hour, and;

(b) The post-test visual inspection shall show no evidence of groundwater ingress through any joint.

6.2 VACUUM TEST

The vacuum test creates differential pressure between the inside and outside of the manhole. This test shall be completed with the manhole completely backfilled and the lid in place.

6.2.1 Procedure

The procedure shall be as follows:

(a) Clean manhole thoroughly;

(b) Seal openings using properly sized or inflatable plugs;

(c) Connect seal plate to manhole opening;

(d) Draw vacuum of -254mmHg (or -338.6mbar) and isolate valves;

(e) Hold test time according to the manhole sizes as listed in the table below:

Table 5 Manhole Test Duration Requirements

Depth (m)	Diameter (mm)								
	675	900	1050	1200	1300	1500	1800	2400	3000
	Time (s)								
<2	11	14	17	20	23	26	33	39	45
3	14	18	21	25	29	33	41	49	57
3.5	17	21	25	30	35	39	49	59	69
4.3	20	25	30	35	41	46	57	69	81
5	22	29	34	40	46	52	67	81	95
5.5	25	32	38	45	52	59	73	87	101
6	28	35	42	50	53	65	81	97	113
6.7	31	39	46	55	64	72	89	107	125
7.3	33	42	51	59	68	78	97	115	133
8	36	46	55	64	75	85	105	125	145
8.5	39	49	59	69	81	91	113	135	157
9	42	53	63	74	87	98	121	145	169
9.5	46	58	69	81	94	105	129	153	177
10	49	63	74	87	98	113	139	165	191

(f) Release the vacuum and remove the test gear and plugs

6.2.2 Acceptance

The test shall be acceptable where:

(a) For the duration of the test the vacuum did not drop below -228mmHg (or - 304mbar).

(b) There are no visible wet patches or “sweating” at any of the pipe penetrations, seals, or riser joints.

6.3 INFILTRATION TEST (CONCRETE MANHOLES)

This test is completed by creating an external water column around the manhole to that will force groundwater through any leaking joints. This method is recommended where manholes are over 3.5m deep or can only be part tested using the hydrostatic testing method up to 3.5m depth. However, the limitation on part testing to 3.5m is that the hydrostatic pressure shall be demonstrated to be higher than the groundwater pressure at the location of the joints being tested. The vacuum test procedure is preferred over this option.

This test does not confirm the lid seal and shall be supplemented with the visual check (smoke test) in section 6.4 or the low pressure air test as per section 6.2.

6.3.1 Procedure

The procedure shall be as follows:

(a) Excavate or provide a moat of approximately 500mm around the circumference of the manhole and fill with water;

(b) A 32mm PVC sleeve is provided adjacent to the manhole wall to 1 m below the hydrostatic test depth. The bottom 1m of the sleeve shall be perforated to allow groundwater to enter the sleeve;

(c) The water in the moat is filled until the groundwater in the sleeve reaches the level of the water in the moat;

(d) The groundwater level is maintained for eight (8) hours.

6.3.2 Acceptance

The test shall be acceptable where:

(a) There are no visible leaks, wet patches or “sweating” at any of the pipe penetrations, seals or riser joints.

6.4 VISUAL CHECK/SMOKE TEST (CONCRETE MANHOLES)

This test shall only be conducted on manholes where the joints and pipe penetrations being tested have not been backfilled over and are visible for inspection of forced smoke leaking through defective seals. The limitation of this test is to manholes that are not located within a 100 year flood plain level and is ideally suited for low risk shallow manholes.

6.4.1 Procedure

The procedure shall be as follows:

(a) Seal openings using properly sized or inflatable plugs;

(b) Connect seal plate to opening of manhole lid with appropriate connection to introduce the smoke;

(c) Introduce smoke into manhole being tested according to the manufacturer’s recommendation;

(d) The smoke shall be introduced for a minimum of 5 minutes;

(e) Inspect joints for smoke leaks.

6.4.2 Acceptance

The test shall be acceptable where:

(a) There is no smoke leaking from any of the joints

6.5 PLASTIC/GRP MANHOLE TESTING

Manholes shall be tested twice:

1. Off-site as a single unit at the manufacturer's facilities according to industry best practice for the material being used; and
2. On installation on site, fully backfilled and connected, and tested per the vacuum test described in section 6.2.

Records associated with the off-site test shall be provided to the QLDC.

7 PROCESS OUTPUTS

Completed test records sheet, in accordance with the attached templates, shall be provided to QLDC for each field test completed.

APPENDIX 1 – LOW PRESSURE AIR TEST (NON PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS	
Parameter	**Result**
Minimum Duration (from Table 1)	
Test Duration (mins)	
Pressure at Start of Test (kPa)	
Pressure at End of Test (kPa)	
Calculate Pressure Drop ΔP (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - ΔP < 7kPa	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 2 – HYDROSTATIC TEST (NON PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS	
Parameter	**Result**
Test Duration (mins)	
Test Pressure (kPa)	
Volume of Make Up Water (l)	
Make Up Water Rate (l/hr)	
Specify Allowable Make Up Rate	
Acceptance Criteria	**Pass (Y/N)**
Allowable Make Up Rate > Measure Make Up Rate	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 3 – CONSTANT PRESSURE TEST (NON VISCOELASTIC PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS	
Parameter	**Result**
Test Duration (mins)	
Test Pressure (kPa)	
Volume of Make Up Water (l)	
Make Up Water Rate (l/hr)	
Calculate Allowable Make Up Rate Q ≤0.4LDH	
Acceptance Criteria	**Pass (Y/N)**
Allowable Make Up Rate > Measured Make Up Rate	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 4 – CONSTANT PRESSURE TEST (VISCOELASTIC PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		**Pipe Diameter**	
Pipe Material & Class		**Pipe Length**	

TEST RESULTS	
Parameter	**Result**
Test Pressure (kPa)	
Pressure after 12 hrs (kPa)	
Volume of Make Up Water (l) **V1 (between hours 2 & 3)**	
V2 (between hours 4 & 5)	
Allowable Make Up Rate (Q = 0.4LDH)	
Calculate 0.55 V1 + Q	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria V2 ≤ 0.55 V1 + Q	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 5 – PRESSURE REBOUND TEST (PE PIPES UP TO DN315)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS – PRELIMINARY PHASE	
Parameter	**Result**
Test Pressure (kPa)	
Pressure after 60 mins decay (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - P60 > 70% of STP	
Visual Inspection	

TEST RESULTS – AIR VOLUME ASSESSMENT	
Parameter	**Result**
Record volume of water bled out (ΔV)	
Calculate: $\Delta V_{max\ allowable} = 1.2 \times V \times \Delta P (1/E_W + D/E_R)$	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - $\Delta V \leq \Delta V_{max}$	

TEST RESULTS – MAIN TEST PHASE	
Parameter	**Result**
Record pressure at start of test phase (kPa)	
Pressure after 60 mins decay (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria – Pressure rises or remains static*	

* 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 90-minute period.

•

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: __________________________

Print Name: __________________________

APPENDIX 6 – MANHOLE HYDROSTATIC TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		**MH Diameter**	
Manhole ID		**MH Material**	

TEST RESULTS								
Parameter	**Hour 1**	**Hour 2**	**Hour 3**	**Hour 3**	**Hour 4**	**Hour 5**	**Hour 6**	**Hour 7**
Volume of water added (l) to maintain level								
Acceptance Criteria	**Pass (Y/N)**							
Pass Criteria - 0.3 litres per 1m diameter per 1m depth per hour								
Visual Inspection								

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 7 – MANHOLE VACUUM TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		MH Diameter	
Manhole ID		MH Material	
TEST RESULTS			
Parameter	**Result**		
Pressure at start of test (mbar)			
Test duration (refer Table 4)			
Pressure at end of test period (mbar)			
Acceptance Criteria	**Pass (Y/N)**		
Pass Criteria – Pressure at end of test < -304mbar			
Visual Inspection			

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 8 – MANHOLE INFILTRATION AND VISUAL TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		**MH Diameter**	
Manhole ID		**MH Material**	
TEST RESULTS			
Acceptance Criteria	**Pass (Y/N)**		
Visual Inspection			

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: __________________________

Print Name: __________________________

CONTENTS

1 PURPOSE

Water supply authorities are required by law to ensure that the water supply system is free from conditions that may be hazardous to public health. The Water Services Act 2021 requires drinking water suppliers to ensure that the drinking water supplied by the supplier is safe.

The purpose of this procedure is to:

> Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of both new watermains and existing watermains following planned or reactive maintenance

> Prevent contamination of the water supply system by defining required best practices for workers and materials that come in contact with water. For pressure pipes, provide confirmation that the pipeline is able to sustain a pressure greater than the design pressure without leakage;

> Ensure compliance with legislative requirements

2 SCOPE

The scope of this procedure is to define the minimum requirements for disinfection across all of the Council water supply system, including but not limited to the following:

- New watermain installations and connections
- Reticulation repairs and maintenance
- Water reservoirs and storage tanks

3 ROLES AND RESPONSIBILITIES

All contractors working on the Council network, or involved in the construction of infrastructure that will be vested to Council, must adhere to the requirements of the QLDC Land Development and Subdivision Code of Practice.

Only QLDC Approved Contractors shall undertake work on the network. Contractors shall ensure that appropriately trained and competent personnel are present to supervise all disinfection activities.

Contractors shall be responsible for annual medical clearance of their water reticulation workers. Contractors shall ensure that their water reticulation workers are medically fit for work on a daily basis.

QLDC may audit the disinfection practices at their discretion to validate that the requirements of this document is being followed.

Any confirmed or suspected contamination to the water supply network must be escalated to QLDC immediately.

4 DISINFECTION OF TOOLS, MATERIALS AND OTHER EQUIPMENT

4.1 VEHICLES

A high standard of cleanliness shall be maintained in the interiors of all vehicles used for water reticulation works.

Vehicles must be equipped with sanitary wipes or antibacterial liquid for hand sanitation when working on site.

All fittings carried in vehicles must be boxed, capped or sealed with plastic wrapping. All pipes must be capped.

4.2 STORES

A high standard of cleanliness shall be maintained in the interior of all stores.

Water supply and wastewater equipment shall be stored separately. All materials shall be stored and handled to minimise contact with foreign materials. Fittings shall be boxed, capped or sealed with plastic wrapping. All pipes shall be capped.

4.3 TOOLS AND EQUIPMENT

All tools used in the construction or maintenance of the main and fittings that come into contact with the treated water must have been thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use.

Larger items of plant and equipment including excavators shall be steam cleaned before use on potable water works. Disinfected tools must not be placed directly on the ground prior to use.

4.4 MATERIALS

All materials used in the construction or maintenance of the main and fittings that come into contact with the treated water must be:

1. provided sealed by the manufacturer under hygienic conditions and are not uncovered until immediately before use,

   Or

2. thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use. Disinfected items must not be placed directly on the ground prior to installation.

A bactericidal lubricant complying with AS/NZS4020 shall be used on all rings and gaskets coming into contact with the reticulated water.

4.5 DISINFECTION AND NEUTRALISING CHEMICALS

A minimum 0.1% solution for disinfection of tools, equipment, fittings and materials is made up of 1 part chlorine solution (i.e. commercially available Sodium hypochlorite solution of 12-15% available chlorine) to 9 parts water and shall have a pH value of between 7 and 8. A newly prepared solution shall be made available at least weekly and the old solution disposed of after dechlorination with Sodium Thiosulphate (or suitable alternative).

4.6 DEVIATION FROM STANDARD PROCEDURES

Where there are deviations from the procedure, for example during emergency works, these works shall be fully documented with supporting information showing the alternative disinfection procedures utilised and the reasons for deviations from the standard procedures. Any changes from the standard procedure needs to be approved by the appropriate service delivery area manager prior to the disinfection being undertaken.

5 NEW WATERMAINS DISINFECTION PROCEDURE

5.1 FLUSHING

The main shall be thoroughly flushed in sections through hydrants, producing sufficient flow velocity to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes. The flow of water shall be from one direction at a time and depending on the position of the flushing point(s), flushing may be required to alternate between opposite directions to ensure all of the water is completely flushed out of the pipe.

5.2 CHLORINATION

Each section of new watermain, including all fittings and service connection pipes, shall be disinfected within 10 days before being placed into service.

The pipe shall be drained completely and then slowly filled with potable water that has been pre-mixed with chlorine in a tanker. The water shall be tested for chlorine concentration before use and contain sufficient free available chlorine (FAC) to produce a uniform concentration of between 15 and 25 mg/l in the pipe.

If pre-mixed chlorinated water is not used the chlorine solution must be injected at a continuous rate to ensure a concentration of 15 to 25 mg/l is in contact with every part of the main (Refer to Section 5.3 for chlorine dosage). This can be achieved by pumping in the chlorine solution or by using a chlorine injector while the main is being filled with water.

The chlorinated water shall be introduced at the lowest point of the section of pipe to be disinfected to ensure that no air is trapped. All service pipes and hydrants shall be left open and allowed to run for a couple of minutes. The services and hydrants shall then be closed to allow the highest end of the main to fill completely. Chlorine levels shall be tested and recorded along the length of the main at a minimum of 150m intervals to ensure effective distribution of the chlorine.

The use of hypochlorite powder, granules or tablets dumped into the pipe or through hydrants is not acceptable under any circumstance.

After 12 hours contact time the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and must be repeated using a solution with a pH less than 9.0.

After 24 hours the residual chlorine concentration must be at least 10 mg/l. If this requirement is not achieved, the chlorination procedure shall be repeated. Once this requirement is achieved, the main and service connection pipes shall be flushed with chlorinated water until the chlorine concentration of the water is between 0.5 to 1.0 mg/l. Watermains shall again be flushed with water equivalent to three pipe volumes. Refer to Section 7 for disposal of super-chlorinated water.

Testing takes approximately 24 hours to complete and the main must be connected within 10 days of an acceptable result. Refer to Section 8 for test sample results. The watermain must remain charged during this time to prevent contamination.

The test results must be provided to QLDC.

5.3 CHLORINE DOSAGES

The required amounts of Sodium hypochlorite must be calculated based on the length and diameter of the main to be disinfected. The steps to calculate the required dose are described below:

I. Use sodium hypochlorite solution. This solution usually has 10% or 15% FAC
II. Obtain a clean water tanker, as used for potable drinking water. The tanker should have a known water capacity
III. Measure the required amount of sodium hypochlorite solution into a beaker and pour it into the empty tanker
IV. Fill the tanker to the appropriate volume and ensure the solution is well mixed;

Example:

A. Calculate the volume of the mains to be chlorinated, that is, 85 m of 100 mm dia. main

$$\text{Vol.} = \frac{85 \times \pi \times 0.12}{4} = 0.67 \text{ m3}$$

$$= 667.6 \text{ litres}$$

Plus 110 m of 150 mm dia. Main

$$\text{Vol.} = \frac{110 \times \pi \times 0.152}{4} = 1.944 \text{ m3}$$

$$= 1.944 \text{ litres}$$

Total volume = 1,944 + 667.6 = 2,611.6 litres

B. The total volume of 2,611.6 litres is less than the volume of the water tanker (say 5,000 litres) so calculate how many millilitres of sodium hypochlorite is required for the 5,000 litre tanker to give a final solution of 25 g/m^3

$$v = \frac{V \times c}{s \times 10}$$

v = volume of sodium hypochlorite in ml
V = volume of water tanker
c = concentration of final solution in g/m3
s = strength of concentrated hypochlorite in % FAC

$$v = \frac{5000 \times 25}{15 \times 10} = 833 \text{ ml}$$

5.4 NEW MAIN CONNECTION

The connection of a new main to existing reticulation may be treated as a medium risk (refer to Section 11.1 for risk classification) situation provided sanitary construction procedures are followed ensuring no contamination of either the new or existing main by foreign material or groundwater.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days of chlorination, the main shall be retested for E.coli as per the initial testing. If any of the new samples fail the E.coli test the disinfection procedure must be repeated.

New local network main connection procedure:

1. Excavate trench and dig sump under the section of the existing pipe to be removed to allow for the connection. The sump shall be of a depth at least 400mm.
2. Confirm that the new pipe is clear of all foreign matter and clean
3. Shutdown and drain the connecting watermain in accordance with good practice.

4. Thoroughly clean and disinfect existing connecting pipework/fittings.
5. Any new fittings to be installed shall be kept clear of the surrounding trench material and when unwrapped placed on a clean surface (e.g. impervious plastic sheet) until installed.
6. Spray all surfaces of fittings, and wipe the interior of open ends of the new and existing watermains with a minimum 0.1% chlorine solution (Refer to Section 4.5).
7. After completion of the work, the watermain must be flushed out through hydrants downstream of the new connection. The volume of water used must be equivalent to at least three pipe volumes.

6 DISINFECTION PROCEDURE FOR RESERVOIRS

Additional guidance for reservoir disinfection is provided in AWWA Standard ANSI/AWWA C652-02 for "Disinfection of Water-storage Facilities".

Network reservoirs shall only be filled and disinfected by a QLDC authorised contractor in accordance with an approved work methodology that includes isolation and disinfection procedures.

6.1 INTENTION

The intention of this procedure is to establish a sustainable reservoir disinfection process that is efficient in the areas of water usage, time and cost. Upon successful completion of this process, the water used for disinfection should be able to be distributed into the network as potable water.

6.2 CLEANING

The reservoir shall be thoroughly cleaned, using a jet-wash and hypochlorite solution, and then inspected by an authorised QLDC representative. Disinfection shall not commence until QLDC has provide approval to proceed.

All equipment used in the disinfection of a reservoir must be oil-free, in good working order, have up-to-date and complete maintenance records and must not pose a contamination risk during the procedure. Use of divers and robotic equipment is subject to specific approval from the QLDC Operations team before the commencement of the procedure.

6.3 RESERVOIR FILLING AND DISINFECTION BY CHLORINATION

The reservoir shall be partially filled with potable water to a volume of 20% of the reservoir's capacity. All inlet and outlet valves on the reservoir shall then be isolated and, if practical, locked prior to disinfection starting.

Chlorine shall be added to the fill volume to result in a FAC of 2.0 mg/L. The water shall then be left to stand for a minimum of 24 hours. Field testing to confirm the chlorine concentration is required using a portable handheld meter; the testing results shall be provided to the QLDC Operations team. Should testing indicate a significant drop in the chlorine concentration, QLDC shall advise how to proceed.

6.4 TESTING

The chlorine concentration shall be measured at the end of the initial 24-hour standing period and, if required, additional chlorine shall be added as the reservoir is filled to the Top Water Level (High) The final chlorine concentration at Top Water Level (High) shall be within the range of 0.6 to 1.0 mg/L. The reservoir shall be filled in such a way that the water is well mixed.

Field testing of the chlorine concentration shall be carried out using a handheld meter with samples taken from representative sample points to confirm the actual FAC concentration. If the reservoir has top and bottom sample points, both points must be sampled. If the concentration is less than the specified minimum, further chlorination and mixing shall be undertaken until this concentration is achieved.

Having achieved the required chlorine concentration from both sample points, the reservoir shall be left to stand for a further 24 hours. Following this period, the reservoir shall be sampled as early as practicable by an IANZ certified laboratory. Sampling must be completed by authorised laboratory personnel only. The required tests are listed in Section 8 of this document.

Acceptable sample results are given in Section 8 of this document and must be achieved before the reservoir is placed into service. If the results are not satisfactory, the reservoir shall be re-chlorinated and re-tested until acceptable results are achieved.

The reservoir can be placed into service following QLDC receipt of acceptable sampling results.

7 DISPOSAL OF CHLORINATED WATER – IF REQUIRED

Should the reservoir disinfection process be unsuccessful for any reason, the chlorinated water must be disposed in an appropriate manner, preferably via discharge to the wastewater network. Discharge of water with residual chlorine concentration into the wastewater network requires prior approval from QLDC. The rate of discharge to the sanitary sewer shall be limited to a maximum of 10 litres per second (further restrictions may apply due to location of discharge).

If the disposal of super-chlorinated water into the sanitary sewer system is not achievable then the water must be de-chlorinated to a maximum residual of 0.02 mg/l before discharge to ground or a stormwater system. Alternatively, the super chlorinated water could be retained in a temporary surface storage pond until the maximum residual is less than 0.02 mg/l before being allowed to discharge to the stormwater drainage system, ground, or into a natural watercourse.

8 LABORATORY TEST RESULTS

Laboratories shall be IANZ certified.

The sample results shall be in accordance with Table 1 before the reservoir or pipeline will be considered satisfactory to put into service. Test results shall be provided to QLDC.

Table 1 Acceptable Laboratory Test Results

Parameter	Acceptable Value
Residual Chlorine	Between 0.6 and 1.0 mg/l
Turbidity	<1 NTU
E. coli	<1/100ml

Note 1: For the disinfection of an existing watermain it is likely that the watermain will have been returned to service before the results are obtained. Field tests may be accepted for medium risk whilst waiting for laboratory results.

Note 2: Should E.coli be identified in any sample either prior to, or following the return to service of the reservoir or watermain, then the response should be as per the Drinking Water Standards for New Zealand 2005 (as amended in 2008), section 3.4.1.2.

QUEENSTOWN LAKES DISTRICT COUNCIL

APPENDIX 1 – WATERMAIN DISNIFECTION CHECKSHEET

<table>
<tr><th colspan="4">GENERAL INFORMATION</th></tr>
<tr><td>Contract No. or Resource Consent No.</td><td colspan="3"></td></tr>
<tr><td>Contractor</td><td colspan="3"></td></tr>
<tr><td>Site Supervisor</td><td colspan="3"></td></tr>
<tr><td>Site Location</td><td colspan="3"></td></tr>
<tr><td>Date & Time</td><td colspan="3"></td></tr>
<tr><td>Pipe ID</td><td></td><td>Pipe Diameter</td><td></td></tr>
<tr><td>Chlorine Type Added</td><td></td><td>Pipe Length</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">TEST RESULTS</th></tr>
<tr><th>Test Point</th><th>Initial (mg/l)</th><th>24 Hours (mg/l)</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>pH Reading at 12 hours</td><td colspan="2"></td></tr>
<tr><td>Laboratory Results Acceptable (Attach)</td><td colspan="2">☐ Yes ☐ No</td></tr>
</table>

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: _________________________

Print Name: _________________________

APPENDIX 2 – RESERVOIR DISINFECTION CHECKSHEET

GENERAL INFORMATION	
Facility	
Asset ID	
RESERVOIR DISINFECTION	
PRE-DISINFECTION INSPECTION	
Date Inspected	
Inspected by	
Cleaned Satisfactorily	☐ Yes ☐ No
INITIAL DISINFECTION	
Date Filled (to 2m depth)	
Chlorine Type, Concentration and Amount Added	
Residual at 24 hours	
Tested By	
Note details of any additional chlorine required	
TESTING AT TOP WATER LEVEL (HIGH)	
Residual Chlorine (Top)	
Residual Chlorine (Bottom)	
Tested By	
Laboratory Results Acceptable (Attach)	☐ Yes ☐ No

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

The following figures are provided by Standards New Zealand. The copyright of these figures is waived.

Figure E1	–	Rural, live and play, access to lifestyle or clustered housing (1 to 6 du)
Figure E2	–	Rural, live and play, access to lifestyle or clustered housing (1 to 20 du)
Figure E3	–	Rural, live and play, access to housing
Figure E4	–	Rural, shop and trade, side or rear service access
Figure E5	–	Rural, shop and trade, access to trade
Figure E6	–	Rural, make and move, primary freight access
Figure E7	–	Rural, make and move, access to office and education
Figure E8	–	Rural, all other situations (where not specified elsewhere in table 3.3)
Figure E9	–	Suburban, live and play, access to houses/townhouses (1 to 3 du, or 1 to 6du)
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Figure E11	–	Suburban, live and play, access to houses/townhouses (1 to 20 du)
Figure E12	–	Suburban, live and play, primary access to housing (1 to 200 du)
Figure E13	–	Suburban, live and play, primary access to housing (up to 800 du)
Figure E14	–	Suburban, shop and trade, work and learn, side or rear service access
Figure E15	–	Suburban, shop and trade, work and learn, access to trade, office, and education
Figure E16	–	Suburban, make and move, side or rear freight access
Figure E17	–	Suburban, make and move, primary freight access
Figure E18	–	Suburban, shop and trade, work and learn, make and move, all roads serving multi-purpose areas involving most or all of the indicated land uses, not specified elsewhere in table 3.3
Figure E19	–	Urban, live and play, access to lifestyle or clustered housing
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Figure E24	–	Urban, shop and trade, side or rear service access
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Figure E27	–	Urban, work and learn, side or rear service access
Figure E28	–	Urban, work and learn, access to lots, or work or learn activities
Figure E29	–	Urban, work and learn, primary access to office and education
Figure E30	–	Urban, mixed use, multiple user access
Figure E31	–	Urban, mixed use, neighbourhood centres (and all other areas serving multiple land uses not listed elsewhere in table 3.3)
Figure E32	–	Centre, mixed use, side or rear service access
Figure E33	–	Centre, mixed use, access to lots or mixed use activities
Figure E34	–	Centre, mixed use, primary access and local movement
Figure E35	–	Centre, mixed use, shared spaces, access way, mall, and community reserve
Figure E36	–	Centre, mixed use, urban street

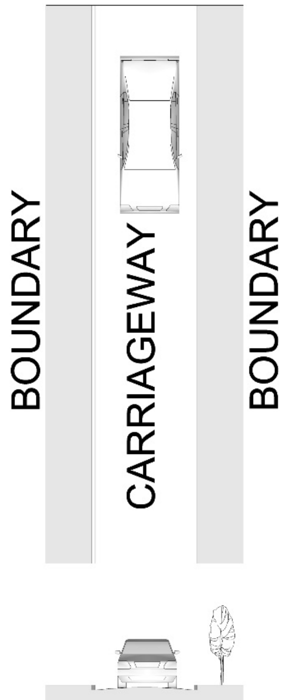


Figure E1 – Rural, live and play, access to lifestyle or clustered housing (1 to 6 du)

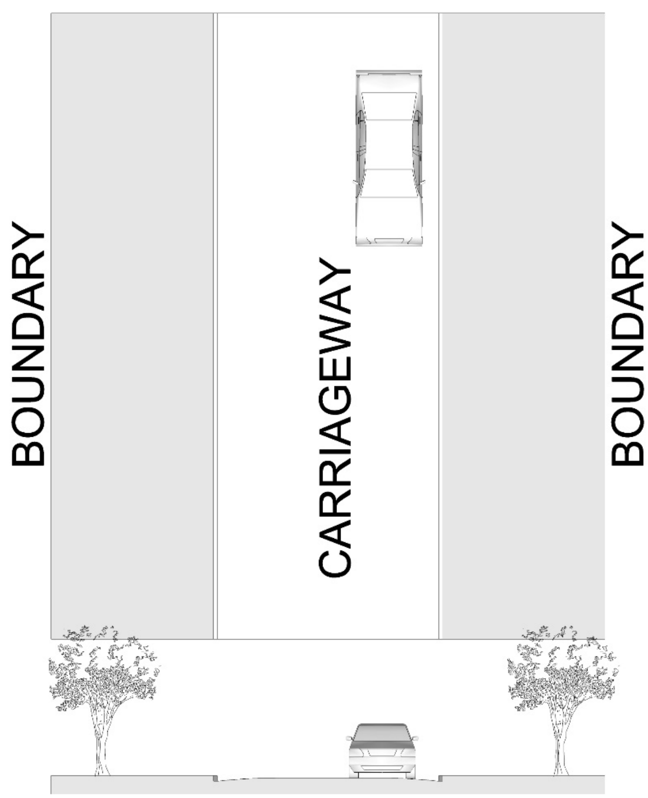


Figure E2 – Rural, live and play, access to lifestyle or clustered housing (1 to 20 du)

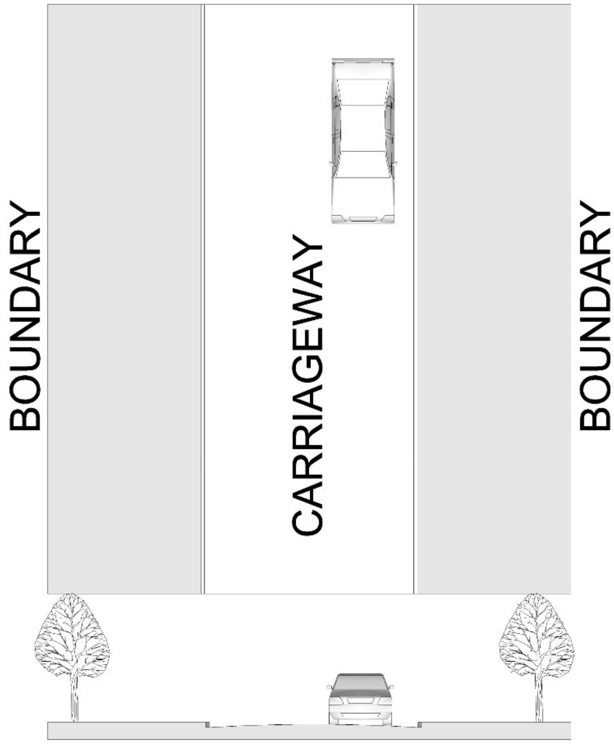


Figure E3 – Rural, live and play, access to housing

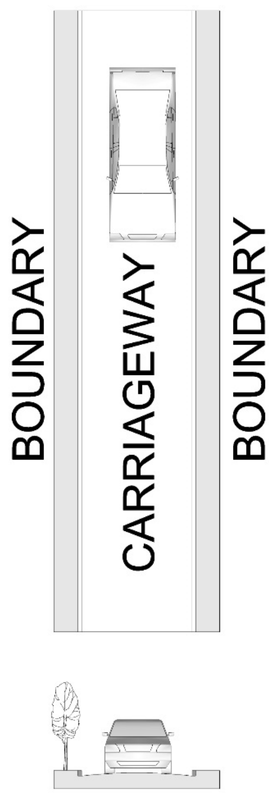


Figure E4 – Rural, shop and trade, side or rear service access

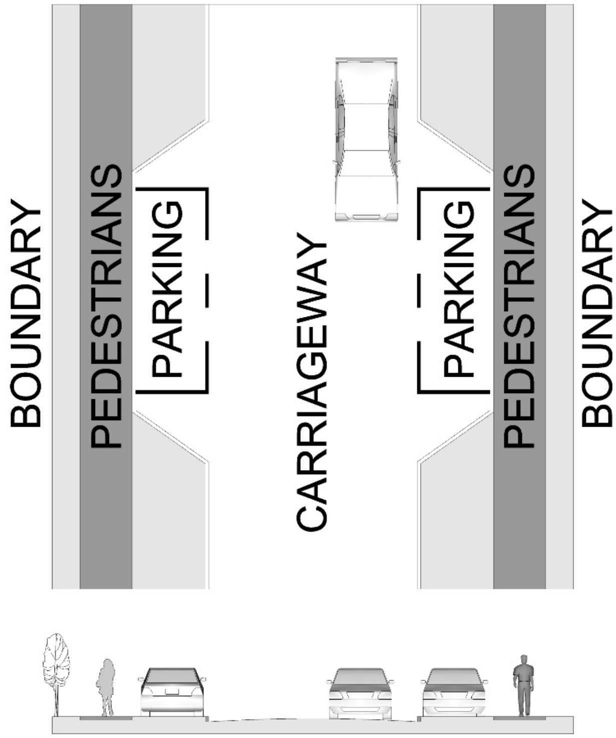


Figure E5 – Rural, shop and trade, access to trade

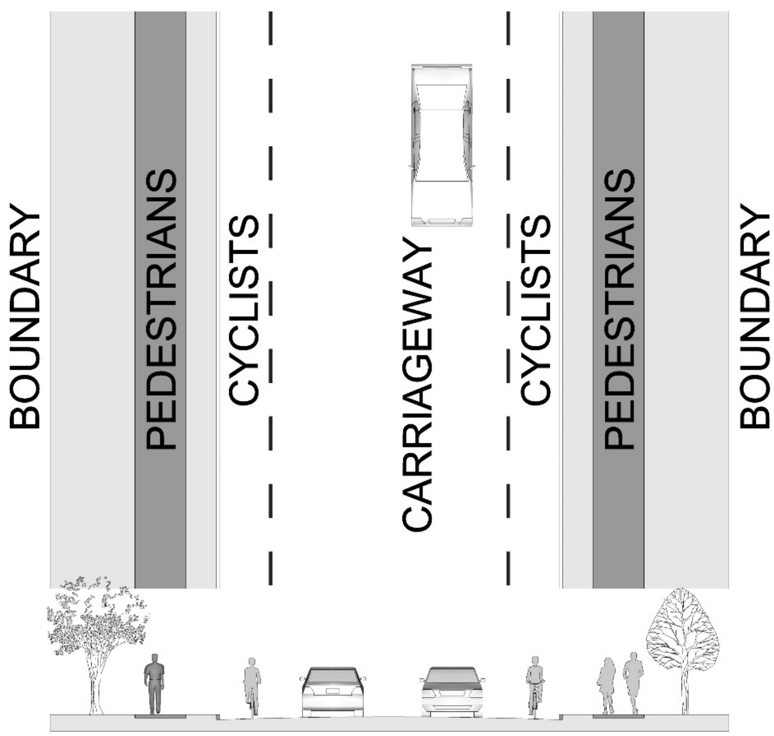


Figure E6 – Rural, make and move, primary freight access

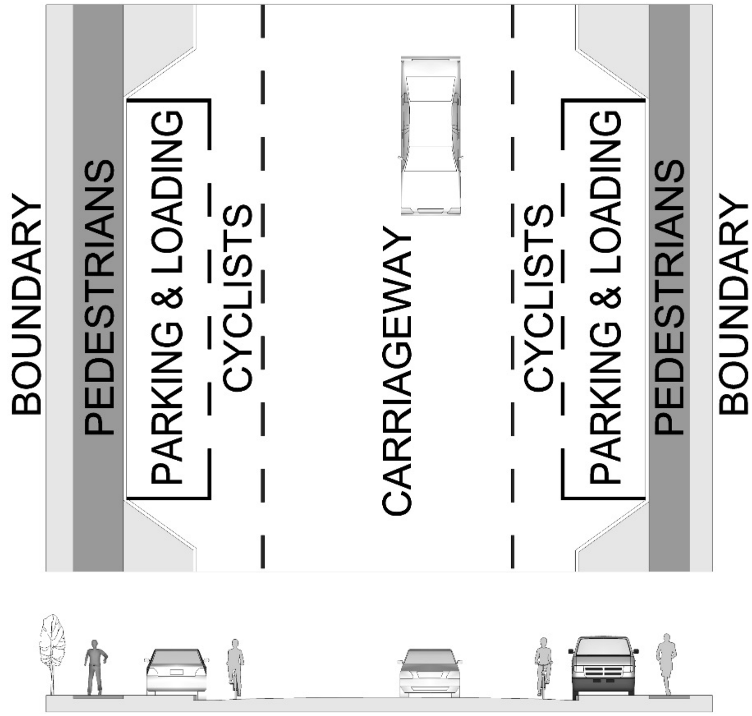


Figure E7 – Rural, make and move, access to office and education

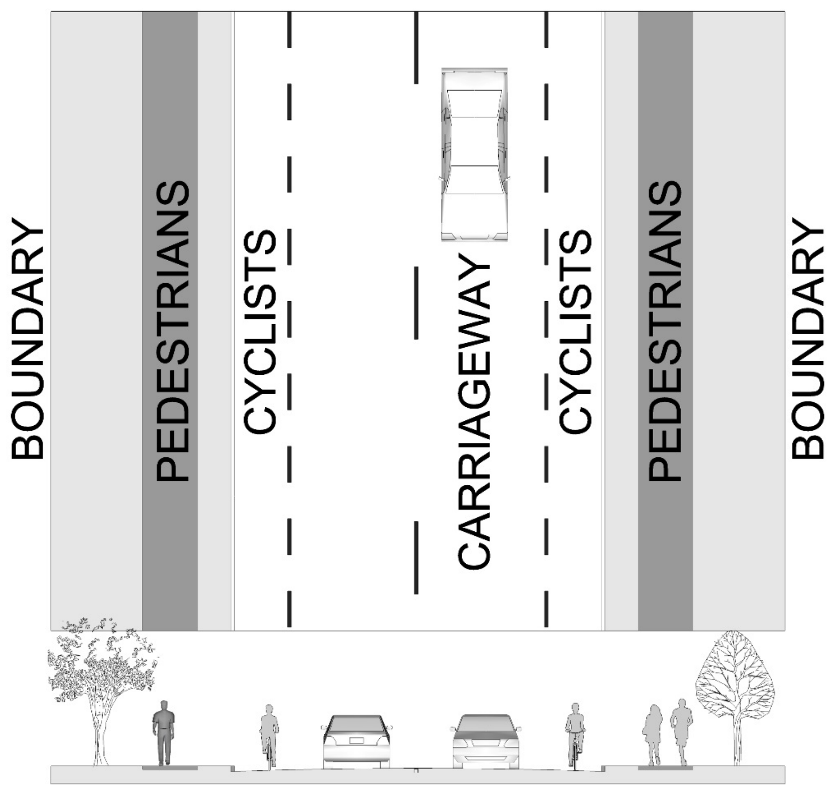


Figure E8 – Rural, all other situations (where not specified elsewhere in table 3.3)

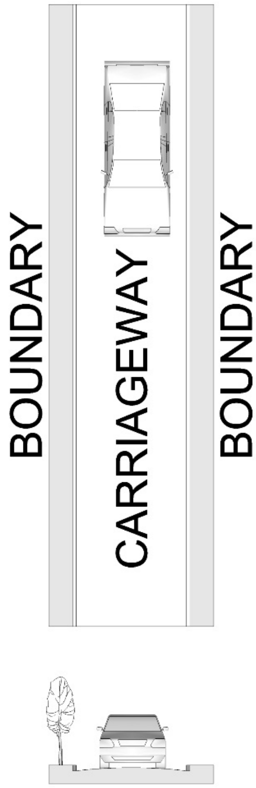


Figure E9 – Suburban, live and play, access to houses/townhouses (1 to 3 du, or 1 to 6 du)

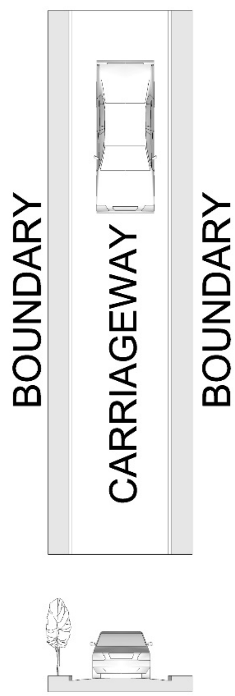


Figure E10 – Suburban, live and play, side or rear service access

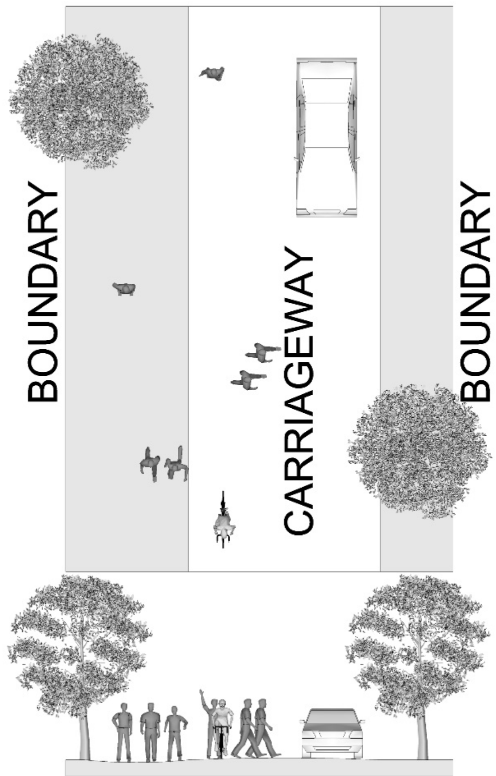


Figure E11 – Suburban, live and play, access to houses/townhouses (1 to 20 du)

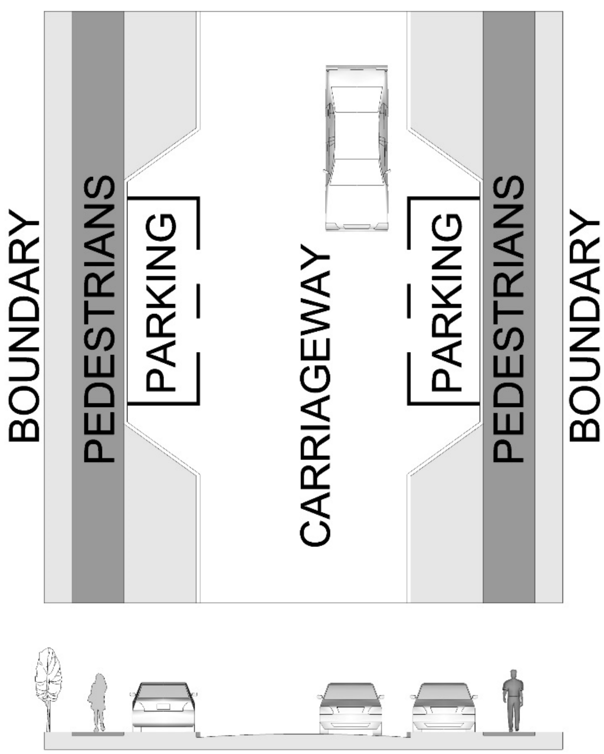


Figure E12 – Suburban, live and play, primary access to housing (1 to 200 du)

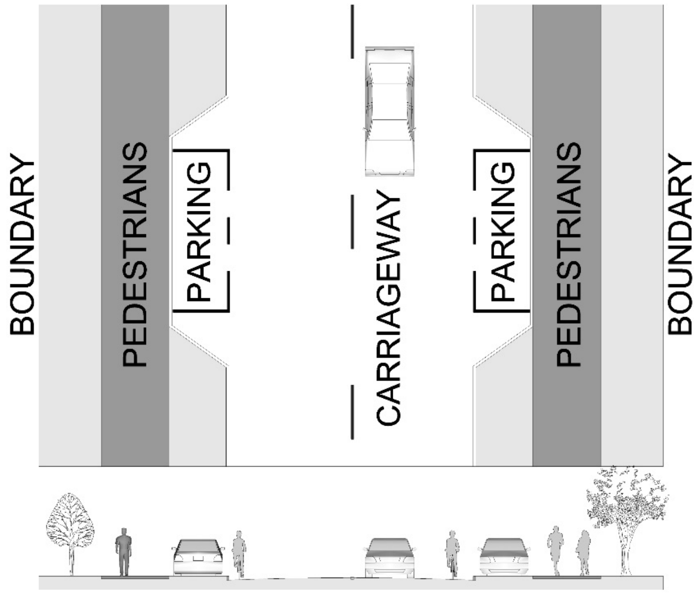


Figure E13 – Suburban, live and play, primary access to housing (up to 800 du)

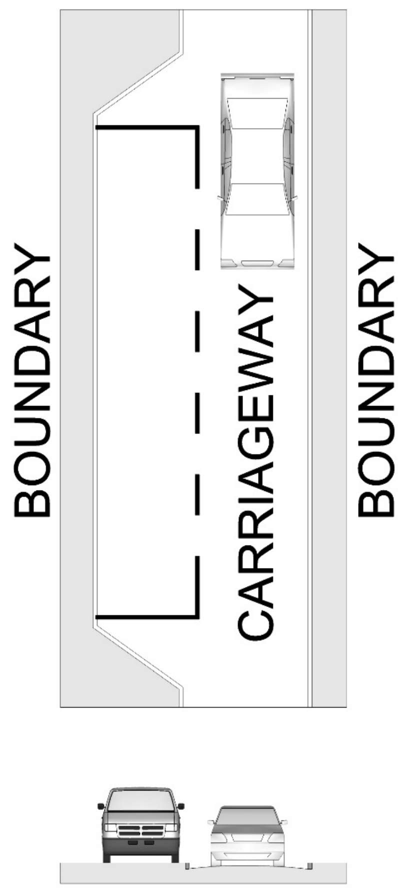


Figure E14 – Suburban, shop and trade, work and learn, side or rear service access

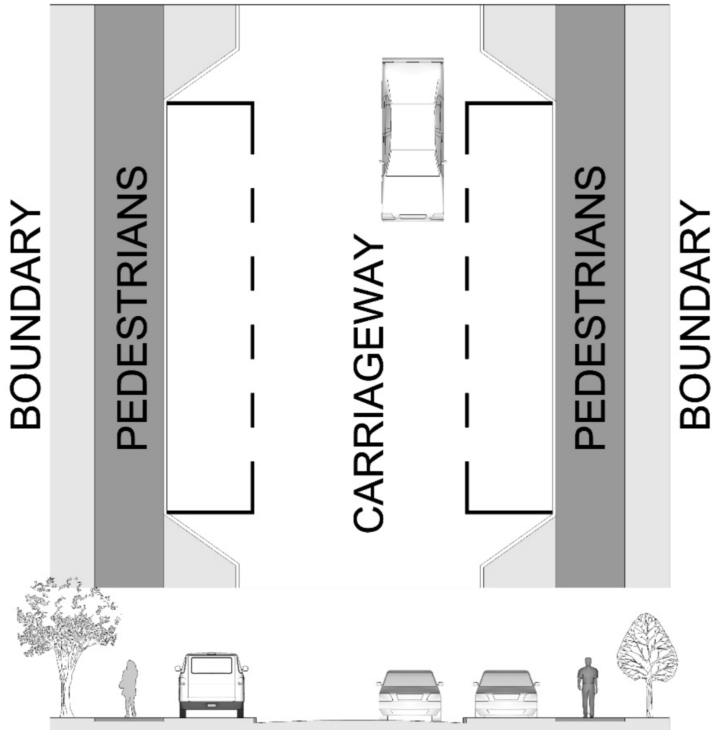


Figure E15 – Suburban, shop and trade, work and learn, access to trade, office, and education

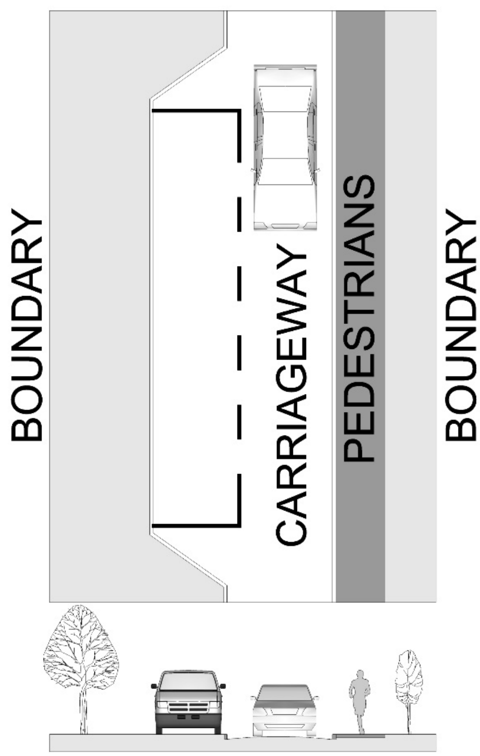


Figure E16 – Suburban, make and move, side or rear freight access

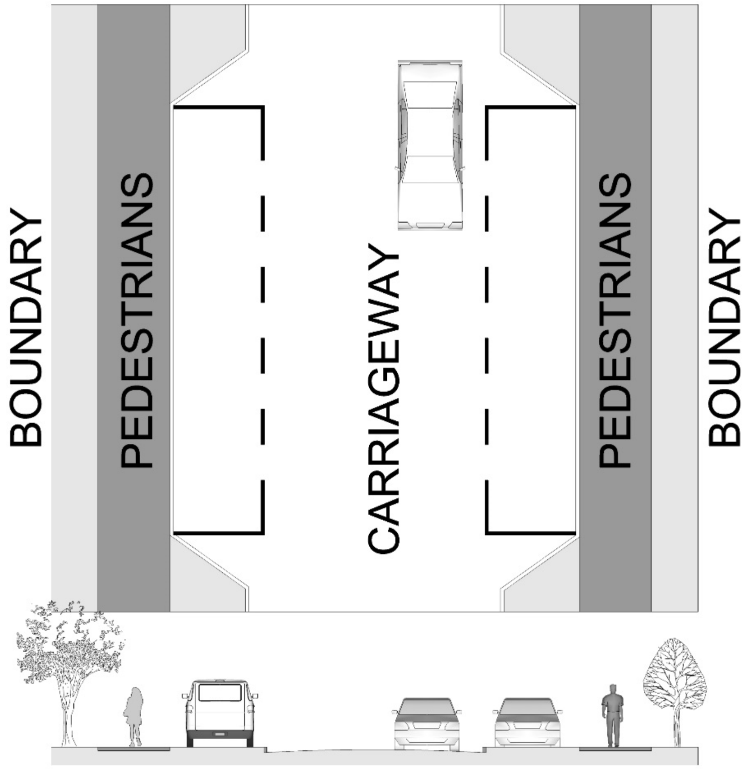


Figure E17 – Suburban, make and move, primary freight access

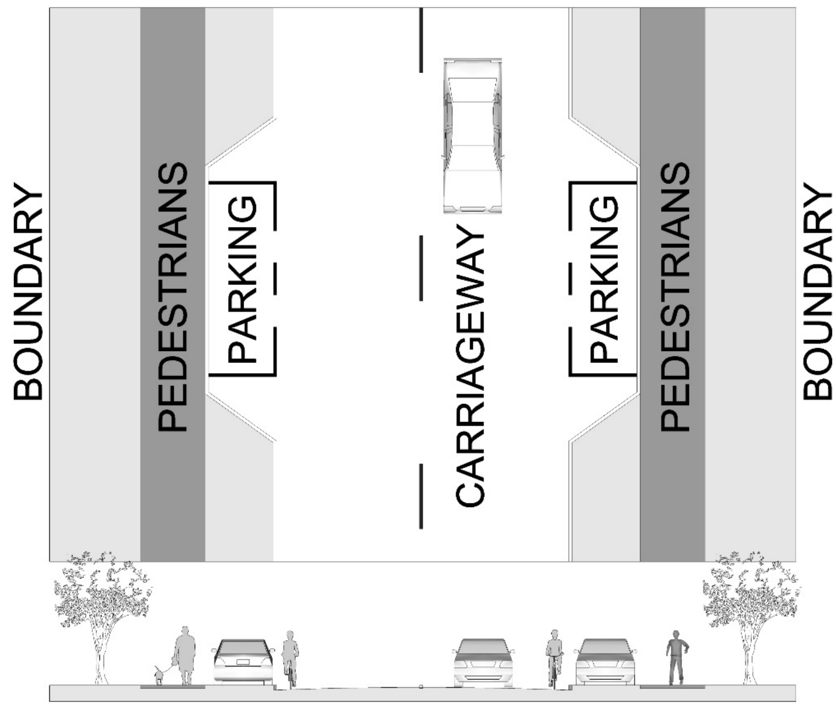


Figure E18 – Suburban, shop and trade, work and learn, make and move, all roads serving multi-purpose areas involving most or all of the indicated land uses, not specified elsewhere in table 3.3

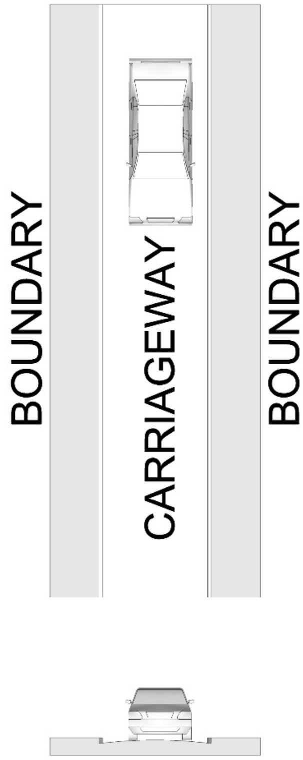


Figure E19 – Urban, live and play, access to lifestyle or clustered housing

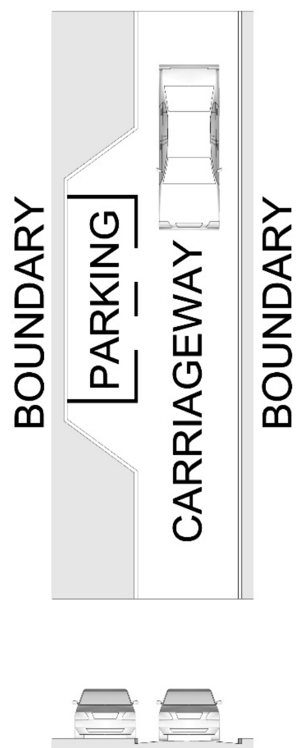


Figure E20 – Urban, live and play, side or rear service access

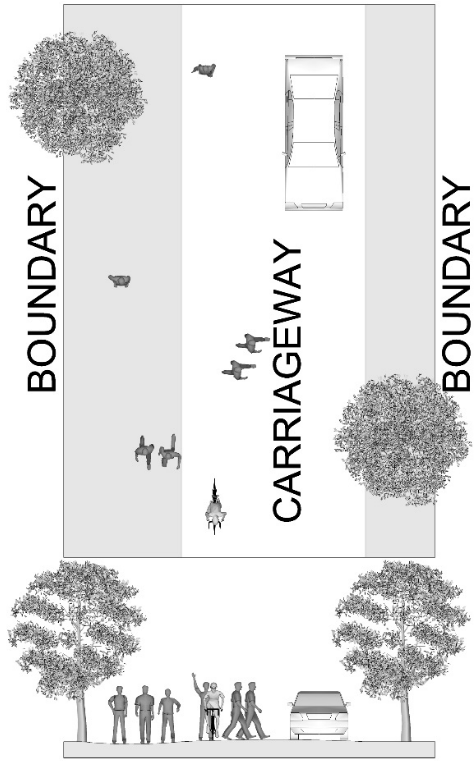


Figure E21 – Urban, live and play, access to houses/townhouses

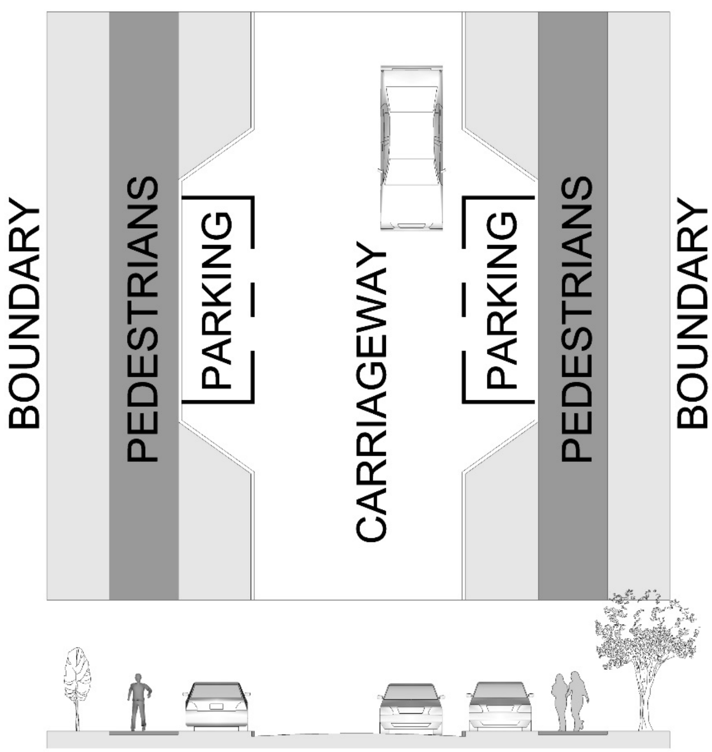


Figure E22 – Urban, live and play, primary access to housing

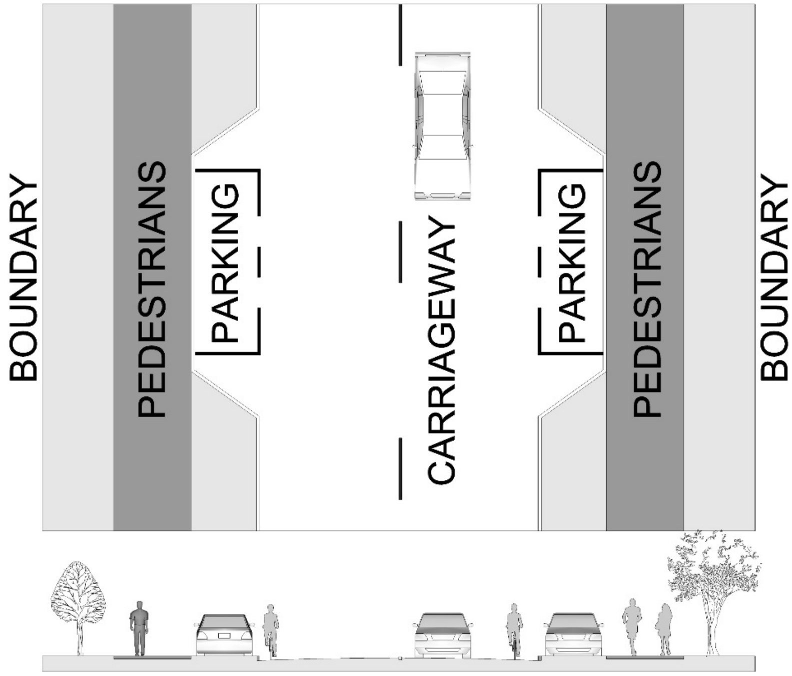


Figure E23 – Urban, live and play, all other land use activity types within this area type not specified elsewhere in table 3.3

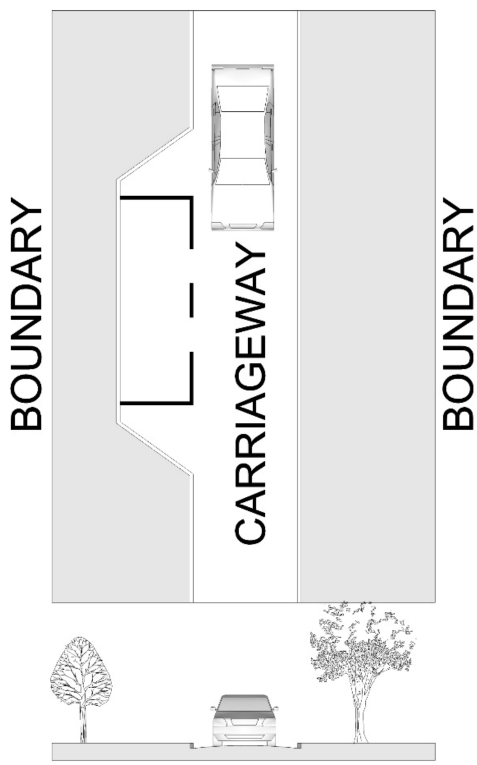


Figure E24 – Urban, shop and trade, side or rear service access

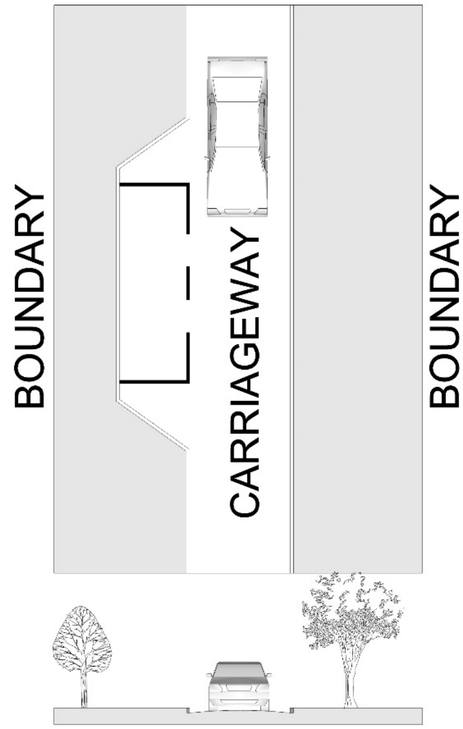


Figure E25 – Urban, shop and trade, access to lots, or shop or trade units

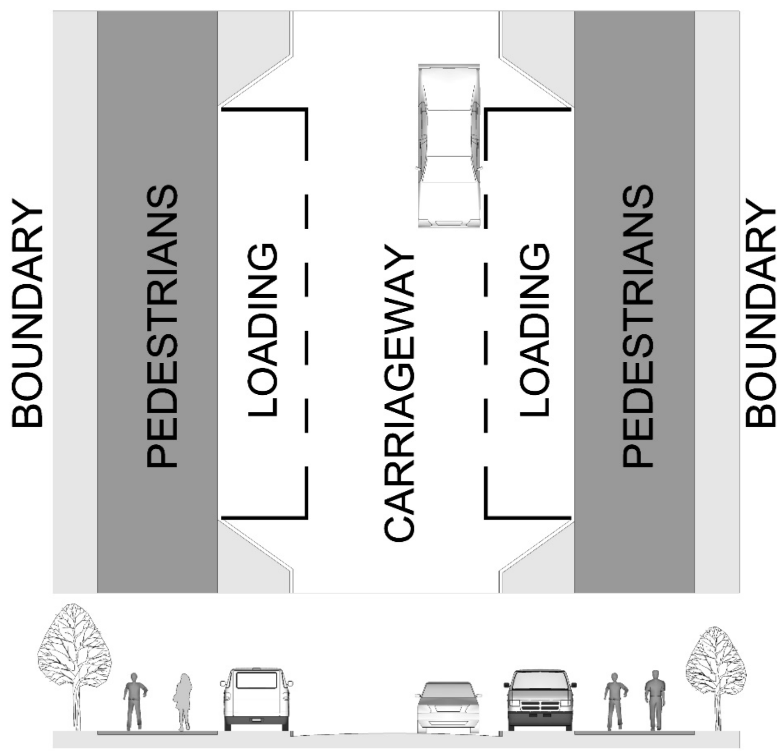


Figure E26 – Urban, shop and trade, primary access to trade

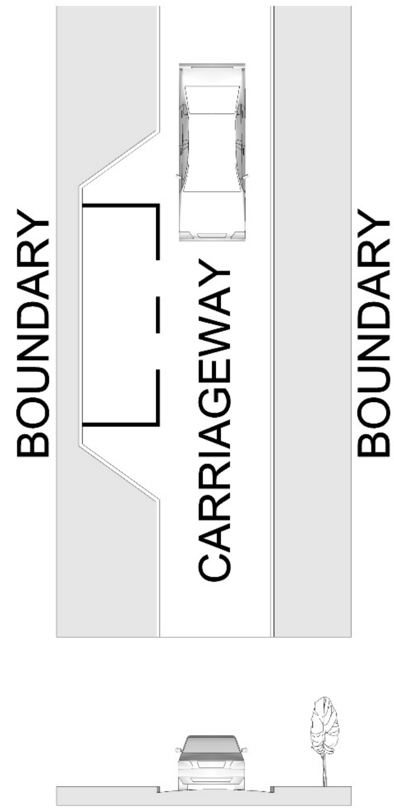


Figure E27 – Urban, work and learn, side or rear service access

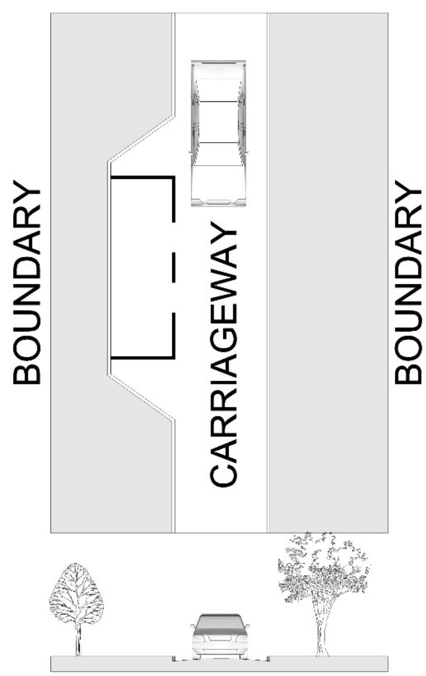


Figure E28 – Urban, work and learn, access to lots, or work or learn activities

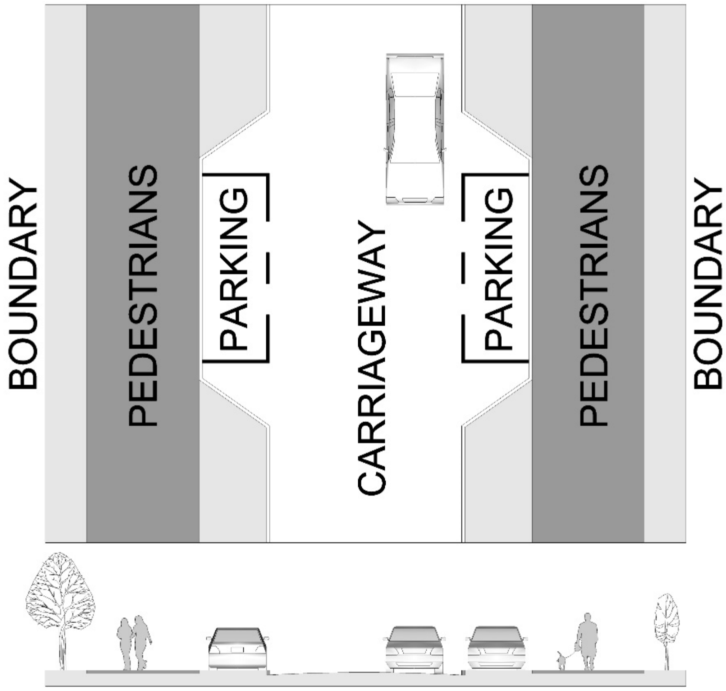


Figure E29 – Urban, work and learn, primary access to office and education

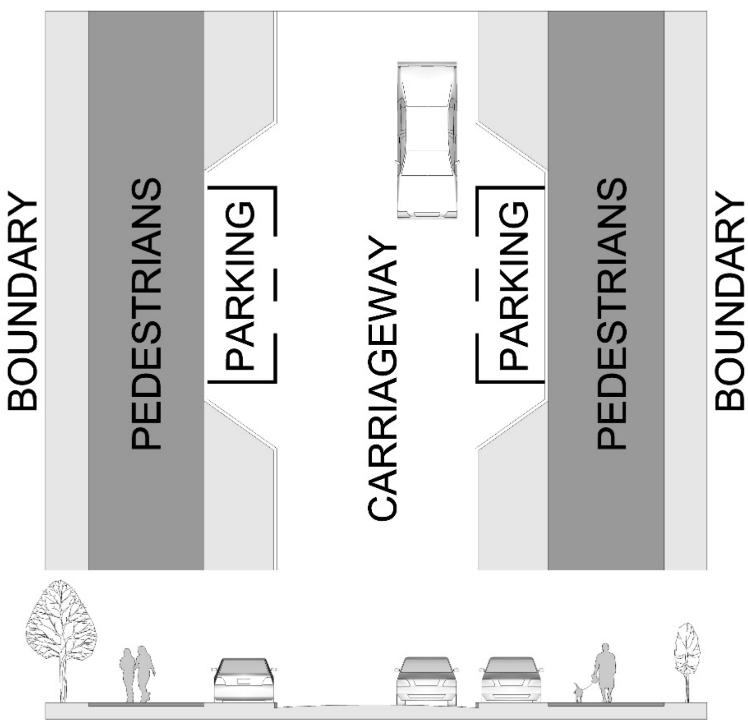


Figure E30 – Urban, mixed use, multiple user access

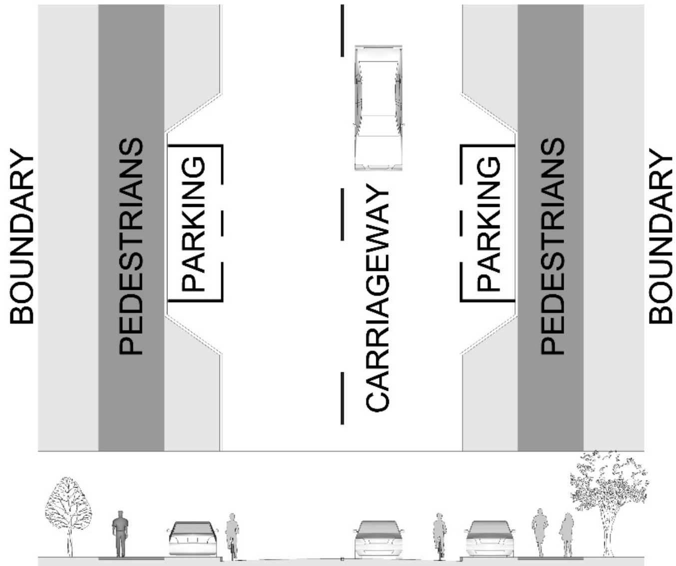


Figure E31 – Urban, mixed use, neighbourhood centres (and all other areas serving multiple land uses not listed elsewhere in table 3.3)

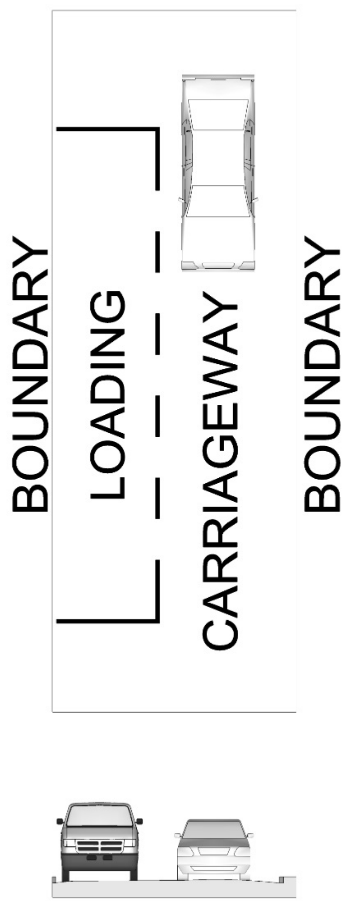


Figure E32 – Centre, mixed use, side or rear service access

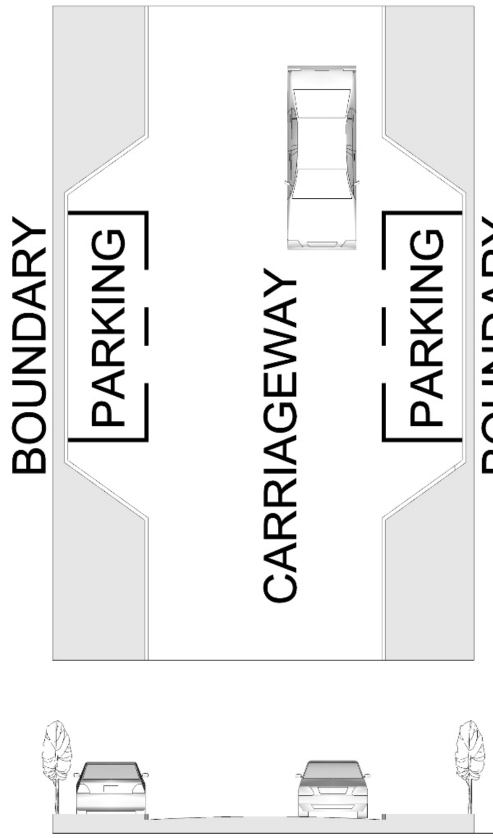


Figure E33 – Centre, mixed use, access to lots or mixed use activities

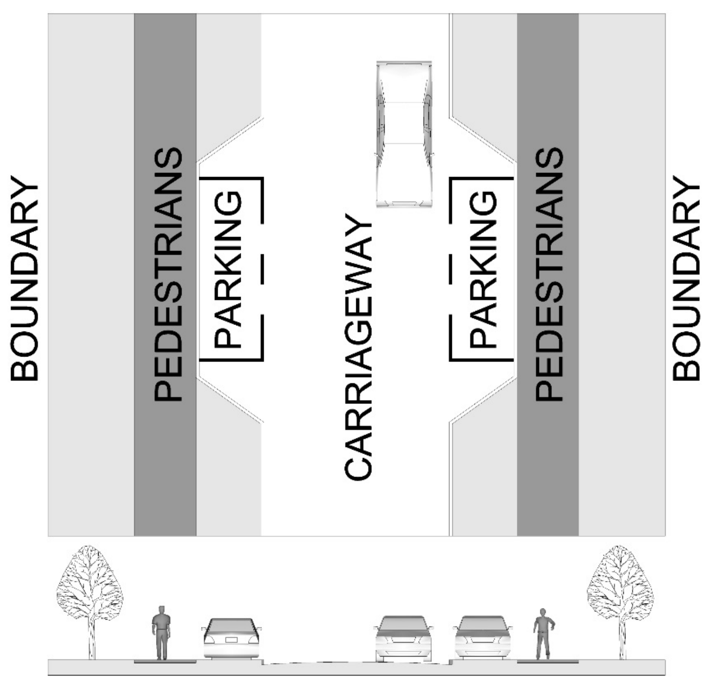


Figure E34 – Centre, mixed use, primary access and local movement

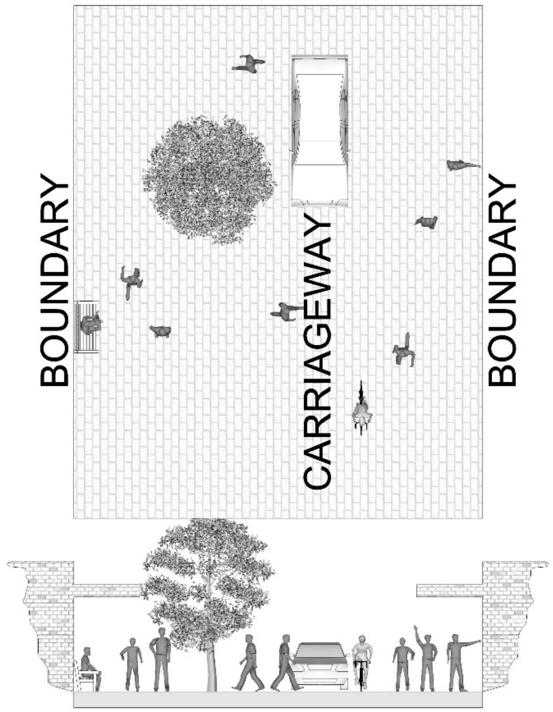


Figure E35 – Centre, mixed use, shared spaces, access way, mall, and community reserve

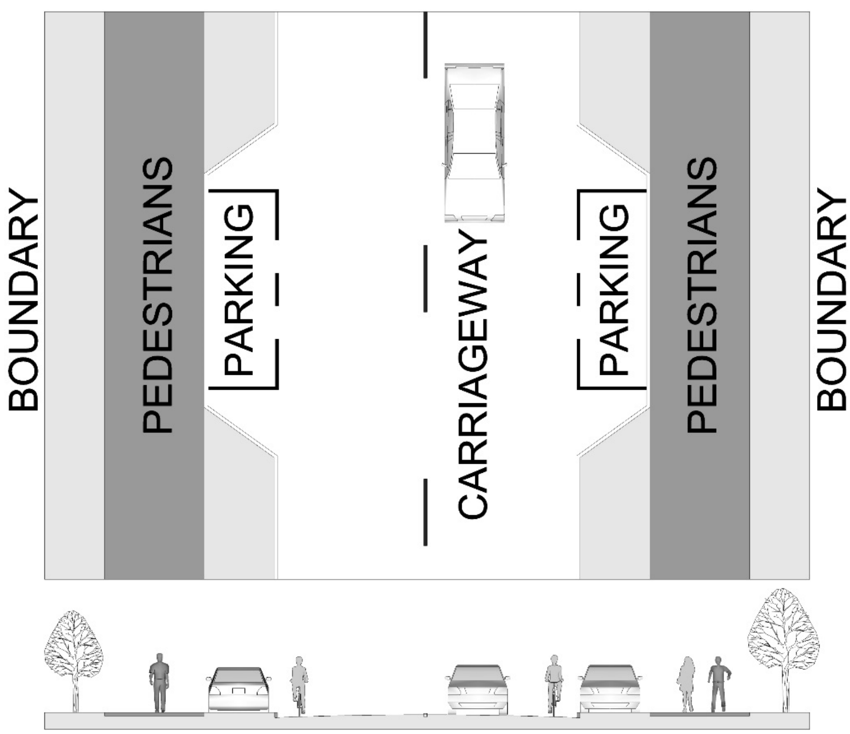


Figure E36 – Centre, mixed use, urban street

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 MATERIAL AND INSTALLATION SPECIFICATION

1.1 GENERAL

1.1.1 Scope

This standard relates to the supply and installation of a permanent automatically controlled watering system.

It includes Drip Irrigation, Fixed Location Systems, fixed spray, pop-up spray, mist spray and trickle irrigation.

The irrigation system shall be designed and installed in accordance with all governing ordinances, laws and regulations that meet all local conditions.

1.1.2 Qualifications

Installers to be experienced, competent trades people familiar with the materials and techniques specified.

Designers to hold an NZQA National Certificate in Irrigation Design or equivalent.

1.1.3 Design

The irrigation system will comply with the following standards:

1.1.3.1 INZ Design Standards for Piped Irrigation Systems in New Zealand 2013

1.1.3.2 AS/NZS 3500. Plumbing and drainage Part 1: Water services

1.1.3.3 INZ Code of Practice for the Design of Piped Irrigation Systems In New Zealand 2013

1.1.3.4 AS/NZS 2845.1 Water supply - Backflow prevention devices - Materials, design and performance requirements

1.1.3.5 AS 2845.3 Water supply - Backflow prevention devices - Field testing and maintenance

1.1.3.6 INZ Irrigation Installation Code of Practice 2013

1.1.4 Design Evaluation

The design report as detailed in 1.91 will be submitted with the irrigation design plan so that the irrigation design and performance can be evaluated before QLDC approval.

1.1.5 Adherence to Design Plan

Contractor must carry out the installation of the system in strict accordance with the Council approved design plan. Any variations must be approved by the Irrigation Designer or Engineers representative. The correct components as specified must be installed.

1.1.6 Performance

Install an irrigation system in accordance with INZ Irrigation Installation Code of Practice 2013.

Meet statutory requirements for backflow prevention.

The uniformity performance indicator units for the individual spray heads and nozzles at the spacing's on the irrigation layout plans shall be greater than:

> Coefficient of uniformity (CU) 85%
> Distribution uniformity (DU) 0.80
> Scheduling coefficient (SC) 1.3

Minimum Sprinkler Operating Pressures:

> Spray Heads 200 kPa
> Rotating Sprinkler up to 7.0m Radius 300 kPa
> Rotating Sprinkler over 10.0m Radius 350 kPa
> Rotating Sprinkler over 14.0m Radius 400 kPa
> Drip Irrigation 200 kPa

Maximum Pressure differential within a sprinkler zone 7%.

Maximum zone water velocity 2.0 m/sec.

Maximum mainline velocity 1.50 m/sec.

The irrigation window for replacing 5mm ET is a maximum cycle time of 5 hours per night to avoid vandalism.

1.1.7 System Pressure Test

It shall be Contractor's responsibility to demonstrate two successful pressure tests: The first at 224c certification the second 12 months after 224c certification sign off.

This will involve first isolating all points of connection to previously existing pipe where they are present.

Pressure testing shall be done in conjunction with the Engineer. The line will be retested until satisfactory. It shall be the Contractor's responsibility to provide all equipment required for the pressure test and provide suitable connection ports. At the point where the system can be pressurised, a 25mm ball valve shall be installed to enable the connection to be made without depressurising the system.

1.1.8 MDPE Pressure Test Procedure

1.1.8.1 As per QLDC Code of Practice Appendix C

Where the initial pressure test fails, the cost to the Council of supervising subsequent tests shall be deducted from the payments.

Where an irrigation system fails the pressure test and yet the leak is unable to be detected by the Contractor, the Contractor shall be required to pay for a professional leak detection service.

1.1.9 Commissioning

Prior to planting or seeding an area, the irrigation contractor shall be required to demonstrate that the system is correctly adjusted and ready to be used on the areas that are being planted.

1.1.9.1 Flush system thoroughly, check heads, sprays and drippers and clean if blocked. Clean strainers. Adjust system for even distribution with no dry areas.

1.1.9.2 The acceptable deviation from the design specification will be:

> flows ±5%
> pressures ±5%
> uniformity - not more than 2% (or 0.02) under the supplied
> performance as submitted for clause 1.3

The system shall be test-run and the correct operation of all components checked. Sprinkler zones should be verified to conform to the approved plan. Sprinkler radius and arc's will be adjusted to avoid overthrow outside of the required irrigation areas.

Once commissioning is complete, arrangement shall be made to demonstrate the system to representatives of the Council and/or the Engineer.

1.1.10 Handover Manual

Two operations manuals for the control system, sprinklers, valves and fittings shall be provided to the Engineer and a laminated copy of the irrigation as-built plans is to be placed inside the control box. The plans should identify each station for ease of operation. The manuals shall include the following.

1.1.10.1 Summary Irrigation Report

The summary report as detailed below.

1.1.10.1.1 Description of Systems

Description of the normal operating characteristics of the irrigation system and operating level.

1.1.10.1.2 Design Brief

General description of irrigation system and what and how it irrigates the different areas.

1.1.10.1.3 Sprinkler Pressure

The sprinkler pressures in each zone detailing the nominal, minimum and maximum for each sprinkler type.

1.1.10.1.4 Valve Operating Pressures and Flows

The require set pressure and flow used on the downstream side of each valve in the irrigation system.

1.1.10.1.5 Water Supply

1.1.10.1.5.1 Number of Supply Take Off points

Number of water supplies in system.

1.1.10.1.5.2 Size off Take Point

The take off connection size for and number of connections.

1.1.10.1.5.3 Maximum Flow of Water Supplies

The maximum flow from each water supply.

1.1.10.1.5.4 Flow and Pressures at Water Supply Take off Points

The flow and pressure requirement for of each irrigation zone at the water supply.

1.1.10.1.5.5 Filtration

Filtration required.

1.1.10.1.6 Sprinkler Run Times

1.1.10.1.6.1 Application rates

Application rates or the sprinklers used.

1.1.10.1.6.2 Zone run Times

The expected zone run times based on an evaportranspiration (ET) rate of 5mm per day.

1.1.10.1.6.3 Maximum System Run Time

The maximum expected system time base on 5mm application per day.

1.1.10.1.7 Water Usage Total

Total water used per day per irrigation cycle replacing 5mm ET.

1.1.10.1.8 Details of the process to follow in the event of a warranty claim.

1.1.10.1.9 The expiration date of the warranty for every item.

1.1.10.1.10 Make, model, size, specification, and date codes of all products.

1.1.10.1.11 Operation manuals or brochures on the valves and sprinklers.

1.1.10.1.12 Spare parts data.

1.1.10.1.13 Trouble shooting information.

1.1.10.1.14 Testing information.

1.1.10.1.15 Successful pressure test certification.

1.1.10.1.16 IQP certification of backflow preventor (if applicable).

All of the above information is to be provided in a addable electronic format and a PVC 3-ring or 4-ring binder. All loose sheets are to be laminated. The name and address of the installing Contractor and that of the company supplying the product (if different) is to be included on the front page of the binder.

The 'as-built' plan, operations manual and commissioning are required for practical completion. The Contractor is to complete and submit to the Engineer the Council's 'asset data information sheet'.

1.1.11 Practical Completion

The Contractor is to liaise with the Engineer and nominated surveyors, to ensure the location of all system components are captured accurately. The following information shall be required:

- The location and depths of all pipe, sprinklers, valves (solenoid, ball and quick coupler) valve boxes, cabling, cable joints, controller, rain switch and soil moisture sensor (if applicable).
- The make and model information of all products, including those in the head works which may already be present (e.g. backflow preventer and water meter).
- Any cable/tubing joint not within a solenoid valve box.
- The size, type and pressure rating of all pipe work.
- Any service locations found outside of the originally documented locations.
- Changes in mainline pipe direction and dimensions and offset measurements for all pipes and pipe junctions.

1.1.12 As Bult Plan

As the system progresses on a daily basis an accurate record of the location, type and size of all sprinklers, fittings, pipes and cables shall be maintained, preferably as a CAD file.

The as-built plan shall clearly illustrate with respect to permanent landmarks, based on dimensioned triangulation from at least two fixed above ground permanent points.

All information and data shall be submitted to the QLDC as per section 1.8.10 (QLDC Code of Practice).

1.1.13 Warranty

The entire system shall be warranted against defective materials and workmanship for the period of 12 months from the ate of practical completion. However certain component products shall have extended warranties:

- Irrigation Sprinklers - Minimum of 3 years
- 25mm Solenoid Drip Control Valves - Minimum of 3 years
- 25mm & 40mm Solenoid landscape Control Valves - Minimum of 5 years

1.1.14 System Maintenance

During the maintenance period the contractor shall be responsible for making good any defects or faults that may occur, including leaks, sprinkler malfunction, control valve malfunction and trench subsidence.

The contractor shall respond to any defects bought to his attention by the client within 2 days.

2 MATERIAL SPECIFICATION

2.1 SPRINKLERS

2.1.1 General

Generally, sprinklers shall be laid out as shown on the plans, but in all cases, adjusted to provide correct and effective coverage of areas as constructed.

2.1.2 Popup Spray Heads

The sprinkler shall feature combination full circle and part circle matched precipitations spay nozzles with a 100mm pop up height. The sprinklers shall have a 15mm (1/2”) BSP female threaded connection and the riser shall be ratcheting to allow easy arc adjustment. Sprinklers shall be operated in groups by solenoid valves as shown on the irrigation plan. Refer Standard Drawing Layout D- 7.

2.1.3 Popup Rotating Sprinklers 20mm

The sprinklers shall feature combination full circle and adjustable part circle drive assemblies. The sprinklers shall have a 20mm (3/4”) BSP female threaded connection and a check-O-matic anti-drain value capable of holding back at least 3 metres of elevation. The riser shall have a pop up height of at least 127mm (5”). Sprinklers shall be operated in groups by solenoid valves as shown on the irrigation plan. Refer Standard Drawing Layout D- 8.

2.2 DRIP ZONES

2.2.1 General

Trees shall be irrigated with two drippers. Pipe work to the trees shall be generally as shown on the plan. Landscape inline drip pipe will be typically spaced at 600mm between laterals and 300mm from the beginning of each planted area.

2.2.2 Drippers

Each tree shall be irrigated with two pressure compensated 4.0 litre per hour drippers attached to a 13mm lateral pipe. The two drippers shall be connected via the 15mm LDPE to the 13mm lateral pipe (500KPa rated) which is to be installed in a ring around the two trees.

The dripper shall connect directly into the lateral pipe and be capable of being taken apart for cleaning. In the event that LDPE dripper lateral pipe is under paving or concrete then the LDPE Lateral will be installed 300mm into the tree pit. Drippers shall be capable of being taken apart for cleaning.

Refer Standard Drawing Layout D- 6.

2.3 VALVES

2.3.1 Solenoid Control Valve Assemblies

The landscape turf and dripper stations shall be controlled with solenoid operated control valves. These will be sized as per the manufactures recommendations. Valves shall be fitted with adjustable pressure regulators specifically designed to fit the solenoid valve. Alternatively, preset or adjustable “in-line” type pressure regulators may be used for small flow drip stations; these shall be set that the downstream pressure is a maximum of 3 Bar. All valves shall feature BSP female threaded inlets, have flow control and internal bleed for manual operation.

In addition, those valves controlling drip zones shall incorporate a 120 mesh filter in the assembly to provide the drippers protection from any debris in the lines.

All solenoid valves will be housed in valve boxes and have manual isolating fitted upstream of the valve. Refer Standard Drawing Layout D- 3.

2.3.2 Lateral Isolation Valves

All lateral isolation valves shall be fig. 125 bronze gate valves, DR rated for in ground use. Valves shall be pressure rated at not less than 14 Bar.

2.3.3 Drip Lateral Isolation Valves

The isolation valve to each section when required shall be a 15mm or 20mm ball valve.

2.3.4 Quick Coupling Valves (QCV)

All quick coupling valves shall be 25mm (1”) BSP female threaded brass valves with single lug key. All quick couplers shall be housed in valve boxes. All QCVs shall be connected to the mainline with swing joint risers to allow correct levelling. All QCVs shall be securely anchored in the ground with a stabilising bar and stainless steel U bolt clamp.

2.3.5 Valve Boxes

All valve boxes shall be constructed from high impact plastic or galvanised steel. They must be able to support the weight of a vehicle without damage. Valve box lids shall be of the bolt-down type and be supplied with bolts fitted.

The following valve box sizes shall be used:

- Lateral Isolation Valves 6” Round
- Landscape & Drip Solenoid Valves 12” Rectangular
- Dripper Lateral Manual Valves 6” Round
- Cable Joints 6” Round
- Water meter, Backflow preventer 22.5” Rectangular

Also refer Standard Drawing Layout D- 1, D-2, D-3, D-4 and D-5.

All valve boxes shall feature T section lids so that the lid is fully supported by the body of the box.

2.3.6 Backflow Preventors

Each connection to the potable water supply must be protected by a double check valve backflow preventer assembly housed in a protective valve box, as detailed in the Standard Drawing Layout D- 1 and D-2.

2.3.7 Wate Meter

Each cnnection to the potable water supply must have a water meter installed immediately upstream of the back flow preventer. The water meter shall be housed in a protective valve box, as detailed in the Standard Drawing Layout D- 1 and D-2. Meter type as per QLDC water metering policy.

2.4 PIPEWORK

2.4.1 General

The use of solvent weld fittings is not permitted.

2.4.2 Mainline

All pipes under constant pressure shall be uPVC to AS/NZS 1477, rated to 12.5 Bar, or PE100 PN12.5 to AS/NZS 4130, rated to 12.5 Bar. Pipes sized 100mm and above shall be PE while those below 100mm shall be MDPE.

2.4.3 Lateral

All lateral pipes downstream of a solenoid valve shall be PE 80B to AS/NZS 4130, rated to PN 9 (9 Bar).

2.4.4 Dripper Laterals

All lateral pipe downstream of the drip zone control valves shall be LDPE, sized as shown on the plans. The LDPE shall be manufactured to (NZS 7601), the following pressures shall apply 15mm – PN9.7, 20mm – PN 9, 25mm PN8.

The end of each lateral shall be terminated in a valve box with a threaded cap/plug to allow flushing.

2.4.5 Dripper Take Offs

From the LDPE lateral a 13mm lateral pipe will be installed in a ring around the tree. Refer Standard Drawing Layout D- 6.

2.5 FITTINGS

2.5.1 PVC Mainline Fittings

All mainline PVC pipe fittings shall be ductile iron with rubber ring or flanged connections. Cast iron or gun metal tapping bands shall be used for valve take offs. All mainline tees and bends shall be ductile iron. All flange connections shall be made using galvanized nuts, bolts and washers.

2.5.2 PE Fittings

All fittings for PE pipe shall be compression type. Take-offs for sprinklers shall be PE tapping saddles, manufactured to NZS/AS 4129, rated to PN 16.5 (16 Bar).

All tapping saddles shall have stainless nuts and bolts and a stainless retaining ring around the threaded section of the saddle.

2.5.3 LDPE Fittings (PN9)

LDPE pipe in the drip irrigation zones shall be joined with Hansen or Anka fittings designed for the purpose and manufactured to NZS 7601.

2.5.4 Inline Drip Fittings

All inline drip pipe shall be joined with Anka 15mm fittings.

2.5.5 Sprinkler Risers

All gear drive sprinklers shall be mounted on swing joint risers.

All sprinklers with an inlet 20mm and greater shall be mounted on articulated risers comprising 3 threaded MF elbows and a 300mm long threaded nipple. All swing joint risers shall have a nominal lay length of 300mm.

All Spray sprinklers shall be connected to the reticulation system comprising two BSP thread barbed elbow (with 4 barbs) and a 300mm length of 15mm LD polythene pipe. Refer standard drawing D7 and D8.

2.6 ROAD, BRIDGE & STREAM CROSSINGS

2.6.1 General

Where pipe crosses a bridge or stream, fusion or butt welded polyethylene pipe shall be used. The PVC pipe shall be terminated with a flange fitting to which the polyethylene flanges will be connected. The transition point and any elbows required shall be secured with thrust blocks to prevent movement. Refer to plan for PE pipe sizes.

The pipework shall be securely strapped to the bridge structure at no more than 1m intervals.

A drain down point shall be fitted to discharge the mainline at each stream crossing. This shall consist of a fusion tapping saddle and 50mm lever ball valve.

Wiring where applicable shall be installed in electrical ducting and securely strapped to the bridge structure at no more than 1m intervals.

2.6.2 Road & Path Crossings

With sizes equal too and less than 63mm a 100mm duct will be installed and when required a 50mm electrical duct complete with draw wire will be installed beside the 100mm duct. Pipes under roads will be installed to a minimum depth of 1m cover. Refer Standard Drawing Layout D- 9.

2.7 CONTROL SYSTEM

2.7.1 General

The control system can be battery powered controllers for irrigation which is used for establishment only. Irrigation which is required to be permanent controlled shall be the conventional AC powered controller suitable for outside installation. Decoder systems can be used on systems which have a greater station count than 24 valves. Decoder system are more acceptable to surge damage and general require a high level of technical expertise when trouble shooting.

Automatic controllers shall be provided for irrigation systems. These should be of 240 volt power supply.

The Controllers are solid state with the state of the art controller technology, which will provide the versatility required for operating the proposed irrigation system. They shall be housed in a protective plastic cabinet and some of their features are:

> Three independent programs, two that can run concurrently.
> Simple program review.
> Water budgeting.
> Programmable valve test.
> Self-diagnostic circuit breaker.
> Non-volatile memory.
> Time battery backup.
> Two year warranty

Battery controllers shall be submersible up to 2m in water as per IP-68 standards with a 2 year warranty. Batteries shall last for a minimum of 1 year's operation.

2.7.2 Control Cables

Cable from the field to the valves or sprinklers shall be multi core polyethylene sheathed cable.

Minimm wire size shall be 1.5mm2. In all cases, one of the cables in multi core shall be black to denote the common wire. No joints shall be made between the irrigation control unit and the valve.

2.7.3 System Grounding

The control system shall have equipment as recommended by the manufacturer to provide surge protection to the irrigation field units. In most circumstances this will be a copper clad earth rod installed in a 150mm valve box connected via 16mm2 copper cable to the irrigation field unit.

2.7.4 Wire Connectors

All wire joints shall be made using grease filled type connectors suitable for below grade burial. King type or 3M DBY or 3M DBR connectors shall be used.

2.7.5 Metallic Detector Tape

150mm above the pipe a metallic detector tape printed with the works "Water Pipe Below" shall be laid over the position of the pipe line. Refer standard drawing layout.

3 INSTALLATION

3.1 SPRINKLERS

All pipe work shall be thoroughly flushed prior to any sprinklers being installed. The sprinklers shall be screwed on to the swing joint and set level with the surrounding ground by using a 500mm straight edge. A 400mm square of biodegradable coir matting shall be placed around each sprinkler to stabilise the soil around the sprinkler and provide a suitable environment for the seed to strike.

Soil around the sprinkler shall be compacted to prevent the sprinkler sinking. The sprinkler shall then be tested for correct operation and arc of coverage. Refer Standard Drawing Layout D- 7 and D-8.

3.2 DRIPPERS

Drippers shall be installed underneath the bark mulch Refer Standard Drawing Layout D- 6.

3.3 VALVES

3.3.1 Solenoid Control Valves

All solenoid valves shall be installed in rectangular valve boxes. Threaded rigid PVC risers shall be used to ensure the valve sits a maximum of 100mm beneath the lid of the valve box for ease of maintenance. The valve assembly shall be centrally located within the box, and no part of the box shall be in contact with any part of the valve or connecting pipe work.

The valve assembly shall be fitted such that it is clear of any soil or backfill material. A 75mm layer of gravel shall be packed under each valve.

Drip zone valves shall incorporate a pressure regulator and 120 mesh filter.

Pressure regulators shall be adjusted to ensure the downstream pressure on the drip zones does not exceed 3 Bar. Refer Standard Drawing Layout D- 3 and D-5.

3.3.2 Mainline Isolation Valves

All mainline sluice valves shall be installed such that the operating nut is vertical, not on an incline. A 250mm (10") culvert pipe or similar shall be cut to fit around the valve and extend up into the valve box to allow easy access and prevent soil burying the valve.

All mainline sluice valves shall be correctly thrusted to prevent their movement as detailed in QLDC plan W05.

3.3.3 Lateral Isolation Valves

Lateral valves shall be installed at mainline depth. A 150mm duct tube shall be cut to fit over each valve operating handle and extend up into the valve box for operation with an extension key. Refer as detailed in QLDC plan W05.

3.3.4 Backflow Preventer

A line strainer shall be installed immediately upstream of the back flow preventer and its valves. An isolating valve must be installed upstream of the line strainer. The backflow preventer, line strainer and all associated valves shall be installed in an approved valve box that provides adequate access for testing and servicing, with the lid accessible at finished grade level. The assembly shall comply with the Water supplies Protection act 1961/87, in accordance with the practical solutions of the Building act 1991 for a medium hazard connection. The backflow Preventer must be tested by an independently qualified person (IQP) Refer Standard Drawing Layout D- 1 and D-2.

3.3.5 Water Meter

A water meter shall be installed immediately upstream of the back flow preventer and its valves. The water meter shall be installed in an approved valve box that provides adequate access for testing and servicing (425mm x 575mm), with the lid accessible at finished grade level. Install with minimum of 10 pipe diameters upstream and 5 diameters downstream. Refer Standard Drawing Layout D- 1 and D-2.

3.3.6 Quick Coupling Valves

All quick couplers shall be housed in valve boxes. All QCVs shall be connected to the mainline with swing joint risers to allow correct levelling. All QCVs shall be securely anchored in the ground with a stabilising bar and stainless steel U bolt clamp.

Where drip isolation valves are used they shall be isolated with a lever ball valve.

These shall be housed in 150mm (6”) boxes, located as close as possible to the LDPE feeder pipe.

3.3.7 Valve Boxes

All valve boxes shall be installed on treated timber or brick supports to prevent them settling. All valve box lids shall be set flush with surrounding ground. Where possible valve boxes shall be installed off pedestrian areas.

3.4 PIPEWORK

3.4.1 General

Pipe work installation involves the trenching, bedding, laying backfilling and commissioning of the pipe work system as shown on the plans.

3.4.2 Trench and Backfill

As per section 6.5 ‘Construction’ from the QLDC Land Development and Subdivision Code of Practice:

6.5.1 Excavation

Excavation of existing carriageways shall conform to the TA’s road opening procedures where these exist. Excavation in existing carriageways shall be carried out in a safe manner with the minimum disruption to traffic and pedestrians.

6.5.2 Embedment

Pipes and fitting shall be surrounded with a suitable bedding material in accordance with Appendix B drawings CM – 001 and CM – 002.

6.5.3 Backfilling and reinstatement

6.5.3.1 Carriageways

Backfilling shall be in accordance with the requirements of the TA. Pipe trenches within a carriageway shall be backfilled using an approved hardfill placed immediately above the pipe embedment and compacted in layers not exceeding 200 mm in loose depth, as per Appendix B drawing CM – 002.

In existing sealed roads, the top section of the trench shall be backfilled as specified by 3.4.2.3. The depth of base course and type of finishing coat seal shall conform to the standard of the existing road construction.

6.5.3.2 Berms

Pipe trenches under grass berms and footpaths shall be backfilled in accordance with the requirements of Appendix B drawing CM – 002.

3.4.3 Pipework

All mainline pipes shall be installed to provide 1m of cover over the pipe in roads, with all other areas being a minimum of 400mm. All pipework shall be joined in accordance with manufacturer’s instructions. Refer Standard Drawing Layout D- 9.

3.4.4 Thrust Blocks

Concrete thrust blocks cast in situ shall be installed on the PVC mainline at each bend, tee, sluice valve or end of line to prevent movement. Pre cast blocks shall not be used. Prior to pouring concrete, the pipe and fittings shall be wrapped in polythene sheet. The thrust block shall be constructed in such a way that the load is evenly spread over a vertical trench wall in undisturbed ground.

3.4.5 Dripper Laterals

The LDPE laterals may be installed by mole plough as long as the minimum depth of 400mm is obtained, dripper, refer standard drawing layout. The lateral pipe must be flushed before the installation of drippers shall be installed on a 13mm lateral ring around the tree. Refer standard drawing layout.

The end of each 15mm lateral shall be fitted with a threaded end cap or in the case of a ring main shall be fitted via a tee to facilitate flushing prior to installing the dripper and for future maintenance.

3.4.6 Inline Drip Pipe

Inline drip pipe for landscape plantings shall be installed on top of the ground and securely anchored by ground staples at 1 metre intervals. Lateral lines supplying water to the in line drippers shall be thoroughly flushed so as to prevent any blockages in the inline drippers. The in line drip pipe will be covered by a bark mulch.

3.4.7 Fittings

All fittings shall be installed in accordance with manufacturer's instructions and in accordance with their intended design use.

3.5 CONTROL SYSTEM

3.5.1 General

All electrical work shall be carried out in accordance with relevant.

New Zealand standards and codes of practice by experienced personnel.

3.5.2 Field Control Cabling

All wire from the irrigation control unit to the valves shall be run in continuous lengths, no joins are permitted in these cables. The cable shall be laid beside the pipe. At joints and valves, 500mm of slack cable shall be left to allow the valve wiring to be completed with ease above ground.

At the control location each pair of wires shall be clearly labelled with the station number that they operate for ease of installation. All wire shall be laid in the trench adjacent to the pipe, the cable shall be 'snaked' and an expansion loop shall be left at bends and tee junctions to avoid stretching the cable when backfilling. The cable shall be laid on one side of the pipe, it shall not be laid crossing over the pipe.

At points where thrust blocks are to be poured the cable must not be buried in the concrete.

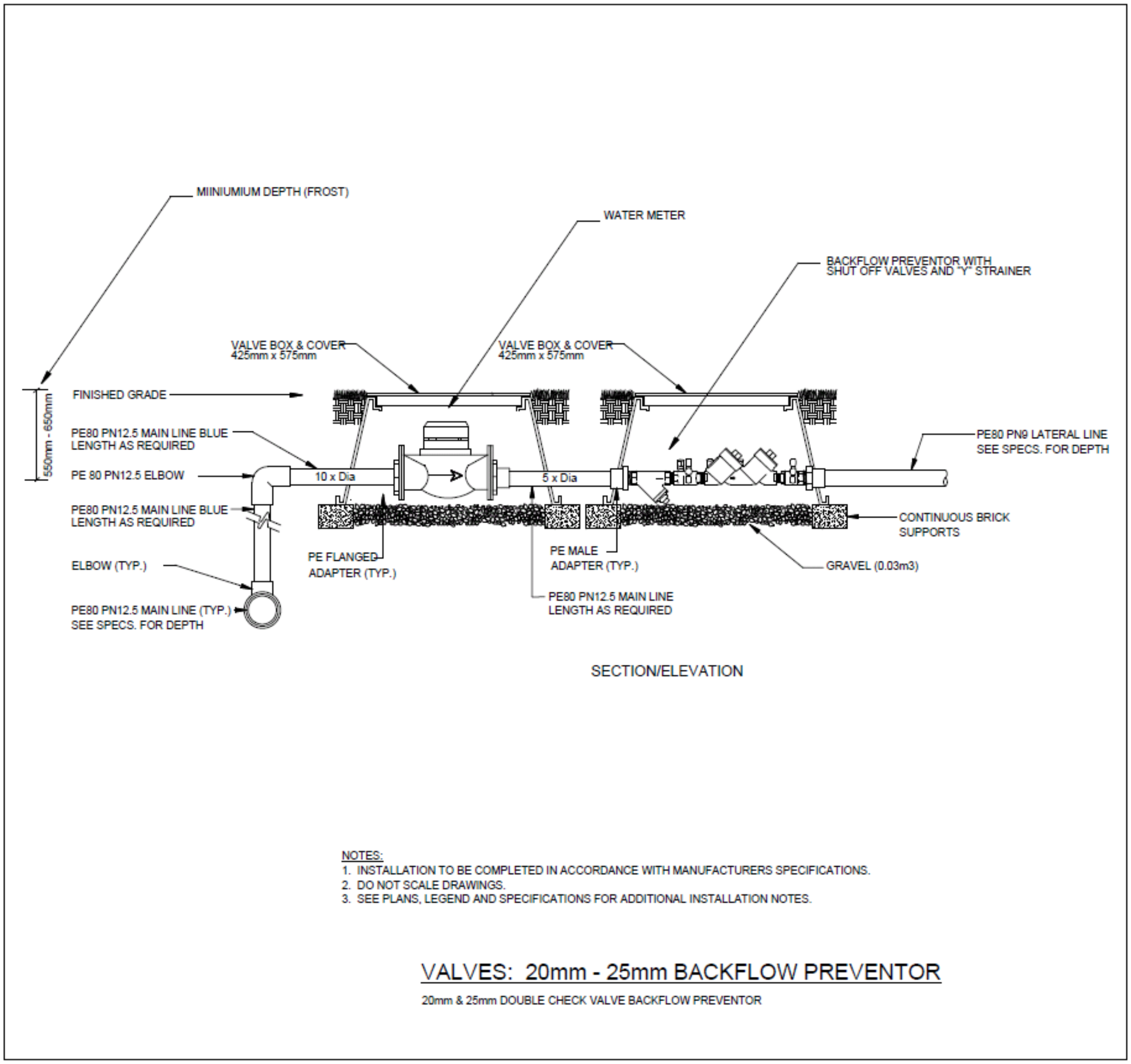
Wherever a cable junction is to be made there shall be at least 500mm of spare cable that can be brought above ground for ease of maintenance.

An accurate record of each control unit number and the stations they operate shall be maintained as the installation progresses. This shall be transferred to the controller as soon as possible and on a frequent basis.

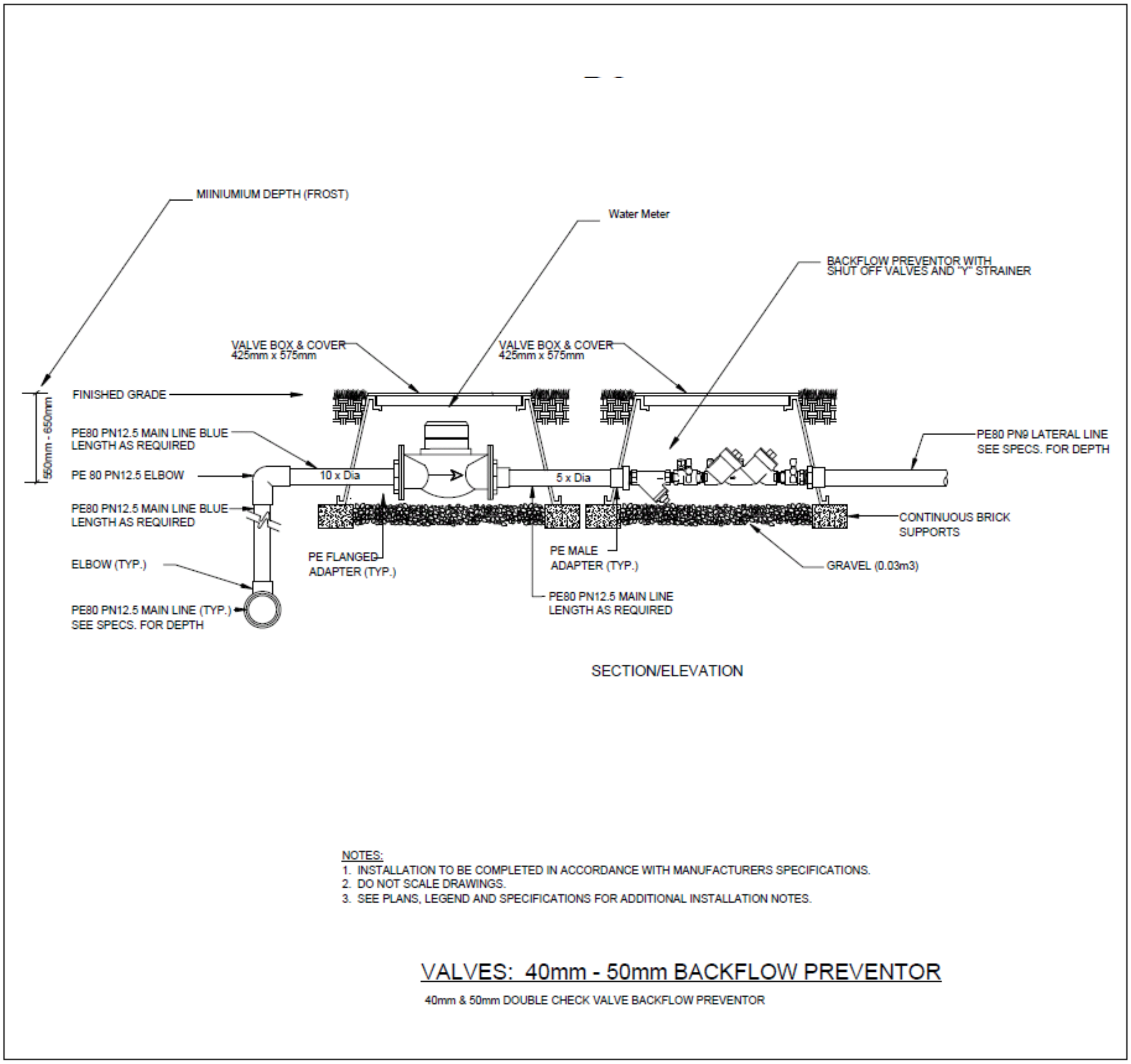
3.5.3 Irrigation Control Units

Controllers shall be installed as per the local authority codes and manufactures recommendations. Controllers shall also be earthed independently of the building earth. This earth shall have a maximum resistance as tested of 10 Ohms.

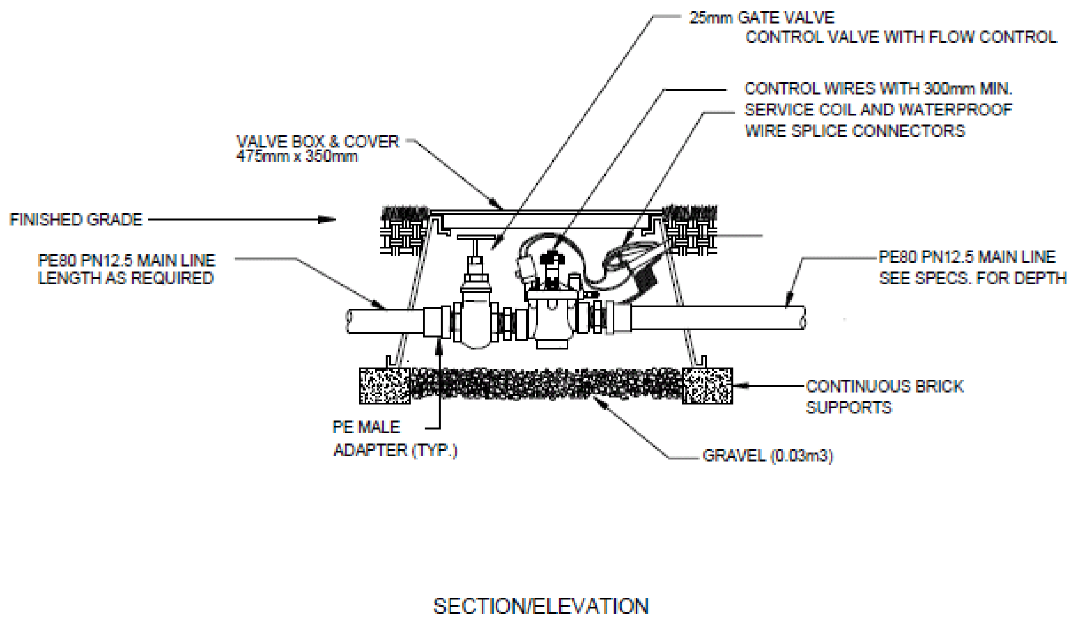
4 IRRIGATION STANDARD DRAWINGS



Standard Drawing Layout D- 1: Connection 20mm – 25mm



Standard Drawing Layout D- 2: Connection 40mm – 50mm

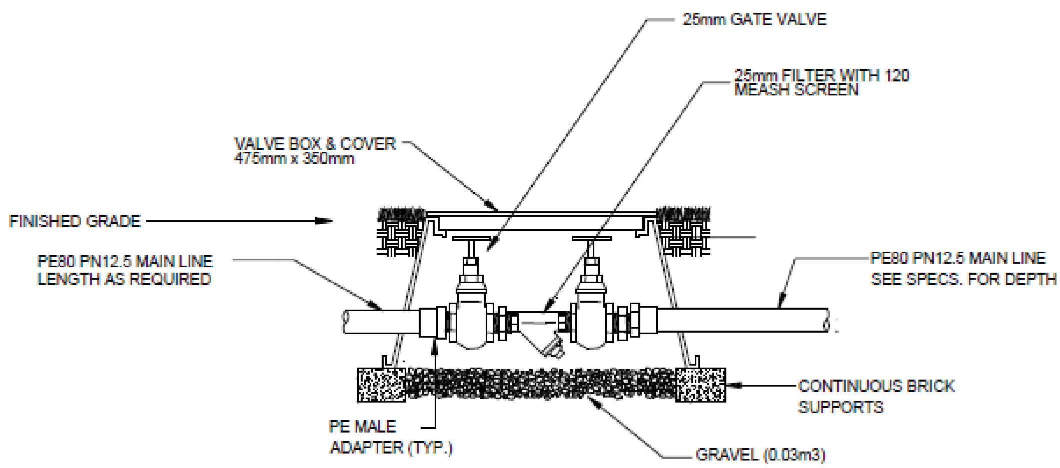


NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

ISOLATING VALVE: 25mm SOLENOID VALVE

25mm Isolating Valve with Solenoid Valve

Standard Drawing Layout D- 3: Control Valving 25mm



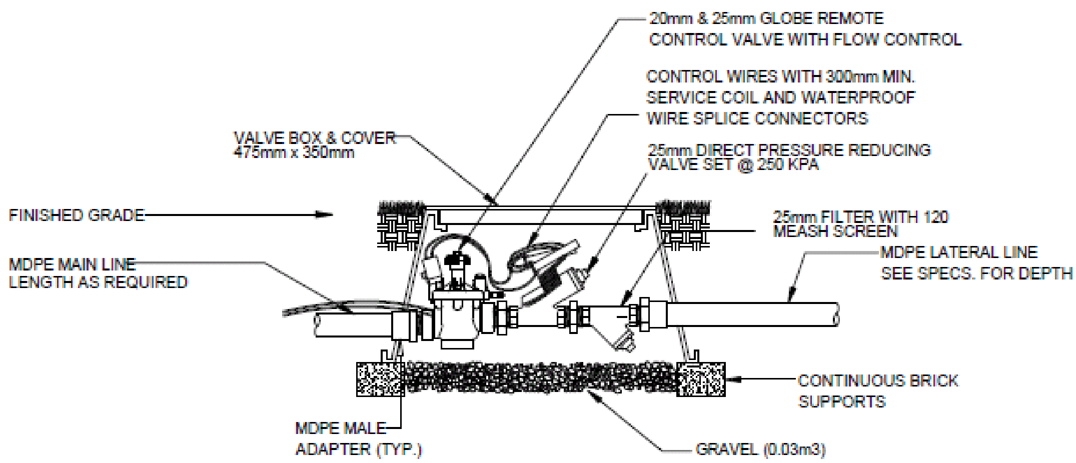
SECTION/ELEVATION

NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

25mm FILTER WITH ISOLATING VAVLES

25mm Fliter with Isolating Valves

Standard Drawing Layout D- 4: Filter – 25mm



SECTION/ELEVATION

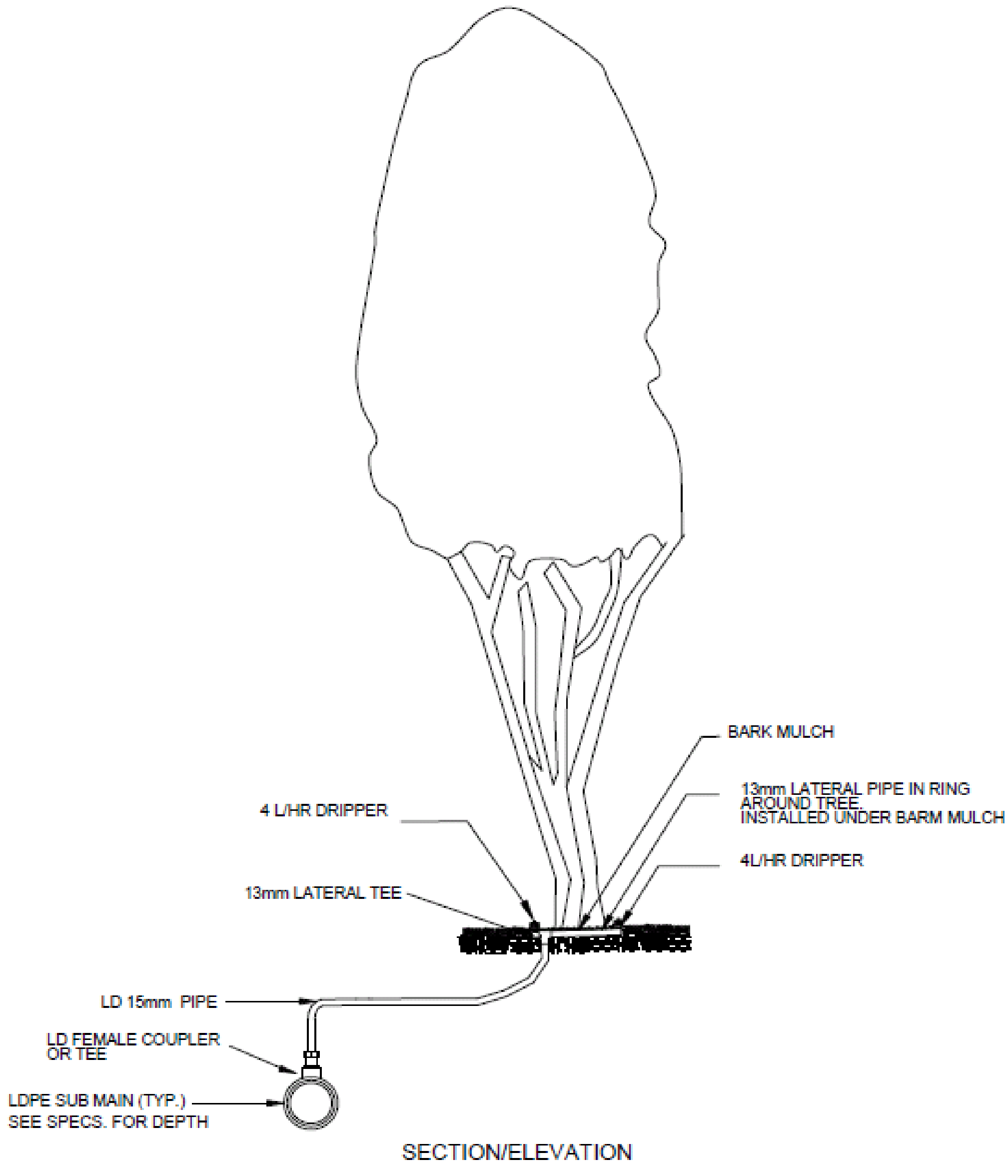
NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

TRICKLE CONTROL VALVES: 25mm SOLENOID VALVE

25mm Solenoid Valve with 25mm Press/Reg Valve & 25mm Filter

Standard Drawing Layout D- 5: Trickle Control 25mm



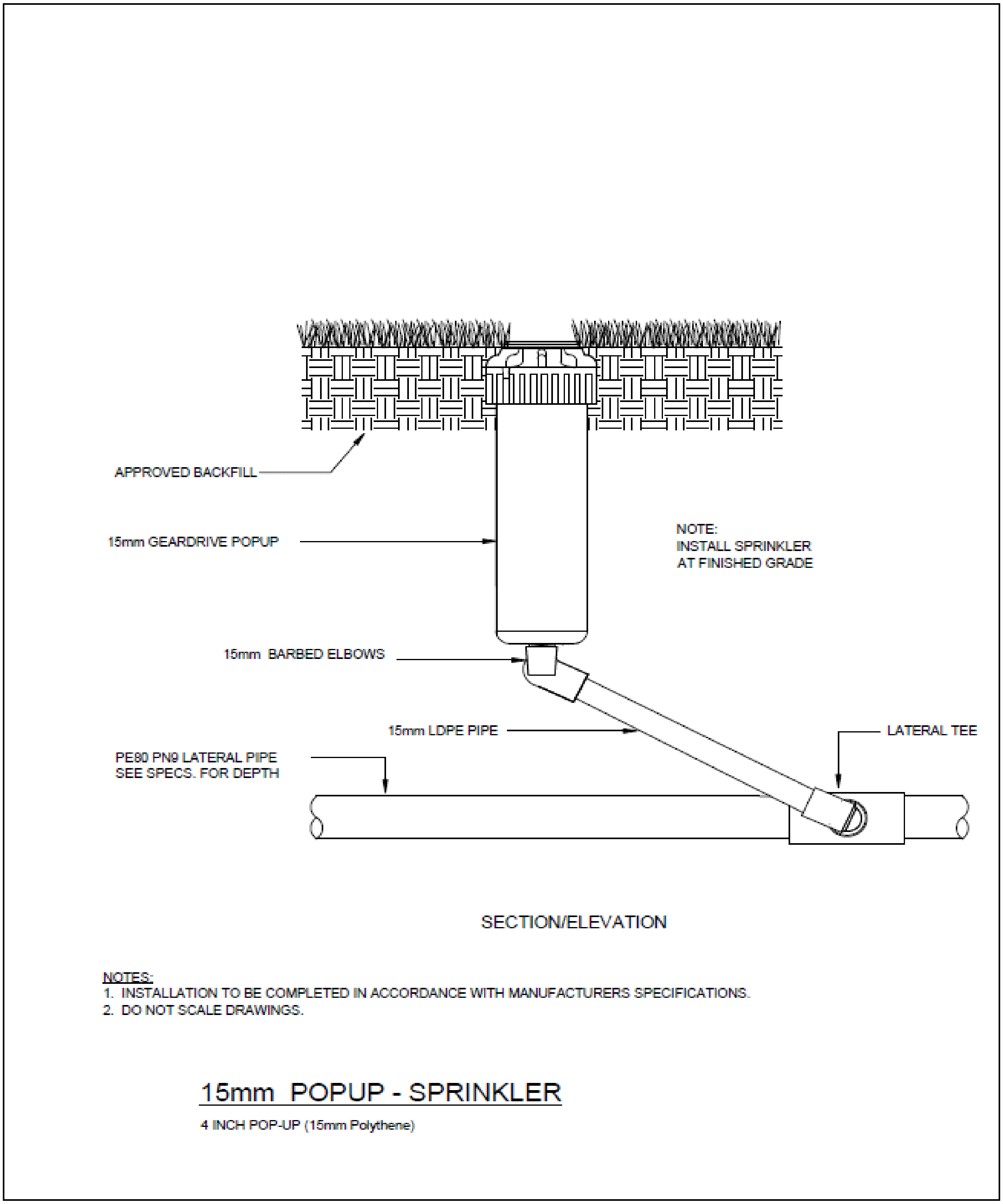
NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

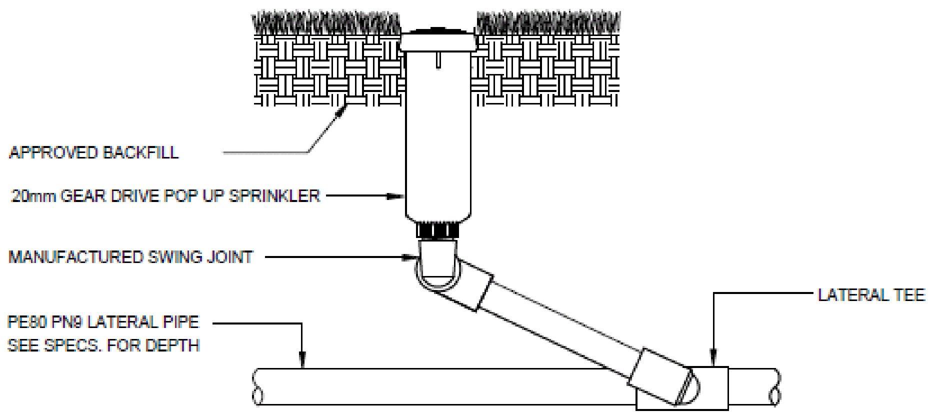
TRICKLE: DRIPPER

4 L/H Compensating Cleanable Dripper

Standard Drawing Layout D- 6: Trickle Dripper



Standard Drawing Layout D- 7: Popup Sprinkler 15mm



SECTION/ELEVATION

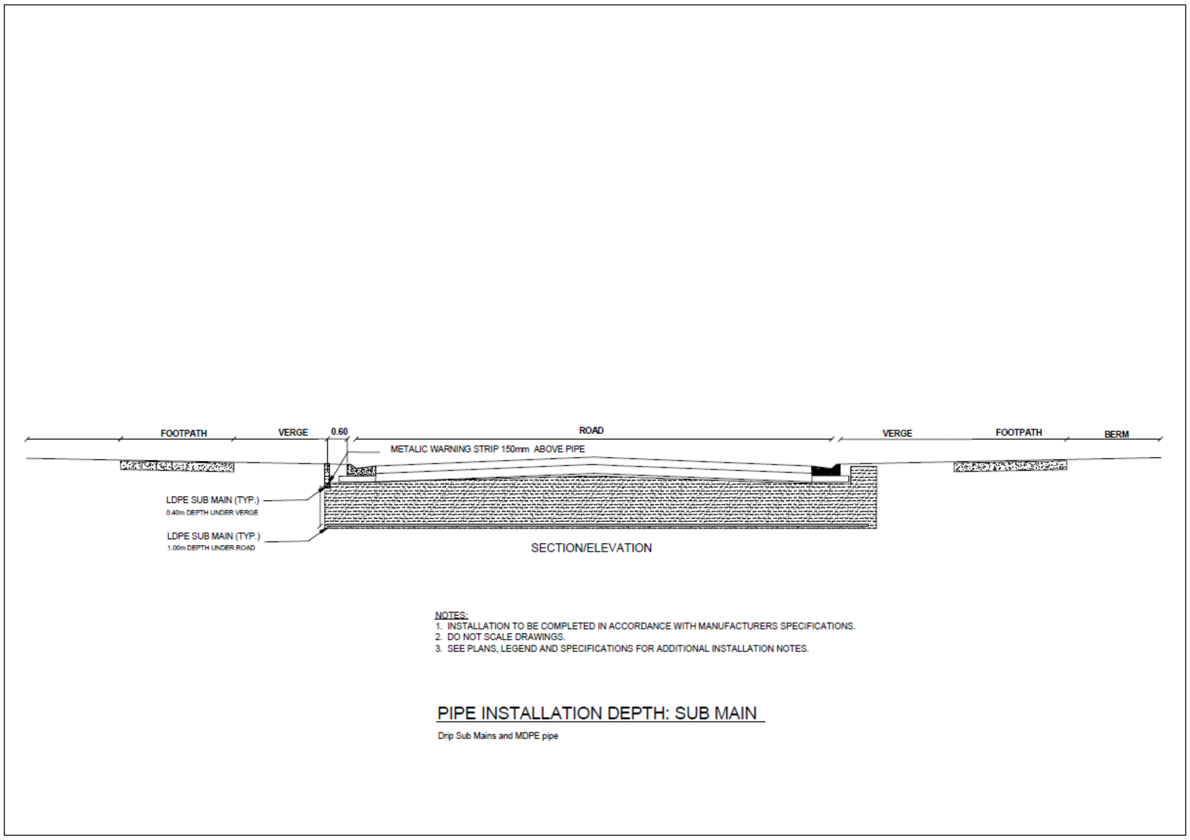
NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. INSTALL SPRINKLER AT FINISHED GRADE

20 mm GEAR DRIVE 100mm POP-UP

SINGLE-STREAM SPRINKLER, SWING JOINT

Standard Drawing Layout D- 8: Gear Drive Popup 20mm



Standard Drawing Layout D- 9: Pipe Installation - Submain

QUEENSTOWN LAKES DISTRICT COUNCIL

1 GENERAL REQUIREMENTS

#	Function	Details
1	Landscaping	

	i.	All-weather vehicle access to the wet-well, valves, electrical and any other major equipment installed on site. Where indivisible components requiring servicing are between 20 and 200kg, design the access for a (crane mounted on a) light truck of:
		• length = 5 metres,
		• width = 2.5 metres and
		• maximum axle loading on 7.00 x 15 single tyred axle = 2500 kg ensuring that:
		  • the rear axle of the truck mounted crane can be brought to within 2m of the vertical centreline of the component to be lifted, and
		  • Insure there is sufficient head room to operate the crane.

	ii.	Hard surfacing (concrete or asphalt) to all areas where sludge, raw sewage or chemicals are likely to spill, draining to the wastewater system or wet-well
	iii.	Washdown area for pump cleaning – with drain back to wet well
	iv.	Ability to locate a mobile standby generator
2	Pumps	
	i.	Duty and standby required
	ii.	Flygt submersible where (where possible Flygt N-Technology pumps)
3	Motor control	
	i.	Soft starters compatible with Flygt pumps.
4	Pipework and valves	
	i.	Knife gate valves used for isolate of each pump and non-return ball valves (both should be housed in individual valve chamber beside wet well).
	ii.	Cast ball check valve
5	Wet well and emergency storage	
	i.	Minimum of nine hours storage (ADWF). A smaller wet well with off line storage is preferred. Where the pump station is considered "large" and has a standby generator and spare pump supplied (additional to duty / standby pumps) – with the agreement with Council, emergency storage may be reduced.
	ii.	May be constructed from pre cast concrete or fibre glass.
	iii.	Venting – Where applicable use of McBerns GM375 Mixed Media Odour filters
	iv.	Automatic well washing (on hinged bracket)
	v.	Manhole adjacent to pump station with cutoff valve. Note - SS knife valve with deflector plate on inlet pipe with valve spindle to top of well. *Allows wet-well and associated pipework to be safely isolated from the sewer system*
	vi.	All pipe work, riser joint & attachments within wet well shall be stainless steel 316
	vii.	Cover lids - McBerns 4-sided safety cover lid type
	viii.	Valve chambers and pits with a 50mm minimum diameter drain hole falling into the wet-well
	ix.	Locate the covers to enhance equipment maintenance and to permit the setting up of davits or tripods for entry to confined spaces.
	x.	Drop structure on the inlet at an angle of at least 45 degrees to prevent the forming of vortices on pumping
	xi.	Any ducts (electrical / control) shall be a minimum of 100mm diameter

#	Function	Details
6	Switchboard	
	i.	Beige in colour to reduce internal heat build-up.
	ii.	Weatherproof protection hoods for any instruments exposed to sunlight. *To prevent degradation of liquid crystal displays by ultraviolet light or moisture ingress from heating and cooling effects*.
	iii.	RTU aerial: Locate the external line-of-site aerial on the furthest side of the building from the road boundary whilst maintaining line of sight. Detail securing of aerials against wind and snow loading. Mount the aerial on a 50mm diameter aluminium scaffolding tube extending two metres above the top of the electrical control cabinet or building. Ensure this pipe is easily lowered to the ground for aerial maintenance
	iv.	Remote pump starting and stopping shall also be provided from the SCADA system
	v.	All ducting from the sewer well and valve chambers to electrical cabinet shall be filled with builders foam
	vi.	UPS required for SCADA control system – to operate for a minimum of 4 hours.
7	Remote Terminal Unit (RTU)	
	i.	Developer to provide proposed method of RTU communication to Veolia for approval. The developer is responsible for all costs associated with the provision of the SCADA communication.
	ii.	Developer is required to use the maintenance contractor for all changes required for the software configuration to Council’s SCADA system and includes graphical interface, pump station reports and pump station generated alarms.
8	Magflow meter	
	i.	Isolating valve in the same or a separate concrete chamber downstream of the meter. *This valve allows isolation of the pressure main if the meter has to be removed, eliminating the requirement to drain the whole pressure main*
12	Water supply	
	i.	RPZ - Wilkins Double Check Valve assembly (Model 350) with DekoRRa 301-BG-C2 insulated backflow enclosure
	ii.	Inlet supply – 32mm Outlet – 25mm with female camlock connection and isolating valve
13	Public Toilets	
	i.	All new public toilet facilities with a pump station or septic tank must be connected to SCADA and comply with this Electrical and SCADA Standard.
	ii.	The following parameters should be monitored for new public toilets connected to SCADA: • Well levels • Pump status • High/low warnings • Any faults • Loss of communications
	iii.	Spare capacity in the RTU should be provided for a flow meter to be installed in the future.

ELECTRICAL & SCADA STANDARD

FOR WASTEWATER PUMP STATION SWITCHBOARD DESIGN & INSTALLATION IN THE QUEENSTOWN LAKES DISTRICT

2025

VEOLIA

ELECTRICAL & SCADA STANDARD

WASTEWATER PUMP STATION SWITCHBOARD DESIGN

for:

Queenstown Lakes District Council

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VERSION CONTROL

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All	Amendments & updates	16 May 2017	Switchbuild
All	Final version	19 May 2017	Veolia
All	Draft review	16 Dec 2021	Veolia, QLDC
All	Final version	20 February 2025	QLDC

OVERVIEW

This Electrical & SCADA Standard for Submersible WWPS has been prepared for Queenstown Lakes District Council (QLDC) to provide for a consistent approach to QLDC submersible WWPS infrastructure through the enforcement by QLDC of a uniform standard.

The specification is prepared specific for Submersible WWPS [2 pump WWPS, external (non building housed) switchboard of <30 kW].

It is intended that:
- This Electrical & SCADA Standard: Submersible WWPS apply for all submersible WWPS of <30 kW within the Queenstown-Lakes District.
- This Electrical & SCADA Standard: Submersible WWPS form the basis for the preparation of tailored individual specifications for pump stations of ≥ 30kW within the Queenstown-Lakes District.

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APPENDIX A – Equipment Data Sheet
APPENDIX B – RTU Standard I/O Configuration and Tag Naming
APPENDIX C – Operations and Maintenance Manual Example
APPENDIX D – WWPS commissioning test and check sheets
APPENDIX E – Standard Electrical Drawings

DRAWINGS

QLDC_WWPS_01 QLDC Pump Station Standardisation <30kw Soft Starter
QLDC_WWPS_01 REG Electrical Drawings Register
QLDC_WWPS_01 STD Standard Project Information
QLDC_WWPS_01 BOM Equipment Schedule
QLDC_WWPS_01 GA - General Arrangements
QLDC_WWPS_01 LDL1 - Label Schedule
QLDC_WWPS_01 01- Wiring Schematics

The enclosed Specification for the Design and Construction of Submersible Wastewater Pumping Station Switchboards up to 30 kW contains references to the following Australian and New Zealand Standards:

AS/NZS 60947.8: Low voltage switchgear and control gear - Protection of electric motors - Built-in thermal detectors and associated control units

AS/NZS 1100: Technical drawing

AS 1101: Graphic symbols for general engineering

AS/NZS 1102: Graphical symbols for electrotechnical documentation

AS 1307.2: Surge arresters - Metal-oxide surge arresters without gaps for a.c. systems

AS 1319: Safety signs for the occupational environment

AS/NZS 1554.6: Structural steel welding - Welding stainless steels for structural purposes

AS 1627.1: Metal finishing - Preparation and pre-treatment of surfaces - Removal of oil, grease and related contamination

AS/NZS 2053.2: Conduits and fittings for electrical installations - Rigid plain conduits and fittings of insulating material

AS/NZS CISPR 11: Industrial, scientific and medical (ISM) radio frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement

AS 2184: Low voltage switchgear and controlgear - Moulded-case circuit-breakers for rated voltages up to and including 600 V a.c. and 250 V d.c.

AS/NZS: 61000.3.6 Electromagnetic compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV and HV power systems

AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS/NZS 3008.1.2: Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand installation conditions

AS 3111: Approval and test specification - Miniature overcurrent circuit-breakers

AS 3112: Approval and test specification - Plugs and socket-outlets

AS/NZS 3133: Approval and test specification - Air-break switches

AS/NZS 3190: Approval and test specification - Residual current devices (current-operated earth-leakage devices)

AS/NZS 3439.1: Low-voltage switchgear and controlgear assemblies - Type-tested and partially type-tested assemblies

AS/NZS 61000.6.1: Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments

AS/NZS 4383: Preparation of documents used in electrotechnology

AS/NZS 4792: Hot-dip galvanised (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialised process

AS/NZS 5000.1: Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 (1.2) kV

AS 5000.2: Electric cables - Polymeric insulated - For working voltages up to and including 450/750 V

AS/NZS 60044.1: Instrument transformer - Current transformers

AS 60269.1: Low-voltage fuses - General requirements

AS 60269.2: Low-voltage fuses - - Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)

AS 60269.4: Low-voltage fuses - - Supplementary requirements for fuse-links for the protection of semiconductor devices

AS 60417: Graphical symbols for use on equipment

AS/NZS 60529: Degrees of protection provided by enclosures (IP Code)

AS 60947.2: Low-voltage switchgear and controlgear - Circuit-breakers

AS 60947.4.1: Low-voltage switchgear and controlgear - Contactors and motor-starters - Electromechanical contactors and motor-starters

AS 60947.4.2: Low-voltage switchgear and controlgear - Contactors and motor-starters - A.C. semiconductor motor controllers and starters

AS 60947.5.1: Low-voltage switchgear and controlgear - Control circuit devices and switching elements - Electromechanical control circuit devices

AS 61800.3: Adjustable speed electrical power drive systems - EMC requirements and specific test methods

AS/NZS CISPR 11: Industrial scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement

AS IEC 61131.1: Programmable controllers - General information

AS IEC 61131.2: Programmable controllers - Equipment requirements and tests

AS IEC 61131.3: Programmable controllers - Programming languages

IEC 60073: Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators

AS 60204.1: Safety of machinery—Electrical equipment of machines

AS 4024: Safeguarding of Machinery

AE-5014: Aurora Energy Network Connection Standards

1 SCOPE OF WORKS

Installation of switchboards designed for the purpose of providing submersible pump control need to meet numerous standards for vesting as future QLDC owned and operated facilities.

1.1 Key design parameters

As a minimum, the switchboard shall be designed to achieve the following;

- House all electrical components,
- Allow for space to accommodate larger switchgear should this be required in the future,
- Be safe for network operators to use without requirement of electrical qualification,
- Be positioned away from wells and other civil structures that might detrimentally affect operation and maintenance of the facility,
- Be built to withstand local environmental conditions together with the potential harm that may result from wastewater odours.
- Conform to this Electrical and SCADA standard.
- For QLDC sites be connected to the QLDC SCADA base station for system monitoring. This station is located at the Veolia Site office.
- For the Lake Hayes Scheme be connected to the SCADA base station for system monitoring. This station is located at the Fulton Hogan controlled, Lake Hayes Estate Treatment Station.
- Consideration of Temporary Traffic Management Requirements and compliance with the Code of Practice for Temporary Traffic Management.

1.2 Conformance to standards

Any electrical contractor engaged to design and install electrical switchgear at new or upgraded wastewater pump stations needs to ensure the above, high level design parameters are met whilst conforming to the following relevant standards;

- Pump station design to meet QLDC infrastructure code requirements,
- Electrical installation to meet all relevant industry and safety standards,
- All electrical work shall be performed in accordance with AS/NZS 3000 and the requirements of the supplier of electrical energy.
- Design and functionality to meet this Electrical and SCADA standard,
- Design approval by QLDC or their approved representatives.

1.3 Expected deliverables

Equipment to be supplied and installed by the Electrical Contractor shall include but not be limited to:

(1) Civil works for switchboard footings.
(2) Supervision over installation of conduits and ducting.

(3) Supply of pumping station electrical cabinet, main switchboard and motor control.

(4) Wet well level indications, controls and associated wiring.

(5) Installation of mounting pole and floodlight.

(6) Installation of telemetry hardware and RTU.

(7) Liaise with Veolia to prepare SCADA alarms and pages

1.4 Provision of documents

The provision of documents associated with the deliverable of new pump station switchboards shall be determined by the requirements of the contract. This shall include, but not be limited to, the following;

- Component list / specification / asset description. This list shall be supplied in a format determined by QLDC for the purpose of populating their Asset Management Database.
- Functional control description for the purpose of understanding pump station control logic and functionality.
- User manuals, equipment manuals and operation manuals.
- Electrical drawings.
- Declaration of Conformity Statements
- Electrical Certificates of Compliance.
- Test certificates and commissioning documents.
- Programming software and print outs of control logic files.

1.5 Commissioning

Commissioning is the most important aspect of the contract. Electrical contractors are expected to liaise closely with QLDC 3 Waters Contractors Veolia (QLDC sites) and Fulton Hogan (Lake Hayes Sites) throughout this process.
A commissioning plan shall be developed together with check sheets that aim to test every functionality of the electrical and mechanical components installed.

Commissioning shall be witnessed by the appropriate QLDC staff and Veolia or Fulton Hogan representatives and signed off by them.

Commissioning checks completed on new wastewater facilities shall include functional testing on the following components;

- Pump performance
- Primary pump control
- Secondary pump control

- Well level measurement
- Flowmeter
- RTU communications and SCADA connectivity
- SCADA I/O checks

2 ELECTRICAL SUPPLY

2.1 General

The power supply shall be a 400/230 V ac, 50 Hz, 3 phase, 4 wire, earthed neutral electrical supply. Where possible, the pillar / plinth which houses the connection to the supplier of electrical energy shall be at pillar / pole top or transformer.

2.2 Electricity Metering

The supplier of electrical energy meters, CT's (if required) and other equipment shall be installed in a manner acceptable to the supplier of electrical energy.

The Electrical Contractor shall arrange with the supplier of electrical energy for the reuse of the existing or replacement of electrical meters as required.

The electrical contractor shall liaise with QLDCs energy retailer to request appropriate power metering at site. Depending on the anticipated power consumption of the facility, QLDC may request a pulse output off the power metering connected through to the RTU for remote monitoring of power use.

3 SWITCHBOARD DESIGN

3.1 Structural design

3.2 Concrete Footing

A concrete footing shall be installed except where ground conditions are deemed to be unstable by either the QLDC Chief Engineer or the Electrical Contractor, in which case an engineered design by an appropriately qualified civil engineer will need to be supplied.

The concrete footing dimensions shall be sized so that is larger in area than the footprint of the switchboard enclosure.

3.3 Plinth

Where the switchboard is floor-mounted, the switchboard shall be provided with a bolt-on, hot dip galvanised rolled steel or stainless steel channel plinth. The plinth shall be approximately 200 mm high and secured to the concrete footing using grade 316 stainless steel bolts and masonry anchors.

The plinth shall not be drilled except for enclosure and securing mounting holes.

Gasket

Where a plinth is required, a rubber gasket shall be installed between the plinth and the switchboard enclosure to ensure that moisture cannot be trapped between the surfaces. The gasket shall be 3mm thick, 3-ply insertion rubber reinforced with 2-ply canvas.

Bolts and fastening equipment

- Bolts used to secure switchboards or major items of equipment shall be in accordance with AS 1252 and have a bolting category of 8.8/S.
- All other bolts, nut, washers and fasteners shall be hot dipped galvanised or grade 316 stainless steel.
- All minor fastenings, saddles, screws, washers, nuts, metal threads etc. shall be grade 316 stainless steel.
- All stainless steel shall be insulated from other metals using plastic washers and spacers to ensure that no galvanic action and/or corrosion can take place.

Conduits

- Conduits shall be supplied and installed for cables in accordance with AS/NZS 3000, this clause and the drawings.
- The Electrical Contractor shall size conduits in accordance with AS/NZS 3000 for the number and size of cables to be installed within each conduit, but shall in no case be smaller in nominal size than 20 millimetre diameter.

- Electrical conduits and conduit fittings shall be medium duty rigid UPVC conduits and fittings in accordance with AS/NZS 2053.2.
- The Electrical Contractor shall install all conduits between the pumping station switchboard and the wetwell.
- The main conduits for the pump power and level control devices between the pumping station and the wetwell shall be 1x 100mm per pump and 1x50mm for instrumentation.
- Any underground bends or elbows installed should be swept long radius bends.
-
- Cap and individually gland the ducts from the sewer well to the cabinet to eliminate any fumes entering the cabinet

3.4 Switchboard specification

Design of the switchboard shall reflect the functionality required of the wastewater pump station.

The switchboard shall be designed with separate internal panels comprising the following critical hardware;

Switchgear

- Generator changeover switch or
- auto changeover switch if there is an on-site generator.
- If there is no on-site generator, an externally mounted generator plug is required for the purpose of connecting a mobile generator.
- External generator plug to be mounted in a lockable enclosure on the side of the switchboard.
- Generator plug should be designed to use with a portable generator of suitable size and application that can be used to run the pump station without the need for on site supervision from an operator ie the front doors of the external enclosure must be able to be closed and locked when a portable generator is connected to the switchboard.
- Generator plug to be IP54 rated.
- Sizing and specification of this socket shall be determined by rating of the pump motors and switchboard.
- Single phase likely to be a 3 pin 10 Amp socket with RCD protection
- 3 phase socket C Form 63A or C Form 125A plug.

Motor Control Centre

- Internal Switchboard Form 3A comprising individual compartments for the main incomer, tariff metering, local services, DB, level duty and telemetry controls, field terminations and pump starters (1 per starter)

- Live parts within an enclosure must be arranged to provide basic protection against direct or indirect contact.
- Soft starters or VSDs to run the pumps
- Pump motor isolators
- Power factor capacitors
- Phase rotation relays
- Under current / over current
- Over voltage / under voltage

Telemetry and SCADA hardware

- RTU to communicate to the SCADA base station
- 24V DC UPS for low voltage supply to critical control gear,
- Suitable communication aerial
- Telemetry panel to be located in the upper portion of the switchboard, close to eye level.

Metering

- Network metering to conform to local Power Supply Authority Standards.

Distribution

- Circuit breakers for local distribution
- This may or may not include the pump circuit breakers

Pump control hardware and instrumentation

- Pump controller
- Primary level control

Flowmeter

- Electromagnetic flowmeter transmitter or display unit
- Pressure monitoring (if any)

3.5 Switchboard and component rating

External enclosures should be rated to IP56.

The switchboard shall be designed and manufactured in accordance with the drawings QLDC_WWPS_01 provided with this Specification and the following:

- Components installed such as motor fuses holders, isolating switches, contactors and motor plugs and sockets etc. shall be sized to suit these ratings.
- The motor starters/VSDs, motor fuses and thermal overloads used for the pumps shall be sized to suit the pump ratings.
- All switching and control devices shall be secured in the switchboard using DIN rail mounting wherever possible.

Switchboard Enclosure

Where a switchboard is to be installed externally, or when required by the project specification for internal switchboards, a custom built metal enclosure shall be in accordance with the following:

1) Principal switchboard enclosure requirements indicated in Appendix A, or where no Principal switchboard enclosure requirements are indicated should be 2mm thick 304 stainless steel (316 stainless steel if enclosure is specifically located in, on or immediately around sewerage and is exposed to an aggressive atmosphere) to be resistant against UV and malodours generated from wastewater or other corrosive marine environments (e.g. marine) or where required by the project specification.
2) Front access shall be provided by hinged lockable doors. Opening the doors shall give access to a dead front panel on which controls and indications are mounted. Locks shall be in accordance with Section 3.4.1. Gas struts shall be used to assist door opening and being restrained.
3) Locking of the enclosure is by means of a stainless steel swing handle and roller rod assembly able to accommodate a standard QLDC water/waste water padlock.
4) Exterior sheetmetal shall have a minimum thickness of 2 mm. Large doors, or doors or panels with a large number of cut-outs, shall have additional thickness or shall have stiffeners added to ensure rigidity.
5) The top surface shall slope to prevent accumulation of water. The slope on single sided enclosures shall be such so as to direct water away from the front of the cubicle.
6) With doors and covers in position, provide a degree of protection in accordance with AS 1939 of not less than:
   (a) IP56 if any component within the enclosure has an IP rating of less than IP5X or
   (b) IP26 if all components within the enclosure have an IP rating of IP5X or greater.
7) Equipment which is installed within outdoor cubicles shall be protected against the effects of excessive temperature by either:
   (a) The equipment being de-rated to accommodate the higher ambient temperatures which are to be expected within the cubicles or
   (b) The cubicles being ventilated to ensure that the cubicle internal temperatures do not exceed the temperature ratings of the equipment

(any ventilation shall not decrease the IP rating of the enclosure) and/or the fitting of a metal sun shield of appropriate design allowing for orientation when installed.

8) Ground and floor mounted cubicles shall be provided with a bolt-on, painted hot-dip galvanised (to AS/NZS 4680) rolled steel channel or stainless steel plinth 200mm high.

9) Seismic restraints should be used to secure the switchboard to any adjacent wall.

10) Provided with an interior automatic LED lamp(s) and a switched socket outlet (with RCD protection), accessible when the front door is open.

11) Switchboards and control panels shall be provided with thermostatically controlled anti-condensation heaters in accordance with Section 3.6.9.

12) Internal switchboard to be powder coated of beige colour with exact colour specification required to be 'RAL 7035 Light Grey Ripple' colour in order to ensure maximum heat dissipation from radiant and/or solar heat. This does not apply to the external enclosure.

13) 304 SS exteriors shall be powder coated with exact colour specification to match Dulux Coloursteel "Desert Sand" with a TSR of 58% and LRV of 51% (unless 316 SS is used, then do not powder coat), with a minimum of one zinc shield base coat and one architectural polyester top coat to a thickness of 80 + or – 20 microns.

14) Stainless exteriors shall be roughed surface with a minimum of one 2 pack polyester etch primer and one architectural polyester top coat.

Displays and local lamp indication

All switches, controls, instrument displays and pump and level indicators used for the operation of the pump station shall be positioned on the switchboard such that there must be no direct or indirect contact with live conductive parts.

Stainless Steel Fabrication

Metalwork required to be manufactured from stainless steel shall be constructed in accordance with the following:

(1) Manufactured from grade 304 stainless steel, unless where the enclosure is specifically located in, on or immediately around sewerage and is exposed to an aggressive atmosphere - 316 stainless steel is required.

(2) Welding shall be in accordance with Table 4.5.1 or Table 4.5.2 of AS/NZS 1554.6 and the surface finish of welds shall be Grade II (a) or (c) in accordance with Table 6.2.1 of AS/NZS 1554.6.

(3) Have a uniform texture on the external surface.

3.6 Ancillary extras

Door locks

Locking of cubicle doors, except for vandal resistant cubicles, shall be 3 point for all doors of height greater than 1000mm. Locks shall be cut with barrels allowing for QLDC contractor access. It should be noted that a different key is used to access Wanaka facilities from those in Queenstown.

Allowance shall be made for all internal doors to open at an angle of 90° when installed in the switchboard.

Padlocks are an acceptable method of securing external cabinet doors on electrical switchboards.

Mounting Pole for Antenna and Floodlight

The Electrical Contractor shall install a radio antenna on a mounting pole in accordance with drawing QLDC_WWPS_01

The mounting pole height shall be determined by the Telemetry Contractor and shall not be less than the height shown on drawing QLDC_WWPS_01

Mounting poles shall be manufactured from stainless steel in accordance with AS/NZS 4792.

Station Identification Signage

A station identification sign may be provided by the QLDC Chief Engineer. Where provided this shall be affixed to the switchboard enclosure by the Electrical Contractor in such a manner as to preserve the IP rating of the switchboard.

Electrical Danger Warning Sign

The Electrical Contractor shall supply and install a danger warning sign on the outside of one of the front doors of the switchboard enclosure. The danger warning sign shall be in accordance with AS 1319 and in particular clause 2.3.4 and shall be engraved "400 VOLTS" as per NZS 3000:2007.

Protection against shock

All electrical equipment installed within the pumping station switchboard shall be shrouded to IP 2X in accordance with AS/NZS 60529 to avoid accidental contact.

Electrical control equipment with an ingress protection rating less than IP 52 shall be mounted within metal enclosure(s) with an ingress protection rating of not less than IP 52 in accordance with AS/NZS 60529.

Service conditions

The equipment supplied shall be suitable and approved for operation in the following range of ambient conditions:

Maximum internal temperature	50°C
Minimum air temperature	-10°C

Equipment which is installed within the cubicle shall be protected against the effects of excessive temperature by either the equipment being de-rated to accommodate the higher ambient temperatures which are to be expected within the cubicles or the cubicles being ventilated to ensure that the cubicle internal temperatures do not exceed the temperature ratings of the equipment. Any ventilation shall not reduce the IP rating of the enclosure.

Forced ventilation or cooling

All cabinets exposed to direct sun should be shaded where possible or have a double skinned top / side.
Forced ventilation is only required when any Motor Control Centre (MCC) inside an electrical cabinet incorporates Variable Speed Drives (VSDs). The load banks inside VSDs result in the generation of additional heat output.
Cooling fans on both the internal enclosures and external cabinet are required in all instances when VSDs are mounted.

Electrical contractors are required to calculate the additional heat output resulting from VSD installations and ensure that this additional heat is dissipated and removed through installation of forced ventilation or cooling. No such cooling mechanisms are required where soft starters rated at ≤ 30kW are installed.

Cubicle Heaters

Cubicle heaters shall be in accordance with the following:

(1) Black heat strip heaters rated at approximately 20 watts per square metre of cubicle surface area and suitable for operation at 230 volts.

(2) Shall be of such a number and shall be installed so that heat from the heaters can readily circulate throughout the cubicles and that heat energy from the heaters will not damage materials or components adjacent to the heaters.

(3) Provided with a thermostat which will energise the heaters when the air temperature inside the cubicle is below 20°C. The thermostat can be either built-in or separate and shall preferably be adjustable. On long panels additional thermostatically controlled heaters shall be supplied and installed, if required, to ensure adequate temperature control within the switchboard or control panel.

(4) Heater and thermostat terminals shall be shrouded to eliminate the possibility of accidental personal contact.

Switchboard Light

An interior automatic LED lamp shall be provided to provide illumination in the switchboard enclosure when the front door is open. The light shall be installed in a location as shown on the electrical drawings QLDC_WWPS_01

4 CABLE SPECIFICATION

4.1 General

- Power, instrumentation and control cables shall be installed in accordance with this clause and AS/NZS 3000.
- The Electrical Contractor shall install all cables between the pumping station switchboard and the wetwell.

4.2 Cable Routes and Methods of Installation

- Unless specified otherwise, cable shall be installed underground in conduits with pits as specified.

4.3 Cable Pits

- Unless otherwise agreed or specified cable pits shall be provided for all underground cable runs where cables change direction and at intervals in straight runs so as to allow easy pulling of the cables.
- Cable pits shall be provided with drainage facilities.
- Cable pits in footpaths or where there is no vehicle traffic shall be provided with covers equivalent to Gatic light duty category.
- Cable pits located where there is vehicle traffic (or loading) shall be provided with covers equivalent to Gatic heavy duty category.

4.4 Cable Joints

- Intermediate joints in cables shall not be permitted.

4.5 Cable Handling

- Cables shall be handled carefully from cable drums or spools.
- Kinks shall not be allowed to develop during unwinding or during installation.
- Cables shall not be subjected to bending radii of less than twelve times the outside diameter of the cables or the manufacturer's recommended minimum radius (whichever is the greater) at any stage during installation of the cables.
- Care shall be taken during installation of cables that the insulation and/or sheathing of the cables is not cut, abraded or otherwise damaged.
- Any cables which are damaged during installation shall be repaired or replaced by the Electrical Contractor to the satisfaction of the QLDC Chief Engineer at the Electrical Contractor's expense.

4.6 Cable Termination

- Cables shall be terminated at the terminals provided in the switchboards and control panels and on the various items of equipment which are supplied and/or installed by the Electrical Contractor.
- Spare cores shall be terminated.
- Cables shall be supported as necessary at all points of termination to prevent undue mechanical strain on the terminations.

4.7 Instrumentation Cable Screens

- Screens of instrumentation cables shall be individually terminated at both ends at insulated terminals.
- The screen between the cable sheath and the terminal shall be insulated with heat shrink tubing.
- The cable screens shall then be earthed at the switchboard end only by looping an earthing conductor between terminals.

4.8 Labelling

- Individual cores of control or instrumentation cables shall be labelled with printed slip on type full circle ferrules.
- The core identification shall correspond with the wiring diagrams.
- Cables shall be identified at the ends by a corrosion resistant tag printed with the cable identification used on circuit diagrams.

4.9 Field Cables

Power Cables

- Power cables shall be in accordance with AS/NZS 5000.1 or 5000.2. Sheathed cables shall have a PVC sheath unless otherwise specified and shall be suitable for use underground.
- All cables shall be of multistrand construction with copper conductors.
- The minimum cross sectional area of any cable shall be 1.5 mm^2.
- The Electrical Contractor shall be responsible for selecting cable sizes in accordance with AS/NZS 3008.1.2.

Control Cables

- Control cables which are required to operate at low voltages shall be stranded PVC insulated PVC sheathed conductor cables manufactured in accordance with AS/NZS 5000.1 or 5000.2 and having a minimum conductor cross sectional area of 1.5 mm^2.
- Control cables which are required to operate at extra low voltage shall be rated for the voltages and currents which they have to carry.
- Conductor cross sectional area shall be not less than 0.5 mm^2.

- For cables which connect input contacts to the switchboard the conductors shall be coloured red or white (as applicable) for single core cables and red/white for two core cables.
- Red coloured cores shall be connected to the terminal nearest the supply or active and white cores shall be used for the switched wires.
- For cables which connect output devices the conductor insulation shall be coloured red or black (as applicable) for single core cables and red/black for two core cables.
- Red coloured cores shall be connected to the terminal nearest the supply or active.

Instrumentation Cables

- Instrumentation cables shall consist of either single pairs or multiple pairs with each pair being of twisted PVC insulated stranded copper conductors in either case.
- Each instrumentation cable shall have an overall screen with a stranded copper drain wire and PVC sheath.
- The conductors of each pair shall have a minimum conductor area of 0.5 mm^2.
- Multicore cables shall be provided with a number of spare pairs equal to not less than 25% of the total number of installed pairs rounded to the next higher whole number.
- All spare pairs shall be terminated in terminals.

Motor Cables

- Cables should be chosen and installed in accordance with best practice
- Shielded cables are to be used in combination with VSDs, unless otherwise approved by QLDC and supported by specific engineering justification.

5 INTERNAL WIRING

5.1 Type

- The Electrical Contractor shall be responsible for selecting cable sizes, in accordance with AS/NZS 3008.1.2.
- Wiring shall be insulated stranded copper conductor in accordance with AS/NZS 5000.1 or 5000.2. Insulation material selected to suit environment.
- The wiring shall be adequately sized to carry the current and the minimum conductor size shall be 0.5mm^2 except in the case of current transformer wiring which shall have a minimum size of 2.5mm^2.
- The ends of control wiring that terminate within the switchboard shall be fitted with bootlace ferrules and identification labels.

5.2 Colour Coding

The insulation of cables and wires shall be in accordance with AS/NZS 3000 and as follows:

(1) Low voltage ac power circuits and CT wiring to be colour coded in accordance with the phase to which they are connected, i.e. RED, WHITE, BLUE with neutrals coloured BLACK.

(2) Low voltage ac cables to be RED or WHITE or BLUE with BLACK neutral.

> ***Note:*** *Control supplies shall be derived from the white phase unless otherwise indicated.*

(3) Extra low voltage dc circuits to be coded GREY (+) and PINK (-).

(4) Extra low voltage ac circuits to be coded BROWN (phase) ORANGE (Neutral)

> ***Note:*** *For two wire dc systems a black wire shall be used for the "earthy" end of the supply, and a red or blue conductor used for the other end depending if the supply is positive or negative with respect to earth.*

(5) Instrumentation loop wiring (4-20 mA, 1-5 V) to be coded GREY where not included within screened cables. Core colours within screened cables may be to the manufacturer's standard.

(6) Earth cable to be GREEN/YELLOW.

5.3 Wiring Installation

Wiring of size 2.5mm^2 or less shall be run wherever possible in side slotted PVC ducts with snap on covers. Ducts shall be adequately sized to accommodate the wiring, including field wiring where applicable. Where ducting is impractical, wiring may be loomed using proprietary looming or sleeving.

5.4 Termination

Internal wiring shall terminate at relays, contactors, switches etc.

All other outgoing wiring shall terminate at rail mounted clip-on type terminal blocks.

All terminals shall be mounted within a PVC enclosure in the cabling cubicle and be adequately shrouded to prevent accidental contact.

5.5 Junction boxes

Junction boxes to be considered where either there is significant distance between the MCC and Wet well or on sites >30kW.

Above ground junction boxes shall be secure and lockable stainless steel cabinets and conform to relevant industry standards. The location of these junction boxes shall be between the switchboard and the wet well but shall not interfere with normal operations or introduce ergonomic or trip hazards.

6 MAJOR COMPONENTS

6.1 Motor Control Panel

The motor control panel shall be installed in the pumping station switchboard. The motor control panel shall be constructed of metal and have an ingress protection rating of not less than IP 52 in accordance with AS/NZS 60529.

The motor control panel is to have a mechanism that prevents access to the electrical wiring and components by unqualified personnel. This may be in the form of lockable handles, key locks, tool or other methods approved by the QLDC Chief Engineer.

The motor control panel shall house all controls for the pumping units. Operator control and indication equipment shall be located on the front panel of the motor control panel.

6.2 Remote Telemetry Unit

An RTU shall be installed in the pumping station switchboard by the Telemetry Contractor as shown on drawing QLDC_WWPS_01

The RTU shall be enclosed in a metal enclosure with an ingress protection rating of not less than IP 32 in accordance with AS/NZS 60529.

6.3 Earthing

Pumping station switchboard earthing shall be provided in accordance with AS/NZS 3000 and in particular the multiple earthed neutral (MEN) provisions of the rules. Any external earthing cables must be protected against mechanical damage.

6.4 Labelling

Controls and Indications

Controls and indications shall be labelled with titles provided in this Specification or, where these are not specified, titles which adequately and accurately describe the function of units.

The use of the manufacturer's standard escutcheon plates is permitted.

Purpose made labels shall be manufactured from engraved, laminated plastic which results in:

(1) white lettering on a red background for warning labels and

(2) black lettering on a white background for other labels.

The minimum lettering height for purpose made labels shall be 4mm.

Labels, other than manufacturer's standard escutcheon plates which shall be attached in accordance with the manufacturer's directions, shall be fixed to the surface by pins, screws.

Embossing tape shall not be used.

Contactors, Relays and Other Control Equipment

Contactors, relays and other components shall be labelled with the designation or label name used in the control circuits.

Labels shall be fixed by rivets, pins or screws.

Embossing tape shall not be used.

Terminals

Terminals shall be labelled with number corresponding to the control circuits and termination schedules.

Wiring

Wiring shall be labelled by means of slip on ferrules or heat shrink numbered to correspond with the control circuits. Jumper wires of less than 50 mm length and which are visible for their entire length need only be labelled once, but other wiring shall be labelled at each end.

6.5 Controls and Indications

General

Controls, indications and alarms shall be provided as required to operate the station.

Motor Protection

Motor thermal overload protection shall be provided as a minimum. Thermal overload protection shall be provided using a thermal overload relay or the soft starter/VSD inbuilt thermal protection. Where soft starter inbuilt thermal protection is used, the circuit shall be designed to ensure that the soft starter protection continues to monitor motor current when the soft starter is bypassed.

Control Voltages

Pump control circuits shall operate at 24 V dc, with the exception of the pump contactor coil circuits which where required to, may operate at 230 V ac.

Labelling

The following controls shall be provided and labelled (labels shown in upper case, colour shown in brackets) as a minimum:

(1) PUMP 1 MODE SELECTOR, AUTO/OFF/MANUAL

(2) PUMP 1 START

(3) PUMP 1 STOP

(4) PUMP 2 MODE SELECTOR, AUTO/OFF/MANUAL

(5) PUMP 2 START

(6) PUMP 2 STOP

(7) DUTY SELECTOR, 1-2/2-1/ROTATION

(8) PUMP STATION FAULT RESET (Black)

(9) MODE SELECTOR AUTO CONTROL / RTU CONTROL

Indications

The following indications shall be provided and labelled (labels shown in upper case, colour shown in brackets) as a minimum:

(1) PUMP 1 RUN (Green)

(2) PUMP 2 RUN (Green)

(3) PUMP 1 MOTOR FAULT (Red)

(4) PUMP 2 MOTOR FAULT (Red)

(5) PUMP 1 REMOTE LOCKOUT (Amber)

(6) PUMP 2 REMOTE LOCKOUT (Amber)

(7) PUMP 1 HOURS RUN

(8) PUMP 2 HOURS RUN

(9) PUMP 1 MOTOR CURRENT

(10) PUMP 2 MOTOR CURRENT

(11) SCADA (RTU) CONTROL ACTIVE (Blue)

(12) WETWELL HIGH LEVEL (Red)

(13) PUMP CONTROLLER FAULT (Red)

(14) WETWELL LEVEL (%)

(15) AC MAINS ON (White)

6.6 Control Circuits

Control Circuits shall be designed in accordance with the requirements of AS 60204.1 and AS 4024 and with this clause unless otherwise specified in the project Specification or shown on the Specification drawings.

Control circuits shall comply with the following:

(1) Local control circuits shall operate at 24 V dc.

(2) The following shall operate at 24 V dc:

a) Indicator lights.
b) Pushbuttons (with the possible exception of emergency stop pushbuttons).
c) Control and selector switches.

d) Other control equipment on cubicle front panels and false mounting panels.
e) Control relays.
f) Control wiring external to the switchboards or control panel.

(3) Alarm relays shall be energised in the non-alarm condition (failsafe).

(4) Phase Fail Relay to provide indication only where motor protection is provided by a Variable Speed Drive or Soft Starter. Where pumps are Direct Online (DOL) then the Phase Fail Relay shall ensure that the function unit is stopped and latched out if a power supply failure is detected. A delay shall be incorporated to ensure that short power "flicks" of less than 10 seconds duration are not considered as a power failure. Automatic fault reset shall be provided on power restoration for common controls and all functional units.

(5) Controls circuits shall be designed to ensure that all latched circuits are reset automatically and that items of equipment will be available to run without the need for manual resetting following a power failure.

(6) Control circuits and/or PLC programming shall be designed to ensure that starting of the first duty functional unit is delayed for an adjustable period of time after power is restored following a power supply failure (as detected by the phase failure and under voltage relay).

(7) Control circuits shall be designed to ensure that all faults are reset using a local FAULT RESET pushbutton. This local reset shall operate independently of any PLC installed and continue to operate if any PLC fails.

(8) Fault circuits shall be designed to ensure that items of equipment or functional unit alarms (once detected) remain active in the control system (following a fault sensing device reset) until the alarm is reset using the local FAULT RESET pushbutton or a remote fault reset function (when provided). This control system reset shall only be possible following resetting of the fault sensing device.

(9) Control circuits and switchboards shall be designed to ensure that manual resetting of all fault sensing devices (e.g. thermal overload, Soft Starter, VFD etc.) shall be possible from the front panel of (and external to) the switchboard (or false mounting panels where controls and indications are installed on the false mounting panel). This requirement does not apply to short circuit protective devices (i.e. circuit breakers) that are not providing motor overload protection (i.e. TOL protection).

(10) Control circuits for functional unit (e.g. a pump) shall be designed to ensure that RUN and FAULT (as a minimum) indicator lamps continue to operate when the functional unit has MANUAL mode selected and when any PLC installed fails. This requirement shall include functional units operated by variable speed drives (VFD's) where the functional unit has MANUAL of OFF selected and is operated directly from the VFD (or the VFD control panel).

(11) Pump protection faults (e.g. No Flow) shall be latched and time delayed and shall continue to provide protection when the pump is operating in all modes (e.g. MANUAL mode).

(12) All functional unit faults detected shall activate the functional unit local and remote (e.g. SCADA and telemetry) fault indication signals.

7 INSTALLATION REQUIREMENTS OF ELECTRICAL COMPONENTS

7.1 Ratings

Where current and/or voltage ratings for components are specified and/or shown on the specification drawings, components shall have ratings not less than those specified or shown.

Where current and/or voltage ratings are not specified or shown then components shall have current and voltage ratings adequate for the duty which they are to perform.

When determining the ratings allowance shall be made for:

(1) frequency of usage,
(2) making and breaking currents,
(3) power factor (where applicable),
(4) prospective fault current and
(5) ambient temperatures which will occur at the point of installation.

7.2 Degree of Protection

The degree of protection of components which are mounted on the outside of switchboards or control panels shall be suitable for the location and application and shall not be less than that of the switchboards or control panels.

The degree of protection for electrical equipment installed within the switchboard shall provide a degree of protection of not less than IP2X in accordance with AS/NZS 60529.

7.3 Circuit Breakers

All circuit breakers installed shall be selected to ensure that they discriminate with, and operate prior to, the supplier of electrical energy fuses upon occurrence of a fault. Circuit breakers installed to protect pump motor circuits shall be selected in accordance with the manufacturer’s requirements to meet this specification.

Discrimination

Where circuit breakers are installed in series, discrimination shall be provided for tripping currents up to the maximum prospective fault current for the installation.

Moulded Case Circuit Breakers

Moulded case circuit breakers shall be in accordance with either AS 2184 or AS 60947.2 and the following:

(1) Three pole.
(2) Suitable for 400 volt 3 phase 50 Hz operation.
(3) Quick make manual closing.
(4) Quick break manual opening.
(5) Trip free.
(6) Automatic opening on overcurrent and short circuit.

(7) Provided with mechanical status indication, i.e. open, closed and fault.

(8) Lockable in the open position.

(9) Provided with safety interlocks to prevent the compartment door from being opened with the breaker in the closed position and to prevent the breaker from being closed with the compartment door opened.

(10) Suitable for uninterrupted duty.

(11) Rated for the full load current of the circuit.

(12) Have a rated short circuit making capacity not less than the prospective short circuit current of the supply.

(13) Have a rated service short circuit breaking capacity not less than the prospective short circuit current of the supply.

(14) Provided with instantaneous tripping.

(15) Provided with inverse time delay tripping.

Miniature Circuit Breakers

Single pole and multi-pole miniature circuit breakers shall be in accordance with AS 3111 and the following:

(1) Shall have a current interrupting capacity suitable for the prospective fault current and not less than 6 kA symmetrical.

(2) 3 single-pole breakers shall be replaceable by 1 three-pole breaker and vice versa.

(3) Any miniature circuit breaker which is used to isolate its associated electric motor shall, in addition, be provided with facilities to padlock the switch in the OPEN or OFF position.

Surge Protection

Surge Arrestors to be fitted and have discharge current of 20kVa.

7.4 Residual Current Devices

Residual current devices shall:

(1) Be in accordance with AS 3190.

(2) Be type II devices in accordance with AS 3190.

(3) Be combined miniature circuit breaker/residual current devices in accordance with the requirements of the miniature circuit breaker requirements of this specification.

Residual current devices shall be tested before being placed into service to ensure that:

(1) the tripping current is set to the appropriate value; and

(2) the unit trips in less than 30 milliseconds at a test current of 10 mA.

7.5 Isolating Switches

Isolating switches must be provided for all electric motors. These shall be in accordance with AS/NZS 3133. Any switch which is used to directly isolate its associated electric motor by switching the phase conductors shall be a motor control switch as defined in the Standard and shall, in addition, be provided with facilities to padlock the switch in the OPEN or OFF position.

All single phase isolating switches which are rated at 20 A and above and all multiphase isolating switches shall include a positive indication, which shall include the words ‘ON’ and ‘OFF’, of the position of the switch.

7.6 Composite Fuse Switch Units

Composite Fuse Switch (CFS) units shall be in accordance with the air break switch requirement of this specification and the following:

(1) Accommodate HRC fuses.

(2) Triple pole units.

(3) Individual contacts separately and fully shrouded.

(4) Barriers included between fuse cartridges to reduce the possibility of a phase to phase or phase to earth fault occurring.

(5) Shrouds, barriers and the complete moving contact assembly shall be removable from the CFS enclosure for maintenance purposes.

(6) Provided with facilities to padlock the unit in the OPEN or OFF position.

(7) Provided with safety interlocks to prevent the compartment door from being opened with the CFS unit in the closed position and to prevent the CFS unit from being closed with the compartment door opened.

7.7 Low-Voltage Fuses

Low voltage fuses shall be in accordance with the general requirements of AS 60269.1, applicable requirements of AS 60269.2 and AS 60269.4 and the following:

(1) Suitable for use on a 400/230V 50 Hz supply.

(2) Fuse links shall:
   (a) have a rated breaking capacity of not less than 50 kA at 400 volts 50 Hz or the prospective fault level at the point of installation whichever is higher and
   (b) be of the 'gG' or 'gM' type unless otherwise approved by the QLDC Chief Engineer.

(3) Fuse holders shall:
   (a) have a rated current and a rated power acceptance suitable for the fuse links and

(b) have a protection rating of not less than IP2X in accordance with AS/NZS 60529 with the fuse carriers removed.

(4) Labels shall be fitted on, or immediately adjacent to, each fuse base or each 3 phase set of bases to identify the function and designation of the fuses and to specify the current ratings of the fuse links.

7.8 Meters

General

Where amps and voltages are not displayed on VSD or soft starter display panels, ammeters and voltmeters shall be provided. They shall be square bezel pattern, nominal size 96 mm with an approximate 240° movement. A multi-function meter may be used in place of individual voltmeter, ammeter, kilowatt meter etc. to measure and display the required parameters in a single unit.

Ammeters

Ammeters shall be in accordance with the following:

(1) Provided with a selector switch to allow selection of individual phase currents. An OFF position shall be provided.

(2) Accuracy of ±2.5% or better.

(3) Scaled to correspond to the rated primary current.

(4) Where used for measuring motor current, be overscaled to approximately 6 times the rated current of the associated motor. Full load current shall occur between 60% and 90% of full scale.

(5) Where used for other than measuring motor current, be overscaled to approximately two times the rated current of the circuit.

Voltmeters

Voltmeters shall be in accordance with the following:

(1) Provided with a voltmeter selector switch and potential fuses to allow selection of individual phase to phase voltages. No OFF position shall be provided.

(2) Accuracy of ±2.5% or better.

(3) Scaled to read between 0 and 500 volts.

Multi-function Meters

Multi-function meters shall be in accordance with the following:

(1) Measure and display voltage, current and power in a single integral unit at not less than ± 1% accuracy.

Additional parameters (energy, power factor, individual and total harmonic distortions etc.) shall be included as required by the project specification and/or drawings. The display shall be retained during power failure where used for energy measurement.

(2) Panel mounting.

(3) Suitable for monitoring a 3 phase unbalanced supply and load.

(4) Operation from a 230 V ac auxiliary supply.

(5) Provided with the following remote interfaces where required by the project specification:
  (a) Digital and analogue inputs/outputs programmable to represent the selected parameters.
  (b) RS-485 serial port with industry standard Ethernet protocol.

Hours Run Meters

Hours run meters shall be synchronous motor driven units with a display capable of registering not less than 999999 hours and shall be non-resettable.

Current Transformers

Metering Current Transformers

Metering current transformers shall be in accordance with AS 60044.1 and the following:

(1) Accuracy not lower than Class 0.2 or, where used with test sockets, kW meters, kWh meters or multi-function meters, not lower than Class 1M or higher as required by the project specification.

(2) Rated secondary current of 5 A.

(3) Rated burden sufficient to cover the burden imposed by the connected equipment including cables. Where a test socket is required, an additional burden of 5 VA shall be allowed for external equipment which may be plugged into the socket.

Protection Current Transformers

Protection current transformers shall be in accordance with AS 60044.1 and the following:

(1) Designated as 10P150F20 unless otherwise specified or required to suit the protection relay.

(2) Rated secondary current of preferably 1A.

(3) Transformer ratio shall be determined for correct operation of the associated relay under fault condition taking into consideration the rated accuracy limit factor of the transformer and the burden of the connected circuit.

(4) Provided with test taps where required to be used in conjunction with a test socket.

7.9 Control Relays

All control, interposing, latching and auxiliary relays shall be in accordance with AS 60947.5.1 and the following:

(1) If there is no control circuit or the voltage is not specified, then 24 V dc shall be used unless otherwise agreed by the QLDC Chief Engineer.

(2) Contacts shall be suitable for the type of duty required and shall have a current rating adequate for the load and, in any case, not less than 1 A.

(3) Plug in relays shall be provided with an LED status indicator.

If relays are of the plug-in type and mixed extra-low and low voltages are used within the relays, then all relays which have mixed voltages shall have a Certificate of Suitability from a recognised Statutory Authority for mixed voltage application. Such relays shall not be physically interchangeable with other plug-in relays within the system.

7.10 Timing Relays

Timing relays shall be in accordance with the following:

(1) Electronic type with an adjustable range.

(2) Suitable for operation on the voltage shown on the control circuit drawings or specified in the project specification. If there is no control circuit or the voltage is not specified, then 24 V dc shall be used unless otherwise agreed by the QLDC Chief Engineer.

(3) Contacts shall be suitable for the type of duty required and shall have a current rating adequate for the load and, in any case, not less than 1 A.

(4) Accuracy Class 1.5 or better.

7.11 Equipment Electronic Relays

Any electronic relays that are installed to control individual items of equipment (e.g. a pump) shall comply with the following:

(1) Have a minimum of 20% spare inputs and outputs installed.

(2) Be of the Make and Model specified in Appendix A, unless otherwise approved by the QLDC Chief Engineer.

(3) Operate from 24 V dc.

(4) A copy of all manuals including a disk copy of the program shall be provided.

(5) A copy of any programming software unless the software is the same as that used for programming the main control PLC.

(6) All hardware connectors necessary to allow for connection of a personal or laptop computer to the relay for making program changes shall be provided.

Float Switches

Float switches shall be of the make and model specified in Appendix A and shall contain both normally open and normally closed contacts.

Undervoltage and Phase Imbalance Relays

The relay shall be a combined phase imbalance and undervoltage type with a contact opening for the following:

(1) Voltage below 80% of nominal 400 V ac.

(2) Phase imbalance greater than value set. This value shall be adjustable from 5-15% and initially set at 10%.

Control Switching Devices and Indicator Lights

Pushbuttons, rotary switches and indicator lights shall be in accordance with AS 60947.5.1.

Indicator lights shall be high intensity LED type.

The colours of pushbuttons and indicator lights shall be in accordance with those defined in the project specification, this specification, or if not specified, in accordance with IEC 60073.

8 PUMP MOTOR CONTROL

8.1 Motor control mode

The mode and method of pump motor control shall be determined by the contract specification.
For small wastewater pump stations where this electrical and SCADA standard applies, soft starters are the preferential method of motor control. This assumes that the pumps shall only be required to run at full speed.

8.2 Motor Starting

Direct on line (DOL) starting may be used where allowed by the supplier of electrical energy if approved by the QLDC Chief Engineer. Soft starters/VSDs of the make and model specified in Appendix A and installed to manufacture recommendations shall be used for motor starting where the direct on line starting current exceeds the limitation on starting current set by the supplier of electrical energy. The use of VSDs over soft starters shall be approved by the Principal.

8.3 Motor Contactors

Motor contactors shall be in accordance with the following:

(1) 3-pole or where necessary 4-pole, air break, electromechanical type in accordance with AS 60947.4.1.

(2) Provided with Type 2 co-ordination with short-circuit protective devices in accordance with AS 60947.4.1.

(3) Utilisation category AC-3 and intermittent duty not less than Class 12 as defined in AS 60947.4.1, or a higher category and/or duty class to suit the specified operation requirements if required.

(4) A mechanical endurance of not less than 1 million operating cycles.

(5) Operating coils shall operate at 230 volts 50 Hz single phase.

8.4 Soft Starters

Soft starters shall be ac semiconductor type in accordance with AS 60947.4.2 and the following:

(1) Be of the make and model specified in Appendix A.

(2) Electronic starters are to be installed as per the manufactures recommendations.

(3) Provided with a bypass contactor to minimize energy loss and/or heat generation during operation unless otherwise agreed by the QLDC Chief Engineer.

(4) Be designed and constructed to operate satisfactorily with an emergency stop contactor installed between the starter and the motor. This requirement shall apply at all motor loads up to and including the full load rating of the soft starter.

8.5 Variable Speed Drives

The switchboard design, electrical drawings and line diagrams developed as part of this standard is intended to cover for electrical installations and MCC specification where submersible pump motors are controlled on soft start rather than variable speed drive.

Should the contract specification or principal to the contract identify a requirement for VSD controlled pumps, installation of VSDs should, at minimum, conform to the requirements below;

(1) Shall be of the make and model specified in Appendix A.

(2) Electronic starters are to be installed as per the manufactures recommendations.

(3) C-tick compliant with harmonic and RFI filters incorporating input ac chokes if necessary to comply with the limits of electromagnetic and harmonic disturbances in accordance with AS/NZS CISPR 11, be rated and suitable for use in the first environment in accordance with AS 61800.3 and meet with the requirements of the supplier of electrical energy.

(4) Electromagnetic immunity in accordance with AS/NZS 4252.1.

(5) Capable of sustaining not less than 110% rated output current for a minimum of 1 minute.

(6) Motor cables and wiring shall be in accordance with the variable frequency drive supplier's recommendations. Such requirements shall include the cable type and installation method to satisfy the radio frequency interference and other requirements specified in this Specification.

(7) Harmonic mitigation shall be provided in accordance with network requirements.

(8) Output filters shall be provided to ensure motor maximum voltages are not exceeded.

8.6 Motor Protection Units

Thermal Overload Units

Thermal overload units shall be in accordance with AS 60947.4.1 and the following:

(1) Triple pole, differential action to enhance the performance of protection against phase imbalance or phase failure.

(2) Incorporate ambient temperature compensation.

(3) Include a provision to allow the trip setting to be adjusted.

(4) Suitable for alternative manual or automatic reset and initially selected to automatic reset if the control circuit has a separate RESET pushbutton.

Electronic Motor Protection Relays

Electronic motor protection relays shall be provided for the protection of motors rated at 15 kW and above and a soft starter or VFD is not fitted. The protection relays shall be in accordance with the following:

(1) Provide protection and separate indication for each of the following:

(a) Overload

(b) Winding overtemperature by means of thermistors

(c) Single phasing and asymmetry.

(2) Have selectable current and trip time settings.

(3) Have a test feature.

(4) Suitable for operation from a 230 V ac supply.

(5) Provide finger protection for the terminals (IP 2X) other than the main connections.

(6) Unaffected by the passage of short circuit currents through the unit.

Directly connected units (i.e. without the need for external current transformers) are preferred.

Thermistor Control Units

Thermistor control units shall be used to monitor the operation of thermistors built into motors unless the thermistors are monitored by an electronic motor protection relay.

The control units shall be in accordance with AS 1023.1 and the following:

(1) Suitable for a 230 V ac supply voltage.

(2) Provide a visual indication that a trip has occurred.

(3) Match the type of thermistor, i.e. positive or negative coefficient type.

9 PUMP CONTROL SYSTEM

9.1 Pump configuration

The configuration of the pumps shall be determined at the design stage. This can be one of two configurations;

(1) Duty / standby. This set up will work to run only one pump at any one time. This may be as a result of constraints to power supply and / or hydraulic conditions. This set up will work to run a standby pump when the standby pump start level is reached. This will be as a result of duty pump failure and/or high inflow conditions. Under this configuration the duty pump has to stop running prior to standby start.

(2) Duty / assist. This set up will work to run an assist pump when the assist pump start level is reached. This may be as a result of duty pump failure and/or high inflow conditions. Under this configuration the assist pump can run together with the duty pump.

9.2 Duty rotation

The pump controller shall be programmed to rotate duty pump after each pump cycle. This is to ensure all pumps are regularly run.

Where this function is not a feature of the controller, a duty selector switch shall be installed and shall be labelled 1-2, 2-1.

When 1-2 is selected, pump 1 shall be the duty pump and operate from the duty 1 start and stop levels.

When 2-1 is selected, pump 2 shall be the duty pump and operate from the duty 1 start and stop levels.

The initial setting for the duty start and stop level setpoints shall be determined by the design.

9.3 Pump mode control

A mode selector switch shall be provided for each pump. The mode selector shall have an AUTO, OFF and MANUAL position.

- When pump 1 mode selector has MANUAL selected, pump 1 shall start. irrespective of the wetwell level or SCADA control systems.
- When pump 1 mode selector has AUTO selected, pump 1 shall operate off the primary level measurement device and pump controller.
- When pump 1 mode selector has OFF selected pump 1 shall not run.
- Control for the pump 2 mode selector shall be similar to that of pump 1.

- The operation of pumps when in MANUAL mode shall be independent of any electronic device(s) or common control components other than motor protection. and shall not be connected to such device(s) (e.g. manual running shall be possible during complete failure of the primary level measurement device and pump controller or SCADA system).

9.4 Pump control systems

Pumps shall start and stop depending on the sewage level in the wetwell as determined by set points programmed in the pump controller.

The pumping station shall be controlled by two independent pump control systems as follows;

(1) Primary pump control (operating off a pump controller and wet well level measurement device),

(2) Secondary pump control system (operating off 2nd wet well level device and RTU.).

Remote pump starting and stopping shall also be provided from the SCADA system using Control Outputs off the RTU.

Design of wastewater pump stations in this manner allows for a good level of redundancy should one of these pump control systems fail.

Primary pump control

The primary level measurement device and pump controller shall operate when the mode selector has AUTO selected.

Pump start and stop points shall be programmed into the pump controller and labelled as follows:

(1) START DUTY PUMP

(2) STOP DUTY PUMP

(3) START STANDBY PUMP

(4) STOP STANDBY PUMP

All of the above level setpoints shall represent wetwell level and shall be adjustable between 5% and 95% of wetwell level in 1% increments. All level settings shall be programmed in the pump controller and remain operator adjustable.

- The duty pump shall start when the sewage level increases to the START DUTY level and stop when the level falls to the STOP DUTY level.
- The standby pump will start when the sewage level increases to the START STANDBY level and stop when the level falls to the STOP STANDBY level.

Secondary pump control

The secondary pump control system shall operate from a 2nd wet well measurement device via the RTU. The control circuit shall be wired completely independently from the primary control system in order to provide a fully redundant pump control function.

This secondary pump control system is required to work when any component of the primary control system fails. The functional control of this secondary pump control system is required to achieve the following;

- Automatic switch over of duty / standby and assist pump control functions without intervention of operators,
- Secondary pump start set point configured to be higher than primary control duty start setpoint,
- Pump run signals to be communicated through to the RTU from the motor starter.
- SCADA alarm output to notify operators of the failure of primary pump control system.

Design of the secondary pump control system shall align with the pump configuration when in primary control mode.

RTU Control

Basic automated control of the pumps can also be achieved through pump control programmes downloaded to the RTU at site. The use of these programmes must be agreed by the QLDC Chief Engineer. The programmes shall be supplied by QLDC's SCADA system administrators.

This method of pump control differs from the primary and secondary control systems in that it requires manual selection by the operator on site via a control switch.

It is a useful mechanism for running the pump station in automatic control when the pump controller has failed but the level measurement device remains operational.

RTU control switch

In order to facilitate this feature, a push button between Local and RTU control is required to be installed. The push button is to be wired to a Digital Input on the RTU. This switch shall be labelled Level Control / Local - RTU

Activation of this switch to RTU control enables the following;

- Disengage of primary pump control system,
- Activation of RTU control outputs.
- Automated pump running off set points programmed into RTU.
- Remote manual control of pumps via the SCADA system (this should only be possible when the local pump control mode switches are in AUTO).

The pump run signal from the SCADA system shall operate the pump when the pump mode selector for that pump is in the AUTO position but shall not operate the pump if the pump mode selector is in the MANUAL or OFF position.

9.5 Remote fault resetting

High / low level resets

High and low level fault conditions shall be able to be reset manually or via the SCADA system. Floats will be an indication of level only and not provide any control over the pumps.

A pulse signal from the SCADA system shall be initiated from the base station which when activated will reset the pump station fault. This is a useful mechanism when the high and low level faults activate as a result of a level condition which clears itself.

10 PROGRAMMABLE LOGIC CONTROLLERS

Proprietary "off the shelf" controllers are preferred. A PLC should only be used where a proprietary controller is not suitable.

10.1 Specification

(1) Shall be of the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

(2) Ethernet link shall preferably be used for inter-PLC communications and for communications with a host SCADA system where applicable. Any PLC connected to a SCADA system shall be fitted with one (1) dedicated communication port for that purpose.

(3) An electronic copy of PLC ladder program shall be supplied unless agreed by the QLDC Chief Engineer.

(4) A copy of PLC manuals shall be supplied unless agreed by the QLDC Chief Engineer.

10.2 PLC Programming

The Contractor shall be responsible for programming the PLC.

The contractor should ensure all key parameters and set points may be operator adjustable by the operation and maintenance contractor to allow for adjustment in operational efficiency.

The contractor is advised to communicate the control philosophy of the pump station to the operation and maintenance contractor at the earliest opportunity in order that submersible pump operation is consistent with other pump stations across the Queenstown Lakes district.

At the conclusion of the project the contractor shall supply to QLDC a licensed copy of any software packages required to modify PLC programming. QLDC have copies of the following software and as such copies of the following are not required:

- RSLogix 500 8.40.00 (CPR9)
- RSLogix 5000 20.01.00(CPR9 SR5)
- Control Expert v14.1 - Small (S)

10.3 PID control

PLC control loops employing PID control shall be designed and programmed to ensure that the analogue PLC process variable output signal (i.e. pump speed control signal) is set equal to zero % and the PID calculations cease when the controlled device is not running (i.e. pump is stopped). The process variable signal shall commence calculations using signals that are present when the controlled device commences operation (i.e. "anti-reset windup" shall be programmed into the PLC). Such programming and calculations shall ensure that the process variable does not drive to full scale 100% when the controlled device is started.

When telemetry analogue output signals are used as inputs to the control system for setpoints or control setting, PLC programming shall be designed to ensure that only valid signals are accepted by the PLC. This shall be achieved using time based validation of input signals. The validation shall check input values at regular time intervals (expected to be in the order of 2-10 seconds) and accept the most recent valid value as the control variable. Time validation shall not be used on control signals that are used as feedback in PID control loops. If an invalid setpoint or control signal (e.g. signal < 4 mA or > 20 mA) is detected by the control PLC, the previous value of that signal shall continue to be used by the control system until the next different valid control signal is detected.

If PLC programmes are protected by password, then that password shall be noted in the site documentation and be recorded at the SCADA base station.

10.4 HMI Touchscreen

Any touchscreen installed shall be in accordance with the following:

(1) Shall be of the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

(2) All parameters above shall be easily viewable and adjustable from the front of the touchscreen.

(3) The Touchscreen shall communicate directly to the main control PLC.

(4) The touchscreen shall be provided with two levels of security access coding to restrict access to authorised personnel only. Level one shall be for all liquid level and flow setpoints and level two shall be for PID control parameters and PLC time delay settings in addition to flow and level setpoints. No security shall be required for viewing operational parameters and status information.

(5) The touchscreen shall be colour with a minimum screen size of 140 mm.

(6) The Contractor shall program the touchscreen and provide an electronic copy of the final program to the Principal.

(7) The Contractor shall design the touchscreen screen displays. All such screen displays shall be approved by the QLDC Chief Engineer.

(8) Draft versions of HMI screens are to be sent for peer review.

Any touchscreen installed shall be mounted in the common control cubicle of the switchboard.

The following information shall be displayed on the touchscreen as a minimum:

(1) The current duty selection status for each item of equipment.

(2) Operational status (e.g. run/stop, open/close) for each item of equipment.

(3) Status of all alarms installed for each item of equipment.

(4) Other operation parameters for each item of equipment.

(5) The duty setpoints for each item of equipment.

The touchscreen shall be used to interface and display the following PLC parameters:

(1) All level and flow operational values.

(2) Alarm setpoints.

(3) Control parameters.

(4) PID control parameters for all control systems.

Touch Screen to conform to following colours

Red – Fault

Yellow – Manual/Unavailable

White – Running

Green – Available

11 PUMP CONTROL HARDWARE

11.1 Pump controller

Approved pump controllers presently in use across the Queenstown Lakes District include the following devices;

- Siemens MultiRanger 200 (MR200) pump controller,
- MultiTrode MultiSmart pump controller.
- PLC type as specified in Appendix A.

Secondary pump control systems are a compulsory requirement of all pump station designs.

The pump controller shall provide for a 4-20 mA DC wetwell level input signal, a relay output with changeover contacts for Duty 1 pump run, Duty 2 pump run and level transducer fault.

If the pump controller is programmable, then the Electrical Contractor shall supply a device programmer or appropriate PC software and hardware to program the device.

QLDC have copies of the following software and as such copies of the following are not required:

- RSLogix 500 8.40.00 (CPR9)
- RSLogix 5000 20.01.00(CPR9 SR5)
- Control Expert v14.1 - Small (S)

11.2 Level measurement

Level measurement at QLDC wastewater pump stations is to be undertaken through use of a hydrostatic level transducer. They shall be suitable for use in wastewater and installed to manufactures recommendations.

The transducers shall be configured into any pump control module on site and also be connected to the RTU for remote monitoring via SCADA.

Primary level measurement requires a method of returning an analogue level well level % back to the SCADA independent of the output from the pump controller. This is to ensure remote monitoring of well level can be observed where the pump controller is not operational.

11.3 Installation

The level sensor shall be mounted in accordance with the manufacturer's instructions. Hydrostatic level transducers need to be installed in stilling tubes mounted inside the pump station.

The purpose of the stilling tube is to protect the sensor. The stilling tube shall be made of PVC or stainless steel in order that it is suitable for use in wastewater. It shall be hydraulically linked to the well level in order that sensor measurement accurately reflects well level.

The stilling tube shall be attached to a side wall of the wet well and allow for easy access for operators to remove and clean the transducer inside. All mounting brackets, bolts, nuts and washers shall be manufactured from grade 316 stainless steel.

The level sensor shall be located such that the level sensor and mounting equipment shall not interfere or foul with the pumps during their removal and reinstatement in the wetwell or with the normal removal of any safety grid installed in the wetwell.

- The wetwell level sensor shall be hard wired to the pumping station switchboard.
- Power for all level sensors shall be provided from the switchboard.
- All cables shall be in accordance with this Specification.
- If the level sensor is a non contact type then the level sensor shall be located such that the beam does not detect pumps, pipes and other obstacles in the wetwell.
- Electrical installation of this instrument requires the analogue input signal to be split between RTU and pump controller.
- This is to be achieved using a signal isolator in order that each of these circuits remain separate from each other.

11.4 Level display

A local level display of well level (%) shall be mounted on the control panel of the switchboard in order that operators are able to determine the level of liquid in the pump station without the need to dial into the SCADA system.

11.5 Scaling

Configuration of the level measurement device to the pump controller is required as part of local pump control commissioning. The span of the level measurement (metres) is a critical value and allows QLDC and the maintenance contractor to correlate liquid level with volume for the purpose of engineering design and performance.

- The span of the level transducer should reflect the depth of the wet well from a point above the invert level to the emergency storage chamber to the bottom of the wet well. This is to ensure that any overflow to the emergency storage chamber is captured via the level measurement device.

- The electrical contractor shall supply this value to the maintenance contractor during the commissioning phase.

11.6 Operation

- The hydrostatic level transducer shall operate from a DC battery-backed supply so that it continues to operate and provide a wetwell level signal to the telemetry system during times of power failure.
- The level transducer shall be capable of measuring level over the whole height of the wetwell in which it is installed.
- Where the level transducer 4-20 mA signal has a fixed range, that range should be chosen to correspond as closely as possible to the actual wetwell full level.
- The 4-20 mA signal shall be calibrated such that 4 mA is the wetwell empty level and 20 mA corresponds to overflow level.
- If the level sensor is a non-contact type then the unit shall have in built temperature compensation and be suitable for the conditions inside the wetwell.
- The unit shall have an ingress protection rating of not less than IP 65 in accordance with AS/NZS 60529.

12 BACK UP FLOATS AND PROBES

Back up float switches and/or level probes have an important role to play in the signalling of critical pump station levels to the operator. These are generally set up in order that low level and high level alarms are generated when the liquid of sewage reaches certain levels in the main wet well.
Back up float signals are required to be connected through to the RTU for SCADA alarming. Any high or low level float switches installed need to be independent of the main level measurement device for the purpose of autonomous status feedback.

This standard allows for high and low level liquid detection through the use of two alternative instruments;

- Float switches as per the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer,
- Liquid level probe, as per the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

12.1 Float Switches

Two float switches are generally required to provide indication of pump station status. These floats are designed to operate independently of the primary level control system and are linked through to the RTU for SCADA alarming.

- High level
- Low level

Float switches shall be the type specified in Appendix A or equivalent suitable for specific gravity of 1.0 and with cable length to suit the application.

High and low level floats will manual PUSH TO RESET buttons mounted on the switchboard to allow for local reset.
Remote reset of high and low level fault conditions shall also be made available through the SCADA.

Float switches shall be mounted on a float hanger as shown in Drawing QLDC_WWPS_01 The Contractor shall supply and install a float hanger which is similar in design to QLDC_WWPS_01, with float supports to prevent movement and entanglement.

12.2 Liquid level probes

The level probes allow for a floatless level relay system to be installed with the benefit that one probe can provide a number of outputs.

The probes are available with up to 10 sensors for multi functional alarming and back up pump control. The more basic model, with three sensors, allows for standard high and low level alarming with the potential for a third set point to be configured against an overflow point or back up pump start level.

13 FLOW AND PRESSURE MONITORING

13.1 Flowmeters

All QLDC pump station facilities are to be installed with electromagnetic (magflow) flowmeters on the discharge rising main in order to monitor pump station performance.

Magflow meters installed should be installed to the following standard;

- Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer
- Be installed full bore on the common rising main,
- Be of a diameter that matches the rising main so as not to incur flow restriction or dynamic head losses,
- Mechanical installation via flange connection to the rising main,
- Be mechanically installed to manufactures recommendations conforming the requirement of 5 x dia straight line lengths upstream of the flowmeter and 2 x dia straight line lengths downstream of the flowmeter.
- Be installed inside a manhole or chamber. QLDC recommends use of 1050mm dia manholes for magflow meters of 200mm dia or less.
- Manholes to be installed with 2 x 50mm conduit running between manhole and pump station switchboard or building (one for power, one for signal cable).
- Transmitter or head units to be mounted inside pump station switchboard or building to allow for operators to determine pump flow
- Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.
- Flowmeter scaling to be determined by Veolia. Veolia shall provide a scaling range (litres/sec) that shall be configured to the 4-20mA range of the magflow meter installed.
- Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.
- Pulse output from magflow meter to be configured so that 1 pulse count = 1m3 pumped volume.
- Flowmeter scaling to be determined by Veolia. Veolia shall provide a scaling range (litres/sec) that shall be configured to the 4-20mA range of the magflow meter installed.

- Analogue and digital inputs for magflow connection to be pre-determined by SCADA I/O schedule issued by Veolia or 3 Waters contractor.

13.2 Pressure transducers

All QLDC pump station facilities are to be installed with pressure transducers tapped onto the discharge rising main in order to monitor pump performance and pipeline integrity.

Pressure transducers should be installed to the following standard;

- Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.
- Measuring range of transducer to be appropriate to anticipated pipeline pressures modelled for.
- Connection of transducer to be allowed for via ½' BSP female threaded tapping point above isolation valve mounted on the rising main.
- Pressure transducer to be connected through to SCADA for remote monitoring only. No local display is required.
- Pressure transducers may be hardwire connected through to RTU or through use of alternative protocols such as Modbus. This is because this measurement is considered non critical.
- Analogue inputs for pressure monitoring connection to be pre-determined by SCADA I/O schedule.

14 SCADA AND TELEMETRY

14.1 Roles and responsibilities

Electrical contractors engaged to connect submersible wastewater pump stations to the QLDC SCADA network should be aware of the contractors involved in the administration and management of the SCADA system;

- Countrynet: QLDC telemetry network provider
- Arthur D Riley : QLDC SCADA hardware and software supplier
- QLDC: SCADA system asset owners
- Veolia: QLDC 3 Waters Contractor and SCADA administration / management for QLDC sites. SCADA and SCADA software provider.
- Fulton Hogan Central: QLDC 3 Waters Contractor and SCADA administration / management for the Lake Hayes Scheme
- Switchbuild; Lake Hayes Scheme SCADA hardware and SCADA software provider

Liaison with Veolia for QLDC sites and Fulton Hogan for Lake Hayes sites at the start of this process is recommended in order to confirm all aspects of SCADA design, installation and commissioning.

14.2 SCADA

Veolia or Fulton Hogan shall be responsible for delivery of the following items associated with the installation of SCADA hardware and subsequent connection of the site to the QLDC SCADA system;

- Selection of communication protocol (RTU to SCADA base station)
- Selection of telemetry hardware required
- Development of SCADA I/O schedule
- Allocation of RTU address
- Commissioning checks on all SCADA I/O
- Allocation of SCADA alarm signals
- Configuration of the base station including datalogging, reporting and alarms.
- Development of SCADA GUI screen/s

14.3 SCADA work required of contractor

Any electrical contractors engaged to connect a remote facility to the QLDC SCADA system shall be required to complete the following;

- Supply and installation of the RTU
- Connection of control hardware to RTU
- Installation of telemetry hardware
- Connection of telemetry hardware to RTU
- Connection of local digital and analogue signals to RTU
- End to end signal testing
- Commissioning checks on all SCADA I/O

14.4 RTU supply and installation

The QLDC SCADA system uses Abbey Systems Swampfox Remote Telemetry Units (RTUs) to communicate with remote pump station facilities.

The QLDC Lake Hayes Scheme SCADA system uses Kingfisher Remote Telemetry(RTU's) to communicate with remote pump station facilities.

Installation of these RTUs shall conform to the following standards;

- Installed to manufactures recommendations
- Installed with back up 24v DC UPS
- Installed inside a dedicated telemetry panel at eye level.
- There must be a minimum of 75mm clearance around the remote telemetry unit and the radio transmitter.
- All connections to the RTU shall be via a telemetry terminal strip.
- Assignment of terminals to field I/O shall be in accordance with Appendix B.

RTU wiring

All contact signals must be voltage free (rated at not less than 24 V dc 0.5 A, 2 wires per signal).

All field wired 4-20 mA signals shall be isolated for connection to the RTU, and shall comply with the following:

(a) Linear with the respect to the measured variable.

(b) Capable of driving a load of 750 Ohms.

(c) Two wire, shielded with shield earthed at the switchboard end.

Backup power supply for RTU

QLDC require all RTUs to be installed with a backup power supply in order that remote monitoring of the pump station can continue in the event of a power outage (mains fail).

This shall be achieved through the use of a DC UPS with capacity to supply the RTU and critical instruments for four hours.

14.5 Signal transmission and telemetry hardware

Signal transmission from the pump station to the SCADA base station shall involve the installation of an antenna.
The type and size of antenna to be installed shall be determined by the 3 Waters Contractor or the radio survey (see below).
The most common form of hardware installed at pump stations across the Queenstown lakes district includes;

- Microwave dish,
- Cellular antenna

Antenna installation

Installation of antenna shall be undertaken to the following conditions;

- Conformance against relevant standards
- The antenna shall be mounted on a stainless steel mounting pipe.
- All fastening and securing brackets, nuts, bolts, washers etc. shall be manufactured from grade 316 stainless steel.
- The radio antenna installation shall be designed and constructed to withstand the prevailing conditions and wind speeds of 120 km/h.
- All cabling to be glanded through the switchboard.
- IP rating of the switchboard shall not be compromised by the mounting of the antenna.
- The antenna shall not be mounted less than 3m above ground level.

Communication method

QLDC 3 Waters Contractors will advise of the preferred method of communication between pump station and SCADA base station. Method of protocol may vary depending on geographical location.
Methods of communication between RTU and SCADA base station used across Queenstown lakes district include the following;

- IP radio
- Cellular

Radio Path Survey

It should be noted that it may be necessary for the electrical contractor to conduct a radio path survey to determine the availability of an acceptable radio path from the base station to the pumping station.

The results of this survey shall be provided to the 3 Waters Contractor who will liaise with the contractor as to an agreed specification for the communication system prior to its installation.

14.6 SCADA I/O

The following signals shall be provided to the telemetry terminal strip for input to the RTU using the terminal numbers specified in Appendix B:

Digital inputs

(1) AC POWER FAILURE (opens on fault: from under-voltage and supply failure relay)

(2) HIGH LEVEL ALARM (opens on fault, from wetwell level device)

(3) LOW LEVEL ALARMS

(4) PUMP 1 RUNNING (closed when running, from motor starter)

(5) PUMP 2 RUNNING (closed when running, from motor starter)

(6) PUMP 1 FAULT (opens on fault)

(7) PUMP 2 FAULT (opens on fault)

(8) PUMP 1 AUTO SELECTED (closed when auto selected)

(9) PUMP 2 AUTO SELECTED (closed when auto selected)

(10) PUMP CONTROL FAULT (opens on fault)

(11) FLOW VOLUME (totaliser pulse from flowmeter)

(12) SCADA CONTROL (on when pulsed)

(13) UPS Alarms

14.7 Analogue inputs

(1) MOTOR 1 CURRENT (Amps)

(2) MOTOR 2 CURRENT (Amps)

(3) WETWELL LEVEL (% full)

(4) INSTANTANEOUS FLOW (litres/sec)

(5) DISCHARGE PRESSURE (kPa)

14.8 Digital outputs

The following signals shall be provided from the output of the RTU to the telemetry terminal strip. This allows for some remote operation and control of the site.

(1) SCADA RUN PUMP 1 (closed when pump to run)

(2) SCADA RUN PUMP 2 (closed when pump to run)

(3) HIGH / LOW LEVEL RESET

(4) RTU Control Enabled

14.9 Analogue outputs

No analogue outputs are required for wastewater pump station operation.

15 SCADA SOFTWARE CONFIGURATION

15.1 SCADA administration

The SCADA software provider is responsible for software configuration of the pump station to the SCADA base station. Pumping station measurements and status shall be stored and archived for performance monitoring and engineering design requirements by QLDC and third parties.

Veolia shall provide the following:

(1) A graphical user interface (GUI) at the SCADA base station for the pumping station.

(2) The calculation, display and logging of alarms at the base station (both pump station and telemetry generated).

(3) Configuration of all remote signals and measurements as specified in Appendix B.

15.2 Graphical User Interface (GUI)

The SCADA software provider shall produce and make operational the GUI for the pumping station. The GUI shall display all critical pump station and measurements to ensure pump station performance can be monitored remotely by network operators.

The SCADA software provider shall configure and test all alarms and indications included on the pumping station GUI. Testing of these shall be made in conjunction with the electrical contractor on site.

15.3 Pump station alarms

The SCADA software provider shall configure the SCADA base station such that the following pumping station alarms are displayed on the GUI, appear in event logs and activate the appropriate pager(s) in accordance with existing alarm classes, where appropriate, or as determined by the QLDC Chief Engineer:

(1) High Level.

(2) Power Fail.

(3) Pump 1 Fault.

(4) Pump 2 Fault.

(5) Wetwell Level Device Fault.

16 INSPECTION AND COMMISSIONING

16.1 General

All electrical equipment manufactured under the Contract shall be tested at the manufacturer's works to ensure that the equipment complies with this Specification.

Witness tests may be carried out in the presence of and to the satisfaction of the Principal inspecting officer.

The Electrical Contractor shall give the QLDC Chief Engineer a minimum of ten (10) working days' notice of the manufacturer's intention to conduct tests.

All works testing costs, including the supply of plant, materials, gauges and instruments shall be the responsibility of the Contractor. All test instruments shall have current calibration certificates, if applicable, and all certificates shall be made available for checking by the inspecting officer.

16.2 Commissioning format

Veolia have developed a structure for testing of new pump station facilities vested to QLDC. The format of this commissioning follows a logical review of the operation and functional testing of all major mechanical and electrical components and instruments. A recommended format for facility commissioning is as follows;

- Civil works and structures
- Pipework and valving
- Switchboard construction to specification
- Pump performance
- Fault conditions
- Primary pump control
- Secondary pump control
- Local pump control
- Auto pump control
- Remote pump control
- High and low level alarming
- Instrumentation
- SCADA communication
- SCADA signals (local vs SCADA)
- SCADA measurements

16.3 Pump station functionality

Works tests shall be carried out to thoroughly test out functions of control and back up pumping systems, alarm outputs, local and remote status indication, pushbutton and reset functions.

Testing shall include, but not be limited to, the following

Pump performance

- Duty flow output vs design curve
- Discharge pressure vs design curve
- AUTO/ MANUAL / OFF mode switches

Fault conditions

- Pump RUN / pump FAULT
- High and low level faults alarm outputs and control outputs (if any)
- Primary pump control fault
- Level measurement fault

Primary pump control

- Duty pump start / stop set points
- Standby pump start / stop set points
- Assist pump start / stop set points
- Duty pump rotation (method)

Secondary pump control

- SCADA alarm outputs
- Duty pump start / stop set points
- Standby pump start / stop set points
- Assist pump start / stop set points

16.4 Switchboard inspection

At the completion of the installation or at the completion of agreed subsections of the work, the Electrical Contractor shall, in the presence of the inspecting officer conduct site acceptance tests on all equipment which has been supplied and/or installed as part of the Contract. The testing shall be in accordance with the Specification and to the satisfaction of the inspecting officer.

The Electrical Contractor shall give the inspecting officer not less than ten (10) working days' notice of his intention to undertake the tests.

The provision of all necessary equipment for testing shall be the responsibility of the Contractor. All test instruments shall have current calibration certificates, if applicable, and all certificates shall be made available for checking by the inspecting officer before testing commences.

16.5 Switchboard testing

The Electrical Contractor shall, in the presence of the QLDC Chief Engineer inspecting officer, carry out site tests to demonstrate that the installation is in accordance with the specified requirements and that the installation operates correctly.

Equipment which has been satisfactorily performance tested or witness tested in the manufacturer's works need not be site tested except to:

(1) check the installation and interconnections;

(2) check for any damage or deterioration which may have occurred since the works tests; and

(3) demonstrate that the system functions in accordance with the Specification.

Control circuits / local distribution

The tests shall be carried out in accordance with the relevant Standards and shall include the following where applicable:

(1) insulation resistance tests

(2) earth resistance tests

(3) continuity tests

(4) polarity tests

(5) calibration checks

(6) sequencing tests

(7) functional tests

The series of test below are required demonstrate the integrity and correct operation of the system including protective devices and remote operations, indications and controls.

Protective units, relays etc. which allow current injection or similar to check their settings shall, during testing, have each function tested and calibrated.

Units which may be adjusted (e.g. thermal overload relays) shall be adjusted to the appropriate settings in accordance with the manufacturer's written instructions.

SCADA Testing

The Electrical Contractor shall liaise with the SCADA software provider ~~Veolia~~ throughout SCADA testing to ensure local pump station status is reflected through the SCADA system

The inspection and tests shall include, but not be limited to the following:

(1) SCADA comms check to ensure strength of signal and protocol type allows for robust signalling and communication back to the SCADA base station,

(2) Performance tests to ensure that all inputs and outputs confirm to the SCADA I/O schedule.

(3) Instrument checks to ensure mapping and scaling ranges are accurately determined and match.

(4) Remote control checks to ensure all control outputs installed at site map through to the correct local functionality.

Test Results

The results of all site tests shall be neatly and legibly recorded during the progress of the test on the approved test sheets. A copy of the test sheets, co-signed by the Electrical Contractor and the inspecting officer, shall be handed to the inspecting officer on completion of the tests.

Sign off on SCADA signalling, controls and alarms is required by both the maintenance contractor and electrical on-site contractor.

An example of a generic test sheet is provided in Appendix D. The test sheet shall be modified by the Contractor to include any additional tests required to demonstrate compliance with this specification and any variations approved by the QLDC Chief Engineer.

Commissioning sheets should be provided in the O & M manual in order to provide operators with a record of pump station performance results during testing and commissioning.

17 ELECTRICAL DRAWINGS

17.1 General

All drawings produced shall be in accordance with AS/NZS 1100, AS 1101, AS/NZS 1102, AS/NZS 4383 and AS/NZS 60417 as applicable.

Contractors Drawings shall be prepared using a CAD system.

Drawings shall be plotted at the same scale as they were drawn/composed (1:1) to maintain the original intended line and text attributes.

The drawing shall be A1 or A3 size in accordance with (AS/NZS 1100 Part 101).

17.2 CAD Files

- The Contractor shall provide CAD files for all electrical and instrumentation Final Contractors Drawings. CAD files shall be provided to the QLDC Chief Engineer at the same time as the Final Contractors Drawings.
- Each CAD drawing file shall contain all information used to produce the drawing including externally referenced information (e.g. AutoCAD X'refs should be bound into the drawing file).
- Drawings produced using AutoCAD shall be supplied in .DWG format. All other CAD files shall be supplied in DXF format.
- Drawings produced using AutoCAD shall, where possible, be produced using QLDC Chief Engineer drafting defaults (a copy of the Principal defaults file shall be made available to the Contractor on request). Each drawing produced using AutoCAD and not using the Principal standard defaults shall be supplied with an individual plotter setup file(s) to enable reproduction of the original drawing.
- CAD files (including .PC2, .PC3, .CTB or .STB files) shall be named with the drawing number in accordance with this clause except that the dash "-" shall be replaced with an underscore "_" (e.g. 00_4031.DWG).
- CAD files (including .PC2 files etc.) shall be named with the drawing number.

17.3 Drawing Details

Drawings produced by the Electrical Contractor shall show the following information, where applicable:

(1) Detailed material and parts list.

(2) Electrical power and control circuit schematic drawings which shall:

- Give ratings of all components.
- Show all cable types and sizes.
- Be drawn as vertical ladders with each line numbered.
- Show cross referencing of remote contacts etc. using line numbers and other drawing numbers if required.
- Identify spare cores of field cables by their respective cable, core and terminal numbers where applicable.

Drawing GENERAL 09-01 has been included as a means of establishing quality standards required for electrical schematic drawings. Circuitry shown is not an indication of facilities or methods required to achieve requirements.

(3) Layouts of the pumping station switchboard and motor control panel.

17.4 Submission of draft electrical drawings

The Electrical Contractor shall:

(1) Submit a copy of the scaled drawings to the QLDC Chief Engineer for examination prior to manufacture or commencement of work.

(2) Allow time in his/her program for the QLDC Chief Engineer to examine, or subsequently re-examine in accordance herewith, the drawings submitted by the Electrical Contractor. The time to be allowed to the QLDC Chief Engineer for such examination shall be not less than ten (10) working days.

Upon examining the drawings, the QLDC Chief Engineer may direct comments or queries to the Electrical Contractor on those drawings. If drawing modifications are required as a result of the examination, the Electrical Contractor shall supply revised drawings for re-examination.

(3) Not depart from the details shown on drawings examined by the QLDC Chief Engineer in accordance with this Clause unless the Electrical Contractor has first amended the drawing accordingly, submitted it for re-examination in accordance with this Clause and had it returned by the QLDC Chief Engineer signifying approval to proceed.

If manufacture or construction commences prior to approval from the QLDC Chief Engineer, any re-work shall be at the Electrical Contractor's expense.

17.5 Submission of final electrical drawings

Prior to the date of practical completion, the Electrical Contractor shall provide two (2) sets of Final Contractors Drawings which have not been folded, punched or marked to the QLDC Chief Engineer. The QLDC Chief Engineer shall determine if copies submitted as Final Contractor Drawings are of an acceptable quality. If the drawings are deemed by the QLDC Chief Engineer to be unacceptable, the Electrical Contractor shall re-submit drawings which are of an acceptable standard.

Final Contractors Drawings shall:

(1) Be provided for all equipment and structures included in the Contract.

(2) Include all "As Constructed" information which shall include all changes brought about during manufacture, installation, construction, testing and commissioning.

(3) Show signatures of authorising and/or approving personnel.

(4) Be on white paper not less than 80 gsm thick and shall be suitable for reproduction by conforming with the requirements of AS/NZS 1100.

One copy of the Final Contractors Drawings protected by a protective sleeve shall be left in the pumping station switchboard.

18 OPERATIONS AND MAINTENANCE MANUAL

18.1 Format

The Electrical Contractor shall supply to the Engineer's Representative three (3) copies of Operations and Maintenance Manuals ("O&M Manuals") which shall be prepared according to the content requirements provided in Appendix D.

A first draft copy shall be submitted to QLDC 3 Waters contractor, for review as part of the process to ensure all pertinent information is included.
Operations and Maintenance Manuals shall be in accordance with the following requirements:

(1) Wholly in the English language, clear, legible and contain all pertinent information relating to the functional control, operation and maintenance of the facility and its components.
(2) Be presented in a format that matches the example contents page in Appendix D.
(3) Include the manufacturer's manuals for all supplied equipment. This includes but is not limited to manuals for installation, configuration, programming, maintenance and troubleshooting.
(4) Include complete parts listing which shall include the manufacturer's name, parts catalogue number and, where applicable, the local agent's name, address and telephone number.
(5) Include drawings of the actual equipment supplied, including detailed ladder and schematic circuit diagrams.
(6) Include any relevant safety procedures.
(7) Where PLCs are supplied, hard copy program listings in ladder format shall be provided. In addition, electronic copies of the PLC programs and supporting files shall be supplied on CD ROMs.
(8) Any passwords or codes required for access.

18.2 Content

The operating component of the Operations and Maintenance Manual shall include a description of the operation of the equipment and clear and logical instructions for the operator.
The operating manual shall describe the operation of the equipment under manual and under remote and/or automatic control.

The instructions shall include:
(1) starting, running and stopping procedures;
(2) functional control processes;
(3) sequencing and control logic descriptions;
(4) measured parameters;
(5) Fault conditions and SCADA alarms.

The maintenance component of the Operations and Maintenance Manuals shall contain all relevant information for the maintenance and repair of the equipment and shall include:

(1) Identification of items of equipment, including model and serial numbers.
(2) A brief description of the equipment and its operation.
(3) All necessary setting up procedures.
(4) All maintenance procedures including suggested preventative maintenance schedules.

18.3 Asset register

Veolia and QLDC wish for any electrical contractor installing switchgear at a submersible pump station to document the components installed for the purpose of recording within QLDCs HANSEN Asset Management System.

The list of components and instruments detailed on this list should reflect the 'big ticket items' mirrored in the switchboard specification in Section 3.2

Contractors may wish to seek additional information on this requirement from both Veolia and QLDC.

Contractors shall be required to populate an Excel spreadsheet issued by QLDC titled; Asset register template for consultants/ contractors/ project managers (Sept 2015, Version 9).

This register seeks to quantify the components installed in newly vested facilities and capture their cost (both capital and installation).

Costs of big ticket items are required for QLDC insurance purposes.

18.4 Provision of additional documentation

All relevant documentation generated as a result of testing, inspection and certification of installation shall be supplied by the electrical contractor. This shall include, but not be limited to, Declaration of Conformity Statements and Electrical Certificates of Compliance.

APPENDIX A

EQUIPMENT DATA SHEET

Note : Compatible alternatives may be considered with the approval of QLDC Chief Engineer

Component	Equipment Standard	Comment
Panel Operators	Schneider 22mm ZB5 Rockwell 800F	
MCB's and RCD's	Schneider Acti 9	
Motor Circuit Breakers	Schneider GV2 Rockwell 140m	
Signal Isolators	Weidmuller	
Interface Relays	Omron Rockwell	
Contactors and Overloads	Schneider LC1 – LRD series Rockwell 100 – 193 series	
Surge	Weidmuller	
Terminals	Weidmuller	
Complex Selector Switches	Kraus and Naimer	
RTU: QLDC Sites	Abbey Systems Swampfox SF-3	
RTU: Lake Hayes Sites	Kingfisher	

DC UPS	Phoenix Trio UPS. 5Amp minimum. With fault, mains and battery monitoring.	
Communications	Swampfox SF-3 Microwave IP – Countrynet Cellular – Veolia supplied modems.	
Pump controller	Siemens MultiRanger 200 (MR200). Panel mount MultiTrode MultiSmart pump controller.	
Wetwell Level Device	Endress & Hauser FMX21 Hydrostatic Level Transducer (4-20mA HART)	
Soft Starter/VSD	Danfoss MCD Series Aucom EMX Danfoss VLT Aqua VSDs Schneider	
PLC	Schneider M340 Allen Bradley Micrologix Series (1100 or 1400)	
HMI	Schneider Magelis	
Floats	Flygt ENM-10	
Level probe	MultiTrode level probe	
Magflow meter	Endress and Hauser Promag (remote)	
Pressure transducer	Endress & Hauser Cerabar T PMP131 (4-20mA)	
Generator Plug	C From 63A or 125A	Compatible alternatives may be considered
Switchboard Enclosure	Switchbuild Dunedin Ltd Phone 03 466 4281 Email sales@switchbuild.co.nz Bremca. 25 Bond St, Invercargill. Phone 03 218 8038	
Switchboard Locks	Flush mounted internal lock with QLDC tumbler pattern	

APPENDIX B

SCADA STANDARD I/O TEMPLATE

DIGITAL INPUTS

0	*kwh pulse*	
1	*P1 Run*	
2	*P2 Run*	
3	*Flow Pulse*	
4	*P1 Auto*	
5	*P2 Auto*	
6	*P1 Fault*	
7	*P2 Fault*	
8	*Hi Level Alarm*	
9	*Lo Level Alarm*	
10	*RTU Control On*	
11	*Critical High Level Alarm*	
12	*Phase Fail*	
13	*Critical Low Level Alarm*	
14	*Seal Fail Pump 1*	
15	*Seal Fail Pump 2*	
16	*Surge Alarm*	
17		
18		
19		
20	*Multiranger Fault*	
21	*UPS Fault*	
22	*UPS Online Mains Fail*	
23	*UPS Battery Low*	
24		
25		
26		
27		
28	*Gen Run*	
29	*Gen on Load*	
30	*Gen Fuel Low*	
31	*Generator Fault*	
32	*PLC Fail*	
33	*Flow Fail*	
34	*Low Pressure*	
35	*RTU Control Enabled*	

ANALOG INPUT SIGNALS

AI		
0	Well Level (by pressure)	
1	P1 Current	
2	P2 Current	
3	Flow L/s	
4	*MR Level by ultrasonic*	
5	*P3 Current*	
6	*P4 Current*	
7	*P1 Speed*	
8	*P2 Speed*	
9	*P3 Speed*	
10	*P4 Speed*	
11	*Pressure*	

DIGITAL OUTPUTS

DO				
0	General Reset	pulse		
1	Start/Stop P1	On/Off		
2	Start/Stop P2	On/Off		
3	P1 Reset	pulse		
4	P2 Reset	pulse		
5	Standby Stop	pulse		
6	Duty 1-2 = Off, 2-1 = On		On/Off	
7	RTU Control Enable		On/Off	
8				
9				
10	-			
11	-			
12	-			
13	-			
14	-			

Items listed below are derived from digital inputs				
Pulse				
0	kwh			
1	*P1 Run Hrs*			
2	*P2 Run Hrs*			
3	*Flow*			
4	-			
5	-			
6	-			
7	-			
8	-			
9	-			
10	-			
11	-			

APPENDIX C

OPERATIONS AND MAINTENANCE MANUAL REQUIRED CONTENT

INTRODUCTION

WASTEWATER PUMP STATION OVERVIEW

- Site Location
- WWPS Criticality

PRINCIPAL COMPONENT DESCRIPTIONS

- Pump Chamber / wet well
- Submersible Pumps
- Valve Chamber
- Electrical cabinet & switchboard
- Soft starters
- Pump controller
- Hydrostatic level transducer
- Power metering
- Magflow meter
- Telemetry
- Generator
- Generator controller
- Rising Main

PUMP CONTROL & SCADA

- Pump controls
- Fault lamps
- Pump configuration
- Pump operation
- Duty / standby pump operation
- Manual / auto operation
- Remote pump operation via SCADA
- Primary pump control
- Secondary pump control
- High and low level alarms
- SCADA I/O
- Digital Inputs
- Digital Outputs
- Analogue Inputs
- Pulse counts
- SCADA Alarms and Operating Responses

ASSET REGSITER

WWPS OPERATIONS & MAINTENANCE

- Monthly Operating / Maintenance Activities
- Yearly Operating / Maintenance Activities
- Troubleshooting
- Pump chamber Level High alarm response
- Pump fault
- Soft starter fault
- Adjusting pump set points on the MultiRanger
- Adjusting pump set points on the SCADA
- Odour complaint
- Wastewater overflow response
- Unblocking a partially or fully blocked pump
- Generator fault
- Loss of SCADA signal

OPERATIONS & MAINTENANCE PROCEDURES

- Cleaning the pump chamber
- Cleaning the level sensor
- Cleaning & maintenance of pressure transducer
- Lifting a pump
- Installing a pump into the pump chamber
- Pump fault troubleshooting
- Isolating plant and equipment
- Unblocking the check (non-return) valves
- Electrical service check
- Pump maintenance & service
- Test running the generator
- Standby generator service

HEALTH & SAFETY

- Risk Assessment

As-Builts

- Electrical, Pump Station and Rising Main

APPENDIX D

WWPS COMMISSIONING TESTS AND CHECK SHEETS

SUBMERSIBLE WASTEWATER PUMPING STATION

TESTING & COMMISSIONING PROCEDURES

TEST/COMMISSIONING PROCEDURES

The following procedures will be used as a basis of commissioning/testing the pumping stations.

Other tests considered necessary to establish the correct operation of the plant and equipment installed shall be performed during commissioning at the discretion of the Veolia commissioning officer(s) as required.

TEST EQUIPMENT REQUIRED (Supplied By Contractor)

Note : It is the responsibility of the Contractor to provide current calibration certificates for the test equipment used during commissioning.

The following test equipment will be required for the testing.

1. Insulation resistance tester (1000V).
2. Earth continuity testing instrument.
3. RCD test equipment.
4. Power factor measuring instrument.
5. Digital multimeter.
6. Low current instrumentation ammeter/calibrator (4-20 mA).
7. Clamp on ammeter (rated for full load current of pump motors).

<table>
<tr><td colspan="2">1. SWITCHBOARD CONSTRUCTION</td></tr>
<tr><td colspan="2">Objectives:
To establish general compliance with construction requirements of specification.</td></tr>
<tr><td colspan="2">Test Procedure:
• Check construction of switchboard including material 316 SS construction.
• Check switchboard rating is IP rating.
• Check main switchboard including IP rating.
• Check motor control panel including IP rating.
• Check RTU including IP rating.
• Check component ratings for pump CB’s, soft starters, bypass contactor are the same.
• Check switchboard constructed from stainless steel.
• Check controls and indications are provided as per design drawings.
• Check plinth hot dipped galvanised secured with 316 SS anchors.
• Check high security locks are fitted with QLDC tumbler.
• Check internal wiring PVC and minimum size & colour coding as per specification.
• Check wiring installed in PVC ducts and terminated in terminals.
• Check controls & indications are labelled as required.
• Check relays, terminals and cables are labelled as required.
• Check current transformer wiring is 2.5 mm^2.
• Check terminal enclosure is installed and manufactured from PVC.
• Check miniature circuit breakers are lockable in the OFF position.
• Check that an RCD was installed on the GPO circuit.
• Check Current Transformers are class 2M or better (2M or less).
• Check that Current Transducers are class 1M or better (1M or less)
• Check ammeter selector (if installed) fitted with an OFF position.
• Check hours run meter has 5 digits minimum.
• Check surge arresters have a discharge current of 20kA.
• Check indicator lamps are 22 mm dia.
• Check phase imbalance relay adjustable from 5 to 15 %.
• Check floodlight is rated at 5000 Lumens</td></tr>
<tr><td>Acceptance Criteria:
• Switchboard constructed from 316 SS.</td><td>Results</td></tr>
</table>

• Switchboard exterior appears to be IP 56. • Main switchboard is IP 32. • Motor control panel is IP 52. • RTU is IP 32. • All components rated for (15 or 30 kW). • Switchboard constructed from stainless steel. • Controls and indications are as per design drawings. • Plinth is hot dipped galvanised secured with 316 SS anchors. • High security swing locks fitted. • Internal wiring PVC, min. 1.5 mm^2 (control) and 2.5 mm^2 (power), colour coding grey for LV & violet for instrumentation. • Wiring installed in ducts and terminated in terminals. • Controls & ind. labels to be engraved plastic 4 mm high letters. • Relays, terminals and cables are labeled as required. • Current transformer wiring is 2.5 mm^2. • Terminal enclosure is installed and manufactured from PVC. • Miniature circuit breakers are lockable in the OFF position. • RCD is installed on the GPO circuit. • Current Transformers are class 2M or better (2M or less). • Current Transducers are class 1M or better (1M or less) • Ammeter selector (if installed) fitted with an OFF position. • Hours run meter has 5 digits minimum. • Surge arresters have a discharge current of 20kA. • Indicator lamps are 22 mm dia. • Phase imbalance relay adjustable from 5 to 15 %. • Floodlight is rated at 150 Watts minimum.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ______________________ **Date :** __________	

Passed By (Veolia Water)	Date :

2. SWITCHBOARD GENERAL EQUIPMENT TESTS

Objectives:

To establish switchboard general equipment complies with specification.

Test Procedure:

- Automatic Switch on cubicle light switch in switchboard.
- Check operation of switchboard light.
- Switch on floodlight switch in switchboard.
- Check operation of floodlight.
- Check anti-condensation heater and thermostat fitted.
- Connect measuring meter, turn thermostat temperature down.
- Check that 230V is applied to anti-condensation heater.
- Reset thermostat to operating temperature.
- Test operation of 230V GPO on switchboard.
- Test operation of GPO RCD using RCD test equipment.
- Activate LAMP TEST pushbutton and check all lights operate.

Acceptance Criteria:	Results
• Switchboard light installed and operates when door is opened. • Floodlight operates as required. • Anti-condensation heater fitted and operating. • Anti-condensation heater operating. • Switchboard GPO operates. • RCD operates at required test current. • LAMP TEST operates all lamps correctly.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ______________________ **Date :** __________

Passed By (Veolia Water) ______________________ **Date :** __________

<table>
<tr><td colspan="2">3. SWITCHBOARD PROPRIETARY TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish that proprietary test have been conducted.</td></tr>
<tr><td colspan="2">Test Procedure:
• Disconnect main power supply.
• Check MEN earthing system used.
• Perform insulation resistance test on main busbars.
• Perform earth loop impedance test on main earthing system.</td></tr>
<tr><td>Acceptance Criteria:
• MEN earthing used.
• Insulation resistance above 1.0 MΩ.
• Earth loop impedance less than 0.5 Ω.</td><td>Results</td></tr>
<tr><td colspan="2">Test Result Pass Fail</td></tr>
<tr><td colspan="2">Accepted by
Passed By (Contractor) ____________________ Date : __________
Passed By (Veolia Water) ____________________ Date : __________</td></tr>
</table>

<table>
<tr><td colspan="2">4. GENERATOR CONNECTION TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish correct connections of generator plug. Tests to be undertaken using QLDC supplied generator.</td></tr>
<tr><td colspan="2">Test Procedure:
• Ensure generator is not plugged in.
• Ensure that Main Isolator is closed.
• Check that Generator Isolator can not be closed.
• Switch off Main Isolator.
• Perform conductivity test between all phases of generator plug to main busbars.
• Check that Red, Yellow and Blue phases are connected correctly.
• Close generator isolator.
• Check that Main Isolator can not be closed.
• Open Generator Isolator.
• Close Main isolator.</td></tr>
<tr><td>Acceptance Criteria:
• Generator Isolator can not be closed when Main Isolator is closed.
• Red, Yellow and Blue phases connected correctly.
• Main Isolator can not be closed when Generator Isolator is closed.</td><td>Results</td></tr>
<tr><td colspan="2">Test Result Pass Fail</td></tr>
<tr><td colspan="2">Accepted by
Passed By (Contractor) ______________________ Date : __________
Passed By (Veolia Water) ______________________ Date : __________</td></tr>
</table>

5. PHASE FAILURE RELAY TESTS

Objectives:

To establish correct operation of phase failure relay.

Test Procedure:

- Check that AC POWER OK lamp is illuminated.
- Remove one wire from phase failure relay.
- Check that AC POWER OK lamp goes out.
- Replace wire on phase failure relay.
- Check that AC POWER OK lamp is illuminated.

Acceptance Criteria:	Results
• AC POWER OK lamp goes out on phase failure. • AC POWER OK lamp on when power restored.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ______________________ **Date :** __________

Passed By (Veolia Water) ______________________ **Date :** __________

6. PUMP OPERATION & MOTOR CURRENT TESTS

Objectives:

To establish correct pump and motor current instrumentation operation.

Test Procedure:

6.1 Motor Direction

- Connect main power supply.
- Start Pump 1 and check for correct operation (rotation direction).
- Start Pump 2 and check for correct operation (rotation direction).
-

6.2 Motor Current

- Connect low current ammeter (4-20 mA) to motor current transducer on Pump 1.
- Measure Pump 1 motor current using clamp on (tong) ammeter.
- Observe Pump 1 motor current on switchboard ammeter.
- Compare motor current readings for Pump 1.
- Connect low current ammeter (4-20 mA) to motor current transducer on Pump 2.
- Measure Pump 2 motor current using clamp on (tong) ammeter.
- Observe Pump 2 motor current on switchboard ammeter.
- Compare motor current readings for Pump 2.

Acceptance Criteria:	Results
6.3 Motor Direction • Pumps run correctly and pumps. **6.4 Motor Current** • Pump 1 panel ammeter and analogue the same. • Pump 2 panel ammeter and analogue the same.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ____________________________ **Date :** ____________

Passed By (Veolia Water) ____________________________ **Date :** ____________

7. PUMP OPERATING MODE TESTS

Objectives:

To establish correct operation of the pump mode selector switches.

Test Procedure:

7.1 Off Mode

- Select OFF on the Pump 1 and Pump 2 MODE SELECTOR switches.
- Allow sump level to increase.
- Check that pumps do not run.

7.2 Manual Operation

- Select RUN mode on Pump 1 mode selector.
- Check that Pump 1 starts.
- Select OFF mode on Pump 1 mode selector.
- Select RUN mode on Pump 2 mode selector.
- Check that Pump 2 starts.
- Run pump(s) until sump is empty (below duty 1 start level).
- Select OFF mode on Pump 2 mode selector.

7.3 Pump 1 Automatic Duty 1 Operation

- Select DUTY 1-2 on the DUTY SELECTOR switch.
- Select AUTO on Pump 1 and Pump 2 MODE SELECTOR switches.
- Allow sump level to increase.
- Check that Pump 1 starts at DUTY 1 start level.
- Check thatPump 1 stops at DUTY 1 stop level.

7.4 Pump 2 Automatic Duty 1 Operation

- Select DUTY 2-1 on the DUTY SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 2 starts at DUTY 1 start level.
- Check that Pump 2 stops at DUTY 1 stop level.

7.5 Pump 1 Automatic Duty 2 Operation

- Select DUTY 2-1 on the DUTY SELECTOR switch.
- Select OFF on the Pump 2 MODE SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 1 starts at DUTY 2 start level.

7. PUMP OPERATING MODE TESTS

- Check that Pump 1 stops at DUTY2 stop level.
- Select AUTO on the Pump 2 DUTY SELECTOR switch.

7.6 Pump 2 Automatic Duty 2 Operation

- Select DUTY 1-2 on the DUTY SELECTOR switch.
- Select OFF on the Pump 1 MODE SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 2 starts at DUTY 2 start level.
- Check that Pump 2 stops at DUTY 2 stop level
- Select AUTO on the Pump 1 MODE SELECTOR switch.
- Allow sump to be pumped down to DUTY 1 stop level.

7.7 Rotation Operation

- Select ROTATION on duty selector switch.
- Ensure that Pump 1 & 2 have AUTO mode selected.
- Allow sump to fill.
- Observe which pump is started at DUTY 1 start level.
- Allow sump to be pumped down to DUTY 1 stop level.
- Allow sump to fill.
- Check that the duty rotation changes and the other pump now starts at DUTY 1 start level.

Acceptance Criteria:	Results
7.8 Off Mode • Pumps do not run start when OFF selected. **7.9 Manual Operation** • Pump 1 starts on manual start. • Pump 2 starts on manual start. **Pump 1 Automatic Operation** • At DUTY 1 start level Pump 1 starts. • At DUTY 1 stop level Pump 1 stops. **Pump 2 Automatic Operation** • At DUTY 1 start level Pump 2 starts. • At DUTY 1 stop level Pump 2 stops. **Pump 1 Automatic Duty 2 Operation**	

7. PUMP OPERATING MODE TESTS	
• At DUTY 2 start level Pump 1 starts. • At DUTY 2 stop level Pump 1 stops. **Pump 2 Automatic Duty 2 Operation** • At DUTY 2 start level Pump 2 starts. • At DUTY 2 stop level Pump 2 stops. **Rotation Operation** • Duty rotation alternates correctly between pump starts.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ________________ **Date :** ________ **Passed By (Veolia Water)** ________________ **Date :** ________	

8. PUMP POWER AND INDICATION TESTS

Objectives:

To establish correct operation of the starter, contactors and run indications.

Test Procedure:

- Connect power factor measuring instrument to main supply.

8.1 Pump 1

- Select RUN mode on the Pump 1 MODE SELECTOR.
- Check Pump 1 hours run meter is operational.
- Check that PUMP 1 RUN indicator lamp is illuminated.
- Check Power Factor to ensure that it is not less that 0.95 lagging.
- Select OFF mode on the Pump 1 MODE SELECTOR.
- Check that Pump 1 is stopped using soft starter pump control.

Pump 2

- Select RUN mode on the Pump 2 MODE SELECTOR.
- Check Pump 2 Hours Run Meter is operational.
- Check that PUMP 2 RUN indicator lamp is illuminated.
- Check Power Factor to ensure that it is not less that 0.95 lagging.
- Select OFF mode on the Pump 2 MODE SELECTOR.
- Check that Pump 2 is stopped using soft starter pump control.

Acceptance Criteria:	Results
Pump 1 • Pump 1 hours run meter is operational. • PUMP 1 RUN indicator lamp illuminates. • Power Factor is not lower that 0.95 lagging. • Pump 1 is stopped using soft starter pump control. **Pump 2** • Pump 2 Hours Run Meter is operational. • PUMP 2 RUN indicator lamp illuminates. • Power Factor is not lower that 0.95 lagging. • Pump 2 is stopped using soft starter pump control.	

Test Result **Pass** **Fail**

Accepted by

8. PUMP POWER AND INDICATION TESTS	
Passed By (Contractor)	Date :
Passed By (Veolia Water)	Date :

9. PUMP SOFT STARTER & FAULT CIRCUIT TESTS

Objectives:

To establish correct operation of the soft starters and pump fault circuits.

Test Procedure:

Pump 1

- Ensure that no faults are present.
- Check that Pump 1 alarm relay is energised.
- Select OFF on Pump 1 mode selector.
- Adjust the soft starter overload current to minimum Amperes.
- Select RUN on Pump 1 mode selector.
- Check that Pump 1 alarm relay de-energises.
- Check that Pump 1 Fault indicator is illuminated.
- Select OFF on Pump 1 mode selector.
- Press Pump 1 RESET pushbutton.
- Check that Pump 1 alarm relay re-energises.
- Check that Pump 1 Fault indicator is not illuminated.
- Adjust the soft starter overload current to motor current.
- Select AUTO on Pump 1 mode selector.

Pump 2

- Ensure that no faults are present.
- Check that Pump 2 alarm relay is energised.
- Select OFF on Pump 2 mode selector.
- Adjust the soft starter overload current to minimum Amperes.
- Select RUN on Pump 2 mode selector.
- Check that Pump 2 alarm relay de-energises.
- Check that Pump 2 Fault indicator is illuminated.
- Select OFF on Pump 2 mode selector.
- Press Pump 2 RESET pushbutton.
- Check that Pump 2 alarm relay re-energises.
- Check that Pump 2 Fault indicator is not illuminated.
- Adjust the soft starter overload current to motor current.
- Select AUTO on Pump 2 mode selector.

Acceptance Criteria:	Results
Pump 1 • Fault relay is energised with no fault present.	

9. PUMP SOFT STARTER & FAULT CIRCUIT TESTS	
• Fault relay de-energises on fault. • Pump 1 Fault indicator illuminates on fault. • Fault relay energises when RESET operated. • Pump 1 Fault indicator not illuminated when reset. **Pump 2** • Fault relay is energised with no fault present. • Fault relay de-energises on fault. • Pump 2 Fault indicator illuminates on fault. • Fault Relay energises when RESET operated. • Pump 2 Fault indicator not illuminated when reset.	
Test Result **Pass** **Fail**	
Accepted by **Passed By (Contractor)** ____________ **Date :** ______ **Passed By (Veolia Water)** ____________ **Date :** ______	

10. LEVEL DEVICE TESTS

Objectives:

To establish correct operation of the level indicator/controller & associated controls.

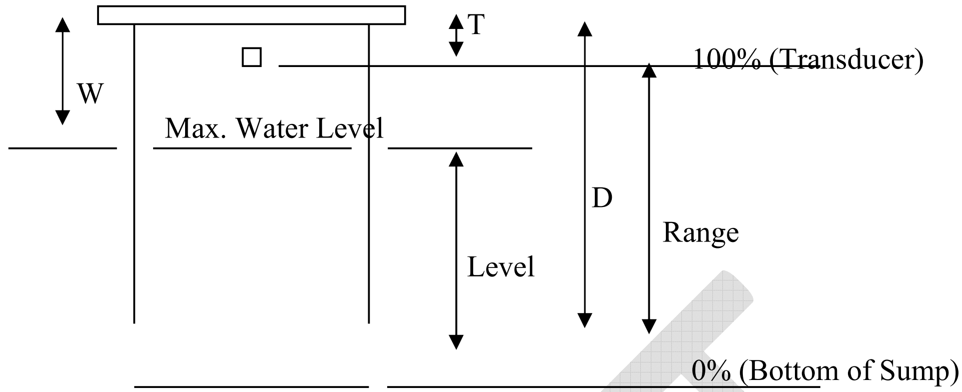
Test Procedure:

- Ensure that power is switched on to switchboard.
- Check that sump level is displayed on the Level Device.
- Switch off power to switchboard.
- Check that level is displayed on the Level Device using battery backup power.
- Connect low current ammeter (4-20 mA) into analogue output.
- Switch pumps on and empty sump.
- Check that sump level reads 0 %.
- Check that High Level Alarm relay is energised.
- Switch pumps off and allow sump to fill.
- Check that de-energises at HLA setpoint on controller.
- Check that HIGH LEVEL ALARM light is illuminated.
- With sump level just below overflow pipe, measure distance from top of sewerage to top of sump and calculate sump level in %.
- Check that sump level is the same as level displayed on level device.
- Select RUN mode on Pump 1 and 2.
- Check that Level Device Faulty relay is energised.
- Simulate sump level device fault condition.
- Check that de-energises.
- Check that SUMP LEVEL SYSTEM FAULT light is illuminated.
- Select AUTO mode on Pump 1 and 2.

Acceptance Criteria:	Results
• Level displayed with power on. • Level displayed with power off (using 12 V battery). • Sump level reads 0 % with empty sump. • energised below HIGH LEVEL sump level. • de-energises above HIGH LEVEL sump level. • HIGH LEVEL ALARM light operates. • Actual sump level the same as displayed sump level.	

• Level device fault is energised with no fault present. • Level device fault de-energises when fault exists. • SUMP LEVEL SYSTEM FAULT light operates when level device fault exists.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ____________ **Date :** ________ **Passed By (Veolia Water)** ____________ **Date :** ________	

General Sump Details



Measured & Operational Site Details

LEVEL	mm	Value
DEVICE SETUP & CALIBRATION DETAILS		
Bottom Of Transducer To **Top** / **Bot** Of Sump Cover		T
Sump Depth To **Top** / **Bot** Of Sump Cover		D
Level Device Range		
Maximum Water Level Measurement (Water level to cover)		W
Level Device Reading at Maximum Water Level		
Required Current at Maximum Water Level		
Actual Current at Maximum Water Level		
SETTING DETAILS		
Overflow Level Float		
Emergency Start Float		
Emergency Stop Float		
High Level Alarm		
Start Duty 2 Pump		
Start Duty 1 Pump		
Stop Duty 2 Pump		
Stop Duty 1 Pump		

Formula

Level Device Range = D - T

Sump level = D – W

$$\text{Required Current at Maximum Water Level} = \left[\frac{D - W}{\text{Range}} \times 16\right] + 4$$

<table>
<tr><td colspan="2">11. EMERGENCY FLOAT SYSTEM TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish correct operation of the emergency float system.</td></tr>
<tr><td colspan="2">Test Procedure:
Emergency Level Float System
• Ensure that pump station has been operational.
• Disconnect battery power to Level Device.
• Switch power off to Level Device.
• Select AUTO on Pump 1 and Pump 2 mode selectors.
• Check that both pumps do not run.
• Check that Emergency Start Float Relay is de-energised.
• Allow sump level to increase.
•
• Replace battery power to Level Device.
• Switch power on to Level Device.
Overflow Level
• Lower Overflow Level Alarm float into sewerage.
• Check that the Overflow Alarm Relay energises and OVERFLOW ALARM is illuminated.
• Reset Overflow Float to correct level.</td></tr>
<tr><td>Acceptance Criteria:
Emergency Level Float System
• Pumps do not run when level below emergency start.
• Emergency start relay is de-energised.
• Emergency start relay energises when level reaches Emergency Start Level and Pump 1 starts.
• After a time delay and Pump 2 starts.
• Pump 1 and 2 stop when level falls below Emergency Stop Level.
Overflow Level
• Overflow alarm relay energises and OVERFLOW ALARM is illuminated.</td><td>Results</td></tr>
<tr><td colspan="2">Test Result   Pass   Fail</td></tr>
<tr><td colspan="2">Accepted by</td></tr>
</table>

Passed By (Contractor)	**Date :**
Passed By (Veolia Water)	**Date :**

12. SCADA CONTROL TESTS

Objectives:

To establish correct operation of common control circuits.

Test Procedure:

SCADA Control

- Ensure that SCADA control is not active.
- Check SCADA Control Relay is de-energised and SCADA CONTROL ACTIVE indicator lamp is off.
- Initiate SCADA control.
- Check SCADA Control Relay is energised and SCADA CONTROL ACTIVE indicator lamp is on.

Acceptance Criteria:	Results
• SCADA Control Relay de-energised & SCADA indicator lamp off when SCADA control is not active. • SCADA Control Relay energised & SCADA indicator lamp on when SCADA control is active.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ______________________ **Date :** __________

Passed By (Veolia Water) ______________________ **Date :** __________

13. SCADA TESTS

Objectives:

To establish all SCADA signals returned correctly to base.

Test Procedure:

SCADA Control

- Review historical logs / alarm logs for all the tests above.
- Check that power fail, pump run, pump fault, emergency level control active, level device fault, high level, pump currents and well level all indicate correctly.
- Check alarms generated to pager for power failure, pump fault, level device fault, emergency level control active and high level alarm.

Acceptance Criteria:	Results
• Power fail indication and alarm paged out	

• Pump 1 and Pump 2 run indication paged out • Pump 1 and Pump 2 fault indication and alarm paged out • Emergency level control active indication and alarm paged out • Level device fault indication and alarm paged out • High Level alarm paged out • Overflow alarm paged out • Pump 1 and Pump 2 currents indicated correctly • Wet well level indicated correctly	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ____________________ **Date :** __________ **Passed By (Veolia Water)** ____________________ **Date :** __________	

14. FLOWMETER TESTS	
Objectives: To establish the flowmeter is working accurately to measure and record pumped flow output from the wastewater pump station.	
Installation check procedure: **Mechanical installation** • Check that magflow meter is installed to manufactures' recommendations and observes the minimum straight line dimensions required upstream and downstream of the sensor. • Check that the magflow meter is installed with grounding disks where installation has been performed in pipelines made of plastic, concrete or those with an insulated lining or coating metal. • Check that rubber gaskets are installed on both sides of the grounding disk as per manufactures recommendations. • Check that the flowmeter is installed in a manhole or similar chamber to allow for any operation or maintenance checking required.	
Acceptance Criteria: • Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.	**Results**

• Transmitter or head units to be mounted inside switchboard to ensure a visible local display is available for operators to view. • Scaling range (4-20Ma) is greater than the maximum flow out of the pump station by a factor of ≥ 1.2 • Scaling range is communicated through to SCADA supervisor. • Pulse output from magflow meter to be configured so that 1 pulse count = 1m3 pumped volume. • Local display to match SCADA flow measurement. Commissioning officers and SCADA supervisor to check. • Analogue and digital inputs for magflow connection to be pre-determined by SCADA I/O schedule • No local alarming or control outputs are required to be configured from flow measurements from the magflow meter. • Any relevant alarming or low / high (abnormal) flow conditions are to be configured against the analogue value returned to SCADA.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ______________ **Date :** ________ **Passed By (Veolia Water)** ______________ **Date :** ________	

APPENDIX E

DRAWINGS

QLDC_WWPS_	QLDC Pump Station Standardisation
QLDC_WWPS_01	REG Electrical Drawings Register
QLDC_WWPS_01	GA - General Arrangements
QLDC_WWPS_01	LDL1 - Label Schedule
QLDC_WWPS_01	01- Wiring Schematics

CONTENTS

1 INTRODUCTION

The Water Supply Pumping Station Design Standard provides a standardised guide for public water supply systems which presents, as far as practical, uniform concepts for water system design. It offers some flexibility, enabling design engineers and consultants to consider alternative designs for specific situations whilst still delivering the optimum design.

1.1 SCOPE

The key issues addressed in these standards are

i. General design principles;
ii. Pumps and pump station design;
iii. Pipeworks and valving;
iv. Hydraulic considerations;
v. Mechanical and electrical design;
vi. Building construction;
vii. Telemetry and SCADA control systems;
viii. Generators and power back-up;
ix. Landscaping requirements;
x. Testing and commissioning requirements;

2 DESIGN AND CONSTRUCTION REQUIREMENTS

2.1 SITE REQUIREMENTS:

> Not be subject to flooding
> Be readily accessible at all times
> Be shaped to divert stormwater around the wells, pumps and structure
> Be protected to prevent vandalism

2.2 ACCEPTANCE OF ALTERNATIVE DESIGNS

For operational reasons it is a requirement that there be a large degree of uniformity among the Council's water supply pumping stations. Council will consider alternative designs on their merits, where the design results in an equivalent or better performing infrastructural development than that complying with this standard. Any acceptance of alternative designs applies to that particular proposal only.

Alternative designs may be considered:

i. To provide flexibility to meet the circumstances and requirements of the site
ii. As a means of encouraging innovative design
iii. To produce a lower life cycle costing and / or greater operational reliability or
iv. To provide the required resilience in case of land movement due to seismic events

2.3 OPERATION AND MAINTENANCE

Design all system components for safe and convenient operational and maintenance procedures:

i. Keep all equipment out of hazardous environments where possible and keep the number of confined spaces generated through the construction of the new facilities to an absolute minimum
ii. Lay out the site, including vehicular access, to allow easy access to the infrastructure components
iii. Locate pipework to facilitate access to and maintenance of equipment. Provide an uninterrupted accessway around pumps and detail any pipework crossing this path either below floor level in ducts with suitable removable gratings or fixed above head height.
iv. Mount surface pumps on a plinth 200mm above floor level.
v. Detail cables to be either below floor level in ducts with suitable removable gratings or fixed above head height.

vi. Place equipment to facilitate visual inspections and routine maintenance
vii. Specify guard rails or chains around the top of any potential hazard of falling
viii. Consider potential future expansions and make provisions for such
ix. Design the control and alarm system to enable operators to react quickly and properly in emergencies
x. Size and select equipment that facilitates a long service life, low operational costs and low maintenance requirements
xi. Keep the system as simple as possible but as sophisticated as necessary, whilst considering the implications of a rural versus an urban setting;
xii. Prepare complete and useful records - system and equipment drawings and specifications, system calculations, hydraulic models, user manuals and manufacturer/supplier contacts, flow charts, diagrams and Process and Instrumentation Diagrams (P&IDs), legal survey plans and address maps, etc. and include this information in the Operations and Maintenance Manual

2.4 PIPE HYDRAULICS

Design pressure pipelines and fittings to minimise hydraulic.

Velocities in pipes must not be greater than 2.0 m/s unless appropriate water hammer analysis has been done.

Provide a surge and fatigue analysis on all critical plastic pipelines including all pressure mains and where velocities in plastic pipes are greater than 1.0 m/s. Provide action points or mitigation measures to deal with the identified surges

2.5 WALL AND FLOOR PENETRATIONS:

Provide a water stop puddle flange, centred in the concrete for all pipes passing through walls below ground level

2.6 FIXINGS RESTRAINTS AND SUPPORTS

Design restraints, fixings and supports to the fittings, including the ability to withstand the required seismic loading. Where these items are not detailed on the drawings, ensure that the Contractor designs and supplies these fixings to comply with the Building Code.

All fixings to concrete or masonry shall be by bolts, cast-in fixings or chemical. Terrier and powder charged fixings shall not be used.

Specify corrosion protection on fixings, which exhibits equivalent or better corrosion resistance than the material to which they are connected.

Detail clamping to connect fixings to structural steelwork rather than welding or drilling.

2.7 SEISMIC DETAILING

Design flexible connections into pipework on the external side of exterior walls, to allow for relative movement during seismic events. Locate these joints no further than 1.0m from the external wall where possible. Consider punching shear when detailing both the pipework and the wall construction. Flexible connections can be provided by rubber joints, polyethylene pipe or mechanical couplings. If rubber bellows are used, specify that the flexible element is EDPM rubber.

2.8 HEALTH AND SAFETY SIGNAGE

Provide safety signage (no smoking, confined spaces, power, speed limits, potable/non potable water sources, hearing protection areas, site visitor instruction board, rotating machinery etc.) on all facilities prior to commissioning.

Detail confined space warning signs for pump house accesses that are considered a confined space.

Provide a noise hazard warning sign on the personnel door if there are pumps or diesel inside.

2.9 SECURITY

Vandalism is likely at all sites. Detail the building architecture, façade, features and external equipment to discourage vandalism and to minimise damage. Provide an external security light, controlled by a passive infrared sensor for all but simple electrical cabinet installations. Fence all facilities for site delineation and where necessary to restrict access by humans or animals where: ·

i. There is a safety issue for any person that is on the site
ii. Significant vandalism or damage to the site could be expected, or
iii. There is potential for theft or sabotage

Landscaping to afford visibility of the whole site and so to prevent anti-social, unsafe or destructive behaviour.

2.10 LOCKS

Provide standard Council locks to all buildings, chambers and pits, gates and any sensitive or dangerous areas to prevent unauthorised access. Detail locking systems that prevent levers or bolt cutters being used to remove the locks.

3 BOOSTER PUMPS

Booster pumps may be in an open or closed system. Therefore, design the booster pump to either fill a reservoir or to directly supply the network. Each booster pumping station should contain at least two pumps (one duty pump and one standby pump).

Design in-line booster pumps so that:

> Negative Pressure Is Not Produced In their Suction Lines

> Total dynamic head and flow for the system curve can be obtained by all combinations

3.1 NUMBER OF PUMPS

When designing the pumps, include an extra pump over the required number for redundancy i.e. small pump stations shall have a minimum of two pumps. Ensure standby pumps are available for service at all times. Where possible, pumps in a pump set should be identical for operational purposes.

As a guide, where the pump station has the minimum three pumps, the likely set-up and operation may be as follows:

i. Two duty pumps and one stand-by:
   a. Both pumps on VSD - The pump will run up to close to its maximum before the VSD is disengaged and the pump runs at constant speed. The second pump will pick up and provide additional demand up to its maximum duty point
ii. One pump on VSD and one on a Soft start
   a. Once the first pump reaches close to its maximum duty point, the VSD is disengaged and the soft start pump will start and run at its full speed
   b. The VSD pump will then start again and provide any additional capacity required up to the maximum

In both cases the standby pump will be called on if one of the duty pumps goes down. Provide an optimal control scenario for the specific pump station. This approach ensures that the pumps are operated at the maximum possible efficiency for the duties.

Specify 3-phase 415 volt pumps if their motors are greater than 3 kW. Specify water detection and over temperature detection in the motor housing of pumps larger than 3kW. Rate pumps to achieve their design output at no more than 2900 rpm.

3.2 PUMP FEATURES

Specify pumps with hard metal-to-metal face mechanical seals, high quality stainless steel or high tensile steel shafts and high grade bronze, stainless steel or cast iron impellers.

Specify a dynamically balanced unit to ensure long life and vibration-free operational conditions, confirmed by specifying a vibration test to ISO 10816 on the installed unit to confirm alignment, vibration and base harmonics.

Detail grease lubricated, heavy duty ball or roller bearing type bearings and renewable shaft sleeves and wear rings.

For dry-well mounted pumps, specify:

i. Suctions with easy access to clear the impellor eye. This can be a special access cover or an easily removable section of pipe. For example, pumps with suctions greater than 200 mm diameter can be fitted with inspection plates for hand access into the volute and impellor.
ii. End suction pump sets complete with a substantial base plate to mount the pump and motor. Detail the mounting plate to ensure correct alignment at all times and to minimise harmonic vibrations.
iii. “Back pullout” design end suction pump sets, with the motor and wet end of the pump able to be slid out of the volute with minimal work.

For in-line pumps ensure that:

i. The inlet and outlet are placed at the same level where the inlet and outlet pipe diameters are the same.
ii. Accessibility is easy when the pumps are installed in parallel as the pipework can be in the way.
iii. Pumps are installed in a position to permit proposer lubrication and servicing

3.3 ALLOWANCE FOR FUTURE CAPACITY OR EXTENSION

For staged developments such as in Greenfield areas, pump stations can be staged with fewer pumps in the early stage(s) and provision made for the ultimate development scenario. Size these early stage pumping units for the ultimate design flow rate. If an intermediate design flow rate is required, select the pumping units for both conditions, intermediate and ultimate development.

Consider the feasibility of using smaller pump impellers for the earlier stages and upsizing the impellers for the later and ultimate development stages as this could be cost effective if the higher duties can be achieved without overloading the pump. Additional future capacity could also be achieved by replacing pumps installed in the early stages with larger pumps. The starters could be sized for the larger pumps from the start and fitted with circuit breakers and overloads.

If additional pumps are required, make provision for these pumps in the pump station building, the manifold pipework and switchgears. Analyse the various pumping combinations to arrive at the most cost effective combination of staging options.

3.4 WELL PUMP AND MOTOR INFORMATION

Provide the details of all proposed pumps and motors with the Design Report, specifically:

> Make and model
> Physical information (mass, dimensions, delivery diameter etc.)
> Mechanical details (materials, bearing and seal types etc.)
> Manufacturing and testing standards
> Guaranteed performance details (Q/H curves, total pumpset efficiency, rpm
> Minimum operating speed for a variable speed set-up and the reason for this limit
> Rating (kW, rpm, voltage)
> Maximum starts per hour
> Confirmation of continuous rating
> Methods of protection

4 PUMP SUCTION AND DISCHARGE

Design the suction and discharge manifold for future flows without having to take a pump out of service for extended periods of time. Design and size suction pipework so that:

i. It is one size larger than the pump inlet size
ii. Suction pipe is easily accessible to clear any blockages
iii. Suction pipe velocities in table 1 are not exceeded
iv. Allowed on short-term basis (e.g. emergency conditions)
v. Suction cavitation is avoided by flooded suction or having a NPSHA > NPSHR
vi. Eccentric reducers have the obvert horizontal to prevent air entrapment.
vii. Suction lift is within allowable limits for the pump.

Design and size discharge pipework so that:

i. It is one size larger than the pump inlet size.
ii. Discharge pipe velocities in table 1 are not exceeded. Higher velocities should only be allowed on short-term basis (e.g. emergency conditions).
iii. It can withstand the total maximum pressure (including surge)

Suction and Discharge Velocities (m/s)

Pipe Diameter	Velocity (m/s)
Suction Pipe Velocities	
≤ 250 mm ≤1.0	≤1.0
>250 mm ≤ 1.5	≤ 1.5
Discharge Pipe Velocities	
≤ 250 mm ≤ 1.5	≤ 1.5
>250 mm ≤ 2.0	≤ 2.0

5 PUMP MOTORS

Select motors with sufficient capacity to drive the pump. Ensure the motor is non-overloading over the range of duties at which the pumps is expected to operate. Where these requirements cannot be met, submit a non-conformance report to Council.

Do not unnecessarily oversize the motors to achieve the above requirements or the future capacity requirements. Select motors with care as efficiency and the power factor drops in motors running below the load rating.

6 PUMP STATION SCADA

Veolia is Council's manager / operator of the SCADA system.

Provide instrumentation and control at pump stations to measure, control, and monitor the pumping system, as covered in Electrical & SCADA Standard.

Swampfox RTU manufactured by Abbey Systems shall be installed to allow for remote monitoring and alarming functionality (details of IO template for SCADA signals shown in the Electrical & SCADA Standard).

- Developer to provide proposed method of RTU communication to Veolia for approval
- The developer is responsible for all costs associated with the provision of the SCADA communication
- Swampfox to be purchased from Abbey Systems and have area radio channel pre-configured
- Developer is required to use Veolia for all changes required for the software configuration to Council's SCADA system and includes graphical interface, pump station reports and pump station generated alarms

7 APPURTENANT DESIGN

If the pump station's electrical panel is located in a building as defined by the Building Code, specify as a minimum:

i. 4.5 kg fire extinguisher
ii. Approximately A3 size blackboard on wall by personnel door
iii. Lectern, or hinged plan table if space allows

7.1 PRESSURE GAUGES

Specify the installation of pressure gauges which read in kPa, with a pressure range such that the maximum pressure reading is around 50% to 60% of the range. Specify test points on the pump inlet and on ALL delivery pipes. Detail test points that are:

> 1/4 inch BSP female thread
> Fitted with a pipe plug
> Installed as close to the pump as possible
> On the pump side of any valves where possible
> With an accuracy to ±5% or better

Specify test points flush with the inside wall of the pipe, with the test point positioned to minimise the potential for the various velocities or turbulence inside the pipe to affect the gauge reading.

Detail a hole diameter through the test point fitting of less than 4mm to minimise turbulence. This diameter can be increased at distances greater than 4mm from the inside pipe wall.

7.2 WATER SAMPLE POINT

Provide lockable water sampling points that located in an easy and safe access to enable safe collection of water samples for both bacteriological and chemical analysis. These shall be located

On the outside of the Pump station building.

8 FLOW METERS

Specify a Mag-flow meter on the pressure main from the pumping station. Meter type shall be as detailed in QLDC the Water Meter Policy dated August 2015. Meter display shall be located with switch board cabinet.

9 VALVING

Detail sufficient isolation valves to enable the pump station to operate while one pump, or any other major plant item, is being serviced. Specify valves rated to PN16.

Reflux valves to be installed downstream of the pump and upstream of the isolation valve. These should ideally be inside the pump station building. Wafer type non-return valves can be specified for smaller pump headworks (<80 mm pipe diameter).

Locate isolation valves on the discharge pipe at least three pipe diameters from the pump control valves. As far as practicable provide each section of piping which may be isolated with a valved pipe drain.

Install pump control valves (valves to control flow during the start-up or shut-down of the pump) even when a variable speed drive is provided. Configure and connect the control valves so that:

> The pump starts on a closed valve
> They open slowly during start-up
> When the pump is signalled to stop the pump continues to run whilst the control valve slowly moves to the shut position, to avoid water hammer.

10 BUILDING CONSTRUCTION

Design the building to adequately house and allow the efficient operation, servicing and removal of all equipment in the building.

Provide adequate space to move tools and equipment required to perform the entire spectrum of operation and maintenance procedures. Consider future expansion in the design of the building.

Provide a minimum clearance around and between pumps, diesels, open cabinet doors and extended racks of 600 mm.

Locate electrical equipment away from wet areas.

Design a minimum 1.2m wide x 2.0m high personnel service door. Specify solid timber or aluminium doors, with heavy-duty hardware. Detail that large doors fitted for machinery access will open from the inside.

Specify pre-painted long run steel roofing.

Protection of Equipment, Surfaces, Coatings and Dissimilar metals, considering the site's context.

Do not build over pipes or fittings as they require replacement at a future date. If pipes are built over, detail a service pit to contain them, which is large enough for workman to replace the pipe without any excavation or demolition

11 ELECTRICAL AND INSTRUMENTATION DESIGN

Design the electrical installation, including the generator and diesel engines, the motor starters and the three phase generator inlet plug, in compliance with electrical standard.

12 NOISE, VENTILATION AND AIR CONDITIONING

Design ventilation to the pump station and control temperatures inside the room regardless of the outside temperature to a range of:

- Minimum of 5°C
- Maximum of 40°C,.

Consider heat contributions from all sources inside the building or cabinet. Design the ventilation in tandem with the soundproofing, as ventilation may increase external noise levels directly or indirectly.

If air conditioning is required to control the maximum temperature in an electrical room, include measures to maintain internal relative humidity between 40% - 60%, to avoid condensation and static electrical shock.

For intermittent ventilation i.e. active only when there are personnel inside the pump station, specify a fan capable of 30 complete air changes per hour.

Noise generated by the pumping station shall not exceed the Council District plan permitted levels. The design shall include measures to reduce noise appropriately.

13 GENERATORS – BACKUP POWER SUPPLY

Backup generators are required on most pumps. Whether or not a proposed project will require a backup generator will be confirmed by Council and will depend on the risks associated with power failure. Generators may be permanent and fixed or portable as discussed with and agreed to by Council.

As a minimum specify a unit capable of powering the largest pump, plus all auxiliary equipment (ventilation fans, battery chargers, lighting etc.). It must be capable of powering the pump sets from stand still and zero reticulation pressure and, if required, of starting the standby pump when the duty pump is already running at full load.

Size the generator to match the load and method of starting employed at the pumping station. The generator must be a minimum size in relation to VSDs and must have advanced speed control in order to avoid “hunting” of the generator. The generator set must be able to run continuously at the rated output for several days at a time.

Where an onsite generator is not required by Council a mobile standby generator connection shall be provided and located on the outside of the building. Ensure there is sufficient space for parking a standby generator adjacent to the pump station and way from the footpath or carriageway.

14 TESTING AND COMMISSIONING

Council Pumping and Control staff must witness any commissioning work and testing. Involve specialist suppliers and contractors as necessary. Provide at least five working days’ notice of the SCADA functionality checking, any commissioning or testing to Council. Also notify Council of the expected date of handover of operation of the pumping station.

Pre-test any work required to be tested in the presence of Council, to prove it is satisfactory. Prior to pre-testing, ensure that:

i. The installation is in accordance with the specification and drawings, except as varied by accepted non-conformances
ii. All equipment is in proper working order
iii. Programming and settings have been completed and checked
iv. Any automatic controls that might invalidate the tests have been overridden
v. The testing and commissioning schedule (including has been prepared and presented to the commissioning personnel and to Council two weeks before the start of commissioning
vi. Rotation of installed pumps is correct
vii. The outstanding work/defect list is completed

Specify a water test for all concrete tanks and below ground structures to Testing Reinforced Concrete Structures for water tightness where testing is practical.

Provide draft Operations and Maintenance Manuals (OMM) and as-built plans to Council at least 5 days prior to commissioning.

Provide generator load tests.

Provide pump tests to confirm that the finished station meets the design flows.

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 THE GOALS OF THE STREET TREE PLANTING GUIDELINES ARE:

1. To establish minimum expected standards, specifications, and work procedures.
2. To communicate these expectations to all persons and agencies engaged in the planting of street trees within Queenstown Lakes District.
3. To ensure high quality and consistent work practices that results in a healthy, sustainable and aesthetically pleasing urban forest.

1.1 INTRODUCTION

Queenstown Lakes District Council (QLDC) is responsible for the planting, maintenance and replacement of council reserve trees throughout the district. These public and often highly visible trees form an important element of QLDC's asset which is managed by the Property and Infrastructure Team.

Following consultation with QLDC regarding species choice, location and planting methodology, the majority of new street tree planting within new subdivisions are planted as an integral component of any new development, usually requiring the developer to adhere to a fixed maintenance period. Following the completion of this maintenance period, QLDC assess the condition and quality of the new planting and accepts responsibility for the trees and their ongoing maintenance.

This guideline has been produced to provide a minimum standard and direction for the planting of new trees specifically within council's road corridor. It is designed for new sub divisions, retrofitting into existing streets, car parks and all other suburban areas under the maintenance of QLDC.

The processes and expectations laid out in this document will provide clear guidance on planting the right tree, in the right environment and in the right place to provide a valuable tree asset that will enhance the local environment and benefit residents while requiring a minimal ongoing maintenance burden for QLDC and its rate payers.

QLDC is committed to protecting and enhancing the valuable tree asset that is within its area of responsibility. QLDC is also committed to future collaborative working with developers in order to ensure the sustainability of the tree asset for the benefit of future generations. QLDC recognise that amenity trees are planted on the basis of the multitude of social, cultural, economic and environmental benefits they provide for the community and are a significant element in meeting community driven expectations and outcomes.

1.2 BACKGROUND

The Queenstown Lakes District is recognised both nationally and internationally for its enviable environment that is further enhanced by the presence of many magnificent trees and hedgerows which during Spring provide a beautiful display of blossom and emerging new foliage, in Summer welcome shade, in Autumn a spectacular display of rustic colours and in Winter an intricate weave of bare colourful twigs.

Overall, the majority of the districts urban forest trees have attained maturity, with many trees entering senescence and nearing the end of their safe useful life. Therefore it is imperative that all new tree planting is appropriate to the location, successful and sustainable in order for successive tree generations to mature and continue the districts tree heritage into the future.

QLDC has inherited many tree related issues that cause conflict with existing services, residents and the surrounding built environment. Unsuitable species, poor planting location and the lack of available space for roots to extend resulting in hard surface defects as a result of natural root development and expansion (direct damage). This is a common problem throughout the Queenstown Lakes District and beyond.

1.3 STREET TREE PLANTING & CLIMATE CHANGE

How do street trees help combat climate change?

> Trees sequester carbon dioxide directly from the air and transform it into living matter - trunks, branches, roots, leaves, and flowers.
> Deciduous trees planted in strategic locations conserve energy by shading buildings during the summer months. This directly results in a reduced requirement for artificial cooling of buildings and corresponding reduced energy use which means reduced greenhouse gas emissions onsite and from power plants.
> An effective tree canopy in towns and cities helps reduce urban heat island effect, where heavy concentrations of buildings and asphalt adsorb heat and raise urban temperatures by as much as 10°. Lower temperatures mean less energy use for artificial cooling and reduced emissions.
> One large mature tree will sequester 8–10 tons of carbon dioxide from the atmosphere over its lifetime.

The overall effect of urban trees is to cool the local environment during the summer months. Deciduous trees provide summer shade that helps to filter some sunlight from reaching the surface below their canopies. When trees shade buildings, this can reduce summer demand for air conditioning, which in many towns and cities is powered by greenhouse-gas-emitting fossil fuels, such as natural gas or coal. Shade around air-conditioning units can also reduce energy use by partially pre-cooling air before it enters the building. During winter months, deciduous trees provide a spectacular display of autumn colours before they shed their leaves and allow sunlight to penetrate through the canopy, allowing buildings to benefit from the natural warmth of the winter sun.

Beyond their climate change mitigation role, trees also reduce pollution, slow down the water cycle and are important wildlife habitat.

2 TREE PLANTING GUIDANCE

2.1 SITE ASSESSMENT

All trees require fundamental environmental resources. Many sites considered for tree planting are unable to provide these resources, which can contribute to eventual tree decline and failure.

There are many factors to be considered when planting, particularly in the urban environment, therefore a process is necessary to methodically assess the many variables that will be encountered. This stage of planning is essential as these factors impact on soil water retention and movement, drainage, nutrient availability, the severity of soil compaction and root development. Tree roots require very specific conditions in order to thrive and support the tree both structurally and physiologically. Perhaps the most important factor is to ensure that the soil is not overly compacted which can severely inhibit the natural ingress of air allowing gaseous exchange to occur.

Natural factors to be assessed and considered can include:

- Heat and exposure - Increased temperature and sun scorch
- Low temperature, chilling and frost
- Drought
- Mineral deficiency
- Water logging
- Competition for light, water and nutrients
- Acid pH of soil and water
- Exposure to high winds and turbulence
- Soil compaction

Man-made factors to consider can include:

- Above ground factors - Proximity to buildings, utilities, distances to adjacent trees, visibility splays and distance back from kerb edge are significant factors that will determine the appropriate tree species for the location.
- Surrounding surfacing - Roads, pavement, car parking, driveways, new sub division/development site (usually a highly modified environment), berms, verges. The interaction of pavements and berms/verges is a common issue for tree root development.
- Underground factors – Utilities and services will require investigation to establish suitable placement of tree planting locations, or the services should be located away from planned tree planting locations in all new sub-

divisions. Development of the rooting environment will need to ascertain whether any utilities are potentially affected by the proposed tree planting. Mitigation and protection may be required, however, incorporation of services through tree pits is widely accepted where appropriate.

The existing soil should always be considered for use in the tree pit, though it may require soil improvements and/or decompaction, this will vary to individual site requirements and it is recommended that discussions take place with a professional arborist to establish a suitable outcome. The top soil is often removed as part of development. The underlying soil that's left should not normally be considered suitable for tree growth.

2.2 TREE SPECIES SELECTION

When choosing the species of tree to plant, it is recommended that guidance is sought from a suitably qualified professional arborist experienced in the local climatic conditions. Although it is desirable to plant large trees in the urban environment due to their eventual visual benefits to the streetscape, it is not always practical as a result of man-made restrictions such as overhead services and proximity to buildings and highways.

Therefore careful consideration needs to be taken before deciding on the eventual species of tree to be planted.

There are many variables to be considered when choosing a species for any particular site. These variables relate to both the trees to be planted and the conditions in which they are to grow. Design demands are often paramount, but cannot be considered in isolation from all the other factors involved in suitable species selection. All potential impacts on the likely success and longevity of any new planting should be considered.

Nursery catalogues are a useful source of information regarding a species or cultivar to be used. However, catalogues are primarily designed to sell trees and the information contained in them is often partial and incomplete, there are many publications available describing tree species and their characteristics. Local experience and knowledge of young tree performance is often as valuable, and there are occasions when specialist advice is needed.

Trees are adaptive and respond to the local environment in which they are growing, often producing modifications of form which do not match the nursery catalogue description. Site constraints are likely to affect the eventual form, development, speed of growth and eventual longevity of the young tree.

It is imperative that before any decision is made regarding species choice for planting within any QLDC reserve, an early consultation process is initiated with QLDC and the final decision on species choice is agreed with QLDC.

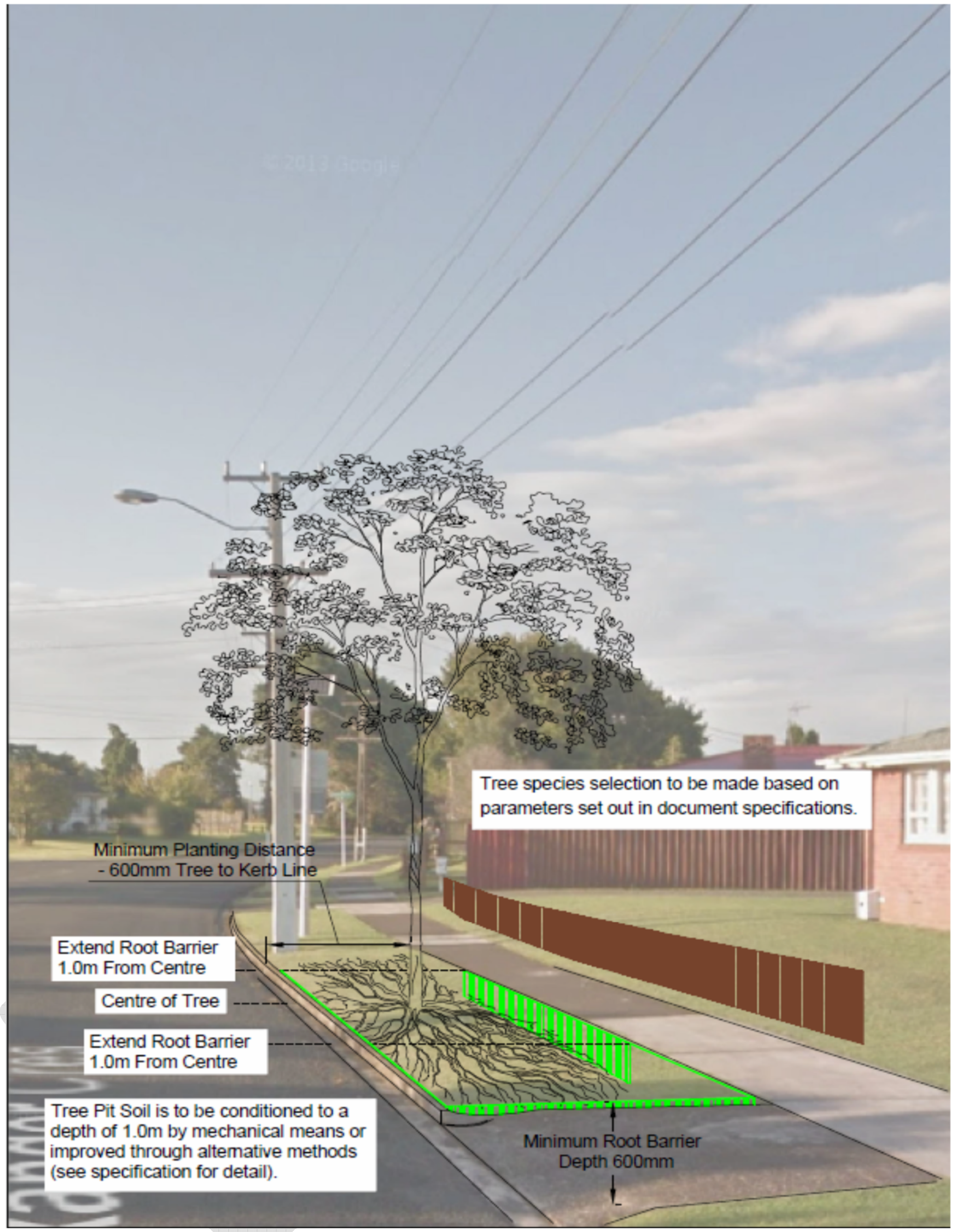
2.3 THE PARAMETERS FOR NEW STREET TREE PLANTING

The following parameters are set out to provide a guide to aid the correct selection of species for the location.

In all locations the following must be adhered to,

- No tree shall be planted closer than 600mm from the inside edge of the road kerb.
- No tree shall be planted to obscure visibility splays.
- No square tree pit opening shall be less than 1200x1200mm and when suitable no less than 1500x1500mm.
- Appropriate, vertically ribbed root barriers or root deflection systems shall be installed and be no less than 600mm deep. In a berm/verge situation the root barrier shall be installed at linear meter either side of the tree centre, longitudinally adjacent the footpath and road kerb. When a square tree pit opening is created the root barriers or deflection system shall be installed at the outer edge of the tree pit.
- Where practicable, the rooting environment shall be manipulated to provide no less than 8 cubic meters of good usable and uncompacted growing medium to encourage the tree to establish and develop to its full potential (Note: final tree pit sizes to be negotiated with QLDC dependant on site constraints and surrounding soil type). Where achievable the soil volume provision shall be greater than 8 cubic meters (advice from a suitably qualified professional arborist should be sought in the relevant amount of soil volume per tree species and the combination of trees per pit).
- In situations where established adjacent trees are already in situ, it is essential that no root damage occurs to any existing trees during planting and the ultimate dimensions of both trees should be considered.
- The distance to potential obstructions are required to be measured or calculated at the planning stage. Such restrictions can include overhead services, adjacent buildings, highways, road signage, lighting columns, power lines and street furniture.
- When new or renewal footpath construction is being undertaken the pavement layout should maximise the space available for the rooting environment of the tree. Flexible pavement options shall be incorporated to protect pavement deflection.
- Once the tree list has been selected for the planting location no other species list shall be used. As new varieties and cultivars are made available that are suitable to each of the species lists they will be populated into the appropriate list.

New street trees shall not be planted where the projected mature canopy spread is within 5 meters of any street light or overhead services.



Example of berm/verge tree selection and protection (Image created by Arborlab)

2.4 TREE STOCK SELECTION

Tree production is the first link in establishing healthy and sustainable street tree planting. Its importance is obvious, and planting projects have often failed through using poor quality trees. Healthy landscape trees are derived from high quality nursery stock. Ensuring that high quality trees are supplied for planting is essential to the successful long term sustainability of any street tree planting programme and an understanding of nursery production systems is therefore critical to enable differentiation between nursery trees of a high or low quality.

If plant quality is sacrificed for superficial looks, stock is sometimes forced to reach a saleable size in the shortest possible time, and while it might be large, it is not necessarily hardy or physiologically ready for planting.

Tree longevity in the landscape begins not at the planting site but at the nursery. The selection of physiologically healthy, mechanically sound and resilient trees is fundamental. Poor production practices on the nursery can cause problems years or even decades after the tree has been growing in the landscape.

The production of young trees is a specialized and complex process, and expert advice is needed when evaluating nursery production systems and good practice. The choice of production system is the responsibility of the specifier and is inextricably linked to the individual site constraints.

2.5 TREE PIT FORMATION

2.5.1 Planting in 100% Engineered Environment – Footpaths, Car Parks, New Roads, Road Upgrades & Combined Tree Storm Water Applications

Based upon a basic conflict of principals between the compaction required for engineering and uncompacted soil environment requirements for root development, provision in areas where the compaction levels are likely to be high will require additional mitigation for the successful integration of trees into the engineered environment.

This Guideline sets a desired minimum requirement, where practicable, of 8m3 of good usable growing medium per tree in these environments (final tree pit sizes to be negotiated with QLDC dependant on site constraints and surrounding soil type).

Combining these factors is achievable through various methods. All of these methods have a higher installation cost associated with them when compared with traditional methods of planting, however it is essential to integrate both the trees requirements and those of the engineered environment to provide a long term benefit. If the rooting environment cannot be manipulated to provide a positive and sustainable rooting environment then no planting should be undertaken.

It is essential that all underground utilities and their locations are confirmed as they may need to be relocated during the installation phase of the tree planting (see drawing 1 below). Research shows that when an adequate soil volume is provided and the infrastructure is correctly built the root development will have very limited interactions with underground services.

Integration of soil into the engineered environment can currently be achieved via three main options, all have been tested worldwide:

- Soil cells
- Vault or rafting
- Structural Soils

Soil cells are the most widely available and a simple way of integration. There are several manufacturers with similar products.

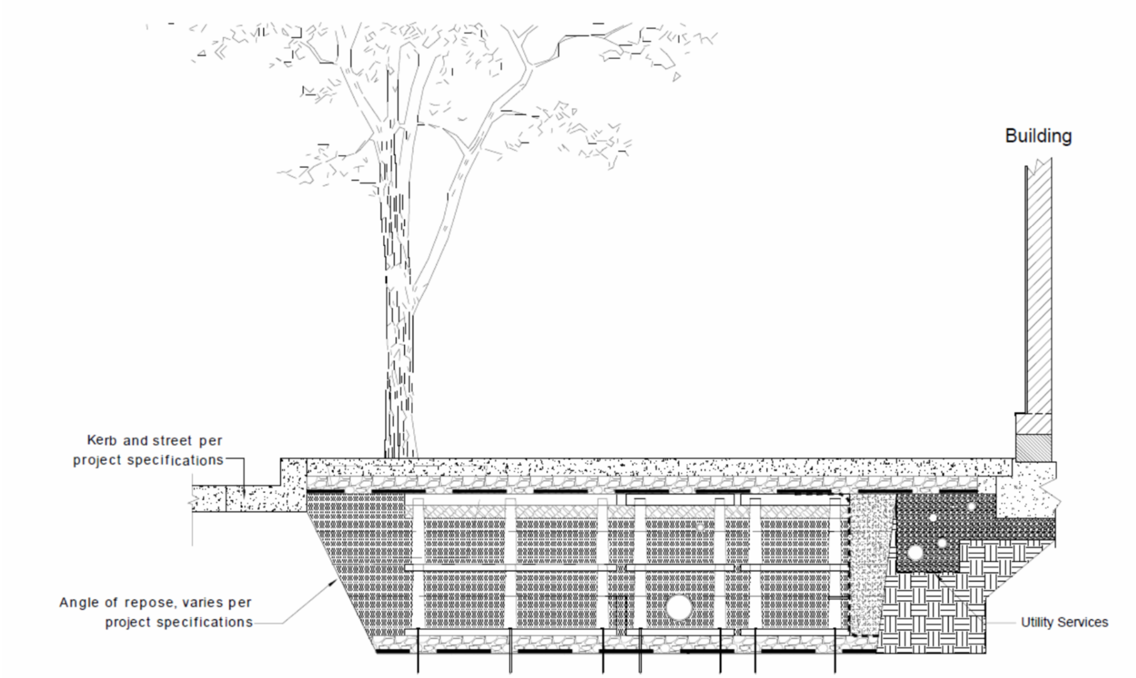
Vaults and rafts are widely used throughout North America (particularly Canada). They require pre cast or cast concrete, as a result they are normally purpose built due to the varying on site factors.

Structural soils blend an aggregate with a clay based soil that allows the blend to have a surface placed over it. More suited for pavements or foot traffic, this system is not suitable for heavier applications such as car parking.

The proposed soil to be integrated into either the soil cells or raft/vault system will require confirmation.

Combined tree and storm water applications are now often an additional benefit when planting trees in engineered tree pits. The emphasis of the soil being uncompacted allows the ingress of water into the proposed solution/pit for temporary holding.

The trees will utilise water runoff from the surrounding area, the soil will release the water at a slower rate post rainfall event and also potentially provide water cleansing affects. The method of integration of water into the engineered tree pit is required to be illustrated, clearly showing how water enters, exits and integrates to the storm water network. Dependant on the soil volume, soil type and potential expected outcomes for the project, the total storm water potential from the proposed engineered tree pit shall be estimated and form part of the information provided to QLDC.



Drawing 1 - Example of engineered tree pit cross section (Image created by Arborlab, amended from DeepRoot drawing)

Integration of trees and infrastructure.

Example of soil cells being laid out into tree pit areas. Image courtesy of Paul Malcolm, MetroGreen.

Tree pits and car parking combined

Use of vertical / slot drainage to combine trees and storm water.

Good species selection in line with the proximity of the building. As the trees develop, some pruning required, for buildings and power line for proposed tram network.

2.5.2 Planting in Partially Engineered Environment – Berms/Verges with Areas of Soft Landscape, Central Median Areas of Roads

Many roads and streets throughout the Queenstown Lakes District have footpaths that have a concrete path, flanked with grass. It is common place for trees to be planted in these areas. The total width of the berm/verge including both areas of concrete and grass needs to be considered when proposals of new street planting is taken into account. There are various layouts of these across Queenstown with differing dimensions of pavement to berm ratios. Prevention of root damage to the surrounding footpath is required. This can be achieved in various ways such as position of planting, root barriers, soil amelioration and flexible pavement options.

The underlying soil type and geology is a critical factor. Soil in situ is likely to need some degree of amelioration. In areas the soil amelioration will require more detailed information. If the soil is not improved or at the very least broken up the roots are unable to penetrate. This leads to surface rooting causing issues with the surrounding infrastructure.

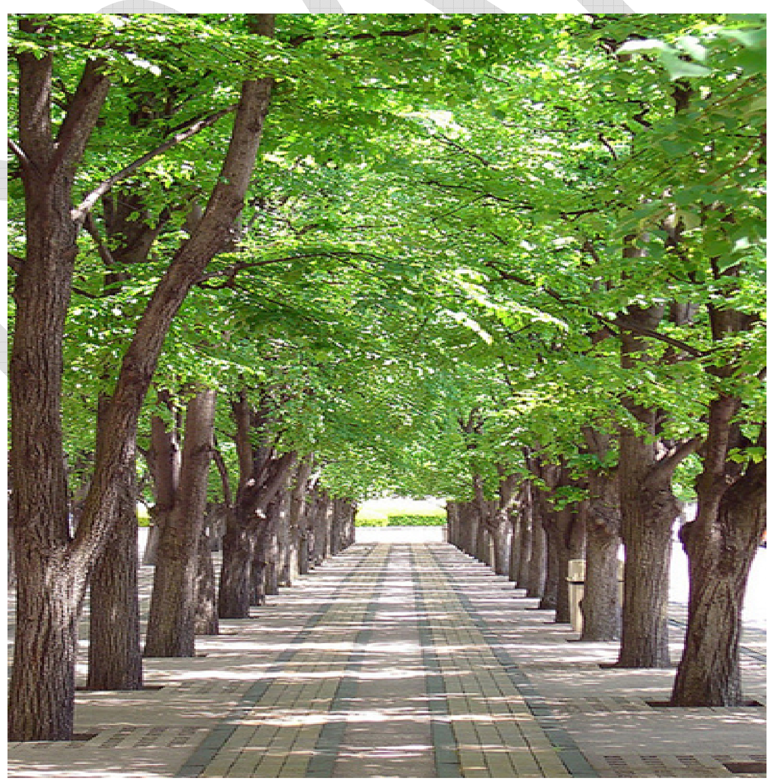
Root barriers will require 1 linear meter either side of the tree stem adjacent all footpaths, road kerbs and other likely areas potentially affected by the rooting matter within 3m of the stem of the tree. The root barriers shall have suitable vertical ribs, this will direct the roots down and prevent girdling that can have long term detrimental effects to the trees development to a depth of 600mm

Consideration to directing the rooting material of the tree under the pavement will provide additional rooting environment and therefore aid the trees development. Pile and beam footpath constructions or the use of soil cells under the pavement, along with the other amelioration techniques illustrated provide integration with minimised defects in the future (see drawing 2 & 3 below).

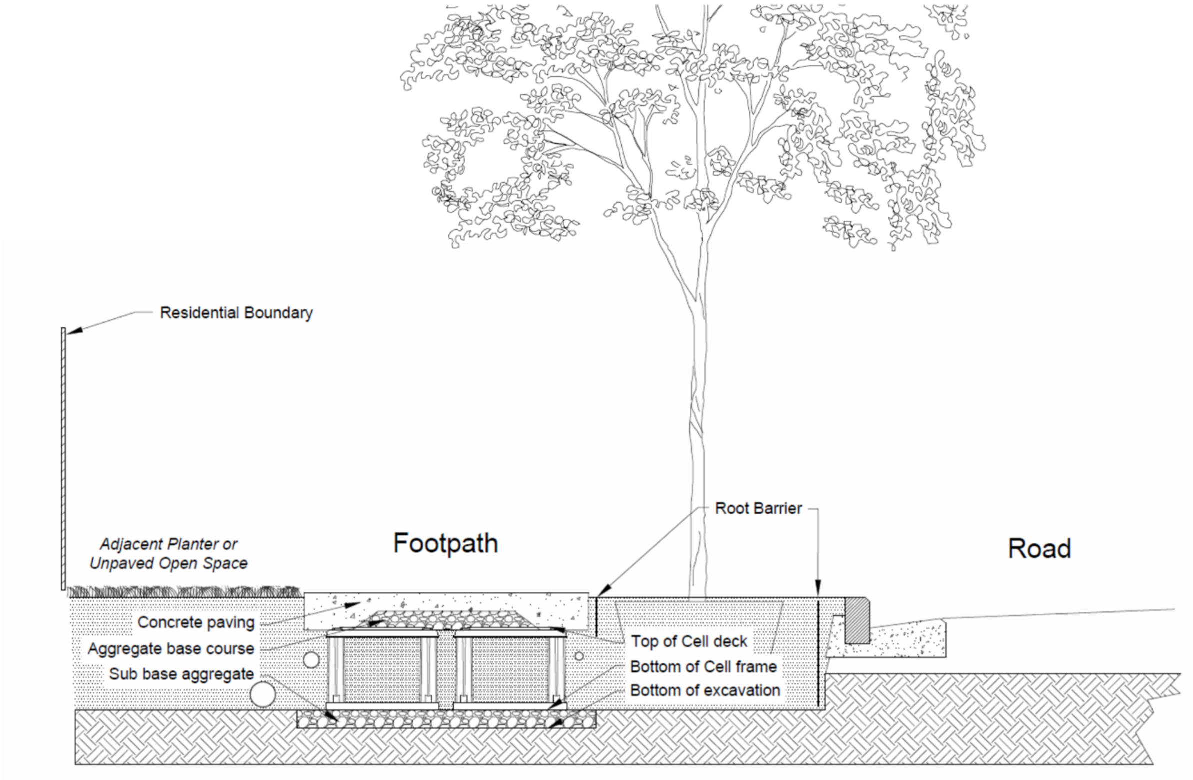
Flexible pavement options that allow movement of the pavement can also be considered e.g. http://www.tripstop.net/

Partially engineered check list

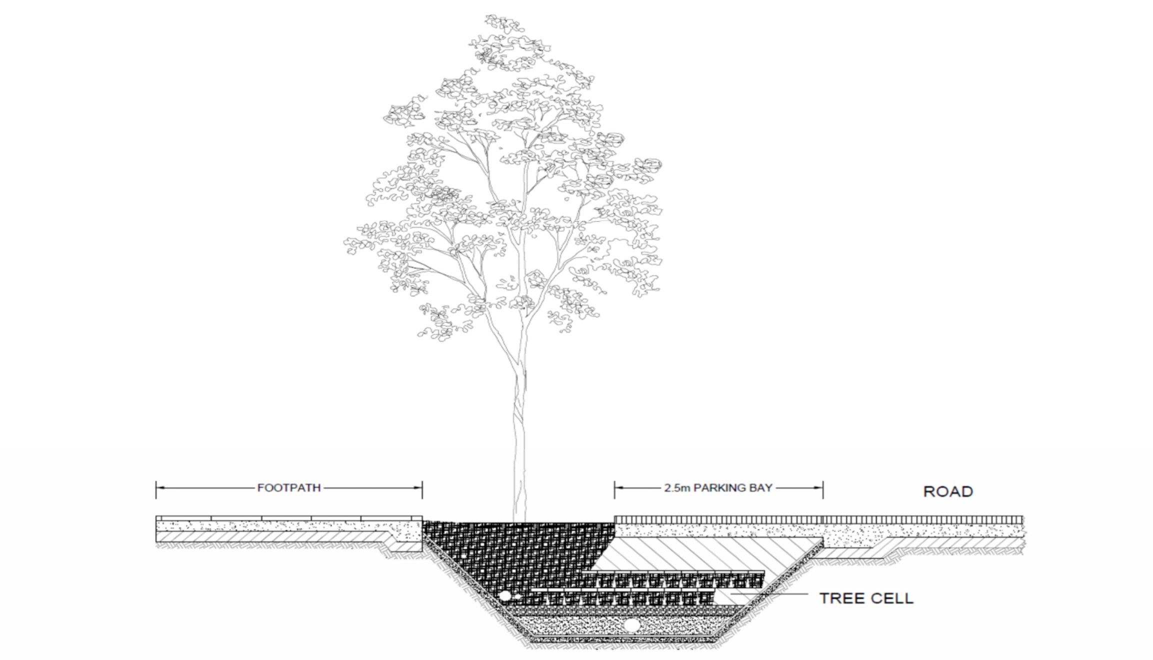
> Soil type ascertained
> Degree of soil amelioration required and proposed
> Root barriers and pavement construction methods proposed to integrate trees



Urban trees successfully growing within an engineered tree pit environment



Drawing 2 - Partially engineered example – Directing roots underneath pavements (Image created by Arborlab, amended from DeepRoot drawing)



Drawing 3 - Partially engineered example – Directing roots underneath parking bay (Image created by Arborlab, amended from MetroGreen drawing)

2.5.3 Planting in Areas of Soft Landscape Greater Than 3m Away From Kerbs, Pavements & Other Engineered Obstructions

In areas of soft landscape away from infrastructure the emphasis will require a suitable species to fit the location. A proposal of the planting specification and soil amelioration will need to be submitted to QLDC for approval.

Soft landscape check list

> Soil type ascertained
> Degree of soil amelioration required and proposed

2.6 PLANTING METHODOLOGY

A planting methodology shall be presented to QLDC for assessment which shall include such details as:

> Planting pit specification
> Soil type (existing and replacement soil)
> Irrigation specification details (if irrigation is to be installed prior to the formation of access driveways, this shall be installed at a depth of no less than 75cm to avoid damage)
> Tree support (normally 3 stakes supporting the new tree at a point no higher than 1/3rd of the trees height)
> Ground treatment around the base of the tree e.g. mulch, hard surfacing, grill

Only when QLDC is satisfied with the proposed planting methodology shall planting works proceed.

2.7 STREET TREE MAINTENANCE AND ASSOCIATED REQUIREMENTS

> Post-planting maintenance and management is important to ensure the establishment and sustainability of all new street tree planting. A full tree management programme with budgetary provision should be in place for all planting schemes. This management programme should be in place for a minimum period of three years (this maintenance period is usually stipulated as a condition of consent).
> The timing and frequency of any irrigation should take into account the prevailing weather conditions, soil moisture release characteristics, and the response of the tree species to water deficits. Regular monitoring must be undertaken to assess the effectiveness of any irrigation.
> *NOTE Nursery trees produced in ideal conditions can take time to adapt to localized planting conditions.*
> Any given volume of soil has the capacity to hold a given volume of water. The water holding capacity of the soil should be established and taken into account when assessing irrigation needs.
> In addition to water-holding capacity, the amount of water available to the tree should be established. Assessing all newly planted trees is impractical, but sample assessments should be made
> The frequency of irrigation is more important than the volume of water given at any one time. This should be accounted for in irrigation plans. Irrigation plans should also take into account the assessments made at the original site assessment and the subsequent species choice made.
> Formative pruning should be carried out as required throughout the early years of a tree's life in the landscape. Some of the nursery-prepared branching structure is temporary and formative pruning should continue until a permanent structurally sound scaffold system of branches typical of the species and appropriate to the site circumstances is produced.
> A formal assessment of young tree health and development should be carried out every six months. This assessment should include foliar appearance, leaf size and density, extension growth and incremental girth development. Continual assessment on an ad hoc basis should be carried out throughout the year.
> All stakes and ties should be checked at least every three months to ensure that the root system remains stable and firm in the ground, and that ties are still effective and not causing any damage to the tree. Any stakes and ties that are found to be not fit for purpose should be adjusted or replaced.
> All stakes and ties should be removed as soon as the developing root system is strong enough to support the tree.
> *NOTE Three full growing seasons are usually long enough for this to occur.*
> Where underground guying systems are used, the wires or straps should be cut as soon as the tree is self-supporting.
> The area around the base of the tree should be maintained in a weed-free condition. The use of herbicides should be avoided and wherever possible aged mulch should be used.

> All mulches should be replenished and hand-weeded as necessary and at least once annually. The mulched area should be enlarged, if practicable, as the tree develops.
> All grilles, grids, guards and other protective furniture should be checked at least annually. Such furniture should be removed as soon as it is no longer necessary to protect the tree, or where there is a risk of physical damage to the tree.
> The soil around newly planted trees should be regularly inspected for soil capping or compaction. Remedial action should be taken as necessary.
> *NOTE Inspections can be visual, but where conditions are extreme, on-site testing and amelioration might be necessary. This can include manually loosening the pit surface with hand tools or more extensive action using an air spade or equivalent. Mulching can prevent further compaction.*
> All trees should be checked on a regular basis for mammal, human and other external damage. Remedial action, where this is possible, should be implemented as soon as practicable following discovery.
> All trees should be checked on a regular basis for pests and diseases. Remedial action should be taken promptly on discovery, where necessary.
> Unless specific nutritional deficiencies are identified, no fertilizer should be applied to newly planted trees.

NOTE If visual inspection reveals symptoms of nutrient deficiency such as leaf scorching, pale foliage or necrotic spots, then further investigation will be necessary with remedial action taken. Remedial action may, in addition to fertilizer application, include pH testing, assessment of organic content and levels of compaction.

> Any tree that fails during the maintenance period shall be replaced with a new tree of the same species and specification.
> The details of all new street tree planting shall be recorded in such a way as this information may be transferred to Queenstown Lakes District Councils GIS software, the information required shall include:
- Planting locations
- Tree species planted and size
- Photographs of the individual trees at the end of the three year maintenance period
- All maintenance works undertaken during the three year maintenance period

2.8 WORLDWIDE CASE STUDIES

http://www.deeproot.com/silvapdfs/caseStudies/LidlCarPark.pdf

http://www.youtube.com/watch?v=8jcLtlbRuRs

http://www.youtube.com/watch?v=mLffDaa2Pak

http://www.youtube.com/watch?v=TlJDJXqwNyA

http://www.deeproot.com/silvapdfs/caseStudies/Charlotte%20Suspended%20Pavement.pdf

http://water.epa.gov/polwaste/green/upload/stormwater2streettrees.pdf

http://www.vtfpr.org/urban/documents/Main%20Streets%20to%20Green%20Streets.pdf

http://urbanforestry.frec.vt.edu/stormwater/Resources/TreesAndStructuralSoilsManual.pdf

http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf

http://www.fao.org/uploads/media/Trees_for_parking_lots_and_paved_areas.pdf

2.9 ENGINEERED TREE PIT EXAMPLES

Soil cells
www.deeproot.com
www.metrogreen.co.nz

Vaults & rafts
http://www1.toronto.ca/city_of_toronto/parks_forestry__recreation/urban_forestry/files/pdf/TreePlantingSolutions_BestPracticesManual.pdf - Section 3.1

Structural Soils
http://www.hort.cornell.edu/uhi/outreach/pdfs/custructuralsoilwebpdf.pdf

2.10 INTERNET BASED INFORMATION

http://thefield.asla.org/2014/04/24/planting-trees-in-suspended-pavement/

http://thefield.asla.org/2014/05/06/rethinking-runoff-shrubs-stormwater/#more-2576

http://thefield.asla.org/2014/01/30/structural-soil-part-1/#more-2176

http://thefield.asla.org/2014/02/19/structural-soil-part-2/#more-2185

http://thefield.asla.org/2013/09/10/soak-it-up-design-competition/#more-1863

http://edmonstonmd.gov/files/Greening_DecaturSt_inclAddendum_v1.0.pdf

http://www.landscapeirrigation.com/ME2/Audiences/dirmod.asp?sid=&nm=&type=Publishing&mod=Publications%3A%3AArticle&mid=8F3A7027421841978F18BE895F87F791&tier=4&id=38FD064F957F4EFAA4BE57F5E7838420&AudID=AC361F5928F54864BFCBBD93E5B8624D

CONTENTS

QUEENSTOWN LAKES DISTRICT COUNCIL

1 INTRODUCTION

The Queenstown Lakes District Council administers over 180km of cycle trails and tracks. These trails and tracks are a valuable asset to the Lakes District and the purpose of this standard is to ensure greater consistency and quality in the development of all new trails. For simplicity, trails (as called in Wakatipu) and tracks (as called in Wanaka) will collectively be referred to as trails by this document.

The development of a cycle trail design standard is being driven by the increasing development of cycle trails in the Queenstown Lakes District and in particular trails developed as part of private land development projects as well as those created by volunteer organisations.

The Council has recently taken over ownership of numerous sections of cycle trail in both Wanaka and Queenstown and many of these have been built with significant design and construction defects which results in the ratepayer funding realignment and repair works. Council is looking to minimise this cost and ensure better quality trails are developed in the future to be fit for purpose.

This standard is intended to guide cycle trail designers and developers to achieve consistently high standards of cycle trail best suited to meet long term community needs (network connections and latent demand) and minimise ongoing maintenance costs to Council, as the trail owner.

The guide has been developed to closely mirror the New Zealand Cycle Trail (NZCT) "Cycle Trail Design Guide", 2010 with minor changes to take into account changes in design and construction that have arisen during the course of the National Cycle Trail projects. The changes are in maximum gradients, surface finish and additional detail on trail geometry that was not dealt with by this previous standard.

The NZCT guide implemented and widely publicised the 1-6 trail grading system used by the mountain biking community. In terms of trails developed within the QLDC, these will be graded 1-3 with tracks graded 4-6 being purpose built mountain bike tracks and not cycle trails. Development of mountain bike tracks is outside of the scope of this standard.

Additionally, the Department of Conservation (DOC) also have track design guides. These mainly relate to walking track construction and are available on the DOC website. DOC has adopted the NZCT grading system of rating trails as 1-6.

2 OVERARCHING GOAL OF THIS DESIGN STANDARD AND CONSTRUCTION SPECIFICATION

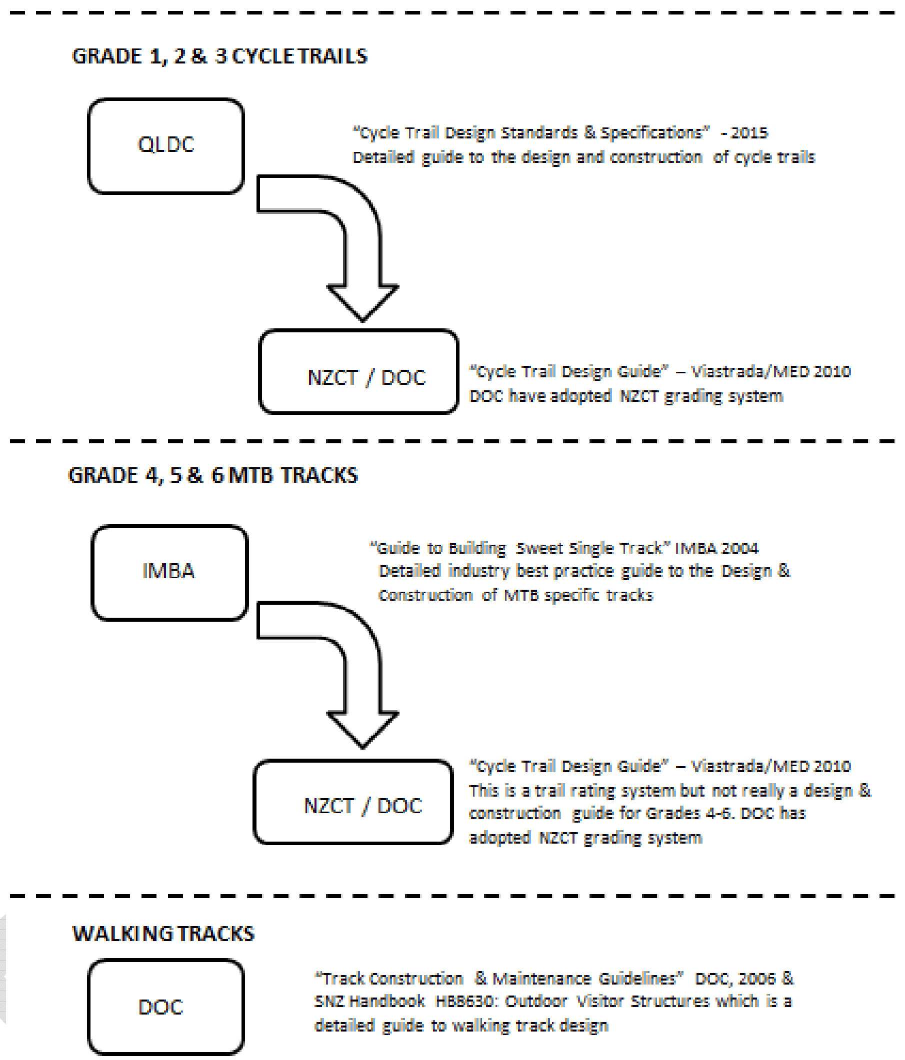
To guide land developers and trail designers to achieve a high quality cycle trail specifically designed and built to cater to the needs of the community(s) it connects and serves and that minimises future maintenance costs to Council.

3 SCOPE OF THIS GUIDE

The design and construction of Grade 1-3 cycle trails. The design and construction of 'mountain bike' tracks (Grades 4-6) is very well covered by the IMBA "Guide to Building Sweet Singletrack" 2004 design guide (Refer references section). DOC's track design guides are best suited for the design of walking tracks only.

The design and construction of trails suited to horses has not been considered as part of this guide.

4 OVERVIEW OF TRAIL AND TRACK DESIGN STANDARDS



5 TRAIL GRADING & USER GROUPS

The New Zealand Cycle Trail Project (NZCT) commissioned a design guide in 2010 as part of the nationwide cycle trail development project. Completed by Viastrada this guide is the best starting point in the identification of a cycle trail grading system. (See Cycle Trail Design Guide 2010 – Ministry for Economic Development)*1*.

Over the intervening 5 years we have refined this system and present the refined grading technical specifications as follows:

EASIEST

I. Grade 1 – Easiest; gentle grades up to 2 degrees (1: 28) with short sections <100m up to 3 degrees, wide (2.5m+) and smooth trail ideal for all user groups. No fall hazards. These are ideal for connecting communities and where families and novice cyclists are likely to be present.

EASY

II. Grade 2 – Easy; Some gentle hills up to a maximum of 4 degrees (1: 14), wide (2-2.5m) with some short (<50m) narrow sections of minimum width 1.5m, smooth surface with critical fall hazards within 2m of track edge fully protected. These are ideal for connecting communities and where families and novice cyclists are likely to be present but where Grade 1 gradients cannot be achieved due to terrain constraints.

INTERMEDIATE

III. Grade 3 – Intermediate; gradients 0-4 degrees typically, more regular hills acceptable up to a maximum 6 degrees (1: 10) where unavoidable terrain, width 1.2-1.5m and extended narrower sections of minimum width 1.2m. Critical fall hazards at track edge protected only. This is essentially an easy mountain bike track.

The majority of trails within the QLDC network are classed as Grade 1-2 with a few being Grade 3. Table 1 gives a breakdown of the various grades for existing local trails.

In order to provide the greatest accessibility to any new trails, every trail should be designed to meet Grade 1 or 2. Grade 3 should only be considered where the users are predominantly not commuters, families or novice cyclists and the trail is not forming part of a connective network to link communities or part thereof. In other words, not a critical linkage to the cycling network.

6 COMPARISON WITH NZCT/DOC GRADING SYSTEM

DOC has adopted the now widely used Kennet Brothers/NZCT trail grading system using numbers 1 to 6 to classify trails according to trail difficulty. Below is a brief overview of the difference to this standard:

- NZCT Grade 1 – Same except grades not allowed to be steep if ridden in one direction only.
- NZCT Grade 2 – Allows maximum grade of 6 degrees (leading developers to use this as a default grade), allows surface roughness like roots and rocks (not suited to rider group), topcourse aggregate of 30mm particle size (too course for good surface finish – Max 20mm)
- NZCT Grade 3 – Allows grades up to 5 degrees (too steep, likely to cause rutting) and maximum grades of 9 degrees (too steep for most riders, ruts badly)

In summary, this new standard responds to the desire of many trail developers to seek the shortest and steepest line for their trails. Setting lower grade limits and including trail geometry and cross fall details in the design specification is aimed at reducing the most common trail defects noted in this region.

1 http://www.nzcycletrail.com/about/resources

7 DETAILED TRAIL GRADE SPECIFICATIONS

The minimum specifications for each trail grade can be expanded as follows:

Grade 1

- A minimum width of 2.5m allowing for side by side riding. This makes passing and overtaking easy, and provides sufficient width for novice riders to feel secure. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons. Width also caters for 4wd vehicle access for maintenance purposes.
- Maximum prolonged gradient of 2 degrees (1:28). Maximum gradient of 4 degrees (1: 14)
- Maximum out-slope cross fall of 3% for straight sections of track.
- Corners shall have a minimum inner radius of 6.0m and in-slope gradient or cross-fall of 6-8% except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 2.5m
- Minimum structure width of 2.0m clear. Clear means between the closest parts of the barriers.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted, well bound smooth riding surface with suitable camber to provide a pleasurable and easy riding experience. Riders should never feel they are going to slide off the trail. Minimum compacted aggregate depth of 75mm
- All water courses to be culverted or bridged
- All areas of fall hazard (exposure) shall be protected with barriers that meet the building code.
- No stiles are to be used. All fences are to be crossed using cattle stops/bollards
- Sight lines – a minimum of 15m clear sight distance is to be achieved around all corners

Grade 2

- A minimum width of 2.0m but generally 2.5m wide allowing for side by side riding. This makes passing and overtaking easy, and provides sufficient width for novice riders to feel secure. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons. Width also caters for 4wd vehicle access for maintenance purposes.
- Maximum prolonged gradient of 4 degrees (1:14) but where length >100m it must be broken with flat recovery sections 10m long minimum at 50-75m spacing's. Maximum gradient of 6 degrees (1: 10) for no more than 30m without a flatter recovery section of equal or greater length
- Maximum out-slope cross fall of 3% for straight sections of track.
- Corners shall have a minimum inner radius of 6.0m and in-slope gradient or cross-fall of minimum 6-8% (to be suited to the trail geometry to ensure slip free riding at design speed) except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 2.0m
- Minimum structure width of 2.0m clear. Clear means between the closest parts of the barriers.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted, well bound smooth riding surface with suitable camber to provide a pleasurable and easy riding experience. Riders should never feel they are going to slide off the trail. Minimum compacted aggregate depth of 75mm

- All water courses to be culverted or bridged
- Areas of significant fall hazard shall be protected with barriers that meet the building code. Areas of exposure where there is not a significant hazard may be protected with fencing, bunding, vegetation or signage
- No stiles are to be used. All fences are to be crossed using cattle stops/bollards
- A minimum of 10m clear sight distance is to be achieved around corners, or additional warning/speed calming measures may be required to avoid user conflict.

Grade 3

- A minimum width of 1.2m but generally 1.5m wide allowing for comfortable single file riding only. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons over short (50m) sections. Width caters for quad bike access for maintenance purposes.
- Maximum prolonged gradient of 6 degrees (1: 10) for sections not longer than 100m with flat sections of minimum 25m length between. Maximum gradient of 9 degrees (1: 6) for no more than 30m without a flat recovery section of equal or greater length
- Maximum out-slope cross fall of 3-6% for straight sections of track.
- Corners shall have a minimum inner radius of 3m and in-slope gradient or cross-fall of minimum 8-15% (to be suited to the corner, speed and trail geometry) except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 1.2m
- Minimum structure width of 1.2m clear. Clear means between the closest parts of the barriers to ensure quad bike access.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted riding surface of either insitu gravels or imported gravel to provide an all-weather surface. Minimum depths to suit ground conditions
- Trail cross fall to provide an enjoyable riding experience for intermediate riders. Riders should never feel they are going to slide off the trail due to incorrect cross slope.
- Water courses may be crossed with fords or be culverted or bridged if required. Any areas of soft or boggy ground shall be made all weather to prevent mud and damage to the trail surface
- Areas of significant fall hazard shall be protected with barriers that meet the building code. Areas of exposure within 1m of the trail edge where there is not a significant fall hazard may be protected with fencing, bunding, vegetation or signage
- Stiles may be used but preference should be given to using Cattle stops for convenience and maintenance purposes. Where a stile is used a gate is required adjoining for maintenance use.
- A minimum of 5m clear sight distance is to be achieved around corners, or additional speed calming measures (trail alignment, sag, etc.) are required to avoid user conflict.

8 CYCLE TRAIL DESIGN CONSIDERATIONS

8.1 STEP 1: IDENTIFY THE USER GROUP & REQUIRED TRAIL GRADE

If the proposed trail is connecting communities and will form part of a larger network, then the minimum standard will be Grade 2 (Always design to achieve the best grade where possible).

The user groups for Grades 1 and 2 are as follows:

a) Families including small children

b) Novice riders who either have never ridden or ride infrequently

c) Cycle tourers and commuters*

d) Mountain bike riders

e) Accessibility users

Groups (a) and (b) require a safe enjoyable cycling experience that is accessible with limited/no cycling skill. The trail must be designed with the needs of the most discerning user group in mind. For the above this would be families and novice riders. Cycle tourers, commuters and mountain bikers have a higher degree of skill and experience making them able to handle less well formed trails2.

Having identified the user group, the designer should aim to achieve the flattest grade possible to meet the highest Grading. This ensures the maximum utility and accessibility to the community irrespective of other aspects of the design.

8.2 STEP 2: DESIGN ALIGNMENT

The designer needs to consider how to fit the trail into the land to minimise gradients, minimise hairpins, control storm runoff and drainage, climb hills, design and integrate structures and achieve the required width and finish that creates or results in a desire line.

8.3 DESIRE LINE

The designer needs to understand where the trail users are coming from (How do they access the trail) and going to (where will they leave the trail network) as well as how will the riders respond to the trail alignment in order to understand the desire line. Desire line refers to the preferred alignment for trail users and manifests itself in riders cutting corners or short cutting sections of trail they consider 'undesirable' when it has not been achieved.

An example of an error in desire line is making curves across a flat open section of terrain when a straighter piece of trail would suffice. Riders are likely to cut corners in this situation. Each section of trail should be considered from the rider's perspective to ensure that desire line is achieved as much as possible.

Ultimately desire line can be hard to predict. A designer needs to consider this especially in open country where riders can see the destination.

8.4 HAIR PINS OR SWITCHBACKS

It is often necessary to use hair pins (corners of ~180 degrees) to negotiate steep terrain. The use of hairpins needs very careful consideration to avoid rutting, erosion damage and safety issues for novice or inexperienced riders.

Hairpins should be graded such that the longitudinal grade through the corner is no more than 2 degrees with the cross-fall sloped to the inside to match the speed of travel such that the corner at the design speed feels safe and secure without sideways slipping.

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2 Commuter tracks require slightly different design considerations outside of the scope of this guide

Hairpin radius should be as wide a possible within the terrain constraints but not less than the minimum specified in design drawing R4030_E3_3 attached in Appendix 2.

The approach to a hairpin should provide enough sight distance for riders to slow down prior to the corner without locking their brakes and skidding. This requires that the approach gradient is quite flat (0-2 degrees) and the surface is well compacted. It is unacceptable to have a constant 4 degree grade into and through a hairpin as the approach will rut causing operational and maintenance issues. Designers may use a rolling-up grade dip (sag) to slow riders naturally prior to a corner. This reduces the likelihood of skidding and loss of control through the corner.

8.5 CURVES, HILLS AND CROSS-FALL

In hilly terrain, curves should follow the terrain. Additionally the terrain should be used to assist drainage with low points in gullies and higher points near ridges. This promotes drainage towards gullies.

The trail surface cross-fall should reflect the terrain and trail geometry. Out sloped corners (very dangerous) are to be avoided at all costs. When a corner is properly designed and built a rider feels well connected to the trail through adequate cross-fall for the design speed and side friction. Refer to the typical cross sections attached for guidance. There are no set rules, but the designer must ensure that the completed trail rides without inducing side slip or fear in the target user group.

8.6 GEOTECHNICAL ASSESSMENT OF TRAILS

At the initial scoping stage it is desirable to undertake a desktop assessment of available information to pin point any possible areas of instability where a trail is proposed. This allows appropriate planning and funding to be included at the design stage. Additionally the designer should walk the trail alignment to confirm no obvious areas of instability

During the design stage known areas of instability should be addressed by specific design or alignments. If avoidable, this is the preferred option. However, as most trails are built on public land adjoining water ways, often the only option is to build over these areas.

As part of the following approval process, areas of instability should be clearly identified on the design plans together with site assessment and solutions. Council wish to avoid ongoing maintenance issues relating to instability in cycle trails and it is hoped such planning will reduce the incidence.

8.7 DESIGN APPROVAL BY QLDC

Prior to any works commencing on the site, the trail designer shall submit the trail design plan, long section (if available – for large projects it is often not possible or cost effective to prepare detailed terrain models), typical cross section, trail design user group and outline of how the trail caters to the user group and fits the trail network together with construction specifications to QLDC for approval prior to commencing any trail works on site.

Additionally the designer shall ensure the proposed trail is marked out on site with flagging tape at no more than 20m intervals and staked in detail for hairpins and curves to ensure the proposed alignment is able to be assessed in detail. The assessment will include a minimum of alignment and gradient checks.

QLDC shall have the opportunity to inspect the trail alignment on site with the designer. Any amendments requested by the Council shall be addressed to Council's satisfaction prior to approval of the works.

While the approval process is designed to identify errors in the design and layout of the trail, it is not possible to anticipate every issue. Further, due to terrain constraints, vegetation cover and access, it may not be possible to assess and design every section of trail in a cost effective manner. Therefore, the design approval does not in itself reduce any liability on the trail developer to achieve the standards and riding requirements detailed in earlier sections of this standard.

8.8 TRAIL CONSTRUCTION & COMPLETION

At the completion of works, the trail contractor and developer shall certify the works as complete and issue a completion certificate in the form of NZS 4404:2010 Schedules 1B & 1C. The Council shall then inspect the works to confirm the completed trail meets the needs of the user groups/community the trail serves. This shall include test riding the completed trail, measuring grades and cross falls and corner radius. The completion inspection is not solely a compliance check but a confirmation of achieving the needs of the trail user.

Where the trail is found to be deficient in terms of grades, alignment, cross fall or other defects (see defects section), the trail developer shall remedy the defect prior to Council signing the s224c certificate and/or taking over the trail asset. Alternatively the trail developer may enter into a cash bond for the value of the works in accordance with Council's bonding policy for land development works.

For trails involving structures that do not require a building consent the trail developer shall submit the following to Council:

> NZS 4404:2010 Schedule 1B (contractors completion)
>
> NZS 4404:2010 Schedule 1C certificate (Construction review)
>
> Typical design details for the structure

Where a structure requires a building consent, the trail developer shall supply Council's Parks Department a copy of the building consent documents including PS1, PS3, PS4 and Code Compliance together with design drawings and/or as-built drawings prior to sign off/acceptance of the asset. While this may be a double up on the BC process, often the design detail is not readily accessible and the purpose is to ensure the Parks Department has a complete set of documents for ongoing operation and maintenance.

Additionally all trails and structures including bridges, culverts, signs, bollards, cattle stops, fences etc. shall be accurately surveyed and an as-built plan prepared and submitted in accordance with Council's land development standards to detail all trail related assets being taken over by Council.

8.9 THE DEFECTS PERIOD

Once the works have been signed off by Council as complete, the trail developer shall be responsible for a 12 month defects period. At the completion of the defects period, Council shall be advised and a final inspection undertaken. The final inspection shall assess the trail as if it were in the new as-built state. That is the trail developer shall be required to present the trail in an as-new condition at the end of the defects period.

If the trail requires changes to alignment to avoid or remedy rutting, surface erosion or desire line errors, the trail developer shall be responsible for such modifications at their cost prior to Council taking over responsibility irrespective of whether these were noted at the time of the design approval or completion inspection as often it takes time for errors in design and construction to manifest through use of the trail.

The following parameters shall be achieved for completed trails at the end of the defects period:

> The trail shall have good flow and speed control that does not result in rutting or surface erosion from skidding
>
> Finished surface shall be interlocking at the end of the defects period and free from loose gravel.
>
> The surface of the gravel and +0.5m either side of the formation edge shall be clear of all weeds. If there are weeds within the surface gravel, this shall be considered a defect and the developer shall be liable to remedy by mechanical removal.
>
> Within all the earthworked areas adjoining the trail, all noxious weeds shall be removed
>
> All verges shall be mown/cut to a maximum 350mm height up to +0.5m off the edge of the formation
>
> Any stormwater erosion shall be stabilised with rock protection or matting
>
> Adverse cross fall shall be rectified
>
> Any silting of culverts or debris in culverts or water tables shall be cleared
>
> Full design width shall be presented
>
> Vegetation shall be clear 1.0m beyond the edge of the trail and 2.5m above the trail

9 TRAIL CONSTRUCTION SPECIFICATION – GRADE 2

Attached as Appendix 1 is the standard Construction Specification for a Grade 2 Trail. The specification outlines the standard work methodologies required to complete a cycle trail to Council standards.

Where designers are forming a Grade 1 or Grade 3 trail, the specification shall be modified in accordance with the section "Detailed Trail Grade Specifications" to take account of differing maximum gradients, curve radius, surface and so forth.

10 TRAIL CONSTRUCTION – TYPICAL CROSS SECTIONS & DETAILS

Attached as Appendix 2 are typical cross section and detail plans ref R4030_E3_1-4. These provide design detail in relation to typical cross sections in different terrain, use of curves and hairpins and other typical details used in cycle trail construction but are not intended to cover every aspect of trail construction.

11 REFERENCES

- International Mountain Bicycling Association (IMBA) "Guide to Building Sweet Single Track"
- Standards New Zealand NZS HB 8630:2004 – Tracks and Outdoor Visitor Structures
- "Cycle Trail Design Guide" 2010 Viastrada/MED, prepared for the New Zealand Cycle Trail Project
- QLDC Cycleway Maintenance Specifications c.2010
- Standards New Zealand NZS 4404:2004 – Land Development & Subdivision Engineering
- "Track Construction & Maintenance Guidelines" 2006, Department of Conservation

APPENDIX 1 – CONSTRUCTION SPECIFICATIONS

QUEENSTOWN LAKES DISTRICT COUNCIL

GRADE 2 - CYCLE TRAIL CONSTRUCTION

Technical Specification

Overarching Requirements

Trail Construction must be compliant with QLDC District Plan requirements for example Earthworks, and have the appropriate Consents, be that Building Consent or Resource Consent. It is the Developer and Project Managers responsibility to ensure that the construction is compliant in this regard.

1. TRACK CONSTRUCTION

1.1. Track Alignment

1.1.1. The track alignment is marked on site with RED/WHITE flagging tape. Markers are generally spaced at 20-50m intervals.

1.1.2. The Contractor is responsible for setting out and constructing the track following these markers.

1.1.3. If the Contractor wishes to deviate the track formation more than two meters either side of the design line, specific approval shall be obtained from the Engineer for every deviation.

1.1.4. Deviation from the design line up to two meters either side may be made to avoid living trees, archaeological features, fallen logs, rocks or adverse ground conditions. Approval from the Engineer is not required in such instance.

1.1.5. The Contractor shall be responsible for ensuring the maximum track gradient requirements in this specification are not exceeded on the track. If the Contractor believes this cannot be achieved on the design line or within two meters of this then he shall advise the Engineer.

1.1.6. The constructed formation shall follow the most practical line to achieve the design grades and to create an enjoyable riding experience appropriate to a Grade 2 trail (See QLDC Cycle Trail Design Standards 2015).

1.2. Formation Earthworks, Width & Grade

1.2.1. During construction compliance with the QLDC Land Development and Subdivision Code of Practice is a requirement, attention is drawn to the following key points;

- During construction sediment control measures should be put in place such as keeping drains clear of loose soil and the use of silt fences, traps or bunds around water bodies. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Long term options include draining to sediment retention ponds where high levels of sediment run off are expected
- Dust mitigation should be used during construction or on any maintenance areas left exposed for extended periods of time. Mitigation incudes wetting ground and long term; use of vegetation on bare land
- Earthworks undertaken must be stable and not prone to erosion

1.2.2. All organic material shall be removed from the track formation area prior to commencing any formation earthworks. Where possible, leaf litter and top soil shall be retained adjacent to the track for spreading over exposed earthworks on completion of the formation.

1.2.3. Tree roots up to 100mm diameter shall be removed where necessary to enable formation excavation.

1.2.4. Where the track is constructed on a cross slope of less than 3 horizontal to 1 vertical, the track bench may be constructed using a combination of cut and fill formation or fill formation as shown on the drawings. Excavated material from the formation may be used to fill the outer edge of the track bench provided it is compacted in place with suitable equipment.

1.2.5. Where the track is constructed on a cross slope of greater than 3 horizontal to 1 vertical, a full cut formation (full bench) detail shall be used as shown on the typical detail. Cut slope batters may be constructed with a max height of 2m with a 1m horizontal bench if higher slope is required. Slope angles (H:V) of 2.5:1 for silt, 2:1 for sand and, 1.5:1 for gravels can be used. Vertical faces can be used for intact rock only, consult Engineer for non-intact rock faces otherwise revert to 1.5:1 specification.

1.2.6. The track formation shall be shaped to achieve the required track width and to ensure the track longitudinal grade is within the required maximum limits. The maximum grade on any section of track shall not exceed the following:

- 1 in 14 (4°) on regular sections of track for lengths less than 100m, otherwise 10m flat sections are to be placed ever 50-75m. Short 30m sections of 1 in 10 (6°) may also be used in conjunction with at least equal length of flatter sections.
- 1 in 30 (2°) on switchbacks and structures
- Or as directed by the Engineer

1.2.7. The required 'usable cycling surface' width shall be 2.0m unless otherwise specified by the Engineer. This shall consider horizontal clearances required from cut/fill batter slopes, handrails (0.5m), trees (0.5m) etc. as detailed in Section 3.5 of NZCT Cycle Trail Design Guide Feb 2010.

1.2.8. Final shaping of the track surface shall take place **after** the installation of culverts.

1.3. Filling

1.3.1. There should be no vegetation or other organic matter in fill material that forms part of the track formation.

1.3.2. Fill material shall be placed in layers not exceeding 300mm loose depth and shall be compacted using appropriate mechanical equipment. Where the slope exceeds 3 horizontal to 1 vertical a bench shall be formed to enable fill material to key into the existing ground and facilitate compaction.

1.3.3. Fill material shall not be used where the moisture content is at or above the plastic limit as densification cannot be achieved. Such material shall be placed outside the track formation.

1.3.4. Fill materials should have an even grading with no segregation, the image below is an example of a non-complying material

1.3.5. Fill slopes shall be left in a smooth and tidy condition. It shall be the contractor's responsibility to make good any batter slumping or subsidence which occurs during the operation of this contract and including during the defects liability period.

1.3.6. Where fill is intended to be placed onto soft or swampy ground, the Engineer may advise the Contactor to lay geotextile material to separate the fill material. Geotextile shall be laid in accordance with manufacturers recommendations.

1.4. Track Drainage

1.4.1. Rolling grade dips (grade reversals) shall be formed in the track surface to divert surface water on sloping sections of track at

1.4.2. ≤30m spacing's where water tables are not installed. Grade reversals shall be 2-3m in length and be of a smooth profile to ensure a smooth ride for cyclists.

1.4.3. Water tables in accordance with the typical details shall be installed on each section of track formation prior to placing top course metal.

1.4.4. Water tables shall have a grade of >1% towards the discharge point (if any). A discharge point shall be provided anywhere there is a sag point in the track.

1.4.5. Water table discharge points shall be installed at the following spacing's or as directed by the Engineer:

1.4.6. 50m where the track grade is ≤ 20:1 (3°)

1.4.7. 15m where the track grade is between 10:1 and 20:1 (3°-6°)

1.4.8. Water table discharge shall consist of minimum 250mm smooth walled culvert under the track to direct water to lower ground on the down slope side of the track.

1.4.9. Culvert pipes shall be installed with a minimum 5% fall to the outlet and a minimum of 150mm cover to the finished track surface.

1.4.10. The inlet to culverts installed for the discharge of water tables shall have a 200mm x 200mm x 250mm minimum deep sump at the culvert inlet which has an invert level at least 100mm below the culvert pipe invert. A 300mm long stop bank shall be provided after the sump pit to force water into the pipe.

1.4.11. Culverts shall be of sufficient length to pass under the track and extend beyond any fill.

1.4.12. The outlets of culvert pipes shall discharge at ground level without a free fall from the end of the pipe. Where the outlet slope is on steep loose material, a rock apron shall be provided to prevent scour.

1.4.13. Culverts shall be smooth bore Farm Tough type colored black of minimum 250mm internal diameter or similar as approved by the Engineer.

1.4.14. The inlet and outlet of culverts that discharge continuous water flows shall include local stone/mortar headwalls.

1.4.15. Where the culvert discharges only stormwater and the inlet or outlet may be subject to maintenance vehicle loads (that is they are within 300mm of the track edge), the headwalls shall be mortared.

1.4.16. For all other culverts where the inlets and outlets are not able to be driven on, headwalls are optional

1.4.17. Lintel rocks for headwalls shall have a minimum diameter (or long side) of not less than 2x culvert diameter for pipe sizes 250- 500mm diameter.

1.5. Track Shaping

1.5.1. Prior to placement of track surfacing aggregate, the track sub- grade shall be shaped as follows

- Crowned surface having a **maximum 3%** fall to each side from the centerline for straight sections in flat country.
- Single slope formation with a 3% fall to the downhill side for straight sections in hilly country or where side drains are not provided.
- Single cross slope formation with a **5-10% fall to the inside of corners** for winding sections.
- If after rain, water is left sitting or pooling on the surface at more than 20mm depth, this will be considered a defect and require rectification by the contractor.

1.6. Pavement Surfacing

1.6.1. Prior to placement of track surfacing, the strength and density of the track sub-grade shall, wherever possible, be improved by the use of suitable compaction equipment such as vibrating rollers or plate compactors.

1.6.2. Suitable surfacing material shall be a crushed & well graded AP2O (or smaller) type aggregate having a maximum particle size of 20mm and be supplied from a weed free source. The stone particles shall be durable with at least 50% crushed faces. Rounded particle river gravels or beach gravels are not acceptable as a track surfacing aggregate.

1.6.3. Ideally the track surfacing aggregate shall have a range of particle size distribution including between 5-8% by weight portion of clay content to facilitate binding the surface.

1.6.4. A sample of aggregate shall be provided to the Engineer for approval prior to placement.

1.6.5. The track surface layer shall have a minimum compacted depth of 75mm minimum (equates to 100mm loose). This layer shall be placed and compacted in a single layer or where additional material is added after compaction the original layer shall be scarified prior to placement of the additional aggregate.

1.6.6. A 5-10mm layer of crusher dust shall be used to cap the aggregate layer and provide a smooth riding surface.

1.6.7. The aggregate shall be placed in such a way as to minimize segregation of the particle sizes. Shovels, beam rakes or excavator buckets should be used to move material if required.

1.6.8. The surface shall be shaped to achieve the required cross fall and longitudinal smoothness with a grader or similar machine. Grading with an excavator is not acceptable.

1.6.9. The aggregate surface shall be compacted after placement with a plate compactor or other vibrating equipment to achieve a well bound surface suitable for cycling. The cross fall of the finished track surface shall be as stated in Section 4.5.1.

1.6.10. To achieve optimum compaction, water shall be sprayed onto the aggregate surface. Compaction will be deemed complete when a well bound pavement surface is achieved which is free of voids and loose stone.

1.6.11. The completed track surface shall be free from loose stones (interlocking mosaic is required) and **surface undulations** to achieve a smooth & comfortable riding experience. Wavy or corrugated surfaces shall be deemed a defect and shall not be acceptable. The final test shall consist of riding a standard non- suspended bicycle along the completed surface to check for such defects. A clegg value of 27 is required on the finished surface (prior to crusher dust application)

1.7. Rock Excavation & Blasting

1.7.1. Areas requiring rock excavation are not necessarily shown on the design drawings.

1.7.2. Blasting of rock may be used where it is not practical to break or remove rock by mechanical means and achieve a solid level surface finish for the formation.

1.7.3. Any rocks that are too large to move whole shall be drilled and blasted.

1.7.4. All blasting shall be carried out in accordance with the Department of Labor Code of Practice for Construction Blasting Safety.

1.7.5. The Contractor shall provide the Engineer with at least 48 **hours' notice before blasting operations are to commence.** The Ministry of Business Innovation & Enterprise shall be notified at least 24 hours prior to the blasting commencing.

2. HERITAGE & ENVIRONMENT

2.1. Archaeological Matters

2.1.1. If any archaeological evidence in the form of mining relics, stacked stone tailings, water races, sluicing, shell, bone, charcoal, greenstone, hangi stone, or artefact is uncovered during any construction, work must cease in that particular area and the Engineer must be notified immediately.

2.1.2. Work in the vicinity of sites where archaeological evidence is uncovered shall not re-commence until the Engineer gives approval. Delays due to unexpected finds may be a variation at the applicable rates.

2.1.3. The contractor shall implement all mitigation measures approved in any archaeological authority obtained from the Historic Places Trust relating to track works. If this is not practical, they shall advise the Engineer prior to any works covered by such Authority.

2.2. Vegetation

2.2.1. The survey line/design plans marked will identify all vegetation requiring removal. Mature trees will be affected in some areas due to legal access constraints but in general the track alignment should consider options around mature trees and any significant fauna. Endeavor to minimize destruction of native flora and promote growth of native species over non-native species.

2.2.2. Any tree exceeding 300mm diameter, that needs removal will be identified prior to the start of any works; any tree exceeding 300mm diameter must have the approval of the Engineer before it can be removed.

2.2.3. The completed track must have a cleared vegetation line of 2.5m vertical and a horizontal line of 1.0m either side of the track edge. All stumps created in the course of the construction are to be removed from track area unless indicated by the engineer. All slash, branches and removed stumps must be removed from site or chipped or burned (note burning requires a permit from the TA).

2.2.4. If a tree has to be retained details are to be supplied to protects the roots of trees \

2.2.5. Will ensure that disturbance to any trees & roots systems is minimised during construction or done in arboriculturally sensitive manner that is within the tolerances of the tree(s).

2.3. Sediment & Dust Control

2.3.1. Silt fences, traps or bunds should be used around water bodies. and cleared regularly to maintain functionality. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Where high levels of sediment run off is expected retention ponds may be deemed appropriated.

2.3.2. Dust shall be mitigated during construction and maintenance activities through wetting of bare soil, covering stockpiles or revegetation.

2.4. Health & Safety

2.4.1. The Contractor shall at all times comply with the provisions of the Health and Safety in Employment Act 1992. The Contractor shall take all necessary steps to ensure that the obligations placed on the "Principal" and the "Person who controls the place of work" under the provisions of the Act are complied with at all times and shall immediately advise the Principal of any obligations not being fulfilled.

2.4.2. The Contractor shall prepare a Safety Plan, which shall identify all potential risks and hazards to all personnel on site. The plan shall include safety procedures, requirements for protective clothing and equipment, safety equipment, mitigation procedures, emergency procedures, emergency communications and any other requirements deemed necessary.

2.4.3. The Safety Plan shall be submitted to the Engineer by the Contractor who shall confirm that the Safety Plan has been implemented and is operating on the site.

2.4.4. If at any stage during the course of the works, the Engineer or the delegated representative(s) observe activities or procedures which do not comply with the Safety Plan, a 'Stop Work' notice may be issued to the Contractor.

2.4.5. Extensions of time arising out of 'Stop Work' notices issued to the Contractor due to non-compliance with the Safety Plan will not be considered.

2.4.6. The Contractor shall ensure that during the execution of the Contract there is no risk to the health and safety of other Contractors or employees of DOC, LINZ or Contact Energy, or to members of the public that may be in the vicinity of the site.

2.4.7. The Contractors' Safety Plan shall include particular procedures with respect to maintaining the safety of users of the track during construction including use of appropriate signage, barriers and other protection deemed necessary.

2.4.8. The contractor shall use all practical means to prevent members of the public from using any structures until such time as a Code of Compliance Certificate has been issued for the structure.

2.5. Building Consent

2.5.1. The Contractor shall comply with all conditions of Building Consents relating to structures.

2.5.2. If inspections are required by the Council building inspectors, it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.5.3. The Principal shall obtain all building consents unless otherwise noted.

2.6. Resource Consent

2.6.1. The Contractor shall comply with all conditions of Resource Consents relating to track formation and structures.

2.6.2. If inspections or monitoring is required by either the QLDC or ORC it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.7. Producer Statements

2.7.1. The Contractor shall, on completion of the works, provide the Engineer with a Producer Statement-Construction (PS3) as setout in NZS 3910:2003 Schedule 6. The issuing of a Certificate of Practical Completion is subject to the receipt of the PS3.

2.8. Reinstatement of Area & Grassing

2.8.1. The Contractor and any Sub-constructors employed by the Contractor shall reinstate all land affected by the works, including the re-establishment of working areas, to a condition at least equal to that at the commencement of the works. Grass seed shall be spread on all areas of spoil where appropriate. All fencing disturbed shall be reinstated with new fencing of the same style as what was removed

2.9. Materials brought onto Site

2.9.1. All aggregate brought onto the site for the purpose of track surfacing or any materials brought in as fill, are to be from a weed free source and are to be inspected and approved by the Engineer prior to delivery on site.

2.9.2. Materials are to be stockpiled in approved places and all remnants removed from the site on the completion of the project, except where the Engineer has approved surplus materials that may be left in stockpiles on the site.

2.10. Removal of Waste Material

2.10.1. All timber cut-offs, surplus materials and any waste is to be removed from the site at the completion of the work

2.10.2. Waste is defined as all foreign material on the site. This includes but is not limited to spilt concrete, nails, wood, plastic and metal off-cuts.

2.10.3. Waste or rubbish being held at the site prior to removal is to be stored in such a fashion that it cannot be blown about by the wind. No tyres are permitted.

2.10.4. Major repairs to machines are not permitted on site without approval of the Engineer.

2.11. Helicopter Operations

2.11.1. The Contractor shall obtain prior approval from the Engineer before each and every helicopter operation.

2.11.2. The Contractor is responsible for obtaining all required Civil Aviation and other permits

QUEENSTOWN LAKES DISTRICT COUNCIL

necessary for helicopter operations.

2.11.3. The Contractors Safety Plan shall include procedures for such operations and the proposed measures to ensure public safety during the operations.

2.11.4. All materials dropped by a helicopter operator either by accident or on purpose outside of approved sites must be reported to the Engineer as soon as possible and any such materials shall be removed as soon as possible. Site restoration work must be carried out to the satisfaction of the Engineer in the event of any damage from dropped items.

3. TIMBER STRUCTURES

3.1. Relevant Standards

3.1.1. The underlying Standards relevant to this Section are:

NZS 3601	Metric Dimensions of Timber
NZS 3602	Timber & Wood Based Products for use in Buildings
NZS 3603	Timber Structures
NZS 3604	Light Timber Framed Buildings
NZS 3605	Timber Piles & Poles for use in Buildings
NZS 3640	Timber Treatment Specifications
NZS 1328	Glue Laminated Structural Timber
NZS HB 8630	Tracks and Outdoor Visitor Structures

3.2. Scope & General

3.2.1. This section of the contract work shall consist of all carpentry including the associated jointing brackets, cleats, bolts, nails etc. as shown on the drawings or specified herein or otherwise.

3.2.2. This includes, but is not exclusive to the construction of boardwalks, barriers and retaining walls.

3.2.3. **All timber shall be sound, free from knots** and well-seasoned and maintain figured dimensions.

3.2.4. All timber shall be rough sawn sizes unless specifically noted otherwise.

3.2.5. Timber shall comply with Table 1

3.3. Timber Treatment

3.3.1. Treatment shall be as noted in the table below. Treatment shall comply with the current requirements of the Timber Preservation Council. All treated timber shall be branded with the appropriate woodmark. It is preferred that timbers be treated at least 2 months prior to installation.

3.3.2. Cut faces of timber sections greater than 50mm thick shall be treated with Metalex or similar field applied preservative treatment.

Table 1: Timber Specification and Treatment

Structure & Application	Species	Grade	Treatment
Round piles	Pinus Radiata.	NZS 3605	H5
Retaining wall boards, Boardwalk end boards and bearers and other sawn timber in contact with the ground or within 150mm of the ground.	Pinus Radiata	G8 or VSG8	H5
Boardwalk joists, bracing, decking and blocking. Barrier balusters and rails	Pinus Radiata	G8 or VSG8	H3.2
Glulam Beams	Pinus Radiata	GL10	H3.2

3.4. Fixtures & Fittings

3.4.1. Bolts and washers shall be hot dip galvanised engineer's bolts of the diameters and sizes shown on the drawings unless specified otherwise.

3.4.2. Bolts may consist of hot dip galvanised or stainless steel threaded rod cut to length on site.

3.4.3. All hot dip galvanised rod cut ends shall be treated with 'dry galv' corrosion protection.

3.4.4. All galvanised bolts in contact with treated timber shall be protected using general purpose grease in pre-greased holes

3.4.5. Thread protrusion past the nut shall be a minimum of one thread pitch after tightening.

3.4.6. All nails shall be 100mm x 4.0mm FH galvanised steel unless specified otherwise.

3.4.7. The contact faces of washers shall be coated with grease.

3.4.8. Washers shall be fitted to both ends of bolts and shall comply with the following minimum standards:

Bolt Size	Washer (mm)
M12	*50 x 50 x 5.0*
M16	*65 x 65 x 5.0*

3.5. Protection Up to Installation

3.5.1. All materials shall be protected against physical damage.

3.6. Standards of Workmanship

3.6.1. All work shall be in accordance with industry best practice

3.6.2. Details not shown on the drawings shall be formed according to the principles of NZS 3604 or referred to the Engineer.

3.6.3. All work is to be accurately set out.

3.6.4. All structural members are to be fixed true to line.

3.7. Foundations & Concrete Work

3.7.1. All Concrete used for the embedment of posts or headwalls shall have a 20mm maximum aggregate size and be a mix designed to have a minimum 28-day compressive strength of 20MPa.

3.7.2. All concrete shall comply with NZS 3104 or NZS 3108 including specification and techniques setout herein.

3.7.3. The contractor shall be responsible for locating any services on site. Any damage to underground services shall be repaired at the Contractors expense.

3.7.4. Excavations for foundations are to be built to the dimensions and details shown allowing for working room as required.

3.7.5. Where holes are dug or augured for foundations, the Contractor is responsible for ensuring the stability of the hole to ensure the hole maintains its required dimensions before pouring concrete. The costs of any stability work will be deemed to be included in the Contractors tender price.

3.8. Glue Laminated Structural Members

3.8.1. All beams shall comply with NZS 1328 GL10 grade.

3.8.2. Material for the members shall be Radiata Pine with a moisture content not exceeding 18%.

3.8.3. All members shall be made for Category 3: Exterior Exposed. The adhesive used shall be resorcinol glue.

3.8.4. End joints should be randomly spaced throughout the depth of a member to avoid concentration of joints.

3.8.5. Finish shall be 'standard' in accordance with NZS 3606 unless specified otherwise.

4. GABION PROTECTION

4.1. Installation

4.1.1. Gabion baskets unless otherwise specified shall be 2m long by 1m high and 1m wide and made from 2.7mm pvc coated wire.

4.1.2. Gabion baskets shall be installed in accordance with the manufacturers recommendations and industry best practice including appropriate backfill, inter-connections and tying and geotextile separation (filter cloth) to prevent backfill migration.

4.1.3. All areas requiring gabion wall installation shall be marked on site by the Engineer prior to installation and agreed with the contractor.

4.1.4. Where gabions are laid more than 1m in height, subsequent layers shall be offset 300mm.

5. TIMBER RETAINING WALLS

5.1. Installation

5.1.1. Timber retaining walls shall be installed in accordance with the design drawings to achieve minimum embedment depths, maximum heights and angles.

5.1.2. All timber retaining walls shall be fixed together with either galvanized bolts/washers or galvanized purlin screws. Nails shall not be used for fixing timbers.

5.1.3. All timbers shall comply with Section 3.3 Table 1 above.

6. TIMBER CRIB WALLS

6.1. Installation

6.1.1. Crib walls shall be installed in accordance with the design drawings

6.1.2. All timber shall comply with Section 3.3 Table 1 above

6.1.3. Timber shall not be joined with nails. All timbers shall be either plated and bolted or plated and galv purlin screwed together to prevent breakage and splitting of timber.

6.1.4. The end and corners of such walls are to be protected with a minimum 100x50 timber running vertically to prevent end breakage

7. CATTLE STOPS & BOLLARDS

7.1. Design & Installation

7.1.1. Cattle stops shall generally be as per the typical detail plan Sheet R4030_E3_4 The cattle stops shall have a minimum trafficable width as per the required minimum structure width for the trail Grade to enable maintenance access

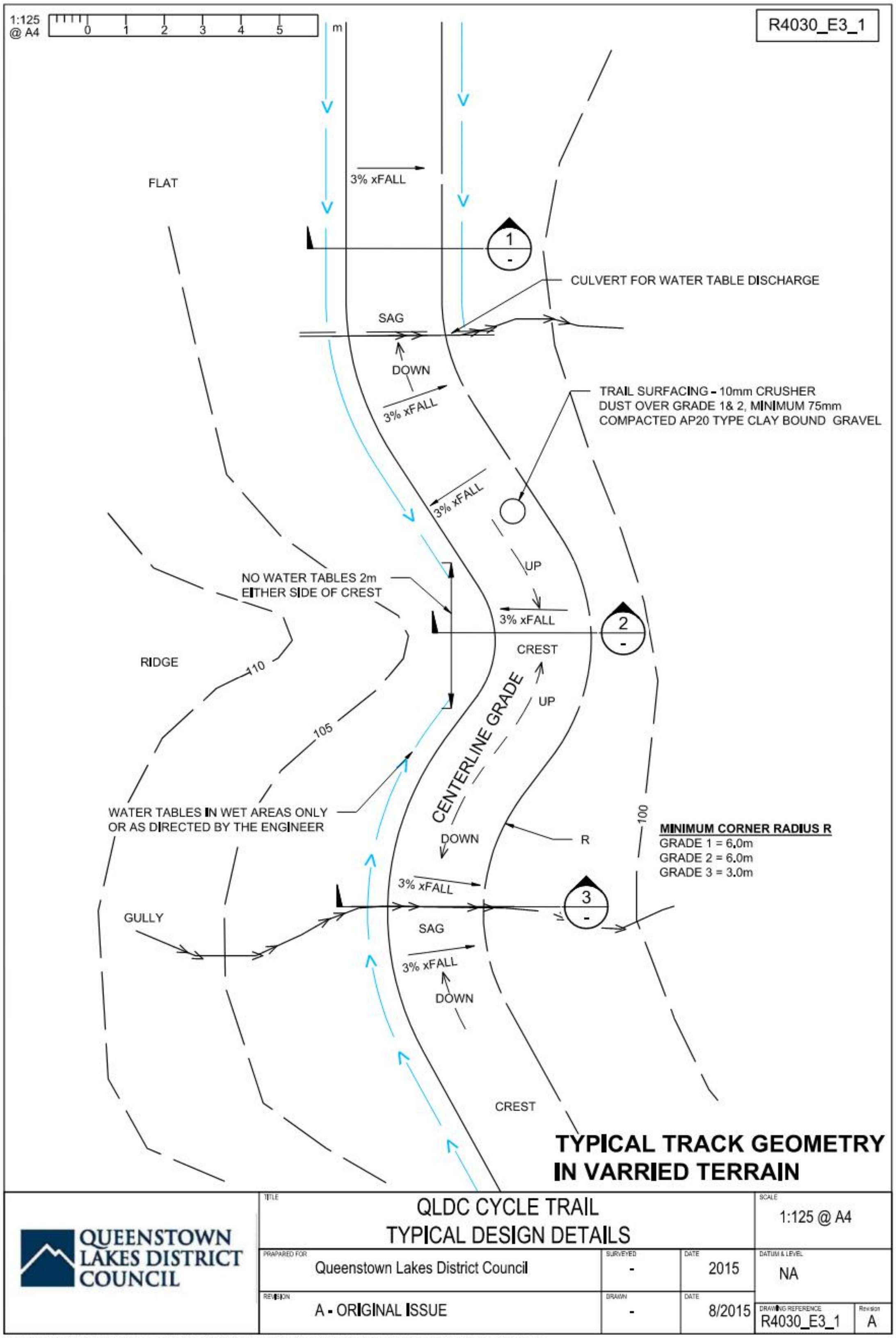
7.1.2. Cattle stops shall have as a minimum a galvanized steel grate consisting of either rounds or flats sharp side up welded to a steel surround. Base and sides may be either timber or metal.

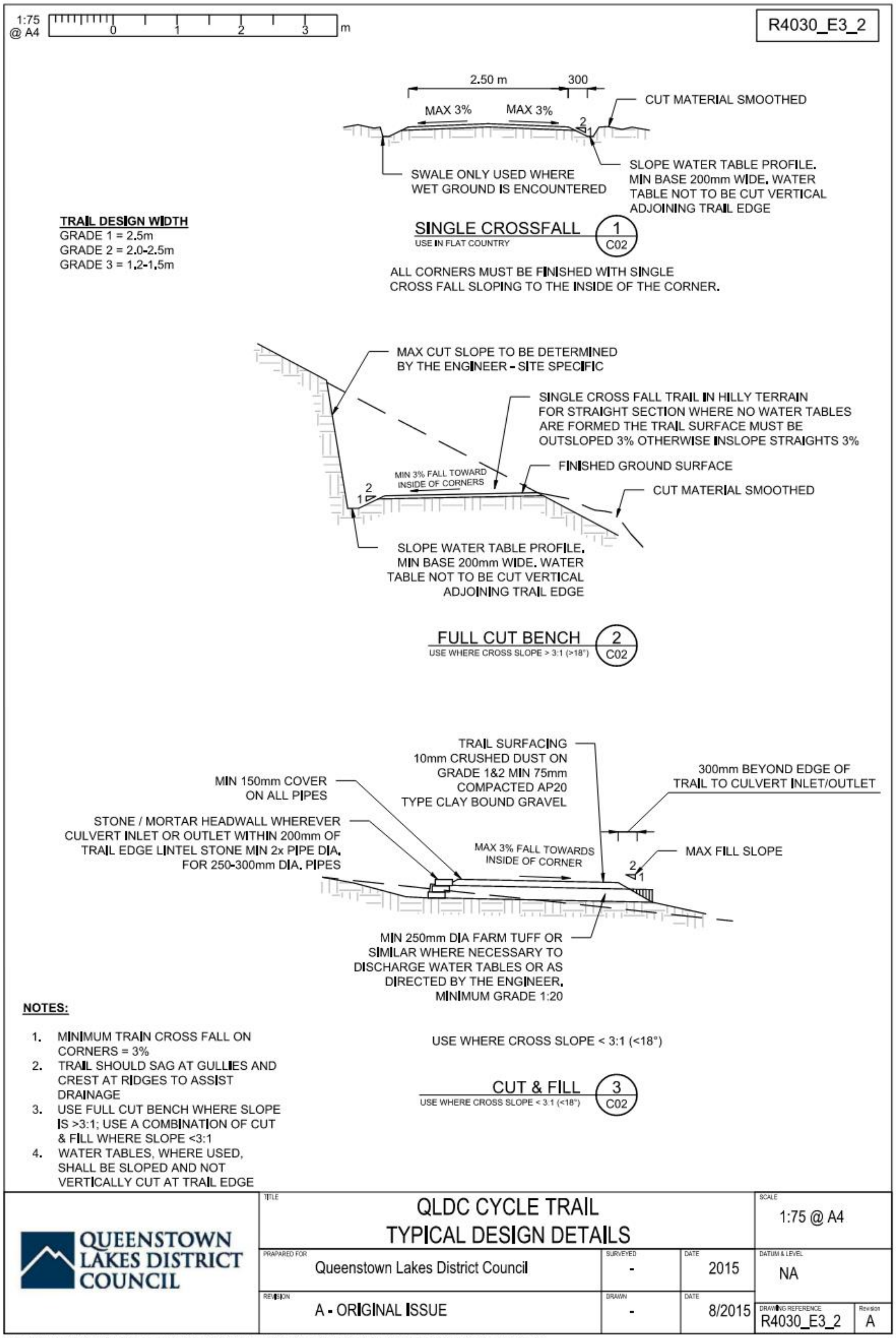
7.1.3. Cattle stops shall be installed at grade with the adjoining cycle trail and in line. Where restricting vehicle access is necessary, a timber bollard shall be installed in the center of one approach and be of the lockable type.

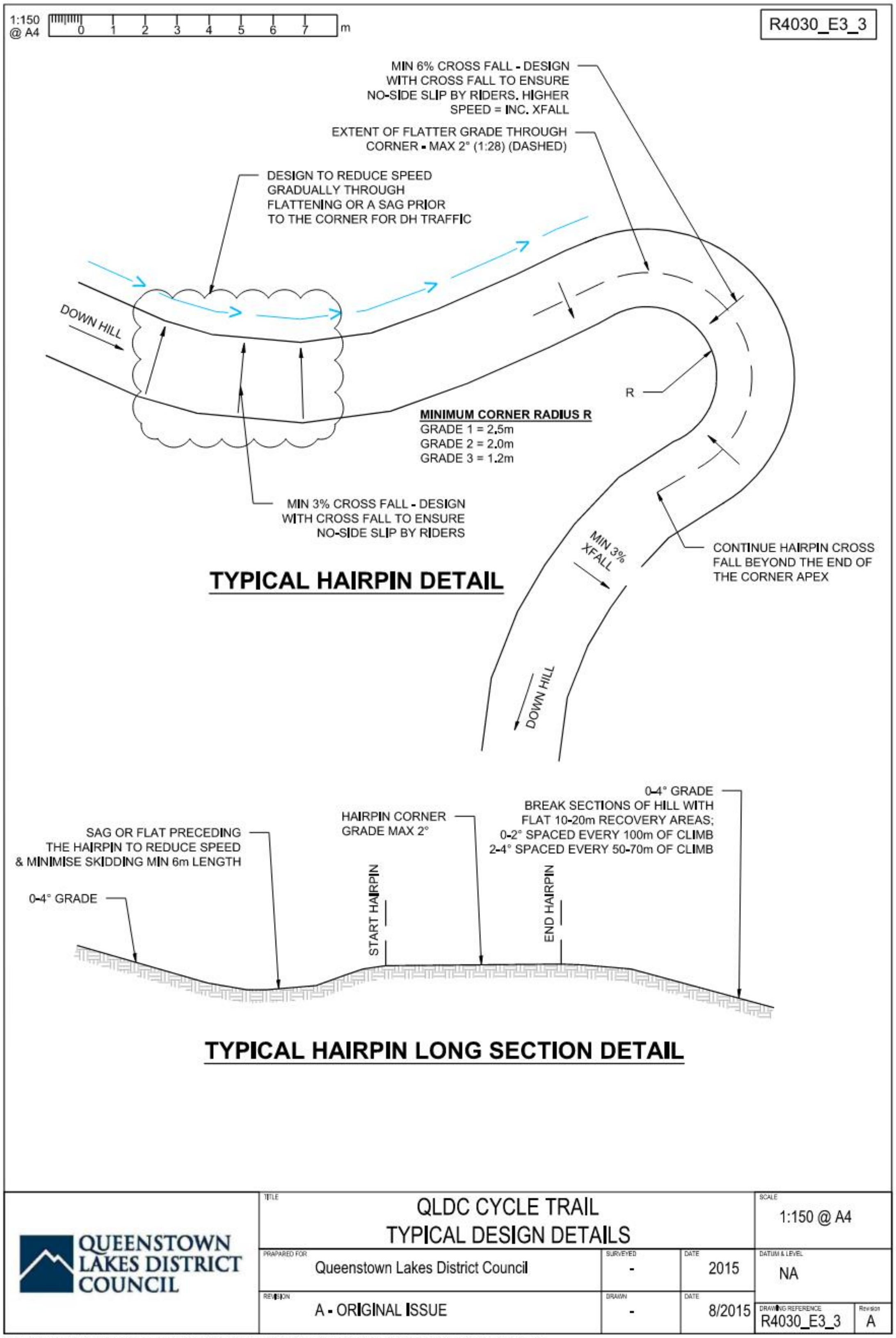
7.1.4. A minimum 100mm flexible pipe shall be installed into the base of the cattle stop to enable hedgehogs to exit from the sump

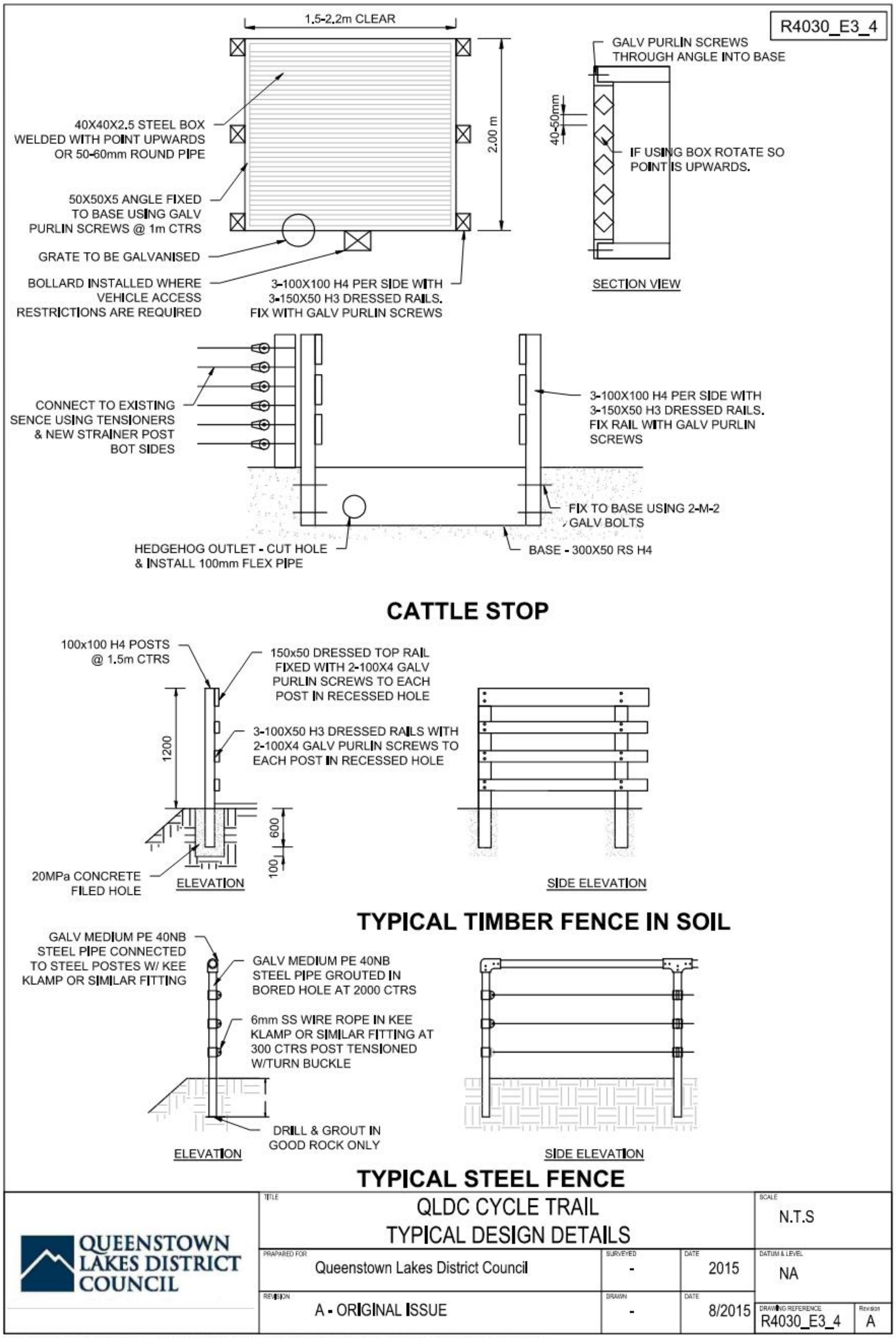
7.1.5. Bollards for use on QLDC trails shall be as per attached typical detail plan XXXXX and shall be installed in accordance with this plan. Bollards can be Macrocarpa but must be treated at ground level and below, frangible and capped on the top surface.

APPENDIX 2 – TYPICAL DESIGN DETAILS




1:75 @ A4
0 1 2 3 m
R4030_E3_2
2.50 m
300
MAX 3%
MAX 3%
CUT MATERIAL SMOOTHED
SWALE ONLY USED WHERE WET GROUND IS ENCOUNTERED
SLOPE WATER TABLE PROFILE. MIN BASE 200mm WIDE. WATER TABLE NOT TO BE CUT VERTICAL ADJOINING TRAIL EDGE
TRAIL DESIGN WIDTH
GRADE 1 = 2.5m
GRADE 2 = 2.0-2.5m
GRADE 3 = 1.2-1.5m
SINGLE CROSSFALL
USE IN FLAT COUNTRY
1
C02
ALL CORNERS MUST BE FINISHED WITH SINGLE CROSS FALL SLOPING TO THE INSIDE OF THE CORNER.
MAX CUT SLOPE TO BE DETERMINED BY THE ENGINEER - SITE SPECIFIC
SINGLE CROSS FALL TRAIL IN HILLY TERRAIN FOR STRAIGHT SECTION WHERE NO WATER TABLES ARE FORMED THE TRAIL SURFACE MUST BE OUTSLOPED 3% OTHERWISE INSLOPE STRAIGHTS 3%
MIN 3% FALL TOWARD INSIDE OF CORNERS
FINISHED GROUND SURFACE
CUT MATERIAL SMOOTHED
SLOPE WATER TABLE PROFILE. MIN BASE 200mm WIDE. WATER TABLE NOT TO BE CUT VERTICAL ADJOINING TRAIL EDGE
FULL CUT BENCH
USE WHERE CROSS SLOPE > 3:1 (>18°)
2
C02
TRAIL SURFACING 10mm CRUSHED DUST ON GRADE 1&2 MIN 75mm COMPACTED AP20 TYPE CLAY BOUND GRAVEL
MIN 150mm COVER ON ALL PIPES
300mm BEYOND EDGE OF TRAIL TO CULVERT INLET/OUTLET
STONE / MORTAR HEADWALL WHEREVER CULVERT INLET OR OUTLET WITHIN 200mm OF TRAIL EDGE LINTEL STONE MIN 2x PIPE DIA. FOR 250-300mm DIA. PIPES
MAX 3% FALL TOWARDS INSIDE OF CORNER
MAX FILL SLOPE
MIN 250mm DIA FARM TUFF OR SIMILAR WHERE NECESSARY TO DISCHARGE WATER TABLES OR AS DIRECTED BY THE ENGINEER. MINIMUM GRADE 1:20
NOTES:
1. MINIMUM TRAIN CROSS FALL ON CORNERS = 3%
2. TRAIL SHOULD SAG AT GULLIES AND CREST AT RIDGES TO ASSIST DRAINAGE
3. USE FULL CUT BENCH WHERE SLOPE IS >3:1; USE A COMBINATION OF CUT & FILL WHERE SLOPE <3:1
4. WATER TABLES, WHERE USED, SHALL BE SLOPED AND NOT VERTICALLY CUT AT TRAIL EDGE
USE WHERE CROSS SLOPE < 3:1 (<18°)
CUT & FILL
USE WHERE CROSS SLOPE < 3:1 (<18°)
3
C02
QUEENSTOWN LAKES DISTRICT COUNCIL
TITLE
QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS
SCALE
1:75 @ A4
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2015
DATUM & LEVEL
NA
REVISION
A - ORIGINAL ISSUE
DRAWN
-
DATE
8/2015
DRAWING REFERENCE
R4030_E3_2
Revision
A
Original Sheet Size A4 [210x297] Plot Date 2018-11-28 at 10:53:17 AM


1:150 @ A4
0 1 2 3 4 5 6 7 m
R4030_E3_3
MIN 6% CROSS FALL - DESIGN WITH CROSS FALL TO ENSURE NO-SIDE SLIP BY RIDERS. HIGHER SPEED = INC. XFALL
EXTENT OF FLATTER GRADE THROUGH CORNER - MAX 2° (1:28) (DASHED)
DESIGN TO REDUCE SPEED GRADUALLY THROUGH FLATTENING OR A SAG PRIOR TO THE CORNER FOR DH TRAFFIC
DOWN HILL
R
MINIMUM CORNER RADIUS R
GRADE 1 = 2.5m
GRADE 2 = 2.0m
GRADE 3 = 1.2m
MIN 3% CROSS FALL - DESIGN WITH CROSS FALL TO ENSURE NO-SIDE SLIP BY RIDERS
MIN 3% XFALL
CONTINUE HAIRPIN CROSS FALL BEYOND THE END OF THE CORNER APEX
TYPICAL HAIRPIN DETAIL
DOWN HILL
0-4° GRADE
BREAK SECTIONS OF HILL WITH FLAT 10-20m RECOVERY AREAS;
0-2° SPACED EVERY 100m OF CLIMB
2-4° SPACED EVERY 50-70m OF CLIMB
HAIRPIN CORNER GRADE MAX 2°
SAG OR FLAT PRECEDING THE HAIRPIN TO REDUCE SPEED & MINIMISE SKIDDING MIN 6m LENGTH
0-4° GRADE
START HAIRPIN
END HAIRPIN
TYPICAL HAIRPIN LONG SECTION DETAIL
QUEENSTOWN LAKES DISTRICT COUNCIL
TITLE
QLDC CYCLE TRAIL
TYPICAL DESIGN DETAILS
SCALE
1:150 @ A4
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2015
DATUM & LEVEL
NA
REVISION
A - ORIGINAL ISSUE
DRAWN
-
DATE
8/2015
DRAWING REFERENCE
R4030_E3_3
Revision
A


R4030_E3_4
1.5-2.2m CLEAR
2.00 m
40-50mm
40X40X2.5 STEEL BOX WELDED WITH POINT UPWARDS OR 50-60mm ROUND PIPE
50X50X5 ANGLE FIXED TO BASE USING GALV PURLIN SCREWS @ 1m CTRS
GRATE TO BE GALVANISED
BOLLARD INSTALLED WHERE VEHICLE ACCESS RESTRICTIONS ARE REQUIRED
3-100X100 H4 PER SIDE WITH 3-150X50 H3 DRESSED RAILS. FIX WITH GALV PURLIN SCREWS
GALV PURLIN SCREWS THROUGH ANGLE INTO BASE
IF USING BOX ROTATE SO POINT IS UPWARDS.
SECTION VIEW
CONNECT TO EXISTING SENCE USING TENSIONERS & NEW STRAINER POST BOT SIDES
3-100X100 H4 PER SIDE WITH 3-150X50 H3 DRESSED RAILS. FIX RAIL WITH GALV PURLIN SCREWS
FIX TO BASE USING 2-M-2 GALV BOLTS
HEDGEHOG OUTLET - CUT HOLE & INSTALL 100mm FLEX PIPE
BASE - 300X50 RS H4
CATTLE STOP
100x100 H4 POSTS @ 1.5m CTRS
150x50 DRESSED TOP RAIL FIXED WITH 2-100X4 GALV PURLIN SCREWS TO EACH POST IN RECESSED HOLE
3-100X50 H3 DRESSED RAILS WITH 2-100X4 GALV PURLIN SCREWS TO EACH POST IN RECESSED HOLE
1200
600
100
20MPa CONCRETE FILED HOLE
ELEVATION
SIDE ELEVATION
TYPICAL TIMBER FENCE IN SOIL
GALV MEDIUM PE 40NB STEEL PIPE CONNECTED TO STEEL POSTES W/ KEE KLAMP OR SIMILAR FITTING
GALV MEDIUM PE 40NB STEEL PIPE GROUTED IN BORED HOLE AT 2000 CTRS
6mm SS WIRE ROPE IN KEE KLAMP OR SIMILAR FITTING AT 300 CTRS POST TENSIONED W/TURN BUCKLE
DRILL & GROUT IN GOOD ROCK ONLY
ELEVATION
SIDE ELEVATION
TYPICAL STEEL FENCE
QUEENSTOWN LAKES DISTRICT COUNCIL
TITLE
QLDC CYCLE TRAIL
TYPICAL DESIGN DETAILS
SCALE
N.T.S
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2015
DATUM & LEVEL
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REVISION
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Revision
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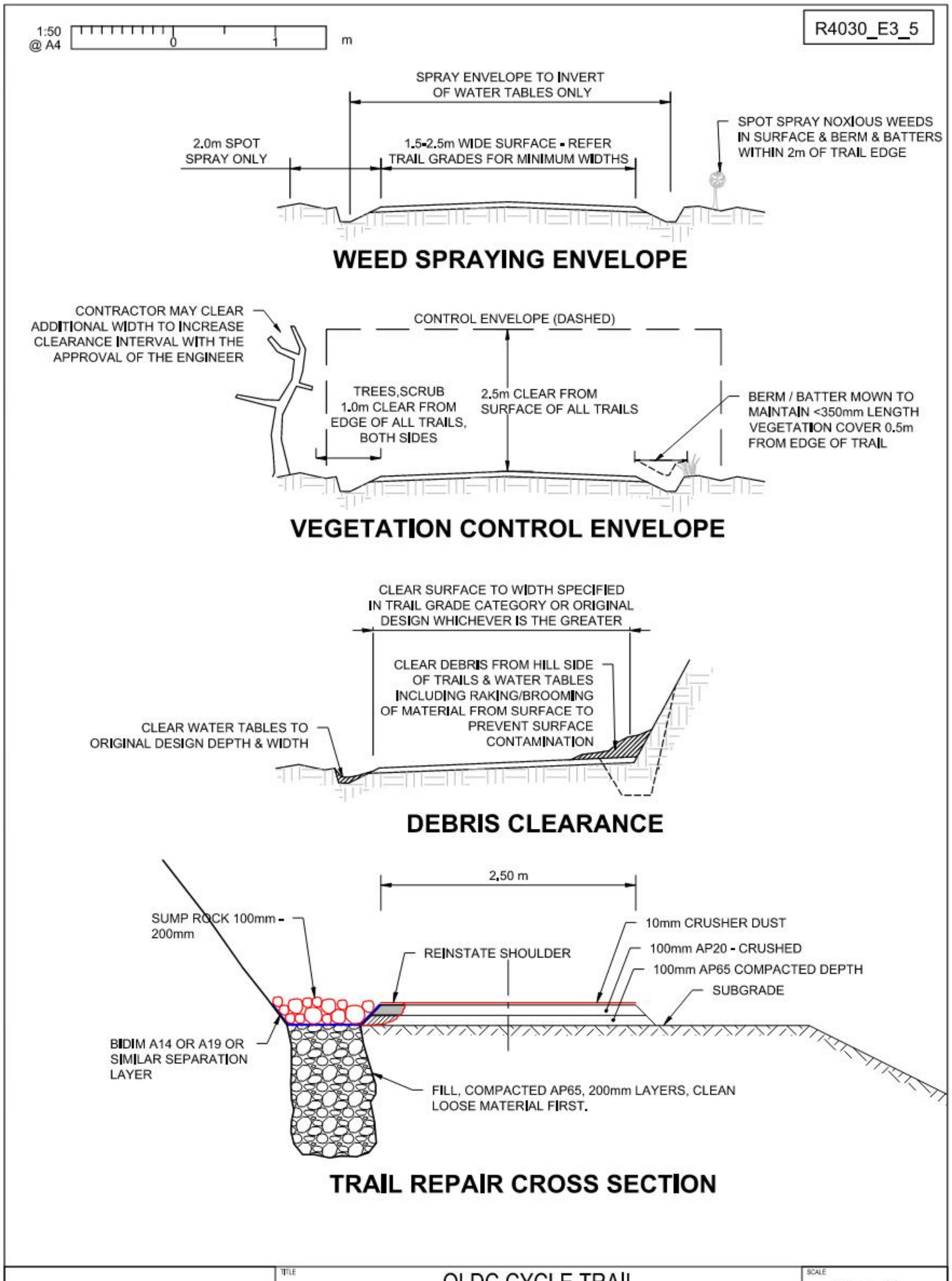
QUEENSTOWN LAKES DISTRICT COUNCIL



QUEENSTOWN LAKES DISTRICT COUNCIL	TITLE: QLDC CYCLE TRAIL TYPICAL MAINTENANCE DETAILS			SCALE: 1:50 @ A4
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	REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2015	DRAWING REFERENCE: R4030_E3_5 Revision: A

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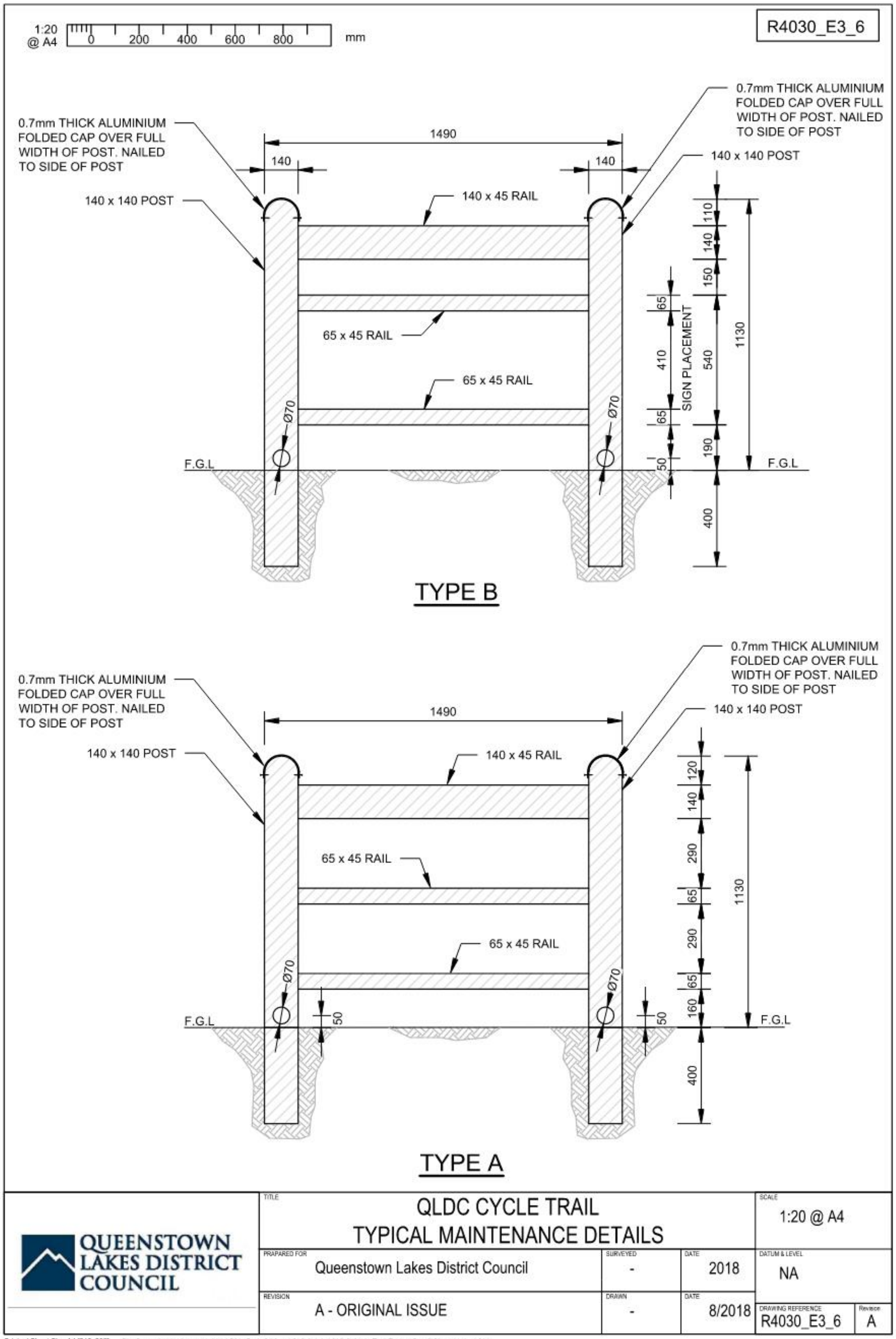

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QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 APPLICATION

This specification applies to all water facility assets that will be vested in or are currently managed by Queenstown Lakes District Council.

2 PURPOSE

The purpose of this specification is to establish a framework of principles to be applied to the representation of three water facility assets in Queenstown-Lakes District's Asset Management System (AMS) Technology One and operational documents.

A facility is defined as a plant or process that is distinctly separated from the distributed network assets. Facilities include, but are not limited to:

> Wastewater treatment plants

> Wastewater pump stations

> Water Supply treatment plants

> Water supply pump stations

There are currently no stormwater pump stations or treatment facilities within the QLDC network, it is intended that these will be included as and when required. Consideration of including other stormwater assets is underway and may be included in future versions.

It is intended that this specification will ensure that the assets can be accurately valued and effectively managed.

It should be noted that network (distributed) assets are entered into Technology One via GIS as per the QLDC As-Built Standard and are not subject to this specification.

3 RELATED DOCUMENTS

This specification should be read in conjunction with the following documents which are on the QLDC Wedsite under Land Developments and Subdivisions:

> QLDC As-built Standard

> QLDC Land Development and Subdivision Code of Practice

4 ASSET REPRESENTATION IN THE ASSET MANAGEMENT SYSEM

To facilitate the purpose of this document, the following will be required/generated for each asset within a facility:

> **UnitID** – Unique ID generated by the Asset Management System (AMS) when the individual asset is created in the AMS environment.

> **Position ID** – a descriptive ID of the function of the asset within the facility.

> **Asset Register Data** – a list of the required asset specification data prior to its import into the AMS. See section 5.

- **Piping and Instrumentation Diagram (P&ID)** - A diagram which shows the interconnection of process equipment and the instrumentation used to control the process[1]

4.1.1 UnitID

For facility asset types the UnitID is generated by using a combination of the Asset Equipment Codes (see Appendix B) and the unique numeric identifier (compkey) generated in Technology One, e.g.:

VLV		150203
Asset Equipment Type		Unique ID (Compkey)

4.1.2 Position ID

A facility is likely to contain one or more individual process areas depending on the design and sophistication of that plant.

The process ID is it to be generated by the designer or owner (where the asset is to be vested) by concatenating the following four elements separated by hyphens:

- Facility ID
- Process ID
- Asset Equipment Code
- Equipment Number

4.1.2.1 Facility ID

A unique Facility ID is generated by QLDC and is a four character alpha code. This is created from two parts, the first being a two character code describing the facility type, followed by a two character code to identify the specific facility. A longer descriptive name with a 25 charactor limit can follow the 4 character code. The current allocated names are listed in Appendix A, e.g:

ST	SP		Shotover Ponds
Facility Type (Sewer Treatment)	Facility ID (Shotover Ponds)		Facility Descriptive Name

4.1.2.2 Process ID

The appropriate two digit process area code is to be selected from one of the types listed in appendix B. New codes are required to be approved by QLDC prior to their use. E.g. 01 (Intake and Screening)

4.1.2.3 Asset Equipment Code

The appropriate three character alpha asset equipment code is to be selected from one of the types listed in appendix C. New codes are required to be approved by QLDC prior to their use. E.g. SCR (Screen)

4.1.2.4 Equipment Number

A three character sequential numeric ID to uniquely identify multiple occurrences of the same asset type within the facility/process, e.g. 001.

This will result in a Position IDs as per the following examples:

Shotover ponds sewer treatment plant inlet screen one:

STSP	-	01	-	SCR	-	001
Facility ID		Process ID		Equipment Code		Equipment Number

---

1 As defined by the Institute of Instrumentation and Control

Shotover ponds sewer treatment plant inlet screen two:

STSP	-	01	-	SCR	-	002
Facility ID		Process ID		Equipment Code		Equipment Number

Shotoer ponds sewer treatment plant UV reactor one:

STSP	-	07	-	UVS	-	001
Facility ID		Process ID		Equipment Code		Equipment Number

4.1.3 Asset Register Data

As per the QLDC Land Development & Subdivision Code of Practice an asset register is required to be provided to the adopted format / level of detail. The asset register shall include (but not be limited to) all process units, civil structures and buildings, earth structures, pipes and appurtenances, process tankage, mechanical and electrical equipment.

Individual assets shall be componentised by the expected design life and the physical location of the assets.

Asset costs are to be the actual cost applicable to each item plus any overhead allocation or installation costs that are included in the Contractor's Contract costs.

5 RESPONSIBILITIES

5.1 DESIGNER

The designer or owner (where the asset is to be vested) is responsible for the creation of the Position ID, along with the reference of the Position ID within all appropriate documents including, but not limited to, design drawings, P&IDs, functional documents and asset schedules.

5.2 CONSTRUCTION CONTRACTOR

The construction contractor or owner (where the asset is to be vested) is responsible for the tagging of assets with the Position ID. All items that are assigned a Position ID shall be physically tagged on site using a system that does not suffer degradation due to environmental conditions such as sunlight or gaseous emissions. The tags for each asset shall be connected by use of a plastic cable tie, the tag itself shall be made from stainless steel and the tag number punched into it.

5.3 QLDC

To enable the generation of position IDs, QLDC will provide a facility ID following a request to the Asset Management Team (threewatersdata@qldc.govt.nz.

6 IMPROVEMENT PLAN

> Improve definition and delineation of facility and network assets.

> Incorporate a Piping and Instrumentation Diagram (P&ID) standard.

> Improve the definitions around the level of componentisation.

> Consider inclusion of include Stormwater detention basins and/or soak pits.

7 REVIEW

This specification will be reviewed annually.

TABLE A – FACILITY NAMES The following are currently allocated facility names as at June 2024.

Water - Pump Stations	
WPAR-ANDERSON RD BST	WPHI-HIGHVIEW TCE
WPAT-ARROWTOWN	WPHT-HEATON PARK
WPAT-ARROWTOWN 1	WPKH-KELVIN HEIGHTS
WPAT-ARROWTOWN 2	WPKG-KINGSTON
WPB3-ARROWTOWN BOOST	WPL1-LAKE HAYES EST
WPBB-BENBRAE	WPLA-HAYES EST BST
WPBF-BORE ARTHURS PT	WPLC-LOMOND CRES
WPBG-BORE GLENORCHY	WPLG-LUGGATE
WPBL-BALMORAL BOOST	WPLH-LAKE HAYES
WPBP-BEACON POINT	WPLW-QTOWN HILL #1
WPBV-BROADVIEW RISE	WPMA-MTASPIRING RD
WPCD-COREBRIDGE BORE	WPMD-MARINA DRIVE
WPC1-CARDRONA RIVER	WPML-MIDDLETON
WPC2-UPPER TERRACE	WPMR-MIDDLETON ROAD
WPCR-CARDRONA	WPPR-PENINSULA ROAD
WPF1-FERNHILL #1	WPPW-PANNERS WAY
WPF2-FERNHILL #2	WPRB-ROYS BAY
WPFD-FRANKTON RD	WPSC-SHOTOVER BORES
WPFH-FAR HORIZON	WPTM-TWO MILE
WPFR-FRANKTON RD	WPWA-WANAKA AIRPORT
WPGB-GLENDHU BAY	WPWB-THREEPWOOD BST
WPGD-GLENDA DRIVE	WPWW-WESTERN WANAKA
WPGR-GOLDRUSH WAY	
WPHA-HAWEA	
WPHH-HIDDEN HILLS	

Water - Treatment
WTA2- ARROWTOWN
WTAT-ARROWTOWN
WTAP-ARTHURS POINT
WTBP-BEACON POINT
WTCV-CARDRONA VALLEY
WTGB-GLENDHU BAY
WTHA-HAWEA
WTHB - HAWEA
WTHT-HAWEA ALT
WTKH-KELVIN HEIGHTS
WTKG-KINGSTON
WTLE-LAKE HAYES EST
WTLG-LUGGATE
WTLH-LAKE HAYES
WTRB-ROYS BAY
WTTM-TWO MILE
WTWI-WESTERN INTAKE

Water - Intakes
WIC1-PRINGLES CREEK
W1C2-CARDRONA RIVER
WIKG-KINGSTON

Water - Raw Water - Reservoirs
RRCV-CARDRONA VALLEY

Water - Reservoirs	
WRAP-ARTHURS POINT	WRKH-KELVIN HEIGHTS
WRAR-ARROWTOWN	WRKG-KINGSTON
WRBB-BENBRAE	WRLC-LOMOND CRESCENT
WRBP-BEACON POINT	WRLE-LAKE HAYES EST
WRCR-CARDRONA	WRLH-LAKE HAYES
WRCV-CARDRONA VALLEY	WRLR-LUGGATE
WRF1-FERNHILL #1	WRMI-MOUNT IRON
WRF2-FERNHILL A	WRMR-MIDDLETON ROAD
WRF2-FERNHILL B	WRMR-MINERS RISE
WRF3-FERNHILL #3	WRNL-NORTHLAKE
WRFH-FAR HORIZON RES	WRPR-PENINSULA ROAD
WRGB-GLENDHU BAY	WRPR-PLANTATION
WRGB-WAITIRI	WRQ1-QTOWN HILL #1
WRGF-GOLDFIELDS	WRQ2-QTOWN HILL #2
WRGR-GLENORCHY	WRQR-QUAIL RISE
WRHR-HAWEA	WRRV-REMARKABLESVIEW
WRJP-JARDINE A	WRSC-SHOTOVER
WRJP-JARDINE B	WR-SE-SICILIAN EST
WRJP-JARDINE C	WRWR-WESTERN
WRJP-JARDINE D	

Water - Irrgation - Reservoirs
IRCV-CARDRONA VALLEY

Water - Irrigation - Treatement
ITCV-CARDRONA VALLEY

TABLE A Continued – FACILITY NAMES The following are currently allocated facility names as at June 2024.

Wastewater - Pump Stations

SPA1-ALISON AVE #2	SPFB-FRANKTON BEACH	SPLP-LANCASTER PLACE	SPT4-ALICEBURNDR #1
SPA2-KINGSTON STREET	SPFF-FASTFLO BLOCK	SPMD-MEADOWSTONE	SPT5-ALICEBURNDR #2
SPA3-ALISON AVE #1	SPFS-FREDERICK ST	SPMP-MARINE PARADE	SPTB-TUCKERS BEACH
SPAP-OXNBRDGE TUN RD	SPGO-GORGE ROAD	SPMR-MCDONNELL RD	SPW1-THREEPWOOD #1
SPAR-AUBREY ROAD	SPGR-GORDON ROAD	SPN2-NORFOLK ST #2	SPW2-THREEPWOOD #2
SPAT-ATLEY ROAD	SPH1-HAWEA ESPLANADE	SPNI-NICHOL STREET	SPW7-THREEPWOOD #7
SPBF-BRIDESDALE	SPH2-SCOTTS BEACH	SPNS-NORFOLK STREET	SPWA-WAN-LUGG HWY #1
SPBM-ARTN-LK HAYS RD	SPHD-HIKUWAI DRIVE	SPOR-OUTLET ROAD	SPWL-WAN-LUGG HWY #2
SPBV-BAYVIEW RD	SPHD-HANLEY DOWNS	SPP1-ALBERTTOWN #1	SPWL-WILLOW PLACE
SPCD-CEDAR DRIVE	SPJA-JONES AVE	SPP2-ALBERTTOWN #2	SPWP-WAIMANA PLACE
SPCD-CARDRONA	SPJV-JACKS POINT VILLAGE	SPP3-RIVERBANK RD	
SPCP-CARDRONA PRINGLE CREEK	SPK1-LAKESIDE RD #1	SPPL-PARK ST LIFT	
SPCR-CEMETERY RD	SPK2-LAKESIDE RD #2	SPPP-STEVENSON RD	
SPCV-CARDRONA VILLAGE	SPKG-KINGSTON	SPPR-129 PENINSULA ROAD	
SPD1-DUNGARVON #1	SPKP-KAWARAU PLACE	SPPS-PARK STREET	
SPD2-DUNGARVON #2	SPL1-LAKE HAYES #1	SPRP-REMARKS PARK #1	
SPDR-DOMAIN ROAD	SPL2-LAKE HAYES #2	SPRS-1A ROBERTSON ST	
SPEA-ESSEX AVENUE	SPL3-LAKE HAYES #3	SPRV-RETIRE VILLAGE	
SPEC-EVENTS CENTRE	SPL4-LAKE HAYES #4	SPSB-SUNSHINE BAY	
SPEP-EELY POINT	SPL5-LAKE HAYES #5	SPSC-STALKER RD	
SPEW-EDGEWATER	SPL6-LAKE HAYES #6	SPT1-CHURCH RD	
SPF2-FRANKTON BEACH	SPLB-LONGBURN AVE	SPT2-HARRIS PLACE	
SPFA-FRANKTON BEACH A	SPLHTB-LAKE HAYES TOILET BLOCK	SPT3-PISA ROAD	

Wastewater - Treatment Plants

STAP-ALBERT TOWN PND
STBB-BENBRAE INNFLO
STBD-BENBRAE DFIELD
STCP-CARDRONA PUB
STCR-PHEONIX 47
STCV-CARDRONA VALLEY
STHP-HAWEA PONDS
STID-INVINCIBLE DR
STKG-KINGSTON
STLP-LANCASTER PLACE
STPP-PROJECT PURE
STSD-SHOTOVER DELTA
STSP-SHOTOVER PONDS
SPSF-SHOTOVER DISPOSAL FIELD
STWP-WANAKA PONDS

TABLE B – PROCESS ID'S

The following are acceptable, as at June 2024, any addition to this list is required to be agreed with the QLDC Strategic Asset Management Team prior to their use.

WW Treatment

01	General and Ancillary
02	Inlet and Screening
03	Biological Treatment
04	Clarifier
05	RAS / Sludge Return Line
06	Sludge Handling / Drying
07	Disinfection

WW Pump Stations

21	General and Ancillary
22	Inlet and Operational Storage
23	Emergency Storage
24	Electrical and Pumps
25	Outlet

WS Intake/Treatment

41	General and Ancillary
42	Bore / Inlet (Including Pumps)
43	Disinfection
44	Contact Tanks

WS Pump Stations (Network)

51	General and Ancillary
52	Bore / Inlet
53	Electrical and Pumps
54	Outlet

WS Storage

61	Inlet
62	Storage
63	Outlet

TABLE C – ASSET EQUIPMENT CODES

The following are acceptable, as at June 2024, any addition to this list is required to be agreed with the QLDC Asset Planning Team prior to their use.

Code	Description	Code	Description	Code	Description	Code	Description
ABL	Air Blower	CAZ	Chlorine Analyser	DVT	Dose/Volume Timer	GBX	Gearbox
ACD	Air Conditioner	CBK	Chain Block	EAV	Electric Actuated Valve	GRS	Grilles
ACT	Actuator	CBL	Cabling	EDD	Electrical Dosing Drive	GRT	Grit Removal
AEL	Analyser Element	CBM	Containment Boom	ELE	Electrical Controls	HAM	Hammer Resister
AET	Aerator	CDB	Chlorine Doser	ELS	Electrical Services	HAR	Harmonic Filter
AIC	Analyser Indicator Controller	CHB	Chamber	EMS	Emergency Shower	HDV	Hand Valve
AIV	Air Bleed Valve	CHL	Chlorine, Chlorinator	FAN	Fan	HER	Heat Exchanger
ALD	Acoustic Door	CLD	Chlorine Leak Detector	FOP	Fibre Optic Panel	HMI	Human Machine Interface
ANT	Antenna/ Arial	CLS	Chlorine Sensor	FIC	Flow Indicator Controller	HND	Handstanding
AOM	Distribution Board	CML	Chamber Lid	FILS	Filter - Storm	HOS	Hose Reel/Hose
ASB	Assembly Kit	CMP	Computer	FIN	Flow Indicating Transmitter	HPR	Hopper
ASM	Alarm System	CDT	Conduit	FIR	Flow Indicating Readout	HST	Hoist
AUT	Autosampler	CNP	Control Panel	FIT	Pipes and Fittings	HTR	Heater
AVR	Automatoc Voltage Regulator	CNT	Centrifuge	FLC	Flowmeter Chamber	HUM	Humidifier
BAS	Basin- Detention, Retention, Sediment	CNV	Conveyor	FLJ	Flexible Joint	HYD	Fire Hydrant
BAC	Battery Charger	COM	Compressor	FLM	Flowmeter	IRR	Irrigation System
BAF	Baffle	CTL	Chlorine Trolley Load	FLS	Flushing Connection	INJ	Injector
BAT	Backup Battery	CWP	Chlorine Weigh Pads	FLT	Cartridge Filter	INS	Instrument
BCN	Beacon	CPN	Cathodic Protection	FNK	Fuel Tank	ITH	IT Hardware
BEL	Bellow (Expansion)	CUL	Culvert	FRE	Fire System	JBX	Junction Box
BIN	Bin/Skip	DAM	Dam	FRT	Filter	KST	Timer/Time Initiated Space
BKP	Backflow Preventor	DCT	Decanter	FSW	Flow Switch	LAB	Laboratory Equipment
BRE	Bore	DIF	Diffuser	FUR	Office Furniture & Equipment	LAD	Ladders
BRG	Bridge	DLG	Data Logger	GCE	Gantry Crane	LAH	High Level Alarm
BLD	Building	DNT	Decant Tank	GCN	Generator Connection	LAL	Low Level Alarm
CAB	Cabinetry	DOM	DO Meter	GEN	Generator	LCU	Level Control
CAM	Camlock Coupling	DRN	Drain - Natural, Manmade.	GNC	Generator Controller	LEI	Level Indicator
CASS	Membrane Cassette	DUC	Ducting	GRC	Grit Classifier		

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TABLE C Continued – ASSET EQUIPMENT CODES

Code	Description	Code	Description	Code	Description	Code	Description
LFB	Lifting Beam	PLC	Programme Logic Controller	SIG	Sign	TOO	Tool
LFS	Lime Hooper & Feeder	PLY	Polymer Tank	SLT	Sludge Storage Tank	TRT	Treatment Device - Wetland, Rain Garden, Tree Pit
LMT	Limit Switch	PMC	Pump Control	SKI	Skimmer (Scum Collector)	TRA	Trap - Pollutant, Silt Trap
LOV	Discharge Louvre	PMP	Pump	SKD	Soakage Device	TRL	Trailer
LPU	Lightening Arrester	PPR	Pump Rails	SOFN	Water Softener	TRN	Transformer
LSH	High Level Switch	POL	Power Pole or Other	SOL	Solenoid Valve	TRR	Telemetry Radio
LSL	Low Level Switch	PON	Pond	SPI	Speed Indicator	TTR	Temperature Transmittor
LSN	Level Sensor	PRG	Pressure Gauge	SPN	Solar Panel	TUM	Turbidity Meter
LTM	Level Transmitter	PRS	Pressure Switch	SPR	Sprinklers	TUB	Turbine
LTR	Level Transducer	PRV	Pressure Reducing/Regulating V	SSR	Scraper	TUR	Telemetry Unit
MAC	Macerator	PSN	Pressure Sensor	STA	Soft Starter	UPS	UPS
MET	Meter	PTR	Prsesure Transmittor	STI	Strainer	UVS	UV System
MHL	Manhole/ Lampholes/ Cleaning E	PSY	Power Supply	SUR	Surge Controller	VDD	Variable Dosing Drive
MIX	Mixer	PTH	Footpath	SUP	Support Structure. Includes Foundation, Anchor Block, Roller, Pad Plinth, Pontoon.	VIB	Vibration Switch
MOC	Moisture Controller	PWS	Pressure Washer	SWY	Spillway	VNT	Ventilation
MOI	Moisture Monitoring Probe	PZM	Piezometer	SWB	Switchboard	VSD	Variable Speed Drive
MPR	Motor Protection Relay	RAI	Rain Gauge	SWF	Screw Feeder	WBR	Water Blaster
MTC	Motor Control	REV	Reservoir	SWW	Screw	WDU	Washdown Unit
MTR	Motor	ROD	Road	SWR	Software	WER	Weir/ Slide Gate
NRV	Non Return Valve	ROT	Rotameter	TAP	Sample tap or similar	WEL	Weigh Element
OFT	Odour Filter	RTR	Router	TAR	Tarriff Metering	WST	Weather Station
PBD	Portable Building (Container/Room)	SAL	Satellite Dish	TEE	TEE	WTR	Weigh Transmitter
PBT	Pressure Break Tank	SAM	Sampler	TEL	Telemetry	WWL	Wet Well Lid
PBU	Polmer Batching Unit	SAT	Surge Anticipating Valve	TEM	Temperature Switch	ZIC	Position Indicating Controller
PCM	Pump Chamber	SBT	SBR Tanks	TIC	Temperature Indicator Controll	ZSO	Position Switch Open
PHA	pH Analyser	SCL	Scales	TNL	Tunnel		
PIC	Pressure Indicating Controller	SCR	Mechanical Screen	TMA	Temperature Alarm		
PIP	Pipework	SIL	Acoustic Silencer	TME	Temperature Element		

CONTENTS

1 PURPOSE

The purpose of this document is to summarise and highlight the requirements for various pavement reinstatements commonly undertaken in Queenstown as a result of excavations for utility services and infrastructure in pavements.

This guide should be read in conjunction with;

- National Code of Practice for Utility Operators' Access to Transport Corridors – 15th July 2020
- QLDC Foam Bitumen Stabilised Pavement – Trench Reinstatement December 2010
- Definitions shall be as per the National Code of Practice for Utility Operators' Access to Transport Corridors – 15th July 2020

2 SCOPE

The scope of this guide is limited to the reinstatement of areas disturbed through the installation or repair of utility services and infrastructure. The guide specifically does not apply to new pavement construction.

3 TRENCH EXCAVATIONS

3.1 PRIOR TO TRENCH EXCAVATION

Prior to the the excavation of the trench:

I. any concrete, asphalt or chip seal surfaces must be cut with a power saw in a clean, straight line through the full thickness of the surface layer;

II. the separation distance (see image below) from the original saw cut must be a minimum of 150mm, except for concrete Carriageways where a minimum of 300mm applies, but more may be required to maintain the integrity of the final trench reinstatement;

III. if necessary, a second saw-cut must be made to ensure that all edges are straight, smooth, parallel to the line of the trench and that minimum trench trimming allowance is achieved; and

IV. all joints must be cut to a depth sufficient to avoid disturbance of adjoining pavement. The depth of cutting must be not less than 30mm, or for concrete carriageways, footpaths, and vehicle crossings the depth must be not less than 80% through the concrete pavement layer. When planning the location of the trenching, ensure that all the requirements of Section 3.5-3.7 (Surface Layer Reinstatement) can be met.

If any break over occurs:

- a further cut must be made to maintain trimming allowances and a clean edge for reinstatement;
- any change in direction of the saw cut must not exceed an angle of 45 degrees to the trenchline;
- the total length of over-break must not exceed 10% of the length of the trench; and
- the length of trim at any one section of over-break must not be less than 1m

Min 150mm **Min 150mm**

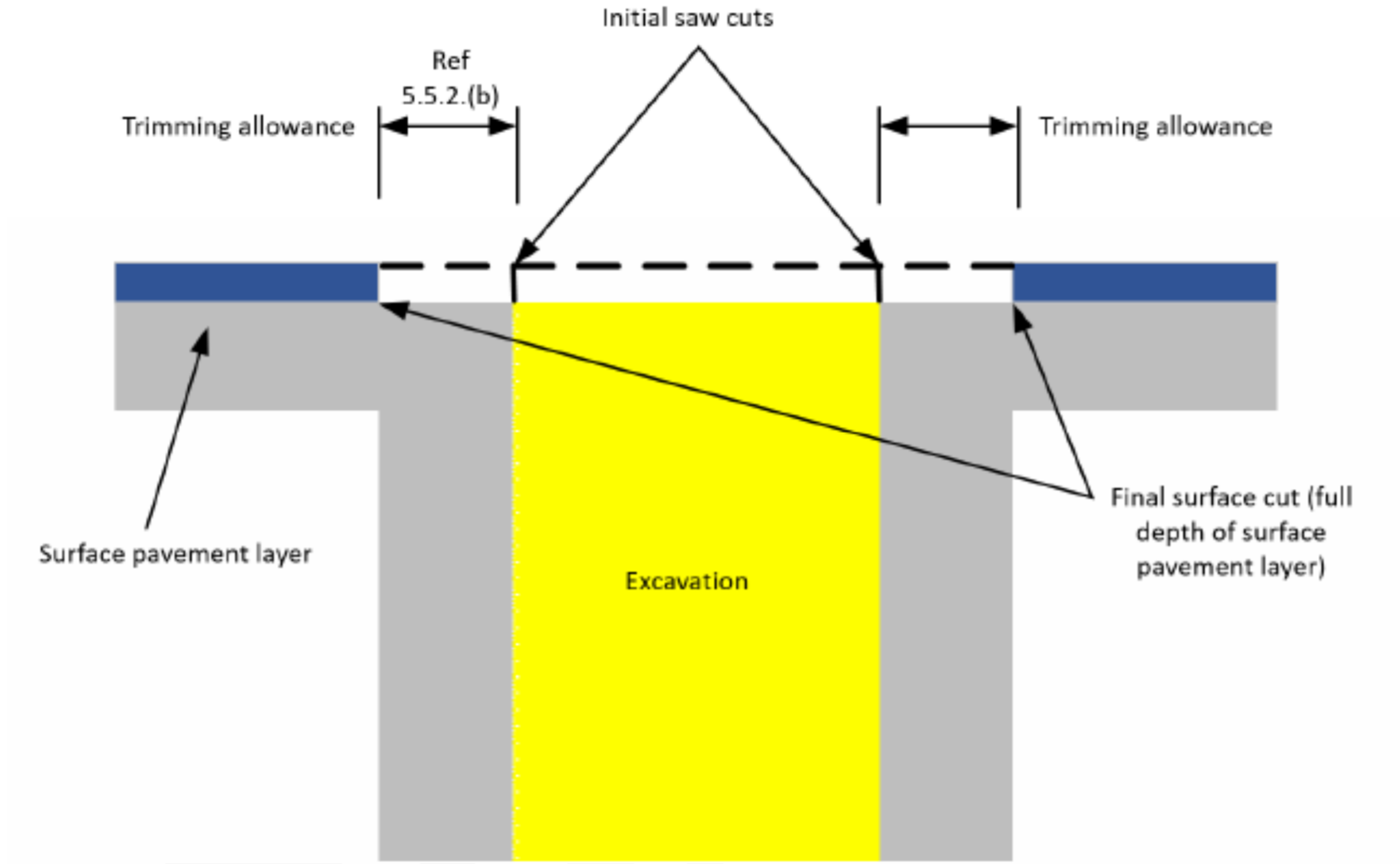

Figure 1 Trench Preparation (Section)

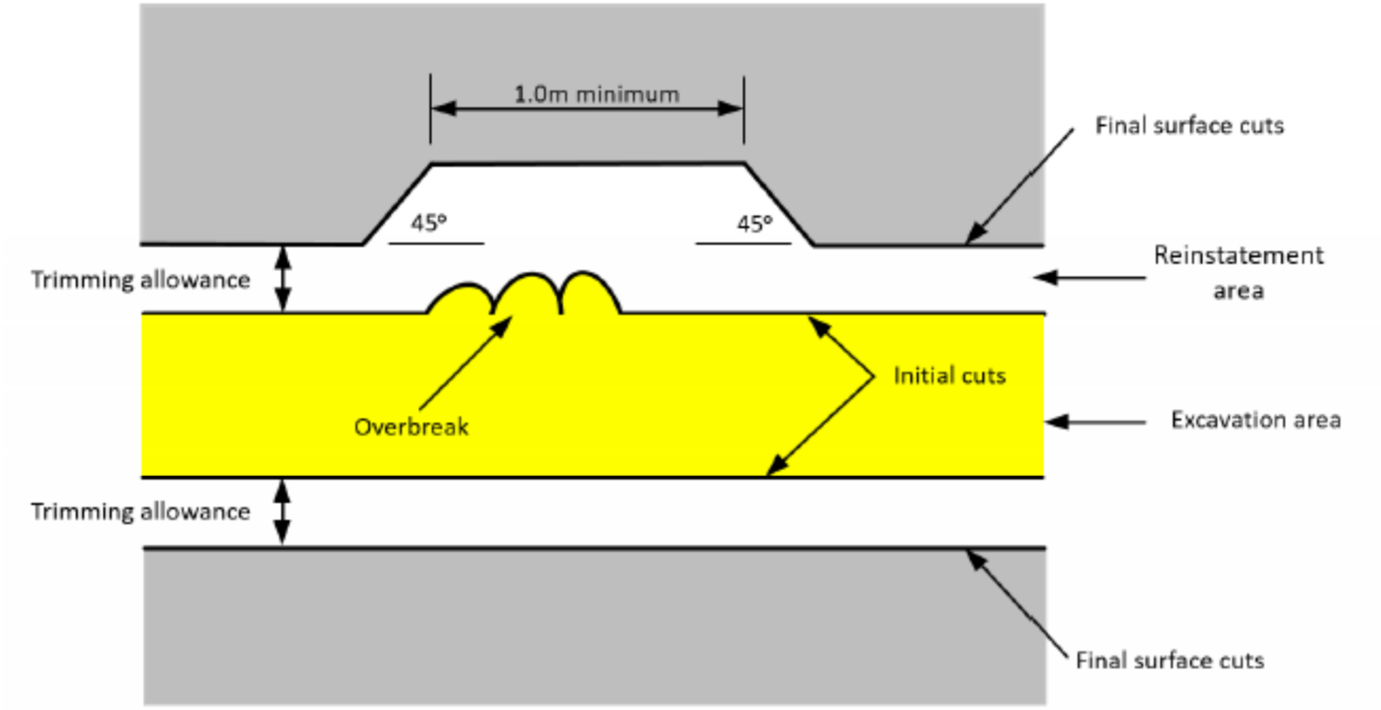

Figure 2 Overbreak Saw Cutting (Plan)

3.2 DURING EXCAVATION

During excavation works:

I. there must be no undercutting of areas adjacent to the excavation;

II. if slumping at the sides of the excavation causes depressed areas adjacent to the excavation, or if the edges of the pavement are lifted during excavation, additional trench cutting outside the original line of the excavation and outside the area of damage must be carried out;

III. excavation to profile/depth must be in accordance with the construction drawings;

IV. the length of open trench must be kept to a minimum and backfilled as soon as practicable;

V. excavated material that is not being used for backfill must be removed from the site;

VI. where groundwater is likely to accumulate as a result of Utility Works, excavations must be permanently drained; and

VII. the Utility Operator must provide temporary support/shoring to all trenches if required to provide lateral support to the excavation and to comply with health and safety Act and codes, including the WorkSafe Good Practice guidelines of July 2016. The Utility Operator must certify this Work in accordance with the requirements of the Building Act 2004. Alternative trench support can include battering, ground stabilisation and sheet piling.

Depending on the depth of reinstatement and width of trench it is best practice to either step the pavement layers into the existing pavement or cut the batter wall at 45 degrees to avoid cracking of the trench on vertical edges.

Effective drainage of the trench is particularly important in rural situations where trenches run through cut areas, fill embankments, or slip prone areas.

3.3 BACKFILL MATERIALS

All Backfill Materials

- must be in accordance with recognised standards and approved by the Corridor Manager;
- must be adequate to ensure that the backfilled area can at least match the pre-trench subsurface integrity;
- must be of sufficient quality and strength to support the imposed loading, including traffic and road construction loading;
- where concrete or other stabilised layers, including geotextile material, exist in the road pavement, the Utility Operator must reinstate the trench with similar material and
- must be neutral or beneficial in effect on any other Utility Structures with which there will be interaction.

The bedding/embedment material must be specified by the Utility Operator and placed as folows:

- in a loose state (sand must be dampened) and tamped to achieve compaction and surround of Utility; or
- in a fluidised state where specifically approved by the Corridor Manager; and
- to a depth of not more than 300 mm above the top of the Utility Structure unless a variance is agreed between the Utility Operator and Corridor Manager.

General Fill

- in Road Carriageway, shoulder and footpath, general fill must be well graded granular material free of deleterious material with maximum stone size 75mm;
- where the Utility Operator uses suitable excavated material in berms, the required compaction standards (Section 3.4 Backfill, Placement and Compaction) must be achieved as per below

3.4 BACKFILL PLACEMENT AND COMPACTION

Placement and compaction of all layers must:

- be in layers not exceeding 200 mm (compacted) thickness;
- allow for appropriate compaction methods around the Utility Structures;
- have mechanical compaction completed for each subsequent layer in turn; and
- ensure lapping of any geotextile material in accordance with the manufacturer's specification.

During backfilling and compaction:

- care must be taken to ensure no damage occurs to Utility Structures during compaction; and
- if over break or other disturbance of the pavement layers occurs, the surface of such areas must be re-cut, excavated and backfilled in compliance with this Section.

Where the strata exposed as side walls of a trench is considered relatively soft, such that there may be risk of settlement arising from ongoing post-construction penetration of the granular fill material into the trench sides, the Utility Operator should discuss backfill options with the Corridor Manager. These may include, for example, the application of a geo-textile liner in the trench, or the use of modified (lime or cement-treated) granular materials in the vicinity of the soft layer/s.

Compaction must:

I. be carried out using suitable plant and equipment to achieve the specifications below. Please refer to the QLDC LDSC2020 COP with examples of trench backfill and compaction dwgs B1-3 and B1-4 from Appendix B Std dwgs and

II. be confirmed by a Clegg hammer, or an agreed alternative, for sub-base and deeper fill; and

III. be recorded on a the contractors own standard form for each job and results of each test shall be made available to the QLDC Corridor Manager on request

The use of a nuclear densometer or similar compaction testing device is required for larger excavations in carriageways (anything exceeding $20m^2$, one entire lane, or with a linear length exceeding 10m).

Table 1 Clegg Impact Value (CIV) Value for Reinstatement

Layer	Carriageway	Footpath
Basecourse	98% MDD (IV40*)	IV 25
Sub-base	IV 35	IV 25
Deeper Fill	IV 25	IV 15

* Only applicable to reinstatements undertaken as part of a QLDC maintenance contract

Where a contractor is undertaking regular reinstatements on hbehalf of QLDC i.e. water leak repairs, or trench reinstatements, NDM testing is required once per month to demonstrate that the methodology is working as intended and the Clegg testing carried out is demonstrating the desired density results.

Figure 3 Aggregate wetted down during compaction to achieve 98% of MDD – note no compaction depression lines

3.5 SURFACING REINSTATEMENT (GENERAL REQUIREMENTS)

The Utility Operator must, unless otherwise agreed with the Corridor Manager:

I. not open Trenched sites to Traffic until temporary or permanent resurfacing is in place;
II. not use temporary resurfacing unless permanent resurfacing is not practicable; and
III. have permanent resurfacing in place within seven ten working days of completion of backfill or temporary surfacing; and
IV. avoid creating longitudinal surfacing joints in wheel tracks where possible.

The Utility Operator must ensure the reinstated surfacing:

I. is installed in clean, long, straight lines parallel to the kerb or Footpath, or for transverse Trenches, perpendicular to the kerb and channel;
II. uses materials that match the surrounding surface in type, quality, texture, skid resistance and strength (note the use of asphalt for trench reinstatements in non-asphalt roadways is acceptable);
III. matches at least the pre-existing surface in smoothness or ride quality for vehicles (vertical movements);
IV. has a finished surface level and adjoining surface shaped to avoid ponding of surface water, such that the deviation of the surface from a 3m straight edge does not exceed 5mm;
V. does not create a lip greater than 5mm where it joins existing seal on Carriageways;
VI. is continuously graded towards stormwater drainage channels or gully entries;
VII. has no lips greater than 3mm high in pedestrian surfaces; and
VIII. be constructed to have a durable and functional life at least equivalent to the residual life of the existing pavement, as determined in consultation with the asset owner; and
IX. if the edge of the final surface cut, inclusive of the excavation/trench trimming allowance, in a Footpath or Road Carriageway is within 1m of a joint or existing edge of the pavement, then the existing pavement must be replaced to that joint or edge "

3.6 SURFACING REINSTATEMENT (ASPHALT)

Asphaltic concrete surfaces shall be designed and constructed in accordance with NZTA specification M10 2020 and M10 Notes (or latest version) and the following requirements;

- Once compaction is undertaken, the finished Basecourse height to finished surface depth must be checked to ensure the minimum depth of Asphalt is placed. This depth MUST be recorded.
- Patches must have a heavy tack coat prior to placing AC, minimum 0.5l/m2 – see example photo below;

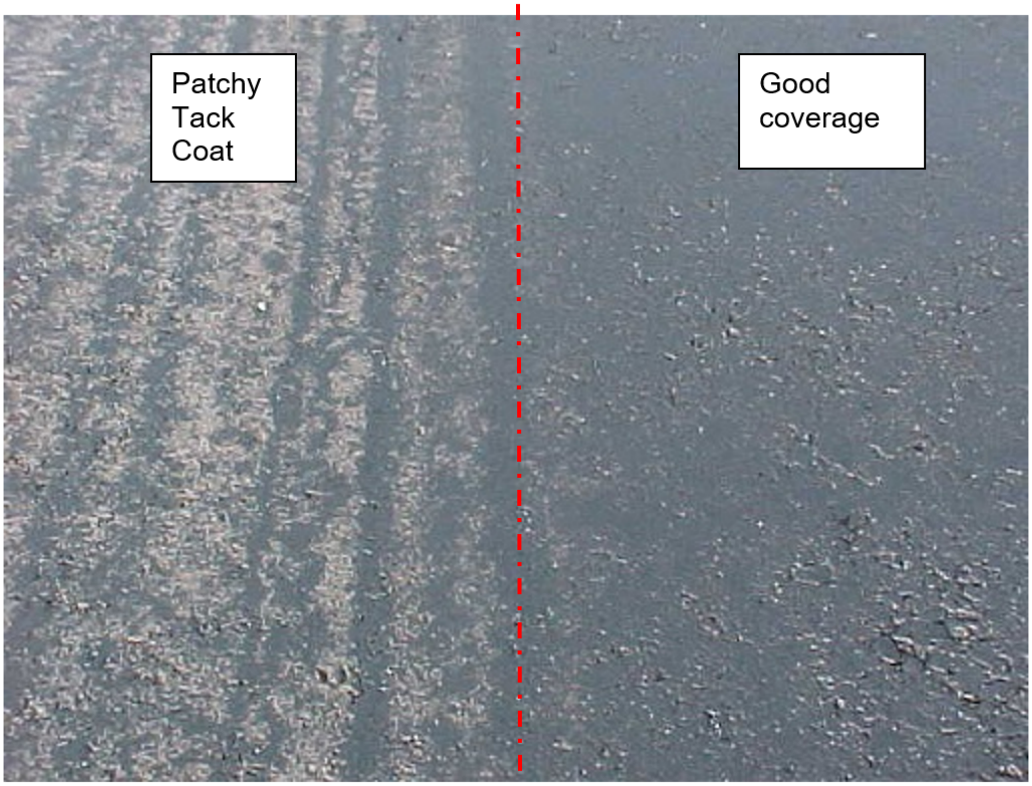

Figure 4 Tack Coat Application Examples

- The temperature of the AC must be recorded prior to placing and during placement to ensure compliance with the minimum temperature requirements.
- The mix design and relevant temperatures are to be recorded on site, preferably on the coontractors own trace sheet or similar that is available on request to the Corridor Manager
- With the exclusion of pothole repairs undertaken under the QLDC Roading Maintenance Contract, all reinstatements are required to be bandage sealed.
- Areas greater than 20m^2, one entire lane, or with a linear length exceeding 10m require a membrane seal underneath the asphalt. The requirements for a membrane seal are per 3.4.4.2 of the COP.

The following temperatures are provided as guidance; however, it is the contractor's responsibility to ensure that they have the appropriate mix temperatures from their suppliers prior to placing the AC;

Table 2 Asphalt Temperature Guidance

Common Reinstatement Mix Types	Mix Temperature	Compaction Temperature	Minimum Layer Thickness
DG7	140-180	165-175	25
DG10	135-160	135-155	35
Mix 10	135-160	135-155	40

Additionally, depending on the ground temperatures at the time of placing, the minimum mix temperature should never be below 95 degrees Celsius or 110 degrees Celsius for polymer modified bitumen asphalts.

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3.7 SURFACING RESINSTATEMENT (CHIPSEAL)

Joint sealing/joint bandaging (required as minimum) and tack coats as necessary, should be part of the proposed methodology for approval, and guidance is included in the Chipsealing in New Zealand Handbook;

I. Chip seal shall be reinstated using a two-coat chip seal; the first coat must be a coarse grade chip (e.g. Grade 3) and the second coat a finer grade (e.g. Grade 4 or 5) to visually blend with the existing adjacent surfacing. The second coat must overlap the existing surface by not less than 100mm;

II. be laid in accordance with the NZTA specification TNZ P/3: First Coat Sealing and the Chipsealing in New Zealand Handbook or;

III. be laid in accordance with the NZTA specifications TNZ P/4: Resealing or TNZ P/17: Performance Based Specification for Bituminous Reseals; and

3.8 OTHER RESINSTATEMENTS

Concrete pavement surfaces

- be no less than 1m in any horizontal dimension in order to provide sufficient mass;
- match adjacent concrete paving depth but be no less than 100mm in depth (vehicle crossing depths may vary between RCAs. Check with your Corridor Manager);
- have reinforcing steel/mesh replaced to the same standard as the existing reinforcing;
- have a strength no less than 20MPa at 28 days. Admixtures may be used to attain the required strength earlier;
- match the surface finish of adjacent areas and if not being overlaid should be broom finished; and
- have construction joints formed to match those existing or be installed at minimum 4m centres.
- To re-establish a tight interlocking pattern with specified joint widths for pavers, it may be necessary to remove adjoining blocks and relay them up to a bordering physical feature such as the Road kerb.

Grass berms

- be reinstated level with clean and weed free topsoil to a minimum depth of 50mm (lightly compacted); and
- use approved seed and rake lightly to mix seed into top 20mm.

4 FOAM BITUMEN PAVEMENTS

In recent years Queenstown has seen an increase in the use of Foamed Bitumen Stabilisation throughout its roading projects.

In areas such as Queenstown, Foamed Bitumen Stabilisation provides many benefits to a roading rehabilitation project, for example;

- A strong pavement
- A pavement less susceptible to temperature effects i.e., frost/thaw
- insitu reuse of existing pavement materials

However, the increased use has created a situation whereby service providers are not accustomed to working with this material.

The following section presents a guide/specification for the reinstatement by providers of service trenches that needs to be carried out in pavements that have been Foamed Bitumen Stabilised. It is not usually practical or possible to have "fresh" foamed bitumen stabilised aggregate available for these maintenance works, so a practical alternative is specified in this document.

4.1 BEST PRACTICE

Prior to the physical construction it is best practice for service providers to be notified well in advance of the proposed carriageway rehabilitation. This can allow the operators to identify projects within the area and undertake any works that may be required prior to the stabilisation of the pavement. The best method of ensuring that a pavement remains watertight and uniformly robust after rehabilitation or maintenance works are completed is not undertaking trenching at all.

If a service must be installed via trenching in the pavement after its rehabilitation, an opportune time to carry this out would be prior to the second coat sealing of the site or prior to any planned sealing of the site. This would aid in the appearance of the final surface and maintaining a continuous water proofing layer.

4.2 FBS REINSTATEMENT SPECIFICATION

The ultimate goal of the trench reinstatement is to replace the excavated material with a material that will have a similar strength, stiffness, compaction and surface as the original material, thus avoiding rutting, cracking, differential settlement and moisture ingress.

Prior to starting the excavation

Saw cut a minimum of 100mm into the existing pavement (this is to provide a good surface to match into the stabilised material and protect the remaining stabilised pavement) and to a width 100mm wider on each side than the required trench width. The surfacing should also be cut further to give the profile depicted in figure 1 (chipseal) and figure 2 (thin AC).

Figs 1 & 2 do not refer to surfacing material. Suggest just refer to Fig 1 and Fig 2.

Excavation

The top 200mm of the excavated material i.e., the stabilised material, is to be stockpiled separately to the remaining material excavated. This material when cement is added (detailed below) will form the basecourse layers of the pavement.

Reinstatement

If the original saw cuts have been destroyed during excavation these are to be re cut to form a smooth surface.

Material to be placed in the bottom of the trench above the service bedding shall be the same excavated material or as per the backfill requirement of the service being installed / repaired.

Material to be placed 400mm from the surface shall be the same excavated stabilized and unstabilised material, with the addition of cement. The amount of cement added should be enough to produce a lean mix, in the order of 60kg of cement per m^3 of soil. Water must be uniformly mixed through the material. Alternatively, if foamed basecourse material is available from another local stabilisation project this can be substituted, provided it is carted and placed without delay.

Material is to be placed in 200mm layers and compacted to achieve the required compaction as per the previous sections of this document.

QA documentation

QA records shall be complied for each job and shall be made available to the Corridor Manager on request.

These shall include the following, which are not exclusive:

- Aggregate testing relevant to the aggregate specification eg TNZ M/4
- Aggregate compaction requirements and all test results which shall demonstrate compliance with QLDC requirements. Evidence of layer depths shall be provided
- Modified aggregate design and testing. All test results shall demonstrate compliance with QLDC requirements
- Surfacing design and production/placement QA showing compliance with requirements such as temperatures, compaction
- Photos of construction suitably labelled to provide time and location information

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

Disclaimer

Introduction

The Queenstown Lakes District Council (QLDC) is responsible for all traffic signals installed on Council roads in the Queenstown Lakes District. All QLDC traffic signals are operated by the Wellington Traffic Operations Centre (WTOC) and maintained by QLDC's agreed maintenance contractor.

This document is designed to assist all interested parties to understand the QLDC functions and the standards that have been adopted to ensure a consistent approach is maintained when designing and installing traffic signals and associated equipment.

Glossary of Terms

AS / NZ	Australian Standard / New Zealand Standard
Active Traffic Management System (**ATMS**)	Technology that provides information to road users by means of Variable Message Signage.
AMDS	The Asset Management Data Standard (AMDS) is a data standard that informs activity management decisions for transport https://www.nzta.govt.nz/roads-and-rail/asset-management-data-standard/
Controller	The equipment (including the housing) that switches power to signal lanterns and controls the duration and sequence of signal displays as defined by the controller personality.
Controller Information Sheets (**CIS**)	A hard copy of the information used to make a Controller Personality that is contained within the PROM.
Controller Personality	The unique program stored in the PROM, which configures the controller to the specific operational design of the intersection.
CCTV	Closed Circuit Television.
CoP	Code of Practice
DP Number	Distribution Point for telecommunications.
FSL	From Stop Line, measurement used for distance from start of detector loop.
ICP Number	Installation Connection Point Number (for electricity power meter).
Intelligent Transport Systems (**ITS**)	Refers to various systems like SCATS, CCTV, VMS and ATMS systems that provide and add information and communications technology to transport infrastructure.
JUMA, JUSP	**Joint Use Mast Arm, Joint Use Service Pole**
KJB	Kerbside Junction Box to access services. For example, detector loop feeders.
NZTA	New Zealand Transport Agency (now Waka Kotahi NZ Transport Agency)
NGEN	Software product developed by RMS to produce .SFT and .M68 files.
PCMCIA Card	A computer card containing the controller personality information housed in the TSC / AS 2578 compliant controller.
PROM	A computer chip containing the controller personality information housed in the TSC3 compliant controller. In this document PROM refers to either a PROM, a PCMCIA card or similar software storage device.
Road Asset and Maintenance Management (**RAMM**)	An Internet accessible system that stores the Traffic Signal assets. RAMM also records the activity of the Maintenance Contractors by the logging of faults as Dispatches and the updating by the Contractors following completion of the job. Contractors' claims are generated from the RAMM system each month end.
RCA	Road Controlling Authority.
Roads and Marine Services (**RMS**) of New	The Authority accepted by Queenstown Lakes District Council as the basis for the QLDC standards and for product approval. RMS also develop and own SCATS traffic

South Wales (**NSW**)	signal software and other products related to SCATS and their output files.
SAT	Site Acceptance Test, commissioning checklist.
.SFT / .M68	File formats for traffic signal software (TRAFF)
Sydney Coordinated Adaptive Traffic System (**SCATS**)	A fully adaptive area wide control system for traffic signals that is linked to the traffic signal controllers running TRAFF software via telecommunication lines.
TRAFF	Traffic signal base software inside traffic controllers on site running the signals.
QLDC	Queenstown Lakes District Council
Vehicle Activated Sign (**VAS**)	VAS is a generic term for a type of road traffic sign that displays a message conditional upon the presence or speed of a road vehicle.
Variable Message Sign (**VMS**)	An electronic traffic sign often used to display a message or picture. The sign display is changeable and dynamic.
Wellington Transport Operations Centre (**WTOC**)	Organisation tasked with operating the traffic signals and the ITS systems for local roads and State Highways around the Queenstown Lakes District by monitoring SCATS and CCTV.
Win Traff	A software programme used to check the controller information by testing the software of the controller personality.

1 REQUIREMENTS FOR TRAFFIC SIGNAL DESIGN

Purpose

The purpose of this document is to give an understanding of the QLDC requirements when undertaking the design, installation or maintenance of traffic signal installations in the QLDC regions, and the delivery of the as-built and data submissions

Who Should Use This Document?

All consultants, contractors and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District should use this document. Where for example, an upgrade is being carried out by an RCA the applicant shall be the assigned. In most situations this would be the traffic signal contractor (who would have most technical experience in providing the relevant information required).

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content, the applicant must read it in conjunction with the QLDC Land Development & Subdivision Code of Practice – 2020 (QLDC CoP). The QLDC CoP contains details on document management and describes processes. The intent is to show what is expected in the application.

This guideline has been created to ensure that the designs of all intersections are to the highest standard, with variations being the exception rather than the norm. It is important that the information submitted as part of new or modified traffic signal layouts are standardised as much as possible. This will enable any further changes that may result from changing traffic conditions to be implemented quickly and simply.

The applicant's project team members are expected to have the experience and knowledge required to provide the relevant details, particularly the production of software and, CIS and traffic signal design. QLDC are not responsible for providing training or resources for designers who are new to the industry as there are suitable courses and consultants who can provide training.

Technical Criteria

The design of the traffic signals must be carried out in accordance with the standards and guidelines listed below and their revised / subsequent replacements:

> QLDC Land Development & Subdivision Code of Practice – 2022.
> QLDC CoP Appendix L – Traffic Signal Guidelines.
> NZTA P43 Specification for Traffic Signals.
> AUSTROADS Traffic Management Guides.
> Road Traffic Standards (RTS) 14.
> NZTA Pedestrian Planning and Design Guidelines.
> NZS1158 Public Lighting Standards.
> QLDC Southern Light Strategy.
> QLDC RAMM Database Operations Manual
> Asset Management Data Standard

The specification of traffic signals equipment shall comply with the current version of NZTA P43 Specification for Traffic Signals or, a written agreement with QLDC for the use of specific components shall be obtained.

The contractor is responsible for ensuring that all equipment that is installed meets the minimum standards. If there is any doubt, the contractor shall be required to provide evidence that the product meets QLDC requirements.

Reference Material

Detailed below are recommended documents to assist in the processes required.

> NSW Roads & Maritime Services, Traffic Signal Design.

- Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.
- Signals National User Group (SNUG).

1.1 TRAFFIC SIGNAL REPORT DOCUMENTATION

Prior to an applicant submitting a traffic signal report to QLDC, it is expected that the applicant liaise with QLDC and produce a Traffic Signal Feasibility Report prior to the Traffic Signal Detailed Design .

Any deviations from QLDC's Requirements and the reasons for the deviations must be summarised in a separate section in the report.

All documents to be supplied in electronic format. This is to ensure that the plans are clear and concise for reviewers, safety auditors and contractors.

1.1.1 Traffic Signal Feasibility Report

A brief traffic signal report with diagrams and maps that includes the following information:

- Site Location Plan.
- A brief description of the reason for proposing the installation of traffic signals.
- Intersection concept drawing/sketch showing proposed site including poles, lanterns, controller, accesses, bus stops and parking, vehicle and cycle lanes, with widths.
- Proposed and existing site layout detailing:
  - Road and Footpath widths dimensioned
  - Boundary, driveways, building lines and verandahs
  - Traffic signal equipment including phasing
  - Existing services, including manhole covers, boundary boxes, bus shelters etc.
  - Trees, garden plots, berms etc.
- Risk Identification and assessment of existing services.
- Assessment of Network Operation Plan, road hierarchy, speed and usage including over-dimensioned vehicles.
- Assessment and map showing user desire lines and facilities that generate traffic and pedestrian movements. For example, Hospitals, Schools and associated safe routes, event venues/clubs, elderly housing areas etc. This data is to be included in the modelling, as is information about the expected use of the network surrounding the proposed site.
- List user hierarchy in priority order, time and day. For example:

  AM Peak 07:00 – 09:00
  1. Cycle
  2. Freight
  3. Vehicles
  4. Pedestrians
  5. Buses

- Existing crash data with a brief analysis of causes and commonalities.
- Modelling Report – refer to Section 2 of this Appendix.
- Movements Data. Examples of periods and types to be considered are:
  - AM Peak turn counts (07:00 – 09:00) for cars, heavies, cycles and pedestrians.
  - Inter Peak turn counts (11:00 – 13:00) for cars, heavies, cycles and pedestrians.
  - PM Peak turn counts (15:00 – 18:00) for cars, heavies, cycles and pedestrians.
  - School Travel turn counts for cars, heavies, cycles and pedestrians.

- Approach design speeds (posted and 85 percentile).

1.1.2 Traffic Signal Detailed Design

If a Traffic Signal Feasibility Report has been prepared, the detailed design scope can be defined clearly with the majority of risks and modelling assessments already identified. However, some of the requirements have been expanded with an emphasis on more detail.

All drawing plans submitted in electronic format, to show as a minimum:

> Legend corresponding to the symbols and hardware depicted on the drawing.
> North Point.
> Title Block.
> Revisions with comments on changes.
> Drawing type (i.e. construction, information, draft).

Detailed Design requirements in addition to the Traffic Signal Feasibility Report are to include the following drawings and documents:

> Cover Sheet and Site Location Plan.
> Existing Survey and Services.
> Proposed Construction and Set out.
> Proposed Signal and Phasing Layout.
> Proposed Ducting and Cable Diagram.
> Tactile Pavers and Pedestrian Layout.
> Proposed Road Marking and Signage.
> Vehicular Tracking Plan.
> Proposed Street Lighting.
> Standard Details (optional).
> Controller Information Sheet (CIS).

The detailed design should include detailed information for the proposed locations of poles, chambers, signs, lighting columns in relation each other and be drawn to scale.

Particular attention to detailing tactile pavers, pram crossings and pole locations, especially mast arms, should be made.

Further modelling work may be necessary during the detailed design process. The requirements are the same as detailed in the Traffic Signal Feasibility Report section, above.

1.1.3 Cover Sheet and Site Location Plan

This sheet will have the name of the project, a locality plan showing the location of the intersection, a brief and a drawing register.

1.1.4 Existing Survey and Services

This sheet is to show the location of all services plotted from the various service authorities services plans. In addition, the information collected by the topographical survey such as existing kerbs, driveways, trees, berms, local facilities such as manholes, valves, poles, streetlights and road marking and signs, must be shown.

We understand the accuracy of underground services plans can be minimal but it is expected that the designer has taken the steps to allow for inspections and trail holes to be investigated before the detailed design is approved.

1.1.5 Proposed Construction and Set Out

This sheet will show the extent of all new physical works to be undertaken such as kerb relocation, new islands, pole and chamber locations, pram crossings showing top and bottom of let-downs, tactile and directional pavers and, where services are being relocated to if applicable.

1.1.6 Proposed Signal and Phasing Layout

This sheet will show the proposed kerbs and road marking, the location and, the type of all signal hardware.

The plans shall be scaled appropriately to size of paper. Ideally, A1 size and include the following details:

> Lane configuration and assignment (arrows).
> Lane widths / carriageway widths (include cycle ways and advance cycle boxes where applicable).
> Detectors numbered (advance / queue loops to show distance from vehicle stop line).
> Signal Groups diagram, labelled and numbered.
> Signal phasing diagram, phase sequences and default sequence.
> Operation features e.g. 'Rest in A'; 'Z- allows filter'.
> Controller position and door opening.
> Poles with number and type (i.e. 5m outreach mast arm pole, JUMA, JUSP, CCTV).
> External Inputs (include type i.e. Detectors - Infrared, Doppler radar, Video, Thermal.).
> Aspects showing visor and type, and louvers (if used).
> Street Names.
> Property Boundaries.
> Kerb Lines.
> Vehicle Crossings.

1.1.7 Proposed Ducting and Cabling Diagram

A Ducting and Cabling Diagram shall be scaled appropriately to size of paper and include the following details:

> Kerb Lines.
> Access Chambers and Label.
> Kerbside Junction Boxes (KJB) and Tobies.
> Signal controller cabinet.
> Duct Lines, specifying the size and number of ducts.
> Poles and pole numbering.
> Detectors and detector numbering (including external inputs, overhead detection etc.).
> Cable runs.

1.1.7.1 Tactile Pavers and Pedestrian Details

Tactile and directional pavers drawn to show actual proposed location. The design must consider location of services to minimise risk during construction. The relationship between:

> Pole location
> Push button with desired angle shown
> Slip and trip hazards, and
> Pedestrian access ramp and associated slope

is essential detail and the consideration given must be included.

The design should consider accessibility needs of disabled or aged users, such as orientation of the crossing to the target kerb ramp, wayfinding on approach and exit, wheelchair crossings of drains, etc.

The designer must consider relocating services or proposed pedestrian access locations to maintain a practical and operational site. Include additional drawings showing these details. For example:

> Staggered crossing to show fencing positions and method of quick removal for maintenance

> Drainage cross fall details showing within a Median Island, and

> Installation of poles on a staggered arrangement to be located behind the kerb to assist minimising trip hazard, footpath cleaning and drainage.

Specifications for type of tactile paver are defined in the QLDC CoP. Plastic tactile pavers maybe considered after consultation with QLDC. Furthermore, in ground pads are not to be used. Alternatives for call cancelling pedestrians can be considered, such as overhead detection. Refer NZTA P43 Specification for Traffic Signals.

1.1.8 Proposed Road Marking and Signage

This sheet will show the proposed road-marking layout with dimensions including the tie-ins with the existing road marking at the extent of the physical works. Any proposed signage should also be included.

1.1.9 Vehicle Tracking Plan

This sheet will show the tracking of the largest vehicles deemed appropriate for the site. Of particular note should be the left and right turning vehicles with respect to limit line location and kerb lines.

1.1.10 Proposed Street Lighting

The street lighting designer shall provide a design that has assessed the proposed traffic signals design in relation to their industry standard documents and appropriate Road Controlling Authority (RCA) Code of Practice (CoP). QLDC shall comment on fit for purpose in relation to the proposed users and demographic environment. Examples by way of guide are:

> Suitable lighting to be installed for vehicle's, pedestrian access and crossing the road and also as part of the project site, and

> On the approaches to site, assist with crime prevention and CCTV operations.

The lighting design proposed for the intersection shall be peer reviewed by QLDC's nominated consultant.

All overhead traffic signal poles are to have a JUMA spigot fitted to facilitate future street lighting or CCTV equipment if required. A waterproof cap shall be fitted to all spigots not used for lighting or CCTV equipment.

The streetlight is to source its power separate from the traffic signals. This is to be discussed with QLDC prior to construction.

1.1.11 Standard Details

Standard signal sheets will show the details particular to signal installations. NZTA P43 Specification for Traffic Signals shows some standard details however the designer may propose alternatives. For example:

> Staggered crossing to show fencing positions and the method of quick removal for maintenance.

> Drainage cross fall details (showing within a Median Island).

The applicant must ensure that all works meet the relevant RCA Development Codes and Standards. For example; ducting standards and depths, approved tactile pavers, waste management and drainage. Refer to the appropriate road controlling authority for relevant development code.

1.1.12 Controller Information Sheet

Controller Software Specification is to be used to develop the Controller Information Sheet (CIS). The newest CIS sheet must show the revisions from the previous version and highlight each change in yellow.

The Controller Software Specification specifies the generic layout and operation of the site and includes any special requirements or logic in terms of detector or signal group operation.

These requirements are specific to each site / signal design. Refer to sections that follow for further details. At a glance, the requirements may include information such as:

> Train Operation.

> Pedestrian Protection (See Pedestrian Control section).
> Special Signal Group Overlaps.
> Bus, Tram or Cycle Logic.
> Conditional Phasing.
> Pedestrian Reintroduction.
> Special Time Setting Substitutions, and
> Special Detector Calling Functions.

MSS bits to be considered for all non-loop detectors such as push buttons, pedestrian overhead and underground detectors, Video, Infra-Red, Doppler Radar. This is so WTOC can monitor the devices and control functions under SCATS variations.

1.2 TRAFFIC SIGNAL EQUIPMENT

This section is referring to considerations during Feasibility and Design stages in relation to location and practical operations rather than equipment performance and specifications where these are defined in the QLDC CoP and NZTA P43.

1.2.1 Controller

The controller and its associated cable draw pit located within the road reserve with the back of the controller facing the intersection where practicable, with Door opening to be shown on drawing.

The controller should be located where it is:

> Close to the power supply and telecommunications.
> On reasonably level ground.
> Accessible to maintenance vehicles and personnel.
> Preferably near a property boundary and away from the edge of road.

The controller should be located where it:

> Can accommodate temporary external portable power supplies.
> Does not interfere with sight distance.
> Does not interfere with pedestrian and shared path facilities.
> Enables maintenance and operation personnel to have a clear view of traffic signals from the controller, if possible.

Where controllers are at risk of minor collision, e.g. with vehicles manoeuvring / parking on verges, protective bollards are to be installed.

1.2.2 Traffic Signal Post Locations

Traffic signal posts shall generally be located in accordance with AUSTROADS Guide to Traffic Management; however we have detailed the requirements for QLDC below.

In addition, an absolute minimum clearance of 600mm shall be maintained between any portion of the fittings, lanterns or accessories and the kerb face. Clearances must be increased where there is a probability of:

> Conflict with the 'overhang' of vehicles such as buses, or
> The 'cutting in' of the rear end of long vehicles or trailers, or
> Where the road has a significant camber which may cause high vehicles to 'lean in' towards the posts and attachments.

The requirements of clearances for over dimension vehicles (See NZTA website for routes) shall be met where applicable.

Where the lateral position is less than 1metre clear from the kerb face (e.g. on narrow medians) consideration shall be given to modifying the intersection geometry (e.g. widening the medians).

Where there are more than two (2) posts along a kerb (e.g. opposite the stem of a T-junction) they shall be laterally offset sufficiently to provide clear sight lines to all aspects from all relevant approaches; i.e. the lanterns and visors on one post do not restrict sight lines to lanterns on another.

Traffic signal posts shall be longitudinally located such that pedestrian push buttons are easily reached from the top of pedestrian ramps by all pedestrians including the disabled. Where this cannot be readily achieved, relocate traffic signal post or when not practical then separate pedestrian push button posts (stub posts) shall be provided.

Pole location and their relationship to tactile pavers and pedestrian access ramps must be carefully considered ensuring drainage and practical installation of poles can be achieved.

Where the requirements for clearances for over dimension vehicles apply, but the geometric layout and signal post location cannot be arranged to adequately cater for over dimension vehicles, hinged or removable traffic signal posts are to be used and placed near a termination pit so that the post can easily be removed.

1.2.3 Use of Overhead Signal Faces (Mast Arms)

The use of overhead signal faces (mast arms) should be minimised and shall only be included with prior approval from QLDC. Where practicable the geometric layout should be modified to avoid the necessity to use mast-arms. As per AUSTROADS Guide to Traffic Management Part 10, mast arms are warranted where the:

- Stopping sight distance to the post-mounted signal face is inadequate, e.g. because of vertical or horizontal alignment, awnings, poles, trees or similar sight obstructions, and
- Roadway is too wide for kerb mounted signal faces to fall within the driver's line of sight.

Care must also be taken to ensure signal lanterns do not conflict with airport lights. Alignment and louvres may need to be modified.

1.2.4 Signal Display Location

In general, primary signal posts and signal displays should be located such that they are as close as practicable to the direct line of vision of approaching drivers, ideally at least 1m from the stop line, taking into account the alignment of the approaching lanes.

Secondary and tertiary signals posts and signal displays should be located such that they are as close as practicable to the direct line of vision of drivers when stationary at the stop line and when manoeuvring through the intersection, whilst taking into account the alignment of the individual lanes. For example; a dual secondary signal display may be out of direct line of vision when the driver is stationary at the stop line but may come into direct line of vision when moving forward and waiting to turn.

To assist in the potential conflict of displays the designer may consider use of aspect louvres and/or visors to maintain safe operations.

Multiple signal displays are used to ensure drivers on multilane roads can see at least one signal display for each movement on approach and on departure. This allows for masking of some of the signals by adjacent vehicles and also provides some redundancy in case of lamp failure.

Signal displays shall be arranged generally in accordance with AUSTROADS Guide to Traffic Management Part 10 with the following variations:

- Split tertiary signals shall not be used.
- Signalised left slip lanes shall have a primary and dual primary signal display located between the projection of the stop line and up to a distance of 3m downstream, consider use of arrows on green display to avoid confusion for Giveway / Stop slip lanes.
- Single-lane signalised left slip lanes shall have at least a secondary signal display located on the median of the cross road.
- Multi-lane signalised left slip lanes shall have a secondary and tertiary signal display, both located in the median of the cross road.

> Where parallel walks / no parallel walks are in place at sites without right turn arrows, there is no requirement for a Dual Far Right Secondary Display.

To assist in placing signals as close as practicable to the driver's direct line of vision, where medians are more than 6m wide consideration shall be given to mounting the dual secondary signals on the same post as the dual primary signals of the opposing direction, instead of the far right corner

Where the right hand turn lane approach is aligned towards the right and filtering is prohibited, splitting the 6-aspect secondary signal face and mounting the right turn arrows column on the same post as the dual primary signals of the opposing direction, and maintaining the dual secondary on the far right corner shall be considered.

1.2.5 Chamber Locations and Ducts

A chamber is generally required on each corner of an intersection. An additional chamber is to be installed immediately adjacent to a controller. This allows for easy installation of cables to the controller, provides more space for maintenance contractors to work and keeps cabling within the controller tidier.

Chamber locations should be placed so as not to cause a trip hazard and where practicable outside of any tactile paving. Furthermore, chambers are to be located where minimum traffic management is required. For example, not on the nose of an island.

All ducting should link back to a chamber location at each road crossing. To minimise carriageway work and disruption to traffic, it is best practice to only cross a main road once (i.e. road having the highest volumes). A minimum of two ducts shall be installed on all road crossings. Cables pull throughs to be installed on all ducts.

1.2.6 Detectors

All loop positions are to be determined early in the design.

All controlled lanes must have detector loops installed including for example left turn lanes under Give Way control to count vehicles only, if there are sufficient detector inputs available.

Advance loops may be required in some instances to optimise signal operation and enhance safety in high-speed environments. If controller capacity allows, detector loops are to be included in uncontrolled slip lanes for traffic counting purposes. Loops on bridge decks or approach slabs should be avoided where practical. Refer Section 3 of this Appendix.

Where there are a high number of cyclists the type and style of loops shall be clearly shown. Cycle lane design requires special attention and these shall be considered on a site by site basis.

Special care is required to ensure that the placement of the loop is in the correct position within the lane. Failure to confirm positions prior to sealing can mean that another loop may be required to be saw cut into the new seal. All loop locations to be accurately located and included on as-built drawings.

The ideal or preferred methodology of installing loops is to place them under the bedding of the pavement prior to sealing in order to avoid repeatedly cutting in a short period of time.

Consult with NZTA P43 Specification for Traffic Signals and the QLDC CoP for details on installation methods.

If the controller cabinet is relocated then the site must be renumbered to comply with the standard convention.

Configure virtual red light running loops in the CIS when there is spare capacity to allow, consult with QLDC as required.

1.2.6.1 Vehicle Detectors

Detectors are numbered anticlockwise from the controller assuming that a line is drawn from the controller through the centroid of the intersection.

The first circuit is the stop line loops, departure loops and counting loops are numbered first, with the departure loop being numbered after the stop line loop it is associated with.

The second circuit is the dynamic loops, followed by the advance dynamic loops.

The reason detectors are numbered anticlockwise is so that an approach will read numerically correct left to right when viewed on a SCATS System Monitor display.

Where there is a secondary part to the signals such as at interchanges, the first circuit is around the part of the intersection closest to the controller, then around the second part of the intersection. Then back to the first part of the intersection for the second circuit. A line is drawn from the controller through the centroid of the second part of the intersection to give the starting point for each numbering circuit.

If a controller is relocated then the site must be renumbered to comply with the standard.

1.2.6.2 Detector Card Configurations for AS 2578 VC5/6 Compliant Controllers

When the new AS 2578 and VC5/6 compliant controllers were first introduced each Detector card had 16 Internal Detectors (Vehicles) and 16 External Detectors (Pedestrian). Since then the manufacturers have provided some flexibility to allow combinations to be used. It is important for the designer to understand and number the loops and pedestrian call detectors in the appropriate manner as this impacts directly on the preparation of the software. Furthermore, VC6 controllers have extended the capacity therefore check with the manufacturer on these specifications.

1.2.6.3 Pedestrian Detectors

Pedestrian detectors are numbered depending upon the card in use. First ascertain the number of detectors available at the controller if it is an existing site or determine the requirement if new. TSC3 Controller Detector cards come in groups of four ranging between 4 and 32.

The AS 2578 Compliant controllers come with a 16, 24 or 32 input Detector card. This consists of vehicle inputs and external inputs. Again, this will depend on the type of controller and the configuration applied.

The pedestrian detectors are numbered from the highest number down as follows and may include more than four pedestrian facilities:

PEDESTRIAN / WALK NUMBER	1 PED	2 PEDS	3 PEDS	4 PEDS	5 PEDS
W1	16	16	16	16	16
W2		15	15	15	15
W3			14	14	14
W4				13	13
W5					12

Table 1-1: Pedestrian Detector Slot Numbering (16 Detector)

A similar configuration will apply across the top end for 24 and 32 detector cards.

In ground and above ground pedestrian detection systems will need to be configured as a pedestrian input. Using Table 1-1 as an example, for four pedestrians we use inputs 13-16 and if we were to install above ground pedestrian detection for all the walks the detection would be numbered 11-4 leaving one unused before the pedestrians. MSS bits shall be used and numbered the same as the pedestrian detector number (where possible). Furthermore all non-loop detectors shall have an MSS assigned for each unit for additional SCATS variation options and monitoring options.

1.2.7 Pole Numbering

Poles are numbered in a clockwise direction from the controller assuming that a line in drawn from the controller to the centroid of the intersection.

Where there is a secondary part to the signals such as at interchanges, the intersection closest to the controller shall be numbered first then the additional part can be numbered in the same format assuming that a line is drawn from the controller to the centroid of the secondary part of the intersection. If a controller is relocated then the site must be renumbered to comply with the standard convention.

1.2.8 Signal Groups

With AS 2578 and VC5 compliant controllers, the number of signal groups can range from 4 to 32 in modules of four signal groups. The recent changes to VC6 controllers may change some of the content listed below, therefore discussions with the manufacturer is expected during the design phase.

Pedestrian signal groups in a sixteen group controller will be denoted as: W1=16, W2=15, W3=14, & W4=13. If there are only two Pedestrian groups then W1=16 and W2=15.

1.2.9 Phasing

The phasing diagram must show the following:

> Each phase in a separate box with the phase label inside the box corner A, F, F1, etc.

> Show only the movements that display green in each phase.

> Indicate movements by an arrow pointing in the direction that traffic will travel.

> Signal groups shown in a circle at the point of the movement arrow for vehicles and beside.

> Pedestrian movements.

> Any Special Flags inside the phase box Z, Z+, etc.

> Indicate if filter turn movements are permitted.

> Label phasing to lanterns.

> Default and Alternative phasing to be shown. Alternative phasing must show split phasing for each approach to assist in maintenance and operations.

> An all red phase to be added to all plans for operational requirements, no detector or input to be assigned to call/demand. Shall be operated only by SCATS Dwell.

The phase sequence must be shown on the plan adjacent to the phasing diagram.

In general, all traffic signals shall be consistent with the standard RMS configuration. Standard phasing configurations are detailed below. Where standard phasing configurations are not appropriate due to the site or traffic flow conditions, the phasing should be designed to:

> Minimise the number of phases

> Minimise cycle time

> Run as many compatible movements as possible in each phase

> Restrict each phase to non-conflicting movements

> Allow each movement to run in as many phases as possible (preferably allowing as many as possible to overlap from the previous phase or into the following phase), and

> Comply as closely as possible with the standard RMS configuration. Examples of a range of standard arrangements are found on the following pages of this document.

The phasing design should consider the use of filter right turn movements. The phasing design should provide the most flexible operation that will accommodate changes in traffic conditions without the need to reprogram the controller personality. This may result in a phasing sequence in which not all phases are used initially. An example of this is the inclusion of repeat right turn phases.

The phasing sequence (i.e. the order in which each phase runs) should be designed to provide the optimum coordinated flow along a corridor. This may change at different times of the day.

1.2.9.1 Filtering Right Turn Movements

At most intersections right turning traffic that has opposing movements will be provided for by installing a separate signal display, giving the right turning motorist a protected turn at some time in the phasing sequence. However, under strict criteria filter turn movements may be permitted in order to improve intersection efficiency.

Whilst the provision of filter turns may improve efficiency, it reduces the potential safety as conflicting movements may now occur. The phasing design must consider a balance between safety and efficiency. When considering allowing filtering, safety must be given a higher weighting in the decision process.

The phasing design at adjacent intersections should also be considered to provide consistency along a corridor and preferably throughout the region.

The operation of such movement should be designed and implemented with prior consultations with QLDC.

1.2.9.2 Repeat Right Turn Phases

A repeat right turn is where the right turn movement is introduced for a second time within the same phase cycle. Repeat right turns can be provided at any site with a right turn phase. Generally the controller logic will have two phases with exactly the same movements (i.e. for a T-intersection B and D) with one phase only introduced when a special facility signal is activated (normally B using the Z+ flag).

Repeat right turn phasing can only be used under Masterlink or Flexilink control modes (not in isolated mode) and is generally provided at peak times. It is unusual to have a repeat right turn phase operating 24 hours a day.

Repeat right turn phasing is normally used where the single right turn phase does not provide sufficient capacity within a cycle for specific flow periods, or it is necessary for progression within a coordinated system.

A typical use is where a right turn bay is too short to cope with the number of right turning vehicles that can arrive within the cycle which results in the right turn queue extending into and blocking the through traffic lane. This reduces the capacity for the through movement and increases the risk of nose to tail type crashes occurring. The use of the repeat right turn is particularly important, under these circumstances, where there is only one through lane.

Repeat right turn phasing should only be considered under the above mentioned conditions. Generally, where vehicles may queue outside of the through lane (i.e. on a painted median), it is more efficient to provide a longer single right turn phase than two short phases. Installation of queue detection loops to be considered in the design.

1.2.10 Pedestrian Control

The hierarchy of signalised pedestrian control strategies range from providing full pedestrian protection through to partial protection during the early stages of the crossing movement. They fit broadly into the following range:

i. Exclusive pedestrian phase with full protection and all vehicle traffic stopped. Also known as Barnes Dance. This is only used where pedestrian numbers are high, in CBD.

ii. Full protection for the whole Walk and Clearance using red arrow.

iii. Partial protection for part of the Walk and Clearance using red arrow and individual push button inputs. Red arrow on a minimum of 6 seconds for one direction and the other direction to be calculated to the last crossing lane using 1.5m per second (this can be reduced on site as required).

iv. Full protected staggered or staged pedestrian movements.

The method of control adopted at any specific site is based on location, traffic volumes, pedestrian volumes and type (i.e. age or disability), intersection layout combined with the aim to provide safe, efficient movement for all users. However, when selecting control options, it is important to ensure, whenever possible, that a consistent approach is adopted within any given corridor. This may result in a more conservative approach being adopted at some intersections to maintain uniformity throughout that corridor.

At signalised intersections, near schools, where there is a high pedestrian demand at the same time each day, the signal operation should be adjusted to cater for the reoccurring demand. This will generally be achieved by increasing the Walk' and/or clearance times.

It is preferable to have all pedestrian push button inputs wired and configured in the CIS individually to enhance pedestrian protection.

MSS bits to be used for every push button to enhance the variation options in Scats. (All non-loop detectors shall have an MSS assigned for each unit for additional Scats variation options and monitoring options).

1.2.11 Cyclists

Cycle lanes are being progressively introduced along some of the main corridors. Cyclists are features managed as part of the 'traffic mix' and there are currently limited special facilities for them at signalised intersections. These facilities are generally in the form of advance boxes or hook turn boxes and do not require special traffic signal control. Where cyclists may be on a side road or one that is not reverted to during phase sequence then detectors may be required to demand the phase for the cyclist.

Cycle detector loops are numbered in sequential order as part of the first circuit of vehicle detectors. Cycle call buttons are external inputs and numbered in descending order after the pedestrian inputs, e.g. W1=32, W2=31, C1=30.

Special care and attention to the detector position, type and detector alarm to be used in the cycle lane and / or cycle box.

Where cycle boxes are used they shall always be behind the traffic signal primary pole. Consultation with QLDC is required at an early stage so we can consult the users groups.

1.2.12 Bus Lanes

Bus priority is becoming more common and requires the allocation of a signal group to each approach using the same convention as above for individual sites. If the bus signal group is demanded then the controller puts in a pre-specified delay to the through movement signal group. Where bus loops are installed these are numbered as part of the first circuit of vehicle detectors in sequential order. Where a separate signal group is provided for bus movements, these are numbered last, after all other vehicle signal groups.

1.3 TRAFFIC SIGNAL DATA SUBMISSION

1.3.1 Provision of RAMM Data

The data for all assets installed and specified in the detailed design must be provided and must be compliant with the Asset Management Data Standard. This includes all assets related to the signals, and any additions or amendments to (but not limited by) e.g. drainage kerb and channel, catchpits, footpaths, lighting, lines, signs, surface, pavements.

Submission of data can be via two options:

a) Utising the RAMM sheets found on the QLDC Webite – or available on request from assetmanagement@qldc.govt.nz.

b) Entered directly into the QLDC RAMM database, please contact assetmanagement@qldc.govt.nz to request access.

This includes attaching relevant multimedia into RAMM.

Practical completion will not be issued until data submission is received and approved by QLDC.

2 MODELLING GUIDELINES

Purpose

This guideline is specifically designed to provide guidance without being prescriptive or limiting the modeller building the model. A proportion of the content of the document is designed to make the model scope, building, submission, review and approval as transparent as possible for all parties without inhibiting the practitioner in the technical construction of the model.

Who Should Use This Document?

Modellers, on behalf of consultants and contractors, should use this document and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District.

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content for modellers it must read in conjunction with the QLDC CoP and this Appendix.

Technical Criteria

The design of the traffic signals must be carried out in accordance with the standards and guidelines listed below and their revised / subsequent replacements:

- QLDC Land Development & Subdivision Code of Practice – 2022.
- QLDC CoP Appendix L – Traffic Signal Guidelines.
- NZTA P43 Specification for Traffic Signals.
- AUSTROADS Traffic Management Guides.
- NZTA Pedestrian Planning and Design Guidelines.

Reference Material

Recommended documents to assist in the processes required are as follows:

- NSW Roads & Maritime Services, Traffic Modelling Guidelines.
- NSW Roads & Maritime Services, Traffic Signal Design.
- Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.
- Signals National User Group (SNUG).

2.1 MODELLING REPORT

The modelling report must show initiative and educated judgement rather than default parameter settings in modelling (e.g. analysis period profile in terms of peak hour factor, demand arriving at back of queue versus counts at stop-line on oversaturated approaches, adjustments to gap parameters, intergreen times, coordinated arrival types). The modelling report must also contain site observations including calculations.

Whichever traffic signal modelling software is used, the user should consult the SIDRA User Guide or SIDRA software Help menus for any model-specific guidance on reconciling the signal timing input and outputs with average SCATS operation for the peak periods. To facilitate more realistic modelling of existing traffic signal site upgrades, SCATS history files of typical peak hour timings can be provided to modellers upon request to WTOC (including signals in close proximity, refer Table 2-1).

Due to the nature of the models, traffic surveys must be undertaken at all intersections to be modelled. Other critical data collection includes signal operation, queue observation and saturation flow measurement (or estimation). Future traffic flows can be estimated using highway assignment models or by applying growth factors as appropriate. Highway assignment models should only be used to estimate traffic growth as they are generally too coarse to adequately produce detailed turn movements.

2.1.1 Modelling Outputs

The designer shall submit a detailed SIDRA report consisting (as a minimum):

> Introduction.

> Background.

> Traffic volumes including any adjustments made to modelled volumes noting in particular, the forecast years(s).

> Each Option should be modelled in Year 0 and Year 10. The land arrangement and phasing of each Option must be shown.

> Analysis Methodology (including details of calibration).

> Analysis Results Summary, including a table highlighting the following for each movement and the intersection as a whole:
- Degree of Saturation (DoS) (maximum 0.90).
- Average Delay (RMS NSW Method).
- Level of Service (LoS).
- 50% and 95% Back of Queue distance.
- Fuel Consumption, Emissions and Cost (total and rate).
- Flow Scale / Design Life Results based on a 10% increase in traffic volumes.
- Pedestrian Movements.

> Discussion on all observations of the analysis results and outcomes.

> Conclusions and Recommendations (e.g. length of extensions to turn lanes, etc.).

> A table indicating the proposed cycle length, phase splits and offsets (if coordinated) that the model suggests be adopted by SCATS for the morning peak, and, afternoon peak.

> Best Level of Service whilst fuel consumption and emission are not the highest rate compare to other level of services.

> The applicant must obtain all traffic data deemed necessary to complete the validation.

> For closely spaced signals, a decision needs to be made and justified on isolated versus coordinated system analysis. An initial isolated analysis should inform the design layout and phasing prior to a full coordinated system analysis, serving as a useful cross-check.

>

2.1.2 Modelling Inputs

The designer shall consider listed SIDRA input data when preparing a SIDRA report for traffic signals at grade and if required, as a network. The list below is a minimum requirement for outputs:

> Lane width

> Grade

> Median

> Approach Cruise Speed

> Vehicle Movements

> HV%

> Peak Flow Factor

> Peak Flow Period

> Signal Coordination

> Phasing

2.1.2.1 Signal Analysis Method:

For intersections running under SCATS Coordinated or Master Isolated Control, use the Fixed-Time / Pretimed analysis option. Although SCATS is an adaptive control system, the Fixed-Time / Pretimed analysis method is recommended to emulate the SCATS control algorithms, especially due to the "equal degree of saturation method" used for determining green splits. SCATS green splits and cycle time may change cycle by cycle. The green splits and cycle time determined by SIDRA INTERSECTION should be considered to represent average timings under SCATS control for the analysis period. Use the Actuated analysis method for intersections operating under the traditional actuated control method. This control method uses maximum green and gap settings and does not implement an equal degree of saturation strategy for green splits.

2.1.2.2 Intersection Dialogue

In the SIDRA intersection dialogue:

Area Type Factor parameter for Signals is used as a saturation flow adjustment factor. It applies to all lanes of the approach. HCM recommends 0.9 for CBD area type. This parameter could also be used as a simple saturation flow calibration parameter which can be specified per approach.

Area Type Factor affects the SCATS MF estimates as well.

2.1.2.3 Geometry Dialogue

Geometry should closely resemble actual alignment and orientation of the intersection.

The following is required as a minimum in the Geometry Dialogue:

> Approach and exit lane data are to be as per the existing geometry for constructed intersections and/or for Construction Plans for approved intersections.

> If slip lanes or continuous lanes already exist then the appropriate selection is required.

> Values for extra bunching should be used if there are upstream signals in close proximity. Extra bunching should only be applied to sign-controlled and roundabout intersections.

Maximum values to be used to simulate the effects of extra bunching should be as shown in Table 2-1- .

Distance to upstream signals (m)	<100	100-200	200-400	400-600	600-800	>800
Extra bunching (%)	25	20	15	10	5	0

Table 2-1 - Maximum values for extra bunching

The maximum basic saturation flow should be 1950 tcu /hr (SIDRA Default). Any higher or lower values than default value should be supported by appropriate data. Saturation flow measurements should be undertaken whenever possible on approaches that are heavily congested or forecasted to be heavily congested:

The following method is recommended to calibrate the saturation flow in SIDRA INTERSECTION:

(i) measure the lane saturation flow, s' (veh/h) using the HCM or ARR 123 method; this saturation flow will have effects of all road and traffic factors (heavy vehicles, turning vehicles, lane width, grade, and so on);

(ii) compare the measured lane saturation flow, s' with the lane saturation flow estimated by SIDRA INTERSECTION, s (veh/h) given in the Lane Flow and Capacity Information table in the Detailed Output report; if they are significantly different (given that all road and traffic factors have been specified as input to SIDRA INTERSECTION correctly), calculate a calibration factor s' / s;

(iii) adjust the basic saturation flow (tcu/h) to s'b = (s' / s) sb where sb is the basic saturation flow (tcu/h) specified as input for estimating saturation flow s (veh/h);

(iv) specify the adjusted basic saturation flow in the Lane Data tab of the Lane Geometry dialog and re-process SIDRA INTERSECTION to estimate saturation flow using the new basic saturation flow (s'b); repeat the process if necessary.

The calibration factor (s' / s) can be used for future design options if it is believed that it adjusts the SIDRA INTERSECTION default basic saturation flow for local driver behaviour adequately. This method is not recommended for short lanes, or for lanes with opposed (permitted) turns.

- ***Saturation Speed:***

***Saturation Speed** is the steady speed value associated with queue discharge (saturation) flow rate. This parameter indicates that vehicles do not accelerate to the speed limit during queue discharge.*

*The **Program** option is selected by default and the data field is blocked. The Saturation Speed is estimated by the program in this case. To use an observed value to override the program calculations, select the **Input** option and enter the value in the data field. The program will use the value you specify. Select the **Program** option again for program to estimate the saturation speed (no need to delete the value in the data field).*

The saturation speed can be observed easily while driving a car, e.g. when the car crosses the stop line after accelerating from the queued position at signals, while its position was more than about the fifth car in the queue.

In addition to estimating the driver response time, Saturation Speed is useful for determining parameters such as various SCATS parameters (occupancy and space time at saturation, DS, best loop length, etc), and parameters for microsimulation (average and maximum acceleration rate, acceleration time and distance during queue discharge).

Saturation Speed is determined by SIDRA INTERSECTION for each approach lane using the method described below. This parameter is applicable to all types of intersection. The Saturation Speed is subject to various constraints related to Approach Cruise Speed and the Negotiation Speed.

For through movements at signalised intersections, the saturation speed, vs is estimated from:

vs = 0.75 vac

where 0.75 is the saturation speed factor and vac is the approach cruise speed.

If the queue discharge behaviour is influenced by existence of signals at a nearby downstream location, then the user can specify a lower value than the program estimate (say 10 per cent lower).

For turning movements at signalised intersections, Exit Negotiation Speed estimated by the program or specified by the user is used as the saturation speed.

For all movements at roundabouts and sign-controlled intersections, Exit Negotiation Speed *estimated by the program or specified by the user is used as the saturation speed.*

The following should be noted in relation to the Saturation Speed parameter in SIDRA INTERSECTION:

> *Movement Classes: the Saturation Speed is not adjusted for Movement Classes.*

> *Queue Move-up Speed: The Saturation Speed is used as an upper limit in determining the queue move-up speed. In previous versions, the Approach Cruise Speed was used for this purpose.*

> *Negotiation Speeds:*

- *For Through Movements at signalised intersections, the Approach Cruise Speed is used as the Approach and Exit Negotiation Speed, van = ven = vac for unqueued vehicles. This is relevant for [geometric delay] calculations.*
- *User-specified Saturation Speed values that exceed the Exit Negotiation Speed are ignored. If a user-specified Saturation Speed is less than the Exit Negotiation Speed, then the Exit Negotiation Speed is reduced to match the Saturation Speed value, ven = vs to ensure that there is no acceleration in the Exit Negotiation section.*

The Driver Characteristics and SCATS Parameters tables in the Detailed Output report include the estimates of saturation speeds and other parameters derived using the Saturation Speed parameter, e.g. driver response times."

Utilisation Ratio, Saturation Speed and Capacity Adjustment Data values should only be changed subject to appropriate intersection data being collected or provided. The Turning Movement Designation should be allocated as per the existing or proposed operation of the intersection.

For wider lane approaches the SIDRA Intersection model should show how the intersection is used rather than how it operates. A wide approach is where width of the lane allows two vehicles to stand next to each other at a Stop line or operate the road as two lane road even though the road is marked as one lane only.

For signalised intersections, the parameters for Buses Stopping, Parking Manoeuvres, Short Lane Green Constraints and free queue should only be inserted if the appropriate intersection data is available.

2.1.2.4 Volumes Dialogue

The following is required as a minimum in volumes dialogue.

> Vehicle volumes are to be based on the most current data collected through an intersection survey/count. Turning Movement Demands are required, which in all cases can be collected by counting arrivals at the back of queue. If a lane or approach is over-saturated (i.e. Cycle failure), then departure counts at the stop-line (presence detectors) only represent capacity, which are likely to be less than the true demand, which the new signal design should accommodate. Thus, stop-line or detector counts are only acceptable if that movement is not over-saturated.

> SIDRA default Peak Flow Factor of 95% is acceptable. Analysis of intersection data collected may impact the Peak Flow Factor used. Supporting documentation is required to justify the factor used other than the default Peak Flow Factor of 95%.

> The appropriate Growth Rate parameter should be used in consultation with QLDC if completing a design life analysis on the intersection.

> Growth rates used for future volume estimation and/or the justification of the methods used to determine future volumes should be included in the final report.

Unit time for volumes and peak flow period should reflect data of the intersection counts where the:

> Maximum unit time for volumes is 60 minutes (unit used is dependent on actual flow data and any variation should be discussed with QLDC and documented).

> Maximum peak flow period is 30 minutes.

- Peak Flow Factor (volume dialogue box) should be carefully assessed to replicate actual Peak Period.

2.1.2.5 Path and Movement Data Dialogue

The Approach Cruise Speed and Exit Cruise Speed for existing intersections should reflect the present intersection conditions. The Approach Travel Distance should be changed to reflect the existing and/or proposed operation of the intersection. The Negotiation Speed and Negotiation Distance can be changed manually to indicate the physical parameters for intersections that have unusual geometry features. Justification should be given for the values used for the intersections of unusual nature. All other items in this dialogue should be the SIDRA default values.

In the Movement Data input dialogue some of the data items may not be available depending on the intersection type and the characteristics of the movement. The default values in the Movement Data Dialogue box should be used unless evidence is provided indicating a different set of values are appropriate. Data in the Pedestrian Effects section can be manually inserted with the appropriate justification provided.

2.1.2.6 Lane Data Dialogue

In the Lane Data input dialogue, you can specify a lane utilisation ratio which is less than 100 per cent in order to allow for lane underutilisation observed in the field. The resulting lane flows estimated by SIDRA INTERSECTION can be compared with the observed lane flows and the lane utilisation ratio can be modified for the estimated lane flows to match the observed values. Where available, SCATS lane flow information is useful for this purpose. The sensitivity analysis facility (the Demand & Sensitivity input dialogue) allows for testing varied values of user-specified lane utilisation ratios.

2.1.2.7 Gap-Acceptance Dialogue

Default values should be adjusted under different geometric arrangements. Therefore, gap-acceptance parameters applicable to particular intersection geometry and flow conditions should be selected by using good judgement and taking into account the local driver characteristics.

Appropriate judgement is required while selecting the critical gap and follow-up headway values to suit the circumstances considering grades, sight distance conditions, opposing movement speeds, number of lanes, and one-way or two-way conditions. Any changes to these values should be justified.

2.1.2.8 Pedestrians Dialogue

The volume of pedestrians and Peak Flow Factor can be altered to suit the intersection counts obtained. The growth rate used under Pedestrian Data should be justified and explained. Data for Crossing Distance, Approach Travel Distance, and Downstream Distance can be changed to reflect the geometry of the existing intersection if this data is available. Default values should be used for all other parameters in this dialogue.

SIDRA default for Pedestrian Walking Speed (Average) in the Pedestrian Data dialogue box is 1.3m/sec. A value of 1.5 m/sec should be used for pedestrian modelling.

Where partial pedestrian protection is proposed the calculation shall be measured ¾ across the full width of crossing.

2.1.2.9 Phasing and Timings Dialogue

The phasing and timing on signalised intersections can be altered to determine the most appropriate solution. However, when modelling the existing intersection, the phasing and timing should be representative of current Phasing and Timing of that intersection. Intersection surveys should be undertaken if the necessary data is not available. Default yellow time of four seconds and red time of two seconds should be used if the measured data is not available.

The maximum cycle time to be used is 120 seconds, consult with WTOC for advice. Cycle time is generally controlled by the SCATS master subsystem. Therefore the cycle time for all intersections linked with the master subsystem should use the same cycle time.

> ***Slip Lanes without detectors:***
>
> *Slip/bypass lane movements should be treated as Undetected under the SCATS control system where turning vehicles using slip/bypass lanes do not cross over stop-line detectors. This is not appropriate in control systems where turning vehicles using slip/bypass lanes cross over advanced detector loops, or with controllers using fixed-time signal plans where the plans are designed to accommodate all turning vehicles.*

> ***Detection Zone length:***
>
> *Effective Detection Zone Length can be specified at all signalised intersections regardless of whether the Analysis Method is specified as; Fixed Time/Pre-timed or Actuated. This is particularly relevant to modelling of intersections running under the SCATS system.*

2.1.3 SCATS Standard Traffic Signal Phasing Diagrams

QLDC has standard phasing arrangements in one of the following forms:

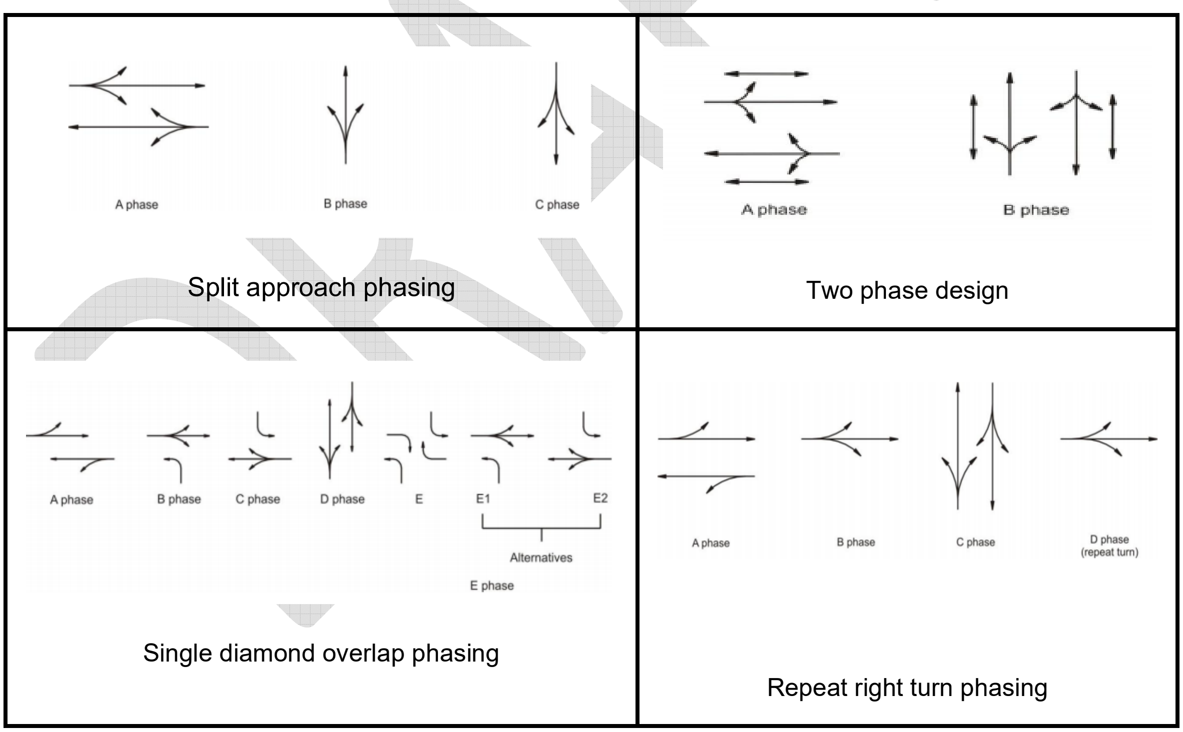
> Conventional phases.

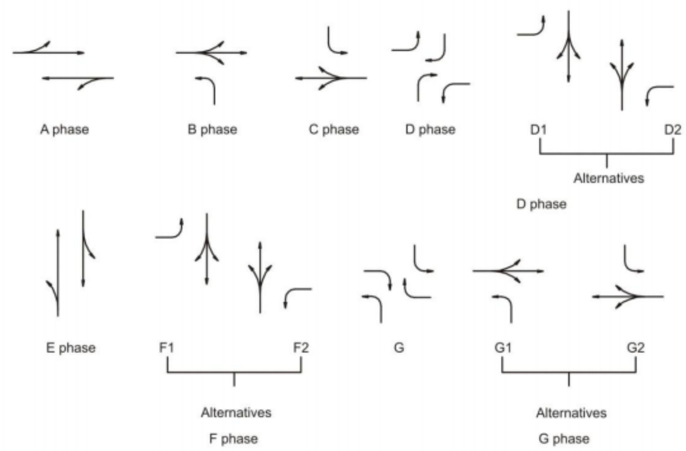
> Conventional phases with turning leading, trailing or repeat right turn phases.

> Diamond phase.

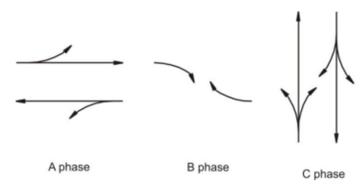
> Split phases.

These phase arrangements should be used in intersection modelling. Refer to Table 2-2 for examples of phasing arrangements.





Double diamond overlap phasing



Diamond turn phasing

Table 2-2 - Examples of phasing arrangements

2.1.4 Calibration

The calibration process should be based on various traffic surveys and site observations. All changes required in order to calibrate the model should be fully documented with an explanation and justification of the change. SIDRA User Guidelines should be referred to for possible calibration methods.

In order to properly identify the effects of future network and/or demand changes on the existing operation of signalised intersections, the timings obtained from a calibrated model of existing conditions (based on observed signal times) should be compared with those obtained from the SIDRA optimised timings. In this way differences can be compared and an explanation provided as to why they may exist.

This comparison is useful in identifying:

> Incorrect model assumptions in respect of traffic behaviour (saturation flows, delays due to pedestrians, queue storage space etc.).

> Incorrect model assumptions in respect of signal operation assumptions (i.e. alternative phase calls, phase skipping, offset, cycle times, minimum greens, clearance times etc.).

> Incorrect SCATS setup.

In addition to the above, many model software packages have specific SCATS input/import and output/export features. The Help instructions regarding SCATS compatibility should be consulted and guidelines followed, to the extent possible. Specifically, SIDRA has a SCATS Parameters Table available in the Detailed Output report[i]:

It provides the user with estimates of the Maximum Flow (MF) and the associated Headway at maximum Flow (HW), Occupancy Time at maximum Flow (KP) and Space Time parameters reported by the SCATS traffic signal control system.

SCATS parameter estimates can be used together with lane flow rates reported by SCATS for the purpose of calibrating SIDRA INTERSECTION against measured conditions. The basic saturation flow parameter can be adjusted so as to match the measures SCATS MF parameter.

The SCATS on-line feedback system determines the MF parameter using a complex set of filtering rules using traffic data collected cycle by cycle during the day. On the other hand, the SIDRA INTERSECTION estimate of the MF parameter is based on average conditions and derived on the basis of various assumptions regarding the factors that influence this parameter.

Therefore, a one to one correspondence should not be expected between a SCATS-reported MF value and the corresponding SIDRA INTERSECTION estimate. However, a comparison of the SCATS-reported value of MF and *associated parameters and the SIDRA INTERSECTION estimates can be of valuable help when saturation flow rates from field surveys are not available.*

The SIDRA INTERSECTION sensitivity analysis facility (Demand & Sensitivity dialog) can be used to vary the basic saturation flow parameter so as to match the SCATS-reported MF parameters.

2.1.5 Outputs

As outlined in the Introduction, the designer shall submit a detailed SIDRA report consisting (as a minimum) of the following:

> Introduction.

> Background.

> Traffic volumes including any adjustments made to modelled volumes noticing in particular the forecast years(s).

> Each Option should be modeled in Year 0 and Year 10. The land arrangement and phasing of each Option must be shown.

> Analysis Methodology (including details of calibration).

> Analysis Results Summary, including a table highlighting the following for each movement and, the intersection as a whole:

- Degree of Saturation (DoS) (maximum 0.90).
- Average Delay (RMS NSW Method).
- Level of Service (LoS).
- 50% and 95% Back of Queue distance.
- Fuel Consumption, Emissions and Cost (total and rate).
- Flow Scale / Design Life Results based on a 10% increase in traffic volumes.
- Pedestrian movements.

> Discussion on all observations of the analysis results and outcomes.

> Conclusions and Recommendations (e.g. length of extensions to turn lanes, etc.).

> A table indicating the proposed cycle length, phase splits and offsets (if coordinated) that the model suggests to be adopted by SCATS for the morning peak, and, afternoon peak (include SCATS Parameters Table from Detailed Output report).

> Best Level of Service whilst Fuel Consumption and Emission are not the highest rate compare to other level of services.

> The applicant must report all traffic data deemed necessary to complete the validation in an appendix. An electronic copy of the software input and output files for all options, showing the phasing and time settings used in the evaluation, must also be provided.

> For closely spaced signals, a decision needs to be made and justified on isolated versus coordinated system analysis. An initial isolated analysis should inform the design layout and phasing prior to a full coordinated system analysis, serving as a useful cross-check.

3 GUIDE FOR USE OF ADVANCE DETECTION

	Yes	No	Maybe
Main Road	Runs in Isolated mode and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient, or • Significant volume of heavy vehicles.	Controlled by SCATS under continuous Masterlink mode and is the Stretch phase.	Controlled by SCATS but may operate in Master Isolated or Isolated mode during off peak periods and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient where slow starting vehicles may cause the approach to terminate early, or • Significant volume of heavy vehicles. • High incidence of Red light running
Minor Road	May operate in Masterlink, Master Isolated or Isolated mode and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient where slow starting vehicles may cause the approach to terminate early, or • Significant volume of heavy vehicles.	• Low volumes with easy or flat approach gradient • Low approach speeds • Single lane approaches. • Low volume of heavy vehicles	• Single lane, low speed, low volumes but may have a steep approach gradient where slow starting vehicles may cause the approach to terminate early • High incidence of Red light running • High incidence of Nose to tail type accidents.
Pedestrian Crossing	At all mid-block signalised pedestrian crossings		

The Table above is intended to provide guidance on where the use of advance detection may or may not be considered appropriate. Each site should be assessed based traffic flows and composition, site layout, safety and efficiency considering the above guide and notes below.

It is recognised that costs of installing and maintaining the additional loops for advance detection are not insignificant but we believe that benefits exist to offset the additional costs associated with advance detection. This is especially so at strategic state highway intersections. The following discussion covers these benefits.

These areas have been categorised into ***efficiency***, ***safety*** and ***traffic data***. Often efficiency can result in greater safety by reducing driver frustration.

3.1 EFFICIENCY

3.1.1 Phase Termination

Under isolated or master isolated vehicle actuated operation, signal phases predominantly terminate on gap identification. Typically a gap setting may be in the vicinity of 3-4 seconds. When a gap is identified at a limit line loop, the last vehicle in a 50km/h traffic stream is already some 50-60metres beyond the limit line. By the time the intergreen period (typically 5 seconds) has expired and the opposing flow commences, the last vehicle is 120-140beyond the intersection.

If the gap is located at an advance loop 40-50 metres ahead of the limit line, the intergreen period will introduce as the last vehicle passes through the intersection, thus eliminating 3-4 seconds of waste time at the end of every phase that is terminating on a gap. The last vehicle will still be 50-60 metres beyond the intersection when the opposing flow commences.

Under SCATS control, although the stretch phase length is predetermined, often the side road phases still utilise gap termination thus enjoying some of the benefits above.

The provision of advance loops allows the specifying of special logic within the controller which utilises the limit line loops to get traffic moving during the first 12 seconds or so, and then interrogates the advance loops only, for gap identification. The software in no way affects the SCATS algorithms and purely provides for more efficient phase termination in phases where gap termination is specified.

It is recognised that under low flows (during the first 12 seconds) or under high volumes where phases are terminating on maximum, the benefits above are not realised, but there are significant periods when this is not the case and overall, motorists would experience a far more responsive operation of the signals.

3.1.2 Phase Introduction

Under isolated or master isolated vehicle actuated operation, whenever a vehicle approaches a red display without an advance loop, the phase demand does not occur until the vehicle has almost stopped at the limit line. The vehicle then has to wait for the 5 second intergreen period before receiving a green display. With an advance loop the demand is lodged 40-50 metres before the limit line and if the vehicle begins slowing, the green display should come on as the vehicle reaches the limit line eliminating the unnecessary stop condition.

Advance loops were the universally recognised control system before the advent of SCATS, and still the preferred positioning in regions where SCATS, or other area control systems requiring alternative loop positioning, do not exist. There appears to be no evidence that phase introduction by advance loops is any less safe than the far less efficient phase call at the limit line.

3.1.3 Approach Priority

With advance loops at varying distances from limit lines on different approaches, a measure of priority can be afforded to a particular movement. On some major state highway intersections, we have provided advance loops 70m or more from the limit line on the priority approach whilst the advance loops on a side road of lesser importance may be positioned only 30m from the limit line. This provides priority to the main road approach both in terms of phase calling and extending the main road phase.

3.1.4 Loop Backup

The provision of advance and limit line loops also provides a level of backup in the event of a loop failure. A faulty loop can be switched out and the approach run with a satisfactory level of service utilising either the advance loops only or the limit line loops only until repairs can be effected.

3.2 SAFETY

3.2.1 Non-use of dynamic approach loops

Prior to SCATS, inductance loops were positioned about 40metres in advance of limit lines in 50km/h zones and further back in higher speed areas. This enabled identification of gaps before reaching the limit line and signals tended to change to yellow as the last approaching vehicle in a platoon reached the intersection. The control system was also aware of any vehicle within 40metres of the intersection and unless terminating on maximum, allowed a further increment of green time to progress the approaching vehicle up to the intersection.

Where advance loops are not used the control system is unaware of approaching vehicles and phases terminate regardless of positioning of vehicles approaching the limit line.

On a co-ordinated route under full SCATS control the dynamic approach loops are irrelevant. The termination of such approaches are controlled entirely by the SCATS algorithms designed to maintain the necessary offsets between intersections. If the intersection falls back to isolated or master isolated control, or for side roads under full SCATS control, the dynamic approach loops are far better positioned to safely and efficiently terminate the relevant approaches.

Using SCATS limit line loops, termination following a gap commences when a vehicle is already well clear of the intersection (thus introducing unnecessary waste time), and regardless of whether another vehicle is now approaching the limit line.

Both premature phase termination and inefficient phase termination encourage ***red light running***. We believe that a combination of SCATS and dynamic approach loops can provide a significant improvement in overall safety at an intersection especially where operational speeds of 60km/h or greater are experienced.

At intersections operating under higher speeds, studies have indicated that very significant safety benefits are obtained by protecting areas known as 'Dilemma Zones' with appropriately positioned dynamic approach loops. A 'Dilemma Zone' is a zone of indecision within which, if the yellow signal comes on, the decision of whether to stop or proceed is not clear and varies from driver to driver thus increasing the risk of rear-end collision. Protection of these zones requires advance loops up to 100metres in advance of the limit line on high speed approaches.

4 PROJECT CHECK SHEET FOR TRAFFIC SIGNALS

Purpose

The purpose of this check list is to summarise what is expected when submitting approval to QLDC.

Who Should Use This Document?

This document should be used by all consultants, contractors and project managers (referred to as "applicant" in this document) involved in the design of traffic signals within the Queenstown Lakes District. Where, for example, a traffic signals intersection is proposed the majority of this document will be filled out by the consultant since the design process is specialised.

Each section must be filled out with tick for submitted, any associated notes / comments; when left unticked please comment the reasons why.

4.1 TRAFFIC SIGNAL PROJECT CHECK LIST OF FILES SUBMITTED

Applicant / Consultant			**QLDC**
Traffic Feasibility Report	✓	Notes / Comments	Approved
Site Location Plan			
Brief description			
Concept Drawing			
Services / Risks			
Road / User Assessment			
Crash Data / CAS			
Movement Data / Counts			
Traffic Modelling Report			
Modelling Data Files			

Applicant / Consultant			QLDC
Road Safety Audit	✓	Notes / Comments	Approved
Pre-Construction Audit			
Post-Construction Audit			

Applicant / Consultant			QLDC
Traffic Signal Detail Design	✓	Notes / Comments	Approved
Cover Sheet and Site Location Plan			
Existing Survey and Services.			
Proposed Construction and Set out.			
Proposed Signal and Phasing Layout.			
Proposed Ducting and Cable Diagram.			
Tactile Pavers and Pedestrian Layout.			
Proposed Road Marking and Signage.			
Vehicular Tracking Plan.			
Proposed Street Lighting.			
Standard Details (optional).			
Controller Information Sheet (CIS).			

RAMM AMDS compliant Data Submission (inlcuding attachment to multimedia.			

Applicant / Consultant			**QLDC**
Software Development	✓	Notes / Comments	Approved
Controller Information Sheet			
.SFT Wintraff Test Report			

5 TRAFFIC SIGNALS SOFTWARE GUIDELINES

Purpose

The purpose of this document is to give an understanding of the QLDC requirements when undertaking the design, installation or maintenance of traffic signal installations in the Queenstown Lakes District.

Who Should Use This Document?

All consultants, contractors, should use this document and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District. Where for example an upgrade is being carried out by an RCA the applicant shall be the assigned. This would in most situations be the traffic signal contractor who would have most technical experience in providing the relevant information required.

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content, the applicant must read in conjunction with this document, the QLDC CoP. The QLDC CoP contains details on document management, flow charts and describes processes. The intent is to show what is expected in the application. The applicants should also refer to NZTA P43 Specification for Traffic Signals.

This guideline has been created to ensure that the designs of all intersections are to the highest standard, with variations being the exception rather than the norm. It is important that the information submitted as part of new or modified traffic signal layouts are standardised as much as possible. This will enable any further changes that may result from changing traffic conditions to be implemented quickly and simply.

This document lists the information that must be shown on the drawing for the traffic signal layout plan. The guideline information covers all the basic data required for a contractor to install the traffic signal equipment. The information will assist QLDC and WTOC to review the Controller Information Sheets (CIS) and the Controller personality as well as allow WTOC to set up the intersection on the SCATS network and provide good operational performance.

This document covers in some detail requirements that must be included in other plans. For example, requirements pertaining to any physical works such as; existing survey and services, proposed construction or road marking. These are essential to provide as complete a picture as possible. The applicant's project team members are expected to have the experience and knowledge required to provide the relevant details, particularly the production of software and, CIS and traffic signal design. QLDC are not responsible for providing training or resources for designers who are new to the industry as there are suitable courses and consultants who can provide training.

5.1 TECHNICAL CRITERIA

The design of the traffic signals must be carried out in accordance with the standards and guidelines listed below and their revised / subsequent replacements:

> QLDC Land Development & Subdivision Code of Practice – 2022.

> QLDC CoP Appendix L – Traffic Signal Guidelines.

> NZTA P43 Specification for Traffic Signals.

> AUSTROADS Traffic Management Guides.

> Road Traffic Standards (RTS) 14.

> NZTA Pedestrian Planning and Design Guidelines.

> Other NZTA, TCC, RMS, AS / NZ standards as agreed from time to time.

The specification of traffic signals equipment shall comply with the current version of the QLDC CoP or a written agreement with QLDC for the use of specific components shall be obtained.

The contractor is responsible for ensuring that all equipment that is installed meets the minimum standards. If there is any doubt the contractor shall be required to provide evidence that the product meets the QLDC requirements.

5.1.1 Reference Material

The traffic signal is very specialist and partially in New Zealand where resources and training is minimal. There we have provided some recommended documents listed below to assist in the processes required.

> NSW Roads & Maritime Services, Traffic Modelling Guidelines.

> NSW Roads & Maritime Services, Traffic Signal Design.

> Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.

> Signals National User Group (SNUG)

5.1.2 Detectors

All loop positions are to be determined early in the design.

All controlled lanes must have detector loops installed including for example left turn lanes under Give Way control to count vehicles only, if there are sufficient detector inputs available.

Advance loops may be required in some instances to optimise signal operation and enhance safety in high speed environments. If the controller capacity allows, detector loops are to be included in uncontrolled slip lanes for traffic counting purposes. Loops on bridge decks or approach slabs should be avoided where practical. Refer Section 3 of this Appendix.

Where there are a high number of cyclists the type and style of loops shall be clearly shown. Cycle lane design requires special attention and these shall be considered on a site by site basis.

Special care is required to ensure that the placement of the loop is in the correct position within the lane. Failure to confirm positions prior to sealing can mean that another loop may be required to be saw cut into the new seal. All loop locations to be accurately located and included on as-built drawings.

The ideal or preferred methodology of installing loops is to place them under the bedding of the pavement prior to sealing in order to avoid repeatedly cutting in a short period of time.

The requirements for the detector numbering convention are detailed in 1.2.6.1 of this Appendix. If the controller cabinet is relocated then the site must be renumbered to comply with the standard convention.

Configure virtual red light running loops in the CIS when there is spare capacity to allow, consult with QLDC as required.

5.1.2.1 Vehicle Detectors

Detectors are numbered anticlockwise from the controller assuming that a line is drawn from the controller through the centroid of the intersection.

The first circuit is the stop line loops, departure loops and counting loops are numbered first, with the departure loop being numbered after the stop line loop it is associated with.

The second circuit is the dynamic loops, followed by the advance dynamic loops.

The reason detectors are numbered anticlockwise is so that an approach will read numerically correct left to right when viewed on a SCATS System Monitor display.

Where there is a secondary part to the signals such as at interchanges, the first circuit is around the part of the intersection closest to the controller, then around the second part of the intersection. Then back to the first part of the intersection for the second circuit. A line is drawn from the controller through the centroid of the second part of the intersection to give the starting point for each numbering circuit.

If a controller is relocated then the site must be renumbered to comply with the standard

5.1.2.2 Detector Card Configurations for AS 2578 VC5/6 Compliant Controllers

When the new AS 2578 and VC5/6 compliant controllers were first introduced each Detector card had 16 Internal Detectors (Vehicles) and 16 External Detectors (Pedestrian). Since then the manufacturers have provided some flexibility to allow combinations to be used. It is important for the designer to understand and number the loops and pedestrian call detectors in the appropriate manner as this impacts directly on the preparation of the software. Furthermore, VC6 controllers have extended the capacity therefore check with the manufacturer on these specifications.

5.1.2.3 Pedestrian Detectors

Pedestrian detectors are numbered depending upon the card in use. First ascertain the number of detectors available at the controller if it is an existing site or determine the requirement if new. TSC3 Controller Detector cards come in groups of four ranging between 4 and 32.

The AS 2578 Compliant controllers come with a 16, 24 or 32 input Detector card. This consists of vehicle inputs and external inputs. Again, this will depend on the type of controller and the configuration applied.

The pedestrian detectors are numbered from the highest number down as follows and may include more than four pedestrian facilities:

PEDESTRIAN / WALK NUMBER	1 PED	2 PEDS	3 PEDS	4 PEDS	5 PEDS
W1	16	16	16	16	16
W2		15	15	15	15
W3			14	14	14
W4				13	13
W5					12

Table 5-1: Pedestrian Detector Slot Numbering (16 Detector)

A similar configuration will apply across the top end for 24 and 32 detector cards.

In ground and above ground pedestrian detection systems will need to be configured as a pedestrian input. Using Table 5-1 as an example, for four pedestrians we use inputs 13-16 and if we were to install above ground pedestrian detection for all the walks the detection would be numbered 11-4 leaving one unused before the pedestrians. MSS bits shall be used and numbered the same as the pedestrian detector number (where possible). Furthermore all non-loop detectors shall have an MSS assigned for each unit for additional SCATS variation options and monitoring options.

5.1.3 Pole Numbering

Poles are numbered in a clockwise direction from the controller assuming that a line in drawn from the controller to the centroid of the intersection.

Where there is a secondary part to the signals such as at interchanges, the intersection closest to the controller shall be numbered first then the additional part can be numbered in the same format assuming that a line is drawn from the controller to the centroid of the secondary part of the intersection.

If a controller is relocated then the site must be renumbered to comply with the standard convention.

5.1.4 Signal Groups

With AS 2578 and VC5 compliant controllers, the number of signal groups can range from 4 to 32 in modules of four signal groups. The recent changes to VC6 controllers may change some of the content listed below, therefore discussions with the manufacturer is expected during design.

Pedestrian signal groups in a sixteen group controller will be denoted as: W1=16, W2=15, W3=14, & W4=13). If there are only two Pedestrian groups then W1=16 and W2=15.

5.1.5 Phasing

The phasing diagram must show the following:

> Each phase in a separate box with the phase label inside the box corner A, F, F1, etc.

> Show only the movements that display green in each phase

> Indicate movements by an arrow pointing in the direction that traffic will travel

> Signal groups shown in a circle at the point of the movement arrow for vehicles and beside
> Pedestrian movements
> Any Special Flags inside the phase box Z, Z+, etc.
> Indicate if filter turn movements are permitted
> Label phasing to lanterns
> Default and Alternative phasing to be shown. Alternative phasing must show split phasing for each approach to assist in maintenance and operations.
> An all red phase to be added to all plans for operational requirements, no detector or input to be assigned to call/demand. Shall be operated only by SCATS Dwell.

The phase sequence must be shown on the plan adjacent to the phasing diagram.

In general, all traffic signals shall be consistent with the standard RMS configuration. Standard phasing configurations are detailed below. Where standard phasing configurations are not appropriate due to the site or traffic flow conditions, the phasing should be designed to:

> Minimise the number of phases
> Minimise cycle time
> Run as many compatible movements as possible in each phase
> Restrict each phase to non-conflicting movements
> Allow each movement to run in as many phases as possible (preferably allowing as many as possible to overlap from the previous phase or into the following phase), and
> Comply as closely as possible with the standard RMS configuration. Examples of a range of standard arrangements are found on the following pages of this document.

The phasing design should consider the use of filter right turn movements. The phasing design should provide the most flexible operation that will accommodate changes in traffic conditions without the need to reprogram the controller personality. This may result in a phasing sequence in which not all phases are used initially. An example of this is the inclusion of repeat right turn phases.

The phasing sequence (i.e. the order in which each phase runs) should be designed to provide the optimum coordinated flow along a corridor. This may change at different times of the day.

5.2 STANDARD TYPES

5.2.1 Midblock Pedestrian Crossing

5.2.1.1 Required Signal Groups

5.2.1.1.1 Vehicle

> SG 1 Main road through movement clockwise from the controller
> SG 2 Main road through movement opposite to SG 1.

5.2.1.1.2 Pedestrian

The midblock crossing will normally have one pedestrian and can be catered for with a much smaller controller than would otherwise be required.

Pedestrian Movement 1 – At a right angle to the main vehicle flow (e.g. SG 4, 8, 12 or 16) but typically SG4.

Note:

Staggered / two stage pedestrian crossings require an additional signal group as the walk phases are normally split.

5.2.2 Staggered Pedestrian Crossing

The configuration of a staggered pedestrian crossing should be left to right. Although this may not be practical, this requirement is so pedestrians are walking towards the main traffic flow. Careful consideration for poles and access would be required in the design.

5.2.2.1 Required Signal Groups

5.2.2.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG1.

5.2.2.1.2 Pedestrian

> Pedestrian Movement 1 – At a right angle with SG1 (e.g. SG 4, 8, 12 or 16) but typically SG4
> Pedestrian Movement 2 – At a right angle with SG2 (e.g. SG 3, 7, 11 or 15) but typically SG3.

5.2.3 T-Intersections

5.2.3.1 Required Signal Groups

5.2.3.1.1 Vehicle

> SG 1 - Main Road through movement adjacent to main road right turn
> SG 2 - Main Road through movement conflicting with main road right turn
> SG 3 – Right turn from main road
> SG 4 – Right turn or right and left turn from side road.

5.2.3.1.2 Pedestrian

> Pedestrian Movement 1 – across side road (i.e. parallel with SG2)
> Pedestrian Movement 2 – across main road and to the left of the side road.

5.2.3.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.3.2.1 Vehicle

> Left turn from main road into side road
> Left turn from side road into main road.

5.2.3.2.2 Pedestrian

If an existing controller has eight signal groups and more than four vehicle groups then it may be necessary to renumber the pedestrian signal groups.

> Pedestrian movement across controlled left turn slip lane from main road
> Pedestrian movement across controlled left turn slip lane from side road.

5.2.3.3 Phasing

Normal Phase Sequence = A : C : D

Alternative phase sequence A : B : C : D

<u>A Phase</u> – SG's 1, 2 and Pedestrian Movement 1.

May also include left turn movement into side road from main road if controlled by a separate signal group.

Note : Where considered safe the right turn movement may be permitted to FILTER turn. Filtering will be controlled through the introduction of the Z- flag. Filtering enabled under Flexilink or Masterlink only. If filtering is enabled, the main road left turn signal group (if provided) shall be in the OFF state.

<u>B Phase</u> – SG's 1 and 3.

May also include left turn from side road into main road if controlled by a separate signal group.

Note : B Phase introduction is controlled through introduction of Z+ flag in Flexilink or Masterlink only.

C Phase – SG 4 and Pedestrian Movement 2.

May also include the left turns into and out of the side road, if controlled by separate signal groups.

D Phase – SG's 1 and 3.

May also include left turn from side road into main road if controlled by a separate signal group.

5.2.4 Split Side Road Phases

5.2.4.1 Required Signal Groups

5.2.4.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG 1.
> SG 3 - Right turn adjacent to SG 1
> SG 4 - Right turn adjacent to SG 2
> SG 5 - Side road movements to the left of SG 1 (clockwise from SG 1)
> SG 6 - Side road movements to the left of SG 2 (clockwise from SG 2).

5.2.4.1.2 Pedestrian

> Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
> Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
> Pedestrian Movement 3 – pedestrian on the left of the C phase side road (e.g. SG 14)
> Pedestrian Movement 4 – pedestrian on the left of the D phase side road (e.g. SG 13).

5.2.4.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.4.2.1 Vehicle

> Right turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Right turn adjacent to SG 6 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 1
> Left turn adjacent to SG 2
> Left turn from C phase side road
> Left turn from D phase side road.

5.2.4.2.2 Pedestrian

> Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
> Pedestrian across controlled left turn slip lane from main road and parallel to SG 2
> Pedestrian across controlled left turn slip lane from D phase side road
> Pedestrian across controlled left turn slip lane from E phase side road.

5.2.4.3 Phasing

Normal Phase Sequence = A : D : E : F

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements into side road from main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG1) approach under the following conditions:

> The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is Z- flag present
> Filtering shall be permitted on the AC (SG2) approach under the following conditions:
> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is Z- flag present.

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the “OFF” state.

B Phase – SG’s 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG1 and from D phase side road if controlled by separate signal groups

C Phase – SG5, Pedestrian Movement 3.

May also include left turn parallel to SG2 and from D phase side road if controlled by separate signal groups

D Phase (least busiest side road movement) –SG 6 and Pedestrian Movement 4.

May also include left turn from main road parallel to SG 1 if controlled by a separate signal group.

5.2.5 Single Diamond Overlap with Split Side Road Phases

5.2.5.1 Required Signal Groups

5.2.5.1.1 Vehicle

- SG 1 Main road through movement clockwise from the controller
- SG 2 Main road through movement opposite to SG 1.
- SG 3 – Right turn adjacent to SG 1
- SG 4 – Right turn adjacent to SG 2
- SG 5 – Side road movements to the left of SG 1 (clockwise from SG 1)
- SG 6 – Side road movements to the left of SG 2 (clockwise from SG 2).

5.2.5.1.2 Pedestrian

- Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
- Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
- Pedestrian Movement 3 – pedestrian on the left of the D phase side road (e.g. SG 14)
- Pedestrian Movement 4 – pedestrian on the left of the E phase side road (e.g. SG 13).

5.2.5.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.5.2.1 Vehicle

- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn adjacent to SG 5 (red arrow only for pedestrian protection)
- Left turn adjacent to SG 6 (red arrow only for pedestrian protection).

5.2.5.2.2 Pedestrian

- Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
- Pedestrian across controlled left turn slip lane from main road and parallel to SG 2
- Pedestrian across controlled left turn slip lane from D phase side road
- Pedestrian across controlled left turn slip lane from E phase side road.

5.2.5.3 Phasing

Normal Phase Sequence = A : D : E : F

A Phase – SG’s 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements into side road from main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG 1) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state i.e. filtering also.

<u>B Phase</u> – SG's 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

<u>C Phase</u> – SG's 2, 4, Pedestrian Movement 2.

May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

<u>D Phase</u> (least busy side road movement) – SG 5 or SG 6 and Pedestrian Movement 3 or 4.

May also include left turn from main road parallel to SG 1 if controlled by a separate signal group.

<u>E Phase</u> – SG 5 or SG 6 and Pedestrian Movement 3 or 4.

May also include left turn from main road parallel to SG 2 if controlled by a separate signal group.

<u>F Phase</u> – SG's 3 and 4.

May also include left turn movements from side roads, if controlled by separate signal groups.

<u>F1 Phase</u> – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups.

<u>F2 Phase</u> – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups.

5.2.6 Single Diamond Overlap with Combined Side Road Phase

5.2.6.1 Required Signal Groups

5.2.6.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG 1
> SG 3 - Right turn adjacent to SG 1
> SG 4 - Right turn adjacent to SG 2
> SG 5 - Side road to the left of SG1
> SG 6 - Side road to the left of SG2.

5.2.6.1.2 Pedestrian

> Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
> Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
> Pedestrian Movement 3 – parallel and to the left of SG 5 (e.g. SG 14)
> Pedestrian Movement 4 – parallel and to the left of SG 6 (e.g. SG 13)

5.2.6.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.6.2.1 Vehicle

> Right turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Right turn adjacent to SG 6 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 1
> Left turn adjacent to SG 2
> Left turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 6 (red arrow only for pedestrian protection).

5.2.6.2.2 Pedestrian

> Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
> Pedestrian across controlled left turn slip lane from main road and parallel to SG .

5.2.6.3 Phasing

Normal Phase Sequence = A : D : E

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements from main road if controlled by a separate signal group.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG 1) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run).

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn adjacent to SG 1 if controlled by a separate signal group.

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

C Phase – SG's 2, 4, Pedestrian Movement 2.

May also include left turn adjacent to SG 2 if controlled by a separate signal group

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

D Phase – SG 5, 6, Pedestrian Movements 3 and 4.

E Phase – SG's 3 and 4.

E1 Phase – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn adjacent to SG 1 if controlled by a separate signal group.

E2 Phase – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn adjacent to SG 2 if controlled by a separate signal group.

5.2.7 Double Diamond Overlap

5.2.7.1 Required Signal Groups

5.2.7.1.1 Vehicle

> SG 1 Main road through movement with stretched phase, clockwise from the controller
> SG 2 Main road through movement opposite to SG 1
> SG 3 – Right turn adjacent to SG 1
> SG 4 – Right turn adjacent to SG 2
> SG 5 Side road through movement clockwise from SG 1
> SG 6 Side road through movement clockwise from SG 2

- SG 7 – Right turn adjacent to SG 5
- SG 8 – Right turn adjacent to SG 6.

5.2.7.1.2 Pedestrian

- Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
- Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
- Pedestrian Movement 3 – parallel to SG 5 (e.g. SG 14)
- Pedestrian Movement 4 – parallel to SG 6 (e.g. SG 13).

5.2.7.2 Optional Signal Groups

Where provided use next available Signal Group in order below.

5.2.7.2.1 Vehicle

- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn adjacent to SG 5
- Left turn adjacent to SG 6.

5.2.7.2.2 Pedestrian

- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 1
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 2
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 5
- Pedestrian across controlled left turn slip lane from main road and adjacent to SG 6.

5.2.7.3 Phasing

Normal Phase Sequence = A : D : E : G.

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements from main road if controlled by separate signal groups.

Note : Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the A-B (SG 1) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

C Phase – SG's 2, 4, Pedestrian Movement 2.

May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by separate signal groups.

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

D Phase – SG's 7 and 8.

May also include left turn movements from main road, if controlled by separate signal groups.

D1 Phase – SG's 5, 7 and Pedestrian Movement 3.

May also include left turn parallel to SG 1 and left turn parallel to SG 5 if controlled by separate signal groups.

D2 Phase – SG's 6, 8 and Pedestrian Movement 4.

May also include left turn parallel to SG 2 and left turn parallel to SG 6 if controlled by separate signal groups.

E Phase – SG's 5, 6, Pedestrian Movements 3 and 4.

May also include left turn movements from side road to main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the D1-E-F1 (SG 5) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 6 bit present (i.e. F2 phase is not permitted to run)

Filtering shall be permitted on the D2-E-F2 (SG 6) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 5 bit present (i.e. F1 phase is not permitted to run).

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

F1 Phase – SG's 5, 7 and Pedestrian Movement 3.

May also include left turn parallel to SG 6 if controlled by a separate signal group.

Note: Phase introduction controlled through introduction of XSF 5 Bit in Flexilink or Masterlink only.

F2 Phase – SG's 6, 8 and Pedestrian Movement 4.

May also include left turn parallel to SG 5 if controlled by a separate signal group.

Note: Phase introduction controlled through introduction of XSF 6 Bit in Flexilink or Masterlink only.

G Phase – SG's 3 and 4.

May also include left turn movements from side roads, if controlled by a separate signal group.

G1 Phase – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by a separate signal groups.

G2 Phase – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by a separate signal groups

5.2.8 Filtering Right Turn Movements

At most intersections right turning traffic that has opposing movements will be provided for by installing a separate signal display, giving the right turning motorist a protected turn at some time in the phasing sequence. However, under strict criteria filter turn movements may be permitted in order to improve intersection efficiency.

Whilst the provision of filter turns may improve efficiency, it reduces the potential safety as conflicting movements may now occur. The phasing design must consider a balance between safety and efficiency. When considering allowing filtering, safety must be given a higher weighting in the decision process.

The phasing design at adjacent intersections should also be considered to provide consistency along a corridor and preferably throughout the region.

The operation of such movement should be designed and implemented with prior consultations with QLDC.

5.2.9 Repeat Right Turn Phases

A repeat right turn is where the right turn movement is introduced for a second time within the same phase cycle.

Repeat right turns can be provided at any site with a right turn phase. Generally the controller logic will have two phases with exactly the same movements (i.e. for a T-intersection B and D) with one phase only introduced when a special facility signal is activated (normally B using the Z+ flag).

Repeat right turn phasing can only be used under Masterlink or Flexilink control modes (not in isolated mode) and is generally provided at peak times. It is unusual to have a repeat right turn phase operating 24 hours a day.

Repeat right turn phasing is normally used where the single right turn phase does not provide sufficient capacity within a cycle for specific flow periods, or it is necessary for progression within a coordinated system.

A typical use is where a right turn bay is too short to cope with the number of right turning vehicles that can arrive within the cycle which results in the right turn queue extending into and blocking the through traffic lane. This reduces the capacity for the through movement and increases the risk of nose to tail type crashes occurring. The use of the repeat right turn is particularly important, under these circumstances, where there is only one through lane.

Repeat right turn phasing should only be considered under the above mentioned conditions. Generally, where vehicles may queue outside of the through lane (i.e. on a painted median), it is more efficient to provide a longer single right turn phase than two short phases. Installation of queue detection loops to be considered in the design.

5.2.10 Pedestrian Control

The hierarchy of signalised pedestrian control strategies range from providing full pedestrian protection through to partial protection during the early stages of the crossing movement. They fit broadly into the following range:

i. Exclusive pedestrian phase with full protection and all vehicle traffic stopped. Also known as Barnes Dance. This is only used where pedestrian numbers are high, in CBD.

ii. Full protection for the whole Walk and Clearance using red arrow.

iii. Partial protection for part of the Walk and Clearance using red arrow and individual push button inputs. Red arrow on a minimum of 6 seconds for one direction and the other direction to be calculated to the last crossing lane using 1.5m per second (this can be reduced on site as required)

iv. Full protected staggered or staged pedestrian movements.

The method of control adopted at any specific site is based on location, traffic volumes, pedestrian volumes and type (i.e. age or disability), intersection layout combined with the aim to provide safe, efficient movement for all users. However, when selecting control options, it is important to ensure, whenever possible, that a consistent approach is adopted within any given corridor. This may result in a more conservative approach being adopted at some intersections to maintain uniformity throughout that corridor.

At signalised intersections, near schools, where there is a high pedestrian demand at the same time each day, the signal operation should be adjusted to cater for the reoccurring demand. This will generally be achieved by increasing the Walk' and/or clearance times.

It is preferable to have all pedestrian push button inputs wired and configured in the CIS individually to enhance pedestrian protection.

MSS bits to be used for every push button to enhance the variation options in Scats. (All non-loop detectors shall have an MSS assigned for each unit for additional Scats variation options and monitoring options).

5.2.11 Cyclists

Cycle lanes are being progressively introduced along some of the main corridors. Cyclists are features managed as part of the 'traffic mix' and there are currently limited special facilities for them at signalised intersections. These facilities are generally in the form of advance boxes or hook turn boxes and do not require special traffic signal control. Where cyclists may be on a side road or one that is not reverted to during phase sequence then detectors may be required to demand the phase for the cyclist.

Cycle detector loops are numbered in sequential order as part of the first circuit of vehicle detectors. Cycle call buttons are external inputs and numbered in descending order after the pedestrian inputs, e.g. W1=32, W2=31, C1=30.

Special care and attention to the detector position, type and detector alarm to be used in the cycle lane and / or cycle box.

Where cycle boxes are used they shall always be behind the traffic signal primary pole.

Consultation with QLDC is required at an early stage so we can consult the users groups.

5.2.12 Bus Lanes

Bus priority is becoming more common and requires the allocation of a signal group to each approach using the same convention as above for individual sites. If the bus signal group is demanded then the controller puts in a pre-specified delay to the through movement signal group. Where bus loops are installed these are numbered as part of the first circuit of vehicle detectors in sequential order. Where a separate signal group is provided for bus movements, these are numbered last, after all other vehicle signal groups.

Appendix N- Pipe Decommissioning Specification (Informative)

Basic specification for decommissioning pipes, subject to alteration should the onsite situation require and approval given by monitoring engineer and QLDC:

- Existing AC pipes exposed during works must be removed to the extents exposed and disposed of responsibly, irrespective of the parameters listed below. If remaining operational, the existing pipe must be replaced with a suitable alternative to the extents exposed.
- Valves, hydrants, fittings and associated street furniture must be removed from all pipe work being decommissioned. These items must be disposed of responsibly; recycling must be prioritised over landfill where practicable.
- Decommissioned existing pipes with **<600 mm** cover must be removed. Pipe must be disposed of responsibly; recycling should be prioritised, if possible, over landfill.
- Existing pipes with between **600 mm and 1000 mm** cover must be assessed against the following hierarchy of treatment:
    1. If reuse as a future utilities duct is possible, cap pipe and ensure its alternate use is captured on as-built information. Where long lengths of reusable pipes are exposed, these pipes must have marker tape, applicable to their future use, installed during backfilling. Assessment for reuse must consider the condition (based on CCTV inspection data where possible) and location of the pipe and the associated structural integrity of the pipe subject to the existing or future possibility of vehicle loading along its alignment. Separation of services in accordance with the QLDC LDSCoP must be achievable.
    2. If reuse is not feasible/practical, the following hierarchy of treatment must be followed, subject to feasibility:
        1. Remove and recycle
        2. Remove and landfill
        3. Internally grout full extent of pipe*
- Existing pipes with **>1000 mm** cover must be assessed against the following hierarchy of treatment:
    1. If reuse as a future utilities duct is possible, cap and mark pipe (marker tape appropriate for its future use). Where long lengths of reusable pipes are exposed, these pipes must have marker tape, applicable to their future use, installed during backfill. Assessment for reuse must consider the condition (based on CCTV inspection data where possible) and location of the pipe and the associated structural integrity of the pipe subject to the existing or future possibility of vehicle loading along its alignment. Separation of services in accordance with the QLDC LDSCoP must be achievable.
    2. If reuse is not feasible/practical, the following hierarchy of treatment must be followed, subject to feasibility:
        1. Internally grout full extent of pipe*
        2. Remove and recycle
        3. Remove and landfill

Notes

- *As-built information must be updated appropriately for the future presence/function of the decommissioned pipework. Information must be provided to QLDC for update of their GIS.*
- *Cover requirements noted are to finished surface level.*
- **Grouting of a pipe is dependent on the diameter of the pipe and the volume of grout required for filling. Where a pipe identified for grouting is >400mm ID, approval for grouting must be sought from the monitoring Engineer and QLDC.*

Disclaimer

Every attempt was made to ensure that the information in these documents was correct at the time of publication. Any errors should be reported as soon as possible so that corrections can be issued. Comments and suggestions for future editions are welcome and periodical reviews are undertaken on a regular basis. Users of these documents must ascertain themselves that they obtain the latest versions as valid references.

PRESSURE SEWER SYSTEM DESIGN STANDARDS

QUEENSTOWN LAKES DISTRICT COUNCIL

1 INTRODUCTION

This document is a supplement to the QLDC Subdivision and Land Development Code of Practice (CoP). It documents the technical standards for the design of Pressure Sewer Systems (PSS) in Queenstown Lakes District and must be read in conjunction with the CoP. Together with the CoP this document details all the information required as well as design and construction standards to be met by developers when seeking engineering acceptance for land development serviced by a PSS.

This document does not cover private pumping facilities to the gravity network (known as pump ups). These are addressed in the Appendix G – Sewer Pump Stations section of the CoP.

2 INTERPRETATION

The definition of a Pressure Sewer System and On-Property Pressure Sewer Equipment will be in accordance with the Queenstown Lakes District Council (QLDC) Pressure Sewer Systems Policy (PSS Policy).

3 STANDARDS AND GUIDANCE DOCUMENTS

Further to Section 4.3 of the CoP and the standard PSS drawings included in the CoP, the other relevant standards and guidance documents are:

- Queenstown Lakes District Council Pressure Sewer Systems Policy;
- New Zealand Building Code (Clause G9 Electricity and Clause G13 Foul Water);
- AS/NZS 1546.1 - On-site domestic wastewater treatment units - Septic tanks;
- AS/NZS 1547 - On-site domestic wastewater management;
- AS/NZS 3000 – Electrical installations (known as the Australian/New Zealand Wiring Rules);
- AS/NZS 3500.2 – Plumbing and Drainage – Sanitary Plumbing and Drainage;
- Queenstown Lakes District Council Water Supply Mains Pressure Testing Code of Practice;
- Pressure Sewer Manufacturer Guidelines
- QLDC Drawing No.: PSS-1 - QLDC Pressure Sewer System Standard Detail
- QLDC Drawing No.: PSS-2 - QLDC Pressure Sewer - Typical On-Property Layout
- QLDC Drawing No.: PSS-3 - PRESSURE SEWER DISCHARGE INTO MANHOLES FOR DN90 - DN180 PIPES
- QLDC Drawing No.: PSS-4 - PRESSURE SEWER DISCHARGE INTO MANHOLESFOR UP TO DN63 PIPES
- QLDC PSS Installer Declaration Form
- Connection to Council Services (CCS) Application Form

4 APPLICATION AND USE OF PSS

The selection of the primary wastewater collection system for a proposed catchment must be agreed with QLDC prior to proceeding with preliminary design. PSS must be used in the pressure sewer areas as defined in the District Plan. The use of pressure sewer systems outside of the mandatory pressure sewer areas is at the discretion of QLDC.

Where a PSS is proposed outside of the mandatory pressure sewer area a detailed technical submission justifying the use of a PSS must be provided in accordance with the PSS Policy.

As per the PSS policy, the on-property pressure sewer equipment, including the gully trap and piping, a pump or grinder pump, collection tank, electrical and control system, and individual discharge pipe up to the private property boundary will installed and owned by the private property owner (refer to the PSS Policy).

Regardless of the eventual ownership of the on-property pressure sewer equipment all requirements as set out in this standard shall apply.

5 APPROVED SUPPLIERS AND CONTRACTORS

Specific pressure sewer system components must only be sourced from an approved supplier, and that same supplier must grant approval of the design and construction of the PSS. Contact QLDC for the current list of approved PSS suppliers. Evidence of the input from an approved supplier shall be provided with the concept plans.

The approved supplier must provide as a minimum the following services:

- Hydraulic design, including modelling if required;
- Input into concept plans including system layout;
- Engagement in a safety in design process;
- Input into engineering drawings, specifications and reports;
- Training of approved system installers and initial oversight of construction;
- Commissioning;
- Troubleshooting/technical support through the Defects Liability Period (DLP); and
- Guarantees / Warranties for the equipment that they have supplied.
- Development and Delivery of the Home-Owner's Manual

The following on-property equipment must be supplied by the approved supplier who provided input into the concept design:

At development stage:

- Boundary kits

At building consent stage:

- Gully trap and piping to the collection tank
- Collection tank and grinder pump;

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version

- Chambers and lids (both trafficable and non-trafficable);
- Electrical and control system, cabinetry and components.
- Piping and connection to the boundary kit

All parts of a PSS must be constructed and commissioned by a Council approved supplier who has been approved for the construction of PSS.

6 SYSTEM DESIGN

The Developers Technical Representative must have oversight of the PSS system design with input from an approved supplier.

Where a development is to be served by pressure sewer, concept plans must be provided and the following must be provided with the concept plans (concept design):

- The operational philosophy of the overall system to show that the design and control requirements have been adhered to (including those for peak smoothing and flushing);
- Evidence of design including future flow rates so demand on downstream infrastructure can be determined by Council;
- For industrial / commercial areas, process data such as estimated daily discharge volumes and peak flow rates as well as sewer discharge characteristics.

6.1 DESIGN METHODOLOGY

The design methodology must be relevant to the operation of the system. Where flow control of any kind, such as peak suppression or flushing, is to be utilised, the system must be modelled by the approved supplier.

If no flow control mechanism is to be utilised, system must be designed by the approved supplier using the Probability Method as outlined in WSA-07. When applying the Probability Method to size pipes, the designer must perform a sensitivity analysis on input parameters such as flow per capita, pipe characteristics and pump units connected and in operation to ensure the selected pipe size meets the design criteria listed in Section 6.2.

6.2 DESIGN CRITERIA

The PSS must be designed to meet the following criteria:

- One PSS chamber, boundary kit and control panel per dwelling (refer also PSS Policy);
- Utilisation of the on-property storage chamber as part of the normal operation of the system in combination with minimised pipe sizes;
- Maximum total dynamic head of 55m;
- Minimum velocity of 0.7m/s;
- Minimum of one flush to be achieved at least once every 24 hours;
- Maximum velocity of 3.5m/s, with exception for at the discharge point as specified in section 7.7.

- Maximum in-network retention time of 6 hours, i.e. the total sewage retention time between upstream entry point at boundary kit and downstream pressure main discharge point. This is to be based on the weighted average of the accumulated retention time in each zone against the total number of connections;
- With the minimum the number of connection points to the existing gravity system.

6.3 STAGING AND SEPTICITY

If the development is to be staged the staging methodology shall be proposed and approval for it sought at concept plan stage. For a staged development the design of the system must ensure that self-cleansing of the system occurs during each phase of development to ensure the risk of septicity is kept to a minimum. Evidence of this, including details of design residence times and velocities at each stage must be supplied with the concept design.

Automated flushing within each part of the network may be used to address the risk of septicity. Automated flushing may also be required in accordance with section 9.2 of this document. Details of any automated flushing must be included in the concept design. This must function during all stages of the development.

If flushing cannot be feasibly achieved by flow control, due to large pipe diameters, staged installation of smaller diameter twin trunk mains may be considered by QLDC. Provision for future twin trunk mains must be installed as part of the first stage of the development and details provided with the concept plans.

Manual flushing as a solution must be authorised by QLDC and may only be utilised in exceptional circumstances. The cost of manual flushing must be met by the developer. Additional infrastructure to facilitate the flushing of mains (such as flushing tanks) will not be permitted.

6.4 DESIGN FLOWS

If a PSS system is expected to service a wet industry or other high-water user, approval must be sought from QLDC at concept design stage that a PSS is an appropriate method of servicing the development. Conversely for an existing PSS, approval must be sought from QLDC at the investigation phase for the building consent if the system is intended to service a wet industry or other high-water user.

Design flows for dry weather must be in accordance with Section 5.3.5 Waste Water Design Criteria of the CoP. For wet weather flow design a peaking factor of 1.2 shall be applied for pressure sewer systems.

6.4.1 HIGH FLOW CONNECTIONS

For connections with the potential to create high peak flows, a suitable means of mitigating the high peak flows must be designed and installed at the time of building consent. Examples of circumstances when high peak flows may be generated include:

- Swimming pool discharges (can be up to 2 l/s for 4 minutes);
- Facilities able to host large events;
- High flow trade premise connections for which a PSS may be an appropriate method of servicing.

The typical mitigation measure is expected to comprise a buffer storage tank to allow for a modulated discharge of wastewater to the pressure sewer system.

In the case of a residential property with a swimming pool the following should be considered:

- reducing pool pump flows;
- an electrical feed from the control panel to the pool backwash pump. This relay should cut power to the backwash pump whenever the alarm is activated.

An appropriate solution to mitigate high peak flows must be confirmed with the PSS supplier and evidence of its feasibility supplied with the building consent application.

6.5 CHAMBER VOLUME

Standard chamber sizes from approved suppliers must be utilised. Details of the standard chamber sizes can be obtained from the approved suppliers. If an installation requires a non-standard chamber approval must be sought from QLDC at building consent stage.

For residential installations the chamber must be sized to provide storage in the chamber above the pump start level equivalent to 24 hours at Average Dry Weather Flow. For trade premise installations the size of the chamber must be selected based on the specific flows for that installation but shall provide a minimum of 24 hours storage. In all cases details of the chamber volume selection are to be supplied with the building consent application.

6.6 MATERIALS

All pipelines for PSS must be constructed from black with cream stripe (colour coded) PE100 PN16 (SDR11) sewer/wastewater compliant pipes that comply with the COP. PSS mains and lateral joints and connections to the boundary kit must be electrofusion or butt fusion jointed. Pipework from the boundary kit to the chamber may be electrofusion or butt fusion or compression jointed.

All pressure Sewer pipework, valves and fittings must use appropriate pressure sewer color coding suitable only for sewer/wastewater applications. Black PE pipe with cream stripe and red surface boxes are required for pressure sewer systems. Use of any pipe and materials intended for other services is strictly prohibited (i.e.: must not use black with blue stripes.)

Chambers must be made of polyethylene or fibre reinforced plastic (FRP). Chamber lids must be made of polyethylene, be child safe and be capable of being locked.

Pumps shall be fully submersible and specifically designed for use in pressure sewer systems.

7 NETWORK REQUIREMENTS

7.1 NETWORK LAYOUT

The network layout must be designed in accordance with the COP and to meet the following criteria:

- PSS mains must have a minimum cover in accordance with the COP and a maximum cover of 1.5m;
- Pressure sewer laterals on private property must have a minimum cover of 600mm where likely to be crossed by vehicles and 450mm elsewhere;
- Bending radii must be greater than 100 x OD of the pipe where the pipe may be tapped on the bend or minimum 75 x OD otherwise;
- Vertical deflections in the alignment must be no greater than 1m in 10m (10%), to reduce the risk of air build-up in the system.
- Network Post construction as-built drawings in accordance with QLDC Asbuilt Specifications and ArcGIS Pro User Guide (3W, OS);

The minimum pipe size for pressure sewer pipes including laterals, is DN40.

7.2 ISLOLATION VALVES

Isolation valves must be positioned:

- On both upstream legs of any three-way branch;
- On the pressure main within 1m downstream of the last house serviced by the pressure sewer system;
- So that there are sufficient valves to allow the isolation of the network into blocks serving no more than fifty properties.

7.3 AIR RELEASE VALVES

PSS pipelines shall be designed in accordance with Section 7.1 to minimise the need for air valves. If a significant high point is unavoidable then an air valve must be installed.

Air valves must be designed to meet the minimum head required to seal the air valve and so eliminate the requirement for drainage. Air valves may be offset no more than four metres from the main. Some minor realignment of the pressure main to minimise this offset may be considered. The pipe connection from the main to the air valve must be the same diameter as the main.

Air valves must be specifically designed for wastewater applications and must meet the following minimum requirements:

- Be rated to PN16;
- Have an epoxy coated cast iron body;
- Be of a double acting anti slam type;
- Be mounted inside a dedicated pit with a Class B vented cover;
- Have an isolation valve to allow maintenance without disruption to PSS main.

Provision of odour treatment at air valve installations may be required. The odour treatment device must be designed to manage intermittent discharges over a range of air flows, be low-profile, damage resistant and effective.

7.4 FLUSHING POINTS

Flushing points must be installed:

- On each branch or sub-zone where the number of connections on a branch line exceeds five (5);
- Downstream of isolating valves, except where there is a downstream flushing point within 100m;
- At 500m intervals along straight sections of main.

In accordance with the wastewater system layout requirements of the COP, flushing points must be installed in a location that is easily accessible for operation and maintenance, being a location where a tanker truck (or equivalent) can be safely parked and operated, given the traffic conditions and access arrangements.

7.5 FLOW METERING

A flow meter must be installed at each of the points of discharge to the gravity network. Meters must be in-line electromagnetic flow meters with a pressure sensor, capable of being connected to Council's telemetry system or another communication method as approved by Council.

7.6 BOUNDARY KIT

A property boundary kit must be installed for all properties served by a pressure sewer system. The concept plans must detail the proposed location of all boundary kits.

The boundary kits must be installed at a uniform distance (150mm min offset) from the property boundary. The following considerations, in descending order of priority, must guide the location of the boundary kit:

1. For a single dwelling the boundary kit should be located as near as practical to the property boundary (150mm min offset), in the road reserve. Where a grassed strip exists between the back of the footpath and the boundary, the boundary kit is to be located in that strip.
2. The boundary kit should be located so as to avoid obstructions of the service line both on the public and private property side.
3. The boundary kit is to be located in a 'non- trafficable' location.
4. If the boundary kit cannot be located in accordance with (1) above, the boundary kit is to be located in compliance with (2) & (3) above.
5. Failing (1) above, the boundary kit can be located in the road reserve so that it can be easily found by operations staff.
6. Failing (1) and (5) above, the boundary kit is to be located within the private property but in a location easily locatable by operations staff using the main access to the property, i.e. near the driveway or front path.
7. Locate in carriageway with trafficable property boundary kit.
8. Boudnary kits shall be have red surface lids colour coded for pressure sewer.
9. Boundary kits shalk have a minimum depth of 400mm.

The location of boundary kits serving properties in a private right-of-way must be approved by QLDC, but will generally be in accordance with the typical common land connection position detail.

7.7 CONNECTION TO EXISTING SEWER SYSTEM

The number of discharge connections between the PSS and the existing gravity system must be minimised. All proposed points of connection must be approved by QLDC. For the minimum requirements in construction for pressure sewer network discharges to gravity networks, refer to Installation Standard Drawings No.: PSS-3 DN90-DN180 pipe sizes entering gravity network manholes, and PSS-4 for pipes up to DN63.

Flow velocities shall not exceed 1.5 m/s at the discharge point. A minimum 4m length of gravity discharge pipe shall be provided prior to the discharge entering the existing gravity sewer system to control turbulence.

Odour treatmentshall be installed at the receiving manhole if the age of the incoming flow is likely to be over four hours. The odour treatment device must be designed to manage intermittent discharges over a range of air flows, be low-profile, damage resistant and effective.

8 ON-PROPERTY EQUIPMENT

8.1 PRESSURE SEWER CHAMBER

The pressure sewer chamber on the property must be located:

- As close as possible to the point in the gravity pipework from the dwelling where all flows join to minimise the length of gravity pipework;
- To meet the minimum clearance distances to structures as specified in the QLDC Wastewater Bylaw (the chamber is considered a service opening in terms of the Bylaw) and to underground services as specified in the COP;
- To provide access at all times for maintenance (e.g. not under a deck or in a carport, garage or shed). The minimum requirement is safe pedestrian access. Access through buildings or dwellings is not acceptable;
- In a non-trafficable location. Acceptance of any alternative is at the discretion of QLDC and any such application must be accompanied by evidence that a non-trafficable location is not viable. A non-standard chamber design and trafficable lids to be rated to minimum Class C loading (AS3996) will be required in these cases;
- Clear of any low spots prone to ponding;
- A suitable distance from any property boundaries to avoid impacts on adjacent properties;
- In a position that minimises the amenity impact of equipment on the use of the property and allows for possible future development (e.g. to the side of lawn areas rather than centrally).

To avoid floatation and settling, installation and backfill requirements must be appropriate for the local ground conditions. If the weight of the tank is not sufficient to prevent floatation, additional anchoring to hold the tank in place must be provided.

Chambers will generally be vented through the cover. If a pump chamber is in a flood prone area, a watertight lid with an external vent is required.

Where there is insufficient space on-property, placement of the storage chamber within the road reserve may be considered. The location of an off-property storage chamber must be approved by QLDC. In all cases power is to be provided from the private dwelling's electrical switchboard.

For existing properties, the position of the pressure sewer chamber on site must be agreed with QLDC and the property owner prior to proceeding.

8.2 CONNECTION TO THE PSS NETWORK

The connection of the pressure sewer lateral to the pressure sewer network must be by means of a EF saddle tee or integral PE tee piece, cut and EF socket welded into the pressure main. Self-tapping EF saddle tees are permitted on all pipe sizes down to and including DN50 pressure main pipes, provided that the tapping does not reduce the internal diameter (i.e. greater than 30 mm for a typical single pump connection).

When installing EF saddle tees, the pressure main pipe must be peeled with a rotary pipe peeler and cleaned according to the manufacturer of the EF saddle tee. All EF saddle tees must be pressure tested in accordance with the QLDC Water Supply Mains Pressure Testing Code of Practice.

8.3 FREEZE/FROST PROTECTION

Any components installed above ground or near the ground surface are to have sufficient frost insulation measures applied.

Below ground equipment shall be designed with sufficient depth for frost protection, and valve boxes shall provide sufficient frost protection.

Where freezing is likely not to be mitigated by passive design and insulation, electric freeze protection is required.

8.4 POWER AND CONTROL BOX

Power to the pump must be provided from the electrical switchboard of the private dwelling that is serviced by the pump. This must be a dedicated circuit not shared with any other connections.

The control box must be mounted on the side of the house with a minimum clearance of 1.2m from the bottom of the box to ground level. The control box should be located within line of sight of the chamber. The distance between the control box and the chamber should be typically be 10m, but must be less than 30m. The location of the control box should be as visually unobtrusive as possible.

The cable conduit must not to be connected to the controller. An air gap of a least 100mm must be provided, with individual glands used for cable entries.

Detailed specification, installation and wiring drawings for the control boxes must be provided at concept plan stage.

A redundant 40mm PVC-U conduit for future cabling between the chamber and the control box must be installed. The duct must be brought through the wall of the chamber at one end and plugged with a rubber plug. The other end must also be plugged and terminate underground directly below the control box.

A label clearly identifying the telephone number to call in case of an issue with the PSS must be installed on the exterior of the control box.

8.5 RELOCATION OF ON-PROPERTY EQUIPMENT

If the property owner wants to relocate any part of the PSS (e.g. pump, control panel, pipeline) written approval must be obtained from QLDC. Detailed designs must be provided to QLDC showing the relocation complies with all the requirements of this document.

A building consent or building consent exemption will be required as part of the QLDC approval process for the relocation. Where written approval is granted the full costs of the relocation shall be borne by the applicant/property owner.

9 CONTROL AND OPERATIONAL SYSTEMS

9.1 STANDARD CONTROL AND ALARM BOXES

The following minimum features must be provided as standard on all alarm and control panels:

- Audible alarm with manual and auto reset, with the manual reset mounted outside of control panel (audible alarm with resident activated off switch, visual alarm that can only be switched off by maintenance authority);
- Visual red light, with the flashing light sequence that gives an indication of the specific fault;
- Manual and timer reset capacity;
- High and low voltage protection;
- Over pressure protection;
- Visual hours run display;
- Ability to record and store a downloadable history of events;
- Adjustable start delay after power failure;
- Back up battery to power control box during power loss;
- Provision of space and ability for future retrofitting of a SIM card for texting of alarms and/or integration with the QLDC telemetry system;
- Insulated lockable cover with corrosion resistant hinges;

- Rated to IP65 or greater;
- A generator plug.

9.2 CONTROL REQUIREMENTS

In all PSS systems the local pump station controls must provide for the following outcomes:

- Pump stop/start levels which prevent wastewater in the chamber going septic;
- Maximum pump starts per hour which meet pump manufacturer recommendations;
- Delayed diurnal starts to minimise pressure sewer network pipe sizing.

In developments where the ultimate number of lots will exceed 100 or where specifically required by QLDC then the following additional control requirements will apply:

- Provision for reducing peak discharge flows from the development by smoothing the diurnal flow peaks;
- Provision of automated flushing within each part of the network such that the minimum scouring velocity is achieved at least one time per day;
- Controlled recovery from a prolonged power outage which limits peak flows and avoids repeated over-pressure pump stop/start cycling.

The programming necessary to achieve the outcomes and requirements must be developed at the concept design stage. Each of the control solutions must be developed in such a way that it can accommodate and perform effectively during all stages of the development with no requirement for re-programming.

It is expected that the above control outcomes will be achieved by programming the individual PSS controllers in blocks or groups using timing delays or triggers. If the developer wishes to provide for a more sophisticated networked control system to achieve the outcomes this must be discussed with QLDC at concept design stage.

The installation of a more sophisticated control system does not necessarily require QLDC ownership of the on-property equipment.

10 TESTING AND COMMISSIONING

10.1 NETWORK

PSS pipe work must be pressure tested in accordance with the COP and the QLDC Appendix C – Field Testing of Pipelines in the Subdivision and Land Development Code of Practice.

After testing all valves must be opened and flushing must be carried out. Flushing must be done from the extreme ends of the system throughout the entirety of the system, including all branches. The network must be divided up for the flushing.

Note that a consent notice will be applied to all lots in the subdivision requiring that all requirements of the concept design is adhered to at building consent stage.

10.2 ON-PROPERTY EQUIPMENT

On-property PSS pipe work must be pressure tested in accordance with the COP and the QLDC Appendix C – Field Testing of Pipelines in the Subdivision and Land Development Code of Practice.

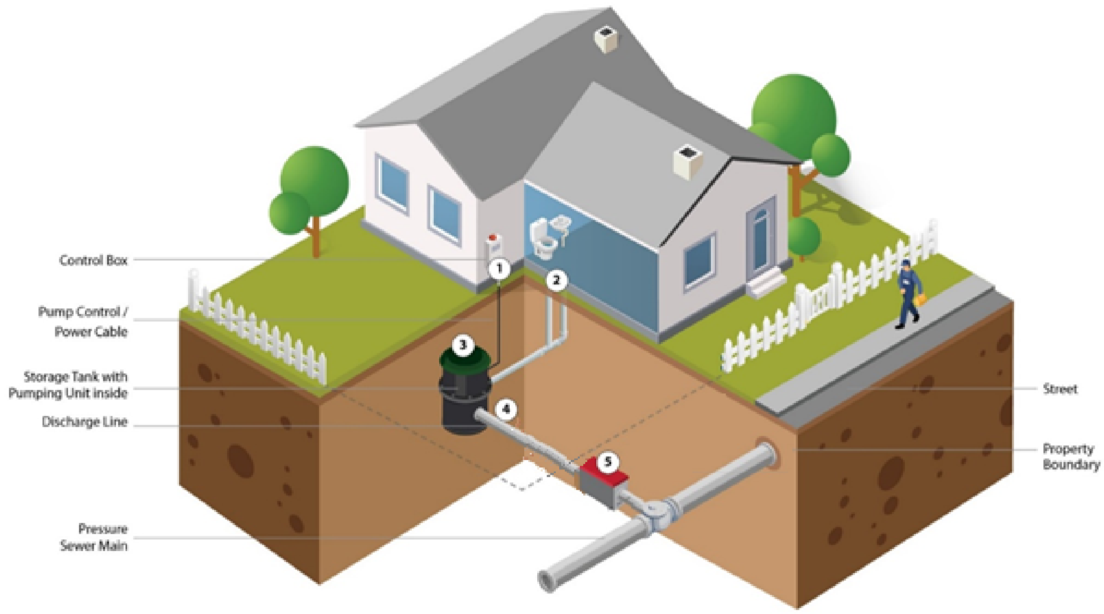
The supplier's recommended start-up and commissioning procedure must be followed and all supplier checklist and/or QA forms completed. The relevant serial numbers must be recorded on the checklist. The commissioning process shall be completed by a Council approved contractor who has been approved for the construction of PSS under the supervisions of the appropriate Council staff.

Prior to the issuing of the Code Compliance Certificate the following must be provided to Council:

- A signed declaration from an approved installer that the equipment has been installed as per manufacturer's specification;
- A signed declaration from the approved supplier who provided input into the concept design that the equipment, including the controls, has been installed as per the concept design;
- A signed declaration from the approved supplier who provided input into the concept design that the equipment, including the controls, has been installed as per the concept design;
- A signed construction producer statement (PS3);
- For individual connections, post construction as-built drawings are to provided by the installation contractor through building conset process.
- A copy of the completed supplier commissioning checklist and an any other supplier QA forms;
- Inclusion on the electrical records to include the pressure sewer;
- For all trade waste installations and for private installations where the on-property equipment is to be privately owned, evidence that a service agreement is in place.

Note this section also applies when on-property equipment is relocated in accordance with section 8.5 of this document.

APPENDIX A. PARTS OF A PRESSURE SEWER SYSTEM



1. The electrical power controls and alarm
2. The household plumbing and wastewater line
3. Storage Tank with Pumping Unit inside
4. A discharge line from the storage tank to boundary kit
5. A boundary valve assembly inside a buried box with a plastic lid located just outside your property

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version

ON PROPERTY LPSS SPECIFICATION

INTRODUCTION

This document is a supplement to the Queenstown Lake's District Council's (QLDC) *'Land Development and Subdivision Code of Practice'* (CoP). It documents the technical standards for the supply and installation of on property pressure sewer equipment in the Queenstown Lakes District and must be read in conjunction with the CoP. These pressure sewer systems are known as and referred to throughout this document as 'Low Pressure Sewer Systems' (LPSS).

This document is not intended to cover private pumping facilities to the gravity network (known as pump ups); however it's use as a proxy for those designs is recognised. These pump ups are specifically addressed in the *'Appendix G – Sewer Pump Stations'* section of the CoP.

This document does not cover, and QLDC do not currently permit, vacuum pressure sewer systems.

This specification is based on the objectives outlined in QLDC's *'Pressure Sewer Policy'* and gives technical information to suppliers to achieve these.

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version

1 CONTENTS

1 DEFINITIONS

1.1 GENERAL

ALARM
A visual and/or audible signalling device used for indication of alarm conditions.

AVERAGE DRY WEATHER FLOW (ADWF)
The combined average daily sanitary flow into a sewer from domestic, commercial, and industrial sources.

BOUNDARY
Survey line separating adjoining properties for the purposes of defining ownership/title.

COLLECTION/PUMP UNIT
A package of sewer components installed on a property, including a collection tank, grinder pump, level switches, pipework, valves and other appurtenances within the unit.

COLLECTION TANK
That part of a collection/pump unit which collects and stores flows from the customer sanitary drain(s).

COMMISSIONING
The running of the plant and equipment to ensure flow through the collection and pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions.

CONNECTION POINT
Point of connection between the collection tank and the inlet pipework. Also called property connection point. See also connection point inspection shaft.

CONNECTION POINT INSPECTION SHAFT
A shaft at the connection point to allow inspection and maintenance of the sanitary drain.

CONTROL/ALARM PANEL
The power and control panel that controls operation of the grinder pump and which contains audible and visual alarm components. The panel also contains a dedicated circuit breaker for power disconnection.

CONTROL VOLUME STORAGE
The storage volume within the collection tank above the pump-off level (BWL) and below the pump on level (TWL).

CORROSION
Deterioration of a material and alteration of its properties due to chemical or electrochemical reaction between the material and its environment.

DEAD STORAGE
The volume within the collection tank below the pump-off level i.e., the volume that remains in the tank after a normal pumping cycle is complete. Also known as collection sump.

DISCHARGE PIPEWORK
Any pipework within the collection tank (i.e., from the grinder pump to the outlet pipework).

ELECTRICAL CABLE
A cable that delivers power from the building electrical distribution box to the control/alarm panel.

ELECTRICAL DISTRIBUTION BOX
A board that disseminates the main power supply to the property and is the primary source for metering.

EMERGENCY STORAGE
The volume within a collection tank between pump on level and overflow level i.e., the volume of sewage that can be accumulated once the pump has been activated and prior to overflow.

GRINDER/CUTTER PUMP

A mechanical device designed to pump liquid and, in the process, reduce the size of solids contained in the sewage.

HEAD
Pressure expressed in terms of the height of a column of water (in metres).

INFILTRATION
Ingress of groundwater into a sewer system.

INFLOW
Ingress of stormwater into a sewer system.

INLET PIPEWORK
A pipeline installed by a licensed plumber within the property boundary and operated by a property owner to convey sewage from buildings to the connection point; constructed to plumbing code standards. Also called house drain, house service line, house sewer, sanitary connection, property drain, sanitary drain, customer sanitary drain.

LEVEL SENSOR
A device used to activate a grinder/cutter pump when a predetermined level of sewage has been reached in the collection tank.

LEVEL SWITCHES
Control devices operating at single point levels to effect control of pump operation.

OPERATING STORAGE
The storage volume within the collection tank above the pump-off level and below the high water/alarm level. Comprises control volume storage and reserve (buffer storage).

OUTLET PIPEWORK
A pressure sewer line located on private property that connects the collection/pump unit to the property boundary assembly/kit, referred to as property discharge line in other publications.

OVERFLOW LEVEL
The level at which the collection tank will begin to overflow. This will be the lower of either the overflow gully level or top of tank.

OVERLOAD PROTECTION DEVICE
A device which protects electrical components from current overload.

PEAK DRY WEATHER FLOW
The most likely peak sanitary flow in the sewer during a normal day. Exhibits a regular pattern of usage with morning and evening peaks related to water usage for toilets, shower, baths, washing, and other household activities.

PRESSURE RETICULATION SEWER
A common main which transfers sewage from a number of properties to a downstream point in a pressure sewer system i.e., a component of pressure sewer reticulation.

PRESSURE SEWER LATERAL
A main that connects a pressure reticulation sewer to a property boundary assembly.

PRESSURE SEWER RETICULATION
A network of mains including pressure sewer laterals and property boundary assemblies which transports sewage from properties to a sewage treatment facility or another sewerage system.

PRESSURE SEWER SYSTEM
A complete system wherein macerated sewage is conveyed under pressure generated by pumping units located on each property to a sewage treatment facility or another sewerage system.

PROPERTY BOUNDARY ASSEMBLY/KIT
A fitting assembly that:

a) Connects a pressure sewer lateral to a property discharge line; and

b) Provides a means of isolating pressure sewer reticulation from a property discharge line and associated collection/pump unit/

It consists of, as a minimum, a reflux valve, inspection tee, and isolation valve and is generally located within a pit at the boundary of the property being served by the system.

PROPERTY CONNECTION SEWER

A short sewer, owned and operated by QLDC, which connects the main sewer and the boundary kit; it includes a junction on the main sewer, a property connection fitting, in some cases a vertical riser, and sufficient straight pipes to ensure the property connection fitting is within the lot to be serviced.

PUMP CONNECTION POINT

The point where the discharge pipework of the pump passes through the wall of the collection tank.

PUMP CONTROL/POWER CABLE

A cable which delivers power from the control/alarm panel to the grinder pump located within the collection tank and transmits control signals between the panel and the pump.

PUMP LEVEL CONTROLLERS

A device that detects sewage levels in the collection tank and initiates pump start/stop sequences.

RESERVE (BUFFER) STORAGE

The volume within the collection tank above the pump-on level and below the high water/alarm level i.e., the volume of sewage that can be accumulated beyond the normal operating volume prior to alarm activation.

SEWAGE

Water polluted by use and discharged to a sewer system.

SEWER

Pipeline or other construction, usually buried, designed to carry sewage from more than one source.

SEWER SYSTEM

Network of pipelines and ancillary works that conveys sewage to a treatment works or other place of disposal; see also *pressure sewer system.*

SURCHARGE

Condition in which sewage is held within a collection tank and sanitary drainage system but does not overflow.

SURFACE BOX

A purpose designed and manufactured pit and cover to provide access to appurtenances for operations and maintenance.

UNUSABLE STORAGE

The volume within a collection tank above the overflow level i.e., the volume of the tank that is unusable.

24 HOUR STORAGE REQUIREMENTS

The volume of wastewater in Litres expected to be produced per day, based on the guidelines outlined in the Queenstown Lakes District Council’s Land Development and Subdivision Code of Practice.

2 GENERAL REQUIREMENTS

Low Pressure Sewer System (LPSS) units offered shall be complete systems including specifically designed collection tanks, grinder pumps, control/alarm panels, level sensors, pipework, and valves. They shall be designed and supplied as an integral unit.

The supplier/manufacturer of the LPSS shall be Aquatec or Ecoflow (or approved equivalent – refer to QLDC approved materials list).

To be considered for addition to the QLDC approved materials list, the supplier/manufacturer must demonstrate proven track record supplying pressure sewer systems in Australia/New Zealand over a period of at least 15 years. The supplier/manufacturer shall provide proof that their products have been designed and built specifically for use in low pressure sewer systems (LPSS). Suppliers/manufacturers shall submit detailed installation and user instructions; and submit evidence of an established service and spare parts backup program, with spare parts and pumps available locally.

2.1 STANDARDS AND GUIDANCE DOCUMENTS

All components included within the LPSS shall comply with the following standards and codes:

- WSA 07-2007 - Pressure Sewerage Code of Australia
- AS/NZS 1546.1:2008 - Septic Tanks
- AS/NZS 3000:2018 - Electrical Installations
- AS/NZS 3500.2:2021 - Plumbing and Drainage
- AS/NZS 2566.1:1998 – Buried Flexible Pipelines – Part 1: Structural Design
- AS/NZS 5065:2005 – Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- Water New Zealand Pressure Sewer National Guidelines
- NSW Health Certification
- SA Health Certification
- ISO9001:2008 – Quality management systems
- ASTM A351
- ANSI/NSF 46:2020 – Evaluation of Components and Devices Used in Wastewater Treatment Systems

2.2 QUALITY ASSURANCE

All collection tanks, pump units, boundary kits, and control panels shall be identified with a unique serial number. These serial numbers shall be:

- Permanently inscribed onto the component at the time of manufacture; or
- attached by means of a 316 stainless steel embossed/engraved plate with stainless steel drive screws; and
- not be painted or stickered; and
- located in a position that can be easily read after installation; and
- sufficiently detailed such that the quality assurance system provides traceability of the manufacturer from the serial number.

All LPSS installed shall comply with the quality assurance specifications outlined in Sections 8 through 11 of this document.

3 COLLECTION TANKS

3.1 GENERAL

Collection tank design and manufacture shall be for complete fabricated units and shall meet and adhere to all applicable standards. For residential units high-grade virgin polyethylene or glass reinforced fibre plastic (GRP) is preferred. Concrete is not an accepted material for any LPSS collection tanks.

Bases of collection tanks shall be domed, with a minimal flat section underneath the pump to minimise solids build up on the floor of the well/tank. LPSS tank depths shall be adapted for specific site conditions, volume requirements, and OH&S purposes when installing.

Collection tanks shall be able to be installed using small lifting equipment in areas with minimal access. The wells shall be of leak-proof design using proven materials and manufacturing techniques. They shall be designed for a service life of not less than 50 years.

The wells, including lids, shall be constructed from materials that are not subject to corrosion from sewage or galvanic action. All parts exposed to sunlight shall be resistant to UV degradation both in strength and colour. The wells, including lids, shall be designed and installed in accordance with AS3996 as below:

- Non-trafficable locations shall be rated to Class A loading.
- Standard chamber design in trafficable locations on-property (i.e., driveway) shall be rated to Class B loading;
- Non-standard chamber design or locations outside the property boundary shall be rated to Class C or D loading.

All metalwork within collection tanks shall be stainless steel Grade 316. Council may approve other corrosion resistant material where adequate corrosion performance can be demonstrated through previous applications.

Collection tanks shall be designed to resist structural failure under all service conditions. Selection of the appropriate pipe class, tank strength/stiffness and embedment, combined with correct manufacturers installation practice, shall be undertaken to achieve this.

Commercial applications of this standard shall comply with all requirements outlined within this technical specification and have specifically engineered designs for each application. Load ratings for commercial installations shall be from Class C to Class E based on AS3996. Examples of tank materials for commercial applications are fibreglass filament wound reinforced fibre plastic (RFP) units in a designed and constructed one-piece construction; or HDPE100 material (Borealis HE-3490-LS) which is commonly used for large underground pipework up to 3 m in diameter.

3.2 TANK SIZING AND VOLUME

All collection tanks shall be designed and sized sufficiently to meet daily flow and 24-hour storage requirements (refer to QLDC CoP), having considered static/dynamic loading and water table requirements in design. Pipe sizes may be based on septicity requirements and confirmed with QLDC prior to construction.

The various storage volume components which make up the total storage requirement for an LPSS collection tank are shown in Figures 1 and 2 and described below.

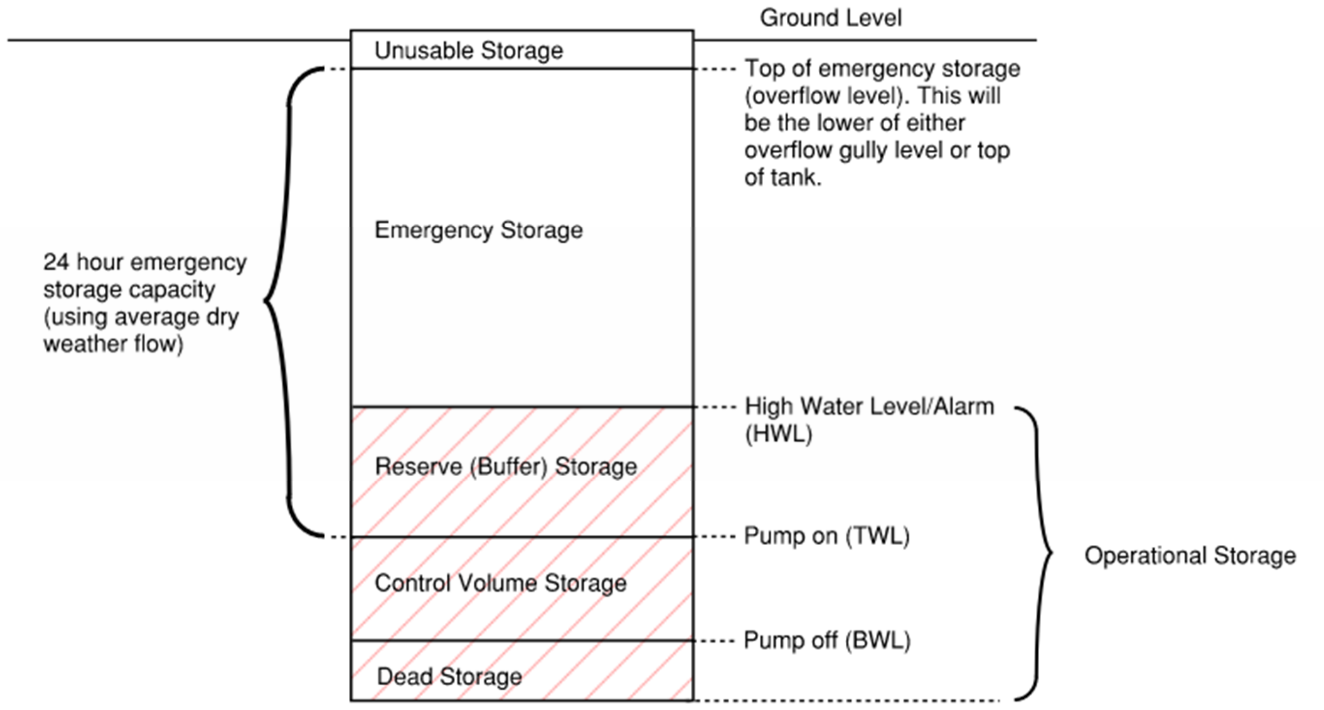


Figure 1. Storage components of collection tanks without network buffering

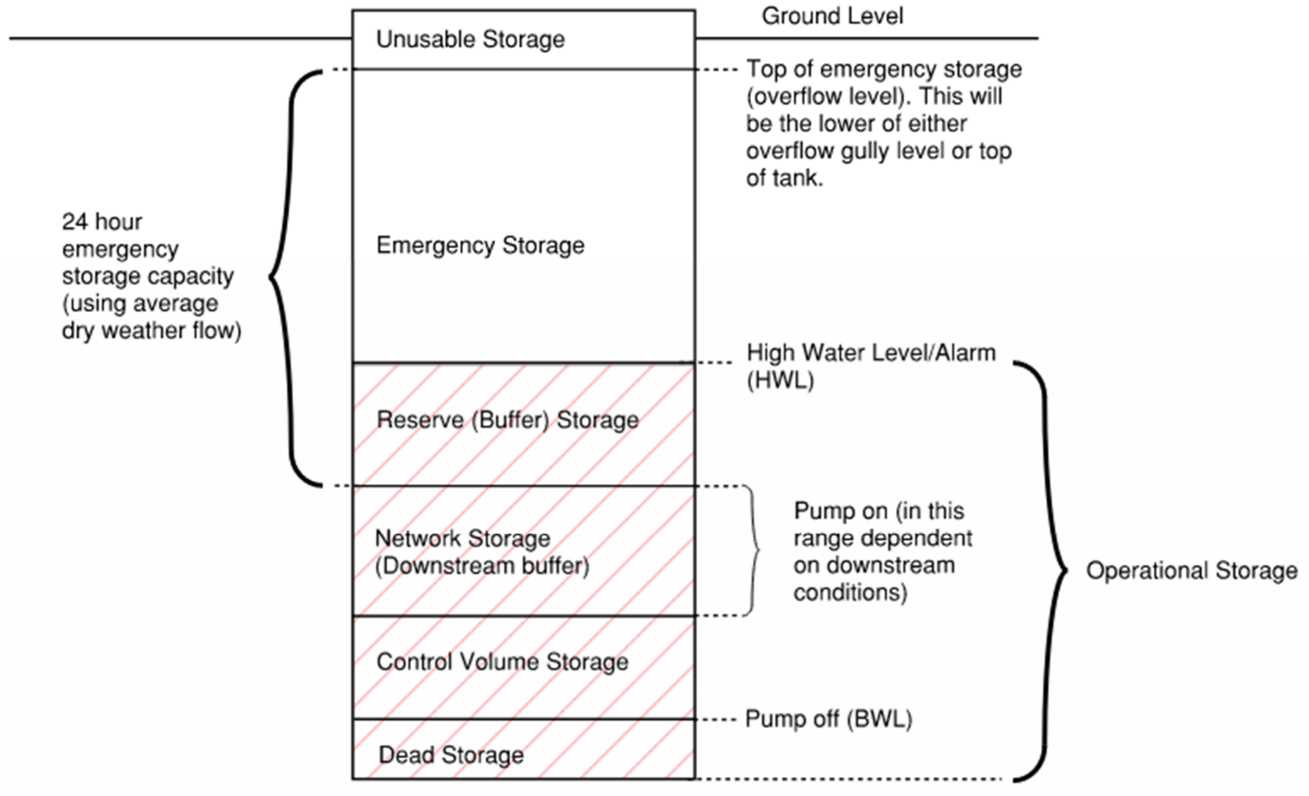


Figure 2. Storage components of collection tanks with network buffering

Residential collection tanks shall have a minimum storage as below:

- For collection tanks that have no requirement for network buffering (i.e., no additional network storage to reduce diurnal peaks entering the wastewater treatment plant):
  - Total Storage Volume of the collection tank (tank size) of at least 900 litres.
  - Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow e.g., 750L for standard household assuming 3 inhabitants). *
- For collection tanks that are in areas that have a requirement for network buffering (i.e., diurnal peak and/or wet-weather attenuation prerequisites due to downstream capacity constraints):
  - Total Storage Volume of the collection tank (tank size) of at least 1100 litres.
  - Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow e.g., 750L for standard household assuming 3 inhabitants).
  - Any sizing of these tanks shall be pre-agreed with QLDC, approved by the Infrastructure Delivery and Engineering Manager, and clearly include all design considerations required into their sizing.

*Where the above cannot be met due to standardised manufacturing constraints, compliance with the above shall be considered for any tank that is within 10% of the requirements outlined.

Commercial collection tanks shall have a minimum storage as below:

- Total Storage Volume of the collection tank (tank size) of at least 1500 litres.

- Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow).

Other tank sizing's or customisations where available in polyethylene or fiberglass require QLDC approval from the Infrastructure Delivery and Engineering Manager. Commercial collection tanks shall be designed on a case-by-case basis to suit the development. In some cases, subject to Council's detailed review and approval, a separate emergency storage vessel may be provided.

Collection tanks shall be selected to allow the most economic installation that meets the network design criteria. The well depth shall be sufficient to allow drainage pipes to be connected without backup in the pipe during normal operation. For normal installations it shall be assumed that the cover to the incoming pipe will be at least 1 m in trafficable areas; and 600 mm in non-trafficable areas as per the Code of Practice.

SPECIFIC REQUIREMENTS FOR COMMERCIAL UNITS AND PUBLIC AMENITIES

The number of pumps installed shall relate to flow output per day and serviceability (i.e., maintaining a minimum time between normal servicing of the pumps over a five year period). Where a two (or more) pump configuration must be installed into the collection tank, pumps shall be: industrial grade 2-stage centrifugal units; 2-Stage centrifugal vortex style grinder pumps; positive displacement/progressive cavity pumps; or semi positive displacement pumps specifically designed for commercial use in LPSS.

Flow and storage may differ from each site due to downstream capacity constraints. The ability to control the number of concurrent pumps operating at any one time shall be considered in order to manage flow conditions and optimise storage requirements across each catchment. Further specifications regarding this capability are included in section 7.2 'Controls'. Each design shall be submitted to QLDC for approval prior to construction.

3.3 LIDS

Collection tank lids shall be manufactured from UV resistant polyethylene and shall blend in with the environment. Lids shall be low profile, no more than 50 mm above ground level, installed to avoid surface water ingress and ponding, and suitable for pedestrian or trafficable areas as outlined in Section 3.1. Any lids in flood prone areas shall be able to be sealed. Lids shall be child safe and capable of being locked. A padlock or approved security bolt with unlocking tool supplied is acceptable. The lid to the tank shall be secured to the well body in such a way that it cannot be removed without special tools.

The lids shall be lightweight, so that one person can open them. Removal of the lid from the collection tank shall give easy access to the pumps and associated equipment. When the lid is removed it shall be possible to see the entire surface of the sewage collected and to use a 100 mm diameter eduction truck hose to empty the tank. It shall also be possible to clean any fats and oils that are sticking to the wall of the tank.

3.4 INLET AND OUTLET CONNECTIONS

All penetrations through the collection tank wall (other than the household drainage line/inlet connection point) shall be factory sealed to ensure no ingress of groundwater.

The collection tank shall incorporate a connection point via an approved 100 mm flexible rubber coupling. This rubber coupling shall be able to be cut short onsite to provide a clear opening for the 100 mm PVC inlet pipework. The inlet connection point shall be installed on the opposing side of the tank as the outlet pipework. All accessories required to install this connection point with a watertight seal shall be provided. The seals shall ensure that there is no ingress of groundwater into the collection tank. Each inlet connection point shall include a connection point inspection shaft consisting of a shaft and threaded cap opening at ground level, which shall be located below the overflow level of the tank.

A 316 stainless steel isolation valve and tank outlet shall be pre-installed into the chamber to connect the discharge pipework to the outlet pipework. Connection points shall not be cored onsite and uniseal connections are not acceptable unless they are an approved repeatable part of the installation system; installed by an approved manufacturer's representative in accordance with manufacturers installation procedures; and each methodology is approved by QLDC in advance; and QA records of these installations are kept and clearly marked.

Commercial units may have larger diameter inlet connections. These sizes shall be confirmed with QLDC in advance and be based on peak inlet flow.

The electrical conduit connections for pump and level controls need to have dedicated bulkhead fittings incorporating an electrical gland inside the chamber which can be tightened and sealed around the cables to eliminate the risk groundwater entering via cracked conduit and into the tank.

3.5 BALLAST

Collection tanks shall be installed with a suitable solution to prevent flotation and resist uplift either through tank design or installation method. Ballast calculations shall be provided for each proposed installation. The design shall prevent the units from floating when the water level is at the top of the unit. This may be achieved by the use of concrete if applicable. The units shall be shaped to adequately bond with any concrete or other backfill material. A factor of safety against flotation of at least 1.5 shall be provided.

3.6 PUMP CONNECTION POINT

Each system shall have a quick disconnection point within the collection tank to allow for efficient removal and disconnection of the pump for maintenance. This quick disconnection point shall be secure and reliable during operations. A 316 stainless steel camlock within the chamber is preferred, however suitable substitutes may be accepted by Council (such as a Goose Neck Mac Union coupler to Valve with pressure relief on outlet pipe).

Except for the pump connection point, the pump shall be able to be removed and reinstalled without the need to dismantle, or risk damage to, any other equipment. It shall be possible to properly reinstall the pumps while the well is near full (below the level of the pump connection point) of sewage. The pump connection points shall be located as high as possible, and in easily accessible locations. The pump connection point shall be accessible from the top of the lid without the need to lean into the tank. Multiple risers are not acceptable due to the health and safety risks they may create.

3.7 VENTILATION

Ventilation shall be provided so that sewage can fill to the top of the tank and empty without causing pressure build-up or suction. This ventilation may be provided through the lid. For flood prone areas, the ventilation system shall ensure that floodwater does not enter the tank and an external vent may be required along the wall of a nearby building.

Trafficable installations shall include a separate vent that is not subject to blocking or damage from vehicle movements.

4 PIPEWORK

4.1 GENERAL

All pipework shall be designed, manufactured, and constructed in accordance with QLDC's Land Development and Subdivision Code of Practice and standards outlined in Section 2.1 of this document. This includes but is not limited to minimum pipe sizes; gradient; gully traps; air vents; cleaning or rodding eyes.

All buried pipework shall be of polyethylene (PE) material and have a minimum pressure class of PN16. Pipework within collection tanks may be PE, PVC, or other suitable pressure piping system. Products, materials, and jointing methods shall be selected and specified for each location to ensure structural adequacy; corrosion resistance; suitability for geological conditions; appropriate construction methods.

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version.

4.2 INLET PIPEWORK

All inlet pipe work (customer sanitary drains) within the private property boundary between the serviceable or rated unit and the collection tank shall be minimised so as to limit unnecessary distances of private gravity infrastructure, and corresponding depths required to achieve appropriate gravity profiles.

4.3 DISCHARGE/OUTLET PIPEWORK

The discharge pipework shall have a pressure relief that may be manually actuated to mitigate the risk of splash back contamination to the operator upon disconnection of the pump.

Where possible, the outlet pipework shall be located parallel to lot boundaries.

5 BOUNDARY KITS

5.1 GENERAL

Each property shall have a boundary kit containing at a minimum:

- Isolation Valve (full bore or gate)
- Check Valve with top access
- Flushing Point

All boundary kit fittings shall be bronze (max zinc component 7%) or grade 316 Stainless Steel with a pressure rating of minimum PN16. The above shall be of integral one piece construction and included within a boundary kit pit.

5.2 BOUNDARY KIT PIT

The boundary kit pit shall have the following characteristics:

- Be large enough to contain valves and flushing points, with a minimum depth of 400 mm.
- Be installed with the cover flush with ground level.
- Be constructed from materials that are not subject to corrosion due to contact with sewage or galvanic action.
- Any parts exposed to sunlight shall be resistant to UV degradation in both strength and colour and shall be of an unobtrusive colour.
- Some pits and covers may be subject to vehicle loads. This is to be confirmed per site, with load ratings the same as for collection tank lids.

6 GRINDER PUMP UNITS

6.1 PUMP GENERAL

A pump with an integral grinder unit shall be supplied with each collection tank. The pump shall be supplied with all necessary pipework, valves, and pressure sensing equipment. The pumps shall be submersible to IP68, specifically designed for the pressure sewer market, and may be one of the following:

- Regenerative Turbine Grinder Pump.

- 2-Stage centrifugal vortex style grinder pump.
- positive displacement/progressive cavity pump; or
- semi positive displacement pump.

All pumps, including the check valves that are part of the grinder pump package shall be tested to NSF/ANSI 46-2007. Pumps shall have a minimum design life of 25 years and include no materials that may degrade significantly while the product is on the shelf.

The pump identification nameplate shall include:

- manufacturer's name;
- address;
- pump type;
- Horsepower
- Hz
- Voltage
- Ampage
- Manufactured date
- Patent
- Serial number
- Head
- capacity;
- size;
- motor kW;
- serial number;
- order/contract number;
- speed;
- year of manufacture;
- and pump casing test head.

The pumps shall:

- Be self-priming;
- Be current models which have proven successful operation under similar conditions;
- Be fit for purpose (i.e. their duty point must be adequate for the area with the highest head requirement, considering implications of the entire catchment and wider area);
- Have easily replaceable parts that protect the integrity of the pump motor by acting as a sacrificial layer;
- Be suitable for domestic, commercial and industrial sewage;
- Be suitable for intermittent operation with up to 20 starts per hour;
- Have a maximum speed of 3000 rpm;
- Have shaft and rotors of stainless steel.

PUMP MOTORS

Pump motors shall be specifically designed for New Zealand (Queenstown Lakes District) conditions, and domestic units shall be at minimum 0.75KW, 240v 50Hz, single phase with IP68 submergence rating. Residential pump units may be air cooled or oil coiled.

Commercial units may be either single phase, or three phase 415v 50Hz, depending on the flows per day, storage requirements, and service intervals. Industrial units shall be three phase 415v 50Hz. Commercial units shall be oil cooled and capable of continuous running for an extended period without deterioration of pump performance.

Each pump shall have an inbuilt anti-siphon valve and a non-return valve located on the discharge standpipe of the pump, removable by a flanged arrangement.

The supplier shall carry spart parts (overnight and complete pump availability) and offer 24-hour support in the case of any faults.

Any industrial units/applications shall be agreed with QLDC prior to construction. Residential units are not considered adequate for industrial applications and will not be accepted.

6.2 PUMP OPERATIONS

Residential pumps shall have a predictable and constant flow rate across the required pressure head ranges, and shall comply with the following head and flow capabilities:

- Maximum flow rate of less than 1.25 L/s at zero head;
- Minimum flow rate of greater than 0.4 L/s at 55 m head;
- Rated for continuous operation at 55 m head;
- Ability to run continuously at no head and maximum flow;
- Ability to operate intermittently at between 55 m and 80 m head
    - 'Intermittent' running is expected to be on rare or unplanned occasions (i.e. after prolonged power outages); and
- Either have the ability to run against a closed discharge head for unintentional long periods of time with no impact on the performance or damage to the pump (for the avoidance of doubt the system shall be designed so that these events are avoided or mitigated) or; otherwise have protections in place to trip the pump so these do not occur.

The maximum designed continuous operating head for any pump in a system shall be 55 m. The pumps shall also have integral built-in protection to mitigate situations where overheating or excessive head is encountered, guarding the integrity of the pump and achieving the longest possible asset life.

The pumps shall also comply with the following requirements:

- Be able to handle sand and abrasive material, with proven results on wearing parts;
- Have a standard cord length of minimum 15 metres (for connection to the control panel), with longer options available from the manufacturer.
- Have all wearing parts of the regenerative pump turbine coated with an approved abrasive coating that has proven performance for pressure sewer applications.
- For progressive cavity style pumps the material of the stator shall be EPDM

6.3 GRINDER/CUTTER PUMPS

Grinding mechanisms shall be designed to minimise the inlet velocity such that solids have sufficient opportunity to be processed. Grinding mechanisms shall be manufactured from materials with proven performance in wastewater environments and with high wear or abrasion resistance. Grinder pump grinding performance shall comply and be tested to ANSI/NSF 46:2007. Suppliers shall provide evidence of a grinder pumps certification and test results from the Household Items Loading Test (section 9.4 table 1 in ANSI/NSF 46:2007). Grinder mechanism shall include features to promote stirring to keep solids in suspension.

Grinders shall comply with the following requirements:

- The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
- The impeller mechanism shall rotate at a nominal speed of no greater than 3000 rpm.
- The grinder shall be placed immediately below the pumping elements and shall be direct driven by a single, one-piece, Stainless Steel motor shaft.
- Should an item come to rest lying inside the cutting or shearing face, the grinder pump should have sufficient torque to restart when debris is lodged inside the grinding mechanism.

The pumps shall be able to handle sewage debris which includes but is not limited to:

- Fibrous items such as sanitary pads, tampons, nylon stockings, underwear, baby wipes etc.
- Flexible items such as condoms, plastic bags
- Solid items such as bottle tops, hypodermic needles, cotton buds
- Coagulating liquids such as fats and oils

6.4 ELECTRIC MOTORS

Electric motors shall be squirrel cage induction type with a low starting current (does not exceed 30 amperes or allowable circuit protection startup currents). Inherent protection against running overloads or locked rotor conditions shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. For submersible pumps, the electric motor shall be IP68 for submergence to a depth of 6 metres. The pump units shall be capable of being operated on a single phase power supply typical of a residential household without the need to augment the power supply.

Semi positive displacement pump motors shall be 0.75kW, 1425 RPM, 240 Volt 50 Hertz, single phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current (does not exceed 30 amperes, or allowable circuit protection startup currents), and high starting/locked torque of 11.4/15.6 Nm.

6.5 PUMP PROTECTION

Grinder pump motors shall be fitted with inbuilt no-flow and thermal overload protection as standard. Current sensors for over pressure protection are also acceptable.

Pump motors shall be suitably sized for the pump type. The grinder pump shall include features to protect the pump from operating under unideal conditions. These features include thermal overload protection, over pressure protection. Pump motors shall be oil-cooled or air-cooled and the supplier shall provide evidence that the motor is capable of operating across the entire performance range and a variety of duty cycles without overheating. For oil-cooled motors, suppliers shall provide proper guidance and training for periodic replacement of dielectric oil and instruction on disposal so oil does not pose an environmental or health and safety risk.

6.6 PUMP ACCESS

The pump shall be able to be lifted by a means other than the discharge pipework or cabling. The pump shall therefore be fitted with a permanently fixed and suitable lifting chain, marine grade polypropylene rope (suitable for sewer conditions) or equivalent for lifting and manoeuvring the pump into position inside the tank.

Pumps shall be installed such that removal from the well can be achieved without entering the collection tank. The internal outlet quick connector and plug for the pump shall be reachable from ground level without the need to lean into the pump chamber.

Commercial Duplex and Triplex grinder pump units shall be installed on 316 stainless steel C-channels for chambers greater than 3 metres in depth. When installed with C-channels the discharge pipework within the well shall also be 316 stainless steel.

Service technicians shall follow local and national health and safety guidelines when handling grinder pumps and other components of the grinder pump system. Lifting trolleys shall be used when installing or removing grinder pumps from tanks.

7 ELECTRICS & CONTROLS

7.1 GENERAL

An alarm/control panel shall be supplied for each collection tank, installed by the unit installer. The control panel shall contain the operational controls and alarms needed to operate the pump, including at minimum:

- Pump/panel Circuit Breaker
- A switch with On/Off/Auto Positions
- Alarm and Control Components
- Battery backup for alarms for at least 48 hours without power.

The pump controller/alarm panel provided shall be a complete control system incorporating all equipment pre-assembled, wired and tested prior to delivery. The panels shall comply with the requirements of AS/NZS3000:2018 Wiring Rules, shall be wired to a dedicated separate circuit breaker at the property's existing meter box, and shall be wall or pedestal mounted.

The control panel identification nameplate shall be visible on the outside of the control box and include at minumum:

- Telephone number to call in case of issue with the LPSS
- Manufacturer's name

A further identification nameplate may be included on the inside or outside of the control box and shall include:

- Pump Type
- Pump Capacity
- Pump Size
- Pump Motor KW
- Serial number
- Order/contract number
- Pump speed
- Year of manufacture
- Pump casing test head.

7.2 CONTROL PANEL

An electrical alarm/control panel shall be supplied for each collection tank. The panel shall be suitable both for wall mounting and pole mounting. The panel shall be constructed to comply with AS/NZS 3000.2018 Electrical Installations. All controls shall be contained within the control cubicle preventing the necessity to remove the pump unit to attend to electrical faults.

The control panel shall be manufactured from polycarbonate or GR 316 stainless steel to ensure robustness and have suitable protection against vandalism and UV rays seen in Australian / New Zealand conditions and be of weatherproof construction to a minimum IP65 rating. It shall utilise high quality componentry. All penetrations shall be on the underside of the panel only and an appropriately sized gland is to be provided to prevent any water ingress. The panel shall be fitted with corrosion proof hinges. QLDC may accept other corrosion resistant material where adequate corrosion performance can be demonstrated.

Internally, the panel shall have a safety barrier (An internal escutcheon panel which covers the entire area of the panel and which only allows access to the operator controls for protection against unauthorised entry) compliant with AS/NZS 3000:2018.

The control panel shall incorporate the following features:

- Key lockable with the lock uniform across all installations
- Audible alarm 90Db with mute button
- Low voltage visual alarm light
- Automatic mute for audible alarms after 5 minutes with 12 hour restart
- Pump/Panel Circuit Breaker (must be double pole)
- Selector switch with Auto/Off/Manual positions
- Compatible with level switches, or 4-20mA, 0-5v and 0-10v pressure transducers
- Under and over voltage protection
- Hours run display
- Number of starts display
- High level and low level (run dry) indication
- Over pressure protection
- LED status indication for pump run fault, pump stop and common faults
- Backlit LCD screen for all status and alarm displays
- Ability to record, view, or store a downloadable history of events
- Inbuilt event history for minimum 4000 events
- Adjustable random restart delay after power failure
- Ground Lug for incoming connections
- Battery backup for alarms
- Generator plug in point (for emergency power outages)
-

The control panel shall be able to be upgraded simply and without enclosure modification to natively support the following:

1) Sim card for cellular based communication or alternative communications module (e.g. fibre optics);
2) Fully integrated SCADA to suit QLDC's existing telemetry system which may include the following features:
    - Adjust start periods or pause pump operation,
    - Full remote visibility of all operational information,
    - 2-way control of all stations,

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- Ability to remotely communicate Firmware updates.
- Real time clock
- USB port access or web based portal for history and real time view faults

Battery backup to allow communications and alarms

Control circuitry and/or level sensors operating in the collection tank shall be low voltage and suitably designed and installed for use in areas that may contain explosive gases.

Cable entries from the collection tank to the control panel shall be designed and sealed appropriately to ensure no fumes/gases are able to enter the control panel. Design shall be rugged, durable, and preventative of gas build up, fire, or explosion. Design shall also be tolerant to operators, maintenance contractor, or owner error.

The control panel shall ensure that the maximum pump starts per hour (recommended by manufacturers) are not exceeded.

SPECIFIC REQUIREMENTS FOR SMART SYSTEMS WHERE WASTEWATER FLOW CONTROL IS REQUIRED

Where Wastewater flow control is required, such as for network buffering to minimise downstream storage requirements, the controller installed at each property must include the following features:

- IP65 minimum rating;
- 240V controlled output to pump;
- Local Pump control on cut in / out levels with remote setting option;
- Telemetry connection for monitoring and control to back end server;
- Fault alarms direct to operators via email and/SMS to include as a minimum the following:
    - High level alarm above cut in level;
    - Power outage alarm (Black out or Brown Out);
    - Communication fault alarm;
    - Pump over current alarm;
    - Pump long run alarm;
    - Level sensor fault alarm.
- Online portal for operator access to include as a minimum the following:
    - Map showing individual connection locations;
    - List showing individual connection status;
    - Filters to select all active alarms;
    - Individual connection graphs of continuous liquid levels monitoring;
    - Options for operator selection of pump controls;
    - Options to add new sites or update controller reference data.
- Operator pump control of individual or multiple selected connections via online portal to include as a minimum the following:
    - Control mode to reduce diurnal peak flows based on network based concurrent pump control;
    - Control mode to generate self-cleansing flushing velocity in network;
    - Control mode to inhibit pumps in an emergency.
- Automated control mode for post emergency recovery to prioritise connections with highest levels and control peak flows;
- Connection hard wire to tablet with App for controller diagnosis to include as a minimum the following:
    - Alarm status;
    - Pump Status;
    - Amps draw during pumping;
    - Pump Voltage ;

- Level reading;
- Comms status with communication network;
- Comms signal strength;
- Comms status with back end server;

- Backup audible buzzer and light alarm on the controller;
- Float switch pump activation trigger and remote alarm in high level situation.
- Spare IO to facilitate connectivity of potable and recycled water pulse meters to achieve daily flow data reporting

7.3 LEVEL CONTROLS

Level Controls shall be installed as per manufacturers recommendations and shall be pre-set at the factory. Level controls shall also have a back-up system to provide an alarm should the main level system fail.

Level sensors for measuring the level of sewage in the pump well shall be supplied. The primary sensors may be integral to the pump unit, or separate from the pump. A separate level sensor shall be used to detect high level in the pump well and to provide a high-level alarm signal. This shall be a back-up system to provide an alarm should the main level system fail. Level sensors may be pre-installed at the factory. If not factory installed, the installer shall be adequately trained to install the sensors and correctly set their levels.

Any pressure sewer system with more than one pump must not utilise level switches integrated to the pump. Separate level controls shall be installed independently of the pump and be connected to the control panel to allow full coordination of pump operation and adjustability to suit each application.

The pumps shall be controlled by probes or pressure sensors installed in the pump well. The probes or pressure sensors shall indicate the following levels:

- Low Level (BWL) – the pump stops;
- High Level (TWL) – the pump starts;
- Above High Level (HWL) – the alarm is activated.

A *'below low level'* sensor may also be supplied which shuts down the pump and activates the alarm. The '*low level'* shall be set as low as possible, while maintaining adequate submergence of the pump. The *'high level'* shall be set as low as possible to minimise storage, while not exceeding allowable pump start frequency at any flow rate. The *'above high level'* shall be set so that in normal operation it is not reached. Adequate volume between *'high level'* and *'above high level'* shall be installed to balance instantaneous inflows. If the operating levels can be adjusted they shall be readily adjustable by a worker remaining outside the well and complying with all OH&S requirements for safe working.

Control circuitry for the level sensors shall be contained in the alarm/control panel. The panel shall also have an OFF/Auto/ON switch or equivalent button configuration for the pumps. The ON setting shall bypass all pump controls except the thermal overload. The pumps shall be protected from overload and over pressure operation.

In situations of recovery after a blackout, pumps shall be programmed to come online through a deliberate strategy that staggers individual pump restarts so they are not all at once (i.e. time delay starts whether locally or from SCADA).

7.4 ALARMS

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version.

The pump controller shall be fitted with an audible alarm (buzzer) and a flashing red light that activates if the level of sewage in the collection tank reaches a high level. The audible alarm shall comply with the lower of: EPA rules; or noise restrictions outlined in QLDC's Operative District Plan ODP (PDP) where applicable. The audible alarm shall run for a maximum of ten (10) minutes and may only be restarted on activation of a new fault after the mute button has been pressed and the initial fault has been rectified.

The control panel shall include a mute button for the audible alarm to silence it on acknowledgement. The mute button shall be accessible externally to the pump control cubicle and shall be located in a protected position (generally underside of cubicle).

The operation of alarms shall be as follows:

- Above High Level: visual and audible alarm activates but pump does not stop. Alarm resets when the high level condition is rectified.
- For all other faults including over temperature, no flow, over pressure, overload, and *'below low level'*: the pump shall stop and operation re-commence when the fault is rectified.

The control panel shall have a reset procedure, which may only be carried out when the panel is opened. The procedure may use either the OFF/Auto/ON switch or a separate "Reset" button. The audible alarm shall be capable of field disconnection without interference to any other electrical functions.

7.5 ELECTRICAL INSTALLATION

All Electrical work shall be performed by a Licensed Electrician and shall be installed to comply with AS/NZS 3000.2018 Electrical Installations. The alarm/control panel shall be suitable for connection to a standard residential meter panel.

8 FACTORY TESTING AND COMMISSIONING

8.1 FACTORY TYPE TESTING

Before any units are installed, the following tests shall be carried out at the suppliers workshop.

Alternatives may be considered by QLDC if the supplier can provide details of a proven, standardised testing regime already adopted by the factory that addresses the intent of the following clauses.

If the unit supplier has already carried out type testing, type test certificates which cover the required tests may be accepted in lieu of factory testing.

Certificates giving records of tests carried out shall be supplied.

A copy of the completed supplier testing certificates and results for all components (tank, boundary kit, pump, electrical and control boxes). Factory Test shall be carried out and serialised for traceability and certificates provided with supply and delivery.

8.2 GRINDER PUMPS

Pump tests shall be carried out in accordance with AS 2417-2001 Annex A, or where not relevant, applicable international standard.

The pump casings shall withstand a hydrostatic test pressure scheduled for a period of 15 minutes without any leakage or permanent distortion.

8.3 COLLECTION TANKS

The collection tank shall be hydrostatically tested prior to installation to ensure that all penetrations are watertight.

The collection tank shall be prepared by installing a short section of test pipe (using the method for installation of inlet pipework) and sealing off all openings and vents. The unit shall then be tested via a hydrostatic test to a pressure of 3 m above the top of the well. The test shall be considered acceptable if there are no drips or weeps.

8.4 BOUNDARY KITS

The boundary kit shall be individually pressure tested at the factory and serialized for traceability of the pressure test. Testing regime shall include closed ball valve test, open ball valve test, and check valve test. Test pressure shall be minimum 16 bar.

8.5 ELECTRICAL AND CONTROL PANEL

The electrical and control panel shall be tested at the factory and serialized for traceability of the tests. Testing regime shall include input/output tests, power-up, logic and programming tests, and communications module testing.

9 SITE TESTING AND COMMISSIONING

Site testing shall be carried out by the unit installer. Completion of commissioning of any unit shall mark the start of the warranty period for that unit.

9.1 GENERAL

All operational tests on the pumping units shall be conducted using Queenstown Lakes District Council's Code of Practice, connection to council services application and integrated three waters bylaw, with the pumping unit only connected to the sewerage reticulation system after these tests using town water have been successfully carried out.

9.2 LEAKAGE TEST

A leakage test shall be carried out after completion of all pipework connections, but before the electrical control panel is switched on. The test shall be performed as below:

- The pump well shall be filled to the underside of the lid.
- Losses shall be observed after a minimum of 2 hours.
- No leakage should be observed.
- This test is to test the pump well, pipe seals and part of the connecting pipework.
- The connecting pipes may need to be plugged temporarily.

If leakage is observed, the collection tank and inlet penetration shall be inspected and any faults found rectified before retesting is undertaken.

9.3 SIMULATED POWER FAILURE TEST

The leakage test shall be conducted immediately before tests for operational readiness. As such, the initial operational tests will commence with the pump storage vessel filled to a high water level.

The pump should thus commence in an alarm mode when the power is turned on to the alarm panel, as per a power failure scenario.

This shall be the first test to determine if the alarms will automatically turn on and then off, as the pump reduces the volume stored in the storage vessel to below the high level alarm, and then to the normal pump 'OFF' levels.

9.4 TIME BASED OPERATIONAL TEST

The pumps shall be considered operationally ready when they have successfully operated for a period of one to four hours (or as needed to achieve 3 on/off cycles) with a constant inflow rate of around 0.1 to 0.2 L/s (this is the typical inflow from a garden hose discharging into the system at reasonable pressure). This test should involve at least three on/off cycles.

The variable time period above has been deliberately included to allow for regions where there are drought conditions being experienced or lack of water for other reasons. The test may be reduced to one hour to minimise any water wastage. QLDC shall instruct the unit installer as to the test parameters to be carried out.

9.5 ALARM TEST

In addition to the above operational test, the unit installer shall suddenly discharge quantities of water into the pumping unit's storage vessel rapidly from large water containers, such that the alarm level is exceeded. The pumping unit shall then be observed to see if the alarm initially comes on and subsequently if the alarm then automatically shuts off, after normal pumping levels have been achieved.

9.6 PUMP PROTECTION TEST

The pump shall also be tested against a closed valve, to ensure that the pump's safety cut-outs are working satisfactorily. This test need be conducted only once and due precautions shall be taken against sudden pipe failure. The pump shall be tested against the closed the boundary property valve.

9.7 COMMISSIONING OF PUMPS

The commissioning will consist of opening the isolation valve(s), and turning on the control panel for automatic operation. Commissioning will be considered complete after one week of fault free operation.

9.8 SYSTEM TEST

Based on the design calculations provided by the designer, the supplier and contractors shall carry out for QLDC to witness tests of the installed system. Flow rates and pressures shall be measured as part of this test to ensure that the system performs in accordance with the design. Any significant departure from the anticipated performance shall be referred to the designer and/or unit installer for rectification.

10 MANUALS

10.1 INSTALLATION MANUALS

Detailed instructions for the installation of the pump stations shall be provided in an installation manual specifically prepared for pressure sewer installations.

The Contractor shall ensure the LPSS is installed and commissioned in accordance with manufacturer's specifications.

10.2 OPERATIONS AND MAINTENANCE MANUALS

The grinder pump supplier shall have a suitably qualified local service agent to support privately owned grinder pumps. The service agent should hold adequate spares to support the install base. The suppliers phone number shall be on the alarm panel to enable the homeowner to contact them in the event of an alarm. The supplier shall demonstrate they have adequate 24/7 support to the homeowners and can achieve a response time within the 24hr emergency storage time.

The unit installer shall provide an operation and maintenance manual for the system. The manual shall comprise the following sections:

- Introduction;
- General principles of operation;
- Technical details of all equipment supplied;
- Typical installation schematics;
- Routine Maintenance (if applicable);
- Troubleshooting;
- Dismantling and re-assembly procedures;
- System design drawings for each area;
- Training Manual.

10.3 SPARE PARTS

A spare parts list and replacement equipment specifications shall be provided to ensure that the owners/operators always have adequate information for procurement and replacement of parts, and to allow service crews to take a replacement unit to all call outs.

Spare parts shall be available locally at all times.

10.4 WARANTIES AND INSURANCE

All warranties shall be provided to the owner as part of the owners operations and maintenance manual.

A warranty for each pressure sewer collection/pump unit shall, as a minimum, begin from the date of delivery and cease not less than twenty-four (24) months following the date of installation. The supplier shall also maintain a quality control system for managing the delivery of pumps and recording the pump numbers, unit serial numbers and delivery dates for warranty work.

The warranty shall be to rectify any defect in the materials and equipment supplied under the contract for the duration of the warranty period. The supplier shall also guarantee the components against installation defects if installed by an accredited pump installation contractor.

11 AS-BUILT INFORMATION PACKAGES

A file shall be maintained on each pressure sewer system area. Information shall be submitted to QLDC in an electronic format and shall include, but is not limited to the following:

REPORTS

- Concept Report
- Design Report
- Final Design Report

RETICULATION MAINS

- Work As Executed Drawings/ As-builts and asset data as per QLDC's standard requirements in the QLDC Subdivision and Land Development Code of Practice;
- Long sections to indicate pipelines that have been directionally drilled;
- Dates of construction completed for the pressure sewer system area;
- Dates made operational;
- Dates of boundary kits installed on the property
- Pressure test results and verification
- Dates of each property lateral laid

ON PROPERTY INFORMATION

- Property Address, lot number, GPS coordinates, owner's details, and any special property features;
- Work As Executed (WAE) drawing for each property;
- Sewer Service Diagram (SSD) requirements for the house drainage details (may be included with the Work As Executed drawings). The house drainage portion of the WAE to comply with all the rules and regulations of Queenstown Lakes District Council. Plans to include but not limited to the following details:
  - well location

  - house sanitary drain connection location
  - all pipe, valves and fittings up to the boundary kit
  - control panel and power and control cable locations
  - boundary kit location
- Tapping point and isolation valve location on common rising main
- The date work commenced on the property The date the work was completed and the installer had left the property
- The date the pump made operational and results of pump testing
- Date and number of pump commissioning certificate
- Manufacturer, serial number and warranty information of pump station/collection tank, electrical/control panel, Isolation details for the site
- Electrical details
- Operation and Maintenance Manual and emergency contact details
- For all trade waste installations and for private installations where the on-property equipment is to be privately owned, evidence that a service agreement is in place

APPENDIX A: TECHNICAL SCHEDULE – RESIDENTIAL UNITS

Pumping Equipment	***Ecoflow - E/One***	***Aquatec - Barnes***
Nominal Duty at 40m Head	0.5 l/s	0.5L/Sec
Maximum Continuous Operation Head	56m	60 metres
Manufacturer	Environment One - E/One	Aquatec Barnes (or approved equivalent)
Country of Manufacturer	USA	USA
Model	Extreeme Series Grinder Pump	OGT 10S2 AU
Type	Progressive cavity	Regenerative Turbine
Casing Material	Cast Iron	Cast Iron ASTM a-48, Class 30
Pump/Motor seal type/material	Mechanical Seal ceramic seat, carbon rotating surface	Mechanical/Silicon Carbide
Pump Shaft Material	One piece Stainless steel	416 Stainless Steel
Pump Impeller Casing	Cast Iron	Stainless Steel
Grinder/Type/Hardness	Forged 4140 cutter wheel with cutter teeth (Rockwell 55-58c)	440C Stainless Steel Hardened to Rockwell C-55
Motor Size (kW)	0.75kW IP68	0.75KW rated IP68 submersible to 9 meters
Motor Protection	Thermal Overload	Thermal Overload
Motor Insulation	Class F	Class F
Electrical Quick Disconnect	Radial Seals Nema 6P	Rated IP68
Pump and Pipework Protection over Pressure Protection (Optional)	Adjustable wattage sensor, typical trip out at 70m -1500W	Pressure control must cut power to unit at preset discharge head and reset automatically.
Sound Level Emissions outside of Pump Well	Not detectable	Not Detectable
Weight of Pump Unit (kg) Maximum	45kg	38kg
Lifting Material	Marine Grade Polypropylene rope	Marine Grade Polypropylene rope

Pipework & Fittings	***Ecoflow - E/One***	***Aquatec - Barnes***
Inlet coupling type/size	Proprietry E/One uniseal to suit 10mm thick wall	Flexible connector/100mm
Discharge Pipework Size & Material (describe fully)	32 PN16 flexible pipework with propriety E/One 316 S/S ballvalve and disconnection gooseneck.	32 PN16 flexible pipework with 316 S/S camlock couplings for disconnection.
Discharge Valve and Tank Outlet	32mm 2 piece 316 stainless steel ball valve and threaded tank outlet.	32mm 2 piece 316 stainless steel ball valve and threaded tank outlet.

Electric and Controls - Standard	***Ecoflow - E/One***	***Aquatec - Barnes***
Pump Controller	Single, Duplex pump operation.	Single, Duplex or Triplex pump operation.
Material	Polycarbonate (lockable)	316 stainless steel (lockable) or polycarbonate (lockable)
Proposed Location	Wall of dwelling	Wall of dwelling
Designed to Australian / New Zealand Standard (Nominate)	AS 3000:2018	AS 3000:2018
Level Switches	***Ecoflow - E/One***	***Aquatec - Barnes***
Type	Pressure switches in head of pump	Float Switch Level Control Assembly
Make	E/One or (Iota for smart controller)	Aquatec (or approved equivalent)

Pump Well - Residential	***Ecoflow - E/One 2013ip***	***Aquatec - Barnes***
Material	Polyethylene	Polyethylene
Designed to Australian / New Zealand Standard (Nominate)	AS/NZS 1546.1.2008	AS/NZS 1546.1.2008
Depth	1660	1.6m
Diameter	1032mm	1000mm
Total Volume	910L	950L
Storage between On level and overflow (L)	692	670

Pump Well - Commercial	***Ecoflow - E/One 2013ip***	***Aquatec - Barnes***
Material	Polyethylene - Large diameter horizontal pipe construction	Fibreglass
Designed to Australian / New Zealand Standard (Nominate)	AS/NZS 2566.1:1998	AS/NZS 1546.1.2008
Depth	Custom built to suit site specific application	2.2
Diameter	1500-1800mm (horizontal)	1070-1850
Total Volume	1500L-20,000L	1500L-15000L as standard with custom built chambers available on request
Storage between On level and overflow (L)	Custom built to suit site specific application	Min. 1168L

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SOUTHERN LIGHT

PART TWO – TECHNICAL SPECIFICATIONS

Queenstown Lakes District Council

Date: February 2025

Document History	Date	Prepared By	Reviewed By	Approved
Council Adopted	9/2/2017	Alison Tomlinson/ Polly Lambert (QLDC) and Ian Campbell (Stantec)	David Wallace	Ulrich Glasner
Page 15 – clarification of NEMA socket	2/8/2017	Alison Tomlinson	Andrew Edgar	David Wallace
Clarification and update to new standards	16/05/2019 31/01/2022 10/07/2024	Ian Campbell (Stantec) Luke Steggles (WSP) and Alison Tomlinson (QLDC) Rodney Hawthorn (WSP) and Sam Metcalfe (QLDC)		

CONTENTS

Introduction

The purpose of this document is to ensure that lighting infrastructure in Queenstown Lakes meets the outcomes specified in the Southern Light, Part One – A Lighting Strategy. That is through providing safe environments for pedestrians, vehicles and to discourage illegal acts as well as ensuring that public lighting is attractive, robust, easy to maintain, cost effective and fit for purpose. This document will set out accepted best practice, minimum manufacturing and performance standards, as well as QLDC asset management and strategic objectives throughout the district, including QLDC vested road and outdoor lighting, private lighting and new developments, including parks and feature lighting.

This technical guide should be read in conjunction with the following which can be found on the QLDC website:

- QLDC District Plan.
- Southern Light, Part One – A Lighting Strategy
- QLDC Land Development and Subdivision Code of Practice

This document shall be used by developers, contractors, consultants, service/utility operators, QLDC design engineers, planners, project managers and others involved in the design, installation and management of new lighting installations. It may be used as a guide to repair or replace existing lighting infrastructure.

It is acknowledged the District has community specific urban design requirements and these will be referenced individually.

In summary this document describes how to complete the detailed design and calculations required for compliance with the applicable standards to achieve the following:

- Provision of vehicular route lighting for vehicle and pedestrian safety
- Provision of pedestrian route/area lighting for pedestrian safety, crime prevention and to enhance the environment
- Provision of lighting infrastructure (luminaires, columns, outreach arms, bracket arms and associated equipment) that is energy efficient, cost effective and will cope with regional climatic and environmental conditions such as extreme temperatures and weather conditions
- Provision of feature and festive lighting (whether temporary or permanent) that do not create excessive glare or spill light into neighbouring properties. Exemptions must be granted by QLDC where this lighting contravenes Southern Light.
- While achieving safe and compliant lighting (as described above) also minimising any negative impacts such as obtrusive (spill) light, glare, and light pollution (upward waste light contributing to sky glow)

Southern Light is a live document subject to periodic review and may be amended at any time as and when directed by QLDC.

1. SCOPE

The main scope of this document includes areas covered by the AS/NZS 1158

- Roads, accessways and rights of way (public & private)
- Reserves and public activity areas
- Pedestrian (Zebra) crossings
- Pedestrian and cycle paths
- Public precincts (e.g., shopping precincts)
- Public access areas (e.g., connecting elements including steps, ramps, subways, footbridges and CCTV)
- Car parks
- Bus stops

- Transport Hub and bike stands
- Vested infrastructure such as pumpstations, reservoirs, treatment plant sites

This document also provides indicative design guidelines for areas outside AS/NZS 1158 which includes, but not limited to

- Parks and Reserves and sports fields
- Illuminated Signs
- Feature Lighting (up-lighting & spot lighting)

Additional guidelines for lighting can be found in AS/NZS 1680, AS/NZS 2293 and the NZ Building Code.

Guidelines for sports lighting (interior/exterior) can be found in AS 2560.

2. STREET LIGHTING ON PRIVATE ROADS

QLDC's policy for street lighting on private roads was amended on 1st January 2004 and encompasses the following:

- Maintenance and operating costs of lights installed on private roads and rights of way after 01 January 2004 shall be the responsibility of lots serviced by such private access roads; and
- All lights installed on private roads, accessways and Rights of Way after 01 January 2004 shall be isolated from the QLDC lighting network.
- All lights installed on private roads, accessways and Rights of Way shall follow the guidance and technical considerations of this document. Refer to Section 28 for further detail.

3. APPLICABLE STANDARDS AND REGULATIONS

The following section lists the standards and regulations applicable to the design, installation, and maintenance of road lighting installations. The latest copies of standards and their amendments shall apply.

Professional Practice and Design:

Engineering New Zealand Practice Note 1 – Guidelines on Producer Statements

Engineering New Zealand Practice Note 2 – Peer Review

Health and Safety at Work Act 2015 (HSW Act)

Safety in Design:

Guide to Health and Safety by Design

Electrical:
The Electricity Act 1992
The Electricity (Safety) Regulations 2010
The NZ Electrical Codes of Practice
The NZ Building Code
AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 7000: Overhead Line Design

Lighting:
AS 2560 (Series): Sports lighting
International Dark Sky Association IDA-Criteria for Community-Friendly Outdoor Sports Lighting
AS/NZS 4282: Control of the obtrusive effects of outdoor lighting
AS 60529: Degrees of protection provided by enclosures (IP Code)
AS/NZS 1158.0: Lighting for roads and public spaces, Part 0: Introduction

AS/NZS 1158.1.1: Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting - Performance and design requirements
AS/NZS 1158.1.2: Lighting for roads and public spaces, Part 1.2: Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance
AS/NZS 1158.2: Lighting for roads and public spaces, Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.3.1: Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting - Performance and design requirements
AS/NZS 1158.4: Lighting for roads and public spaces, Part 4: Lighting of pedestrian crossings
AS/NZS 1158.5: Lighting for roads and public spaces, Part 5: Tunnels and underpasses
AS/NZS 1680 (Series): Interior and workplace lighting
AS/NZS 2293 (Series): Emergency escape lighting and exit signs for buildings
AS/NZS 60598.2.3: Luminaires - Particular requirements - Luminaires for road and street lighting
SA/SNZ TS 1158.6: Lighting for roads and public spaces - Luminaires - Performance
BS 5489-1: Code of practice for the design of road lighting, Part 1: Lighting of roads and public amenity areas
IEC 62262, Ed. 1.0: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
NZTA M30: Specification and Guidelines for Road Lighting Design

Lighting poles (design and construction):
NZTA M26: Specification for Lighting Columns

Refer to the International Dark Sky Association (IDA) for general information and guidelines

4. DESIGN REQUIREMENTS

The applicable design standards shall be the New Zealand requirements of the AS/NZS 1158 series, and the following sections provide a summary of the main requirements. The designer shall be responsible for applying all the specific design requirements of AS/NZS 1158 (as well as any other QLDC specific rules or procedures) to the extent they are applicable whether or not they are included in this document.

Safety in Design

The Health and Safety at Work (HSW) Act requires persons controlling a business or undertaking (PCBU) to ensure so far as is reasonably practicable the health and safety of their workers and workers whose work is influenced or directed by the PCBU. PCBUs must also ensure that the health and safety of other persons is not put at risk as a result of their activities. Part of this duty involves the PCBU eliminating or minimising risks arising from work.

PCBUs, which design plant and structures that are to be used, or could reasonably be expected to be used, in a workplace, have a duty to ensure so far as is reasonably practicable that the plant or structure is designed to be without risks to Health & Safety.

Section 22 of the HSW Act defines 'Reasonably Practicable' as something which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, considering and weighing up all relevant matters including:

- The likelihood of the hazard or the risk concerned occurring;
- The degree of harm that might result from the hazard or risk;
- What the person concerned knows, or ought reasonably to know, about the hazard or the risk and the ways of eliminating or minimising the risk;
- The availability and suitability of ways to eliminate or minimise the risk; and

- That after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk. A SID process aims to address the above matters by designing out safety risks where it is reasonably practicable to do so.

The designer must prepare a Safety in Design (SiD) register and supply as part of the design when presented for review. This shall encompass all assessed Health and Safety considerations created by the design provided for review.

The SiD register integrates hazard identification and risk assessment methods in the design process. It must demonstrate how to eliminate, isolate or minimise the risk of death, injury and ill health to those who will construct, operate and maintain. Where additional requirements to manage uncontrolled risks identified by the designer are needed in later stages of the project, these risks shall also be highlighted and shared (by the designer) with the Principal Designer and Constructors.

5. LIGHT SOURCES AND ADVERSE LIGHTING EFFECTS

All new lighting installations shall utilise light emitting diode (LED) technology luminaires. Refer to NZTA M30 for a list of acceptable luminaires. Alternative LEDs luminaires may be considered for amenity lighting on reserves, provided they meet the minimum manufacturing, testing and performance requirements of NZTA M30 including warranty period. QLDC reserves the right to exclude any alternative LED (not on the current NZTA M30 list) if the designer or supplier cannot clearly demonstrate full compliance with NZTA M30. Other lighting technologies may be considered and shall be confirmed by QLDC before final design is finalised.

As part of the lighting design process the designer shall consider and minimise any potential adverse or obtrusive lighting effects such as spill light, glare and sky glow (upward light). The limits of adverse lighting and methods of mitigation, as provided in AS/NZS 4282, shall be followed.

Private lighting must comply with district plan spill lighting requirements and spill lighting calculations on boundaries need to be included for these.

"No activity on any site shall result in greater than a 3.0 lux spill (horizontal and vertical) of light onto any other site measured at any point inside the boundary of the other site."

Feature and festive lighting outside of M30 may be approved by QLDC on an individual basis. Details of wattage / energy consumption must be supplied as part of the application process.

6. LIGHTING CATEGORIES

The primary aim of any road lighting scheme is to facilitate the safe movement of people. There are two main categories of lighting (Category V and P), and various subcategories, that provide varying levels of lighting based on a number of particular traffic (vehicular and pedestrian) parameters applicable for each type of road.

Category V lighting is applicable to roads where the visual requirements of motorists are dominant e.g. arterial or main roads, motorways and sub-arterial roads.

Category P lighting is applicable to roads and other outdoor public spaces where the visual requirements of pedestrians are dominant e.g., Town Centre areas, local roads, pedestrian pathways and cycleways.

The decision to install a lighting scheme in compliance with AS/NZS 1158 (and any other QLDC policies and procedures), including which subcategory of lighting is applicable, rests with QLDC. This decision is typically based on factors such as night-time traffic flows, composition of traffic (vehicular and/or pedestrian), the need to enhance prestige, risk of crime and other patterns of use.

The designer may select and design to the light category based on the guidance below and proceed at their own risk, however, if QLDC are not in agreement with the selected Sub-Categories we reserve the right to direct the designer to change at the review stage. If there is uncertainty over the category to be used for the design, the developer shall contact QLDC to reach agreement on category, prior to commencement of design.

Note that more than one subcategory may be required within one development, e.g., different road hierarchies and car park lighting.

The designer (or nominated QLDC representative) may be required to assist in the Sub-Category evaluation process for more complex applications, in this scenario no design shall be commenced until QLDC approval has been obtained.

Reference should be made to the relevant parts of the current AS/NZS 1158 series that provide indicative guidance on the application of the different categories and subcategories of lighting. Relevant parts include:

- Figure 2.1 from AS/NZS 1158.1.1 and AS/NZS 1158.3.1 - Example Road and Public Space Types and Indicative Lighting Categories and Subcategories
- Table 2.1 from AS/NZS 1158.1.1 - Category V Lighting Applications
- Table 2.1 from AS/NZS 1158.3.1 - Category P Lighting Applications for Road Reserves in Local Areas
- Table 2.2 from AS/NZS 1158.3.1 - Category P Lighting Applications for Pedestrian and Cyclist Paths
- Table 2.3 from AS/NZS 1158.3.1 - Category P Lighting Applications for Public Activity Areas (Excluding Car Parks)
- Table 2.4 from AS/NZS 1158.3.1 - Category P Lighting Applications for Connecting Elements
- Table 2.5 from AS/NZS 1158.3.1 - Category P Lighting Applications for Outdoor Car Parks (Including Rooftop Car Parks)

It is the responsibility of the designer to ensure they have current editions of AS/NZS 1158, BS5489.1 and any other QLDC lighting standards, policies, and procedures.

7. LIGHTING CATEGORIES AND THE DISTRICT PLAN

To assist in the interpretation of this standard, QLDC has summarised AS/NZS 1158.3.1 Tables 3.3 - 3.7 of the standard to reflect the local needs based on the District Plan zones. Refer QLDC Table 1 below.

Category P (pedestrian) will be the main lighting standard used as it provides standards applicable to most of the roads managed by the QLDC.

The designer should assess factors such as:

- Traffic flows – Using predicted / modelled flows at year 20 to inform the final Sub-Category selection. Contact assetmanagement@qldc.govt.nz to obtain any available held flows by QLDC.
- Composition of traffic (vehicular and/or pedestrian)
- The need to enhance amenity and the activities of adjacent businesses. For example, areas with high volumes of pedestrian movements associated with bars and restaurants will require different lighting consideration to business parks.
- Risk of crime
- The context of wider development within the area. This is especially important for Sub-divisions constructed in multiple stages. The traffic impact assessment should be referred to

inform lighting sub-category selection by way of confirming traffic modelling over a 20-year period for the entire development and not just individual stage.

8. LIGHTING CATEGORIES P-CATEGORY

QLDC Table 1 Lighting Category Summary for Road Reserves in Local Areas (Category P)

Area of Activity	District Plan Zone	Lighting Subcategory*	Average Daily Traffic Flow	Luminaire CCT
Local Roads or streets used primarily for access to abutting properties including residential properties	*** Township, Residential Zones, Rural Zones, Special Zones**	**PR6**	**Less than 1,500 vehicles**	
	Town Centre, High Density Residential, Industrial and Business zones	PR5	**Greater than 1,500 but Less than 2,500 vehicles**	
Pathways (including cycle ways, footpaths along roads, walkways and park paths) where these have been identified for lighting.	Town Centres – designated safe routes and Cycle Commuter Connections	PP3 or PP4	N/A	
	Town Centres - other pathways	PP3	N/A	
	Pathways outside of Town Centres	PP5	N/A	
Town Centre pedestrian activity areas (malls, open arcades, town squares, civic centres	Town Centre	PA3	N/A	
Townships – Main Street Business Area	Township	PR1 or PR2	N/A	**3000K**
Transport terminals and service areas with mixed pedestrian and vehicle movements during hours of darkness	All	PA3	N/A	
Lit Pedestrian Underpass Rural Access Only	All	Refer Section 20.3 NZTA M30:2014 (Applies day and night)	N/A	
Pedestrian Underpass Urban / Semi-Urban, forming part of a commuter route.	All	Refer Table 4 of BS 5489.1:2013 for Daytime Requirement (enclosed subway)	N/A	

		PE1 for Night		

9. LIGHTING CATEGORIES VEHICULAR TRAFFIC ROUTES

Although a number of high-volume vehicular routes within QLDC's geographical area belong to Waka Kotahi, there are still of high-volume roads that meet V-Category or higher P-Category criteria, and this will extend to key routes through new developments and subdivisions.

A site-specific assessment shall be undertaken by a lighting designer to confirm the appropriate lighting sub-category as per the requirements of Section 8 prior to undertaking any design. The following baseline guidance and ranges shall be considered for reference in attributing sub-categories for higher trafficked routes. Note that the use of V1 and V2 is not recommended for the QLDC region.

QLDC Table 2 Lighting Category Summary for Mostly Vehicular Traffic Routes (Category P and V)

Type of Road	Average Daily Traffic Flow	Lighting Subcategory*	Luminaire CCT
Collector Road or Arterial within a district centre Urban Environment with high pedestrian movements, adjacent retail, bars/restaurants, regular intersections and on street parking.	Greater than 2,500 Vehicles	P-Category (PR1 or PR2)	3000K
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 2,500 but less than 5,000 Vehicles	P-Category (PR2 or PR3)	
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 5,000 but less than 15,000 Vehicles	V4	
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 15,000 Vehicles	V3	
Collector Road or Arterial in Intrinsically Dark and Rural Areas	N/A	Unlit or Flag lighting	

10. LIGHTING CATEGORIES CAR PARKS

The following criteria shall apply to lit car parking within the region. Limits to private car parks have also been included in the interest of reducing upward waste light on new commercial developments.

QLDC Table 3 Lighting Category Summary for Off Street Surface Car Parks (Category P)

Type of Car Park	Description of Use	Lighting Subcategory*	Car Park Capacity	Luminaire CCT
Town Centre Public Car Parks, Public Transport Hubs and High Use Private Car Parks	Town Centre (Inner CBD) locations, such as Queenstown, Wanaka and Frankton. Recommended Criteria for Larger Private Business Development, such as supermarkets and retail parks.	PC2	N/A for Public Greater than 30 Spaces for Private	3000K
District Centre or Semi-Urban Public Car Parks and Low Use Private Car Parks	Outside of inner CBD areas listed above and all other lit car parks within the region. Recommended Criteria for all private small business facilities.	PC3	N/A for Public Less than 30 Spaces for Private	

11. DESIGN METHODOLOGY

The following definitions and sections describe the main types of road lighting calculations required and their application is dependent on the category of lighting required.

Table 4 Lighting design methodology

Calculation	Definition	Methodology	Category
Illuminance (E)	Illumination is a general expression for the process of light arriving at a surface and the physical measure of this is illuminance. Illuminance is the luminous flux (lumen - lm) arriving at a surface divided by the area of the illuminated surface.	Unit: lux (lx); 1 lx = 1 lm/m².	Illuminance calculations are required for category P roads and nominated locations on category V roads.
Luminance (L)	Luminance is the physical quantity of light corresponding to the	Unit: candela per square metre (cd/m²).	Luminance calculations are

Calculation	Definition	Methodology	Category
	brightness of a surface (e.g. a lamp, luminaire or reflecting material such as the road surface) when viewed from a specified direction.		only required for category V roads.
Uniformity (U)	The uniformity is a calculated ratio that is used to measure how evenly the light is distributed over a given area or length of roadway.	Uniformity calculations are required for both category V and P roads; however, the method of calculation differs between the two categories.	

CATEGORY V DESIGN OBJECTIVES

The principal design objectives for category V lighting are to provide the following:

(a) Luminance and uniformity of luminance of the carriageway surface to a specified level.
(b) Glare control to a specified level.
(c) Illumination on intersections, carriageway verges, splitter islands and other nominated locations to a specified level.
(d) Limitation of upward spill light from luminaires to a specified level.
(e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
(f) Minimal energy consumption.
(g) Minimal whole of life cost and Warranty opportunities.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

CATEGORY P DESIGN OBJECTIVES

The principal design objectives for category P lighting are to provide the following:

(a) Illuminance and uniformity of illuminance over the road reserve to a specified level.
(b) Glare control to a specified level.
(c) Limitation of upward spill light from luminaires to a specified level.
(d) Limitation to a specified level of the light spilled into adjacent properties.
(e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
(f) Minimal energy consumption.
(g) Minimal whole of life cost and Warranty opportunities.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

LIGHT TECHNICAL PARAMETERS

The principal design objectives (outlined in the above two sections) are formally specified in terms of the following Light Technical Parameters (LTPs):

(a) Parameters that relate to the attainment of the required level of lighting performance.
(b) Parameters that limit the adverse effects of the lighting on:

i. Reduction of glare to enable safe use of the lit space by pedestrians and vehicle drivers
ii. Reduce sky glow to enable night sky viewing conditions
iii. Minimise the amount of spill light to occupants of adjoining properties

Reference should be made to the relevant parts of the current AS/NZS 1158 series that provide the minimum levels of compliance that are required for each category and subcategory of lighting. Relevant parts include:

- Table 2.2 from AS/NZS 1158.1.1 - Values of LTPs for Category V Lighting
- Table 3.3 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Roads in Local Areas
- Table 3.4 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Pathways and Cyclist Paths
- Table 3.5 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Public Activity Areas (Excluding Car Parks)
- Table 3.6 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Connecting Elements
- Table 3.7 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Outdoor Car Parks (Including Rooftop Car Parks)

It is the responsibility of the designer to ensure they have the current editions of AS/NZS 1158 and any other QLDC lighting standards, policies and procedures.

CALCULATION OF LIGHT TECHNICAL PARAMETERS

The calculations of all Light Technical Parameters (LTPs) for category V and P roads shall be carried out in accordance with the computer-based design procedures provided within AS/NZS 1158.2. This standard provides the basic formulae for the LTPs and the associated grid of points (calculation field) over which the calculations are to be made. Hand calculations shall not be accepted.

The use of a specific software application called “SAA STAN” is mandatory for the calculation of the luminance based LTPs for the category V straight road elements. This can be achieved using the software such as “Perfect Lite” or another shell program that is built around “SAA STAN” and which can be demonstrated to reproduce the values of all LTPs provided by “Perfect Lite”.

The calculation software “AGi32” shall be used for the illuminance-based calculations required for Category V road lighting designs.

The calculation software “AGi32” shall be used for the illuminance-based calculations required for Category P road lighting designs.

Other software packages confirming compliance with the AS/NZS 1158 calculation procedure may be utilised if appropriately demonstrated by the designer and agreed prior to design by QLDC.

It shall be the responsibility of the designer to ensure the appropriate software is used to carry out all the required calculations.

Spill light calculations shall be undertaken for all streetlights adjoining residential activities. Horizontal measured at the boundary by a line of points at ground level at 2m intervals and vertical measured at the boundary with the meter facing parallel to the boundary towards the light source by a line of points at 2m spacing from 0m to a height of 12m.

MAINTENANCE FACTOR

A design maintenance factor (MF) is used in the calculations to account for the combined light losses resulting from depreciation in the LED's lumen output and accumulation of dirt on the luminaire over a nominated maintenance period.

The MF is calculated as the product of the following depreciation factors:

(a) *Luminaire Dirt Depreciation Factor (LDD):* This is dependent on ingress protection of the luminaire, environmental zone and the cleaning Interval of the LED Luminaires. Refer to Table 5 below, for LDD for a luminaire with a visor or for a luminaire with exposed optics a LDD of 0.78 shall be used.

(b) Light Source Lumen Depreciation Factor (LLD): The amount of light (lumen output) available at the end of a nominated operating period (85,000 hours - 20 years), as a proportion of the initial lumen output (when the LED was new), expressed as a decimal fraction. The LLD takes into account the operating temperature, driver current and electrical properties and shall be obtained from the luminaire supplier.

Table 5 Luminaire dirt depreciation factor (LDD)

Environmental zone	LDD Factor			
	Cleaning Frequency			
	36 Months	48 Months	60 Months	72 Months
Rural - Category P Lighting	0.95	0.94	0.93	0.92
Urban - Category P Lighting	0.90	0.88	0.86	0.84
Urban and Rural – Category V Lighting	0.95	0.94	0.93	0.92

(c)

The design MF can be calculated as follows:

MF = LDD x LLD

As part of the design delivery process the designer is required to provide information on the MF used in the calculations including the calculation for the luminaires specified and luminaire data to support the selections.

The maximum design MF shall not exceed 0.8 even if the MF calculation yields a higher result.

DESIGN OUTPUT DELIVERABLES

The designer shall submit the following design documents for QLDC approval before commencement of the installation works. Refer to Appendix D of AS/NZS 1158.1.1 and Appendix C of AS/NZS 1158.3.1 for a full list of the mandatory design information required to be submitted. Onus is on the designer to prove the design meets the relevant codes and consents. Work shall not be started until the design documents have been approved by QLDC.

QLDC may request that any submitted design is peer reviewed by one of our approved Lighting Design Reviewers at the cost of the applicant.

Design Submission Check Sheet

The QLDC design checklist can be found on the QLDC website. Note any decorative/heritage columns or luminaires must be approved by Property &Infrastructure via the design check sheet sign off. Specific requirements are as follows.

Layout Drawings

The layout drawings shall be produced using a CAD based computer program, examples can be found in the Appendix and shall include the following minimum information:

The drawings shall show:

(a) Locations of all poles (dedicated lighting poles and/or overhead power poles) where the luminaires are installed and dimensions clearly showing the pole spacings.
(b) A dedicated Lighting Column setback for each position shall be provided showing the distance from the kerb or boundary line. A general note will not be accepted.
(c) All the roadway features including kerbs, carriageway edges, lane markings, property boundaries, traffic/splitter islands, pedestrian crossings, and any other features that form part of the road reserve or carriageway.
(d) Equipment legend detailing the luminaire types (e.g. LED count and driver current/size, power rating),
(e) Luminaire mounting arrangements (e.g. tilt angles, heights, outreaches, etc., poles and outreach arms
(f) Specific column installation details (ground planted, slip base, etc.).
(g) Interaction with above ground and below ground services - annotating minimum clearances required as well as applicable codes to determine those clearance.
(h) Any applicable calculation areas.
(i) Isolux plots from AGI32, showing the relevant contours for each lighting sub-category in the design including isolux lines for each of the minimum required horizontal illuminance values.
(j) The Lighting design drawings shall show the location of all overhead powerline assets and the associated horizontal ECP34 clearances for structure without engineering assessment.

Design Report or Design Statement

A design report or design statement shall be provided along with layout drawings and shall contain comprehensive information detailing all aspects of the design and (in conjunction with the layout drawings) shall be used as a method of verification that the design is fully compliant with the New Zealand requirements of AS/NZS 1158 and any other QLDC requirements. As a minimum the following information shall be provided:

(a) The applicable categories and subcategories for each road.
(b) A list of the design methods employed and presentation of the modelling results to demonstrate compliance. This can be a list of tabulated calculation results with suitable printouts from the lighting software used.
(c) Any areas of non-compliance with the NZ standards and/or QLDC requirements shall be noted along with explanatory notes describing why a fully complying design was not achieved. QLDC approval shall be required for any areas of non-compliance.
(d) Details of the lighting arrangement (e.g. single sided, staggered, opposite, etc.) and geometry (e.g. spacing, mounting height, overhang, up cast angle).
(e) Details of the lighting columns including type, size, material, finish and any particular mounting requirements (frangible, shear based, etc.).
(f) Luminaire details including luminaire name, description, input power, LED count, driver current, optical setting, lumen output and IP/IK rating.

(g) The origin of the photometric file (used in the design modelling) for the luminaires.
(h) The name and source of the computer software used.
(i) The MF used and the basis for the MF selection (refer to Section 12).
(j) Design report should make comment on key service crossing/s interactions, detailing those minimum separations and clearances have been maintained, and/or where technical deviations have been required and contain/reference consents from the respective utility provider for these.
(k) State who signed off the Lighting Design along with relevant credentials/training/experience, refer Section 22.2 of NZTA M30:2014 for acceptable experience.

Calculation Results (Refer to example in Appendix)

- A printout of the calculation results, directly from the lighting software, shall be required to be submitted for approval along with the other design information listed above. The calculation results must be printed directly from the lighting software (i.e. AGi32).
- QLDC will not accept tabulated results (on drawings) in lieu of the actual software printouts.
- Software files of the final accepted design (and any subsequent revisions) should be submitted to QLDC.

Obtrusive Light Calculation Results

Obtrusive light calculations shall be carried out in accordance with AS/NZS 4282 for all new category V street lighting installations, outdoor sports fields and industrial/commercial outdoor work areas adjoining residential properties. All obtrusive light calculations shall be carried out with a maintenance factor of 1.0. Spill light calculations are not required for category P lighting installations unless specifically requested by QLDC. Examples where spill light calculations may be required include (but are not limited to):

- All car parks bordering residential areas
- Lighting of pedestrian activity areas or narrow alleyways adjacent to residential (particularly multi-story apartments where windows may be close to light poles)
- Lighting of areas elevated above other residential developments

Note that the control of glare and upward waste light will need to be demonstrated for all new Category P lighting schemes in accordance with AS/NZS 1158.3.1

QLDC will reject any design that is submitted with missing or incomplete information, or any unjustified areas of non-compliance.

12. LOCAL AREA TRAFFIC MANAGEMENT DEVICES (LATMS)

LATM devices on:

a. V-Category Roads shall be lit to the requirements of AS/NZS 1158.3.1: Section 4.5.2 for the application for the design area. With the point horizontal minimum illuminance requirement being that as defined in Table 2.2 of AS/NZS 1158.1.1 for the selected Sub-Category.
b. P-Category non-local roads shall be lit to the requirements of AS/NZS 1158.3.1 Section 4.5.2.
c. Sub-Category PR5 and PR6 local roads within residential sub-divisions shall be lit (and treated) to the requirements of AS/NZS 1158.3.1 Section 4.5.3. However, the maximum '0.25S' stated in sub-clause (b) is replaced with '5 metres'. The intention of this requirement is to identify the potential hazard to the approaching driver, while reducing the over lighting of residential roads mostly accessed by local residents with their origin or destination in that road.

13. BUS STOPS

A lighting column shall be located on the approach side of the bus stop, within 10m of the start of the bus stop marking.

When a bus turns into or out of a bus stop the bus may overhang the kerb. To minimise the risk of bus vs column collision, any lighting column must be setback at least 3m from the face of kerb where no bus shelter is present, or in line with the shelter structure where a shelter is provided.

Lighting columns shall not be located within 2m of a bus shelter to limit potential public roof top access.

14. FLAG LIGHTING

At isolated rural unlit intersections, consideration of night-time safety issues should occur, the designer should provide details as to whether flag lighting has been considered and reasoning for the outcome. Flag lighting (in addition to reflective strips) should be used as a means of providing advance warning to alert approaching motorists to the presence of the intersection. In such cases specific illuminance design is not required and the following table has been provided as a guide to selecting the most appropriate luminaire and mounting parameters.

The designer should also follow any NZTA guidelines around the use of flag lighting at isolated rural unlit intersections.

QLDC Table 6 Parameters for Flag Lighting

Vehicle Volume (VPD)	Subcategory	Recommended Mounting Height (m)	Recommended Lumen Output (lm)
>15,000	V3	10 or 12	12,500
< 15,000	V4	8 or 10	7,500

15. INNOVATION AND LIGHTING TRIALS

The intention of this document is to inform a standardised approach to exterior lighting within the region. However, it is accepted that standards and technical specifications do not always keep up with industry trends and developments. QLDC would therefore consider any monitored 'trial' design proposal that utilises technology or practices not covered by the document that are focussed toward the reduction of lighting pollution in the interest of preserving the dark sky amenity of the region. The current topics of interest are listed as follows:

- Use of Amber LED Luminaires.
- Use of lower Correlated Colour Temperature White Light Luminaires.
- Part night Street Lighting Switch off in Rural Townships
- Dimming and presence detection to activate Street Lighting during low trafficked hours of operation.

Additional requirements such as community and stakeholder engagement may be required to facilitate some of the 'areas of interest' listed above. It is expected that any proposal submitted for review will identify all project requirements and have undertaken appropriate preliminary risk assessments in the respect of Traffic safety and potential changes in criminal behaviours associated with the proposed lighting trial. QLDC also requires that a cost benefit analysis is undertaken to ensure that no trial implemented under this clause has adverse effects on capital, maintenance or energy budgets.

16. TEMPORARY CONSTRUCTION LIGHTING

Where a roadway, public space or public right of way is currently illuminated by public lighting (or Street Lighting), it is required that the system be maintained to ensure public safety during the hours of darkness.

Where construction takes place within the aforementioned areas, changes to a public lighting installation may be required to facilitate those changes or for the purposes of asset renewal. In such instances, it is the mandatory requirement of QLDC that the Constructor maintains the existing street lighting system within their site, until a point in time where the new lighting is confirmed fully operable.

Temporary Lighting is to be provided where required to ensure the continued safe movement of all road users, however, there is a focus on pedestrians, cyclists and construction workers around the 'site', who are deemed to be at higher risk of incident.

1.16.I MINIMUM REQUIREMENTS

The levels of illumination on the road and/or public space prior to the full (or partial) demolition of the existing street lighting system shall be maintained throughout the hours of darkness until the new lighting system is in full operation.

It is anticipated that in most instances the Constructor will be able to achieve the temporary lighting minimum requirements by establishing new permanent street lighting prior to the removal of the existing assets.

Where permanent lighting systems cannot be maintained throughout construction activities for practical reasons, or no existing lighting is present on site and temporary lighting is required during construction, the Constructor must satisfy additional requirements. The main Constructor must seek advice directly from QLDC to confirm which measures are appropriate prior to physical works beginning.

1.16.II ADDITIONAL REQUIREMENTS

Where comprehensive changes are being made to the infrastructure, a risk-based analysis must be undertaken, and temporary lighting assets may be required during the various stages of construction to replace permanent lighting assets that must be removed for practical reasons. A temporary lighting proposal may take into account the use of Temporary Traffic Management in establishing a practical solution for the site.

It is the preference of QLDC that standard lighting columns with appropriately sized luminaires on moveable concrete foundations are provided. These shall be isolated from public access and shall be arranged to provide adequate illumination as per the minimum requirements. The Constructor will be required to engage a suitably qualified lighting designer (as nominated by QLDC) to confirm the layout required and assess any changes resulting from the construction staging.

Any proposed temporary layout shall be submitted to QLDC for approval prior to implementation and the Constructor must arrange for temporary supplies in liaison with Aurora or have an adequate solar arrangement to operate all night.

Where new roading features are created which require higher lighting levels than the previous usage of the space, these devices shall either remain isolated until permanent lighting is operational, or temporary lighting shall be provided to the requirements of the AS/NZS 1158 and the current version of this document.

1.16.III PEDESTRIAN WALKWAYS

Where pedestrians are affected by temporary works which create enclosed separation from the roading corridor by way of solid barriers greater than 1.5 m height, a 'shipping container' style walk through or under scaffold. The Constructor must provide illumination to a minimum of a 20lux average and 4 lux point horizontal illuminance, utilising white light. This is preferably achieved with 'batten style' linear fittings surface mounted to the underside of the walkthrough's ceiling or fixed to the side of the separating barrier system.

1.16.IV EXCLUSIONS

Proprietary generator-based lighting rigs to illuminate public spaces for the purposes outlined in this section shall not be permitted due to glare and noise issues.

17. DEPARTURES OF THE QLDC TECHNICAL SPECIFICATION FROM AS/NZS STANDARDS

Where there are differences between the QLDC Technical Specification and the AS/NZS Standards this Technical Specification takes precedence. The following are instances where QLDC's requirements differ from (or are in addition to) the Standards:

- Luminaire tilt angles shall not exceed 0° for Category P roads and 5° for Category V roads unless otherwise approved by QLDC.
- Obtrusive light shall be controlled as per District Plan
- On Category V roads the Threshold Increment (TI) shall not exceed 12% (AS/NZS 1158 allows up to 15%)
- AS/NZS 1158.3.1 Section 4.5.3 (b) '0.25S' is replaced with '5 metres'.
- Increased daytime lighting requirement for Pedestrian Underpasses, referring to BS 5489.1:2013 table 4.

The QLDC may also impose other requirements (that deviate from these specifications and/or the AS/NZS Standards) based on special site or community specific requirements, and in such cases the applicant shall be advised accordingly.

18. EQUIPMENT SELECTION AND INSTALLATION REQUIREMENTS

All equipment specified by the designer shall be subject to final approval by QLDC. The design life and durability performance shall be 20 years for all luminaires and 50 years for all other equipment.

QLDC are seeking to reduce the number of different equipment within the district with a view to improving the maintenance and renewal efficiency.

Any new design shall adhere to the approved equipment process. Where decorative equipment has been used in existing development, QLDC's preference will be to discontinue their use in future stages of the development, to reduce future district wide variance in equipment.

The use of different Street Light families within a design to address localised design criteria, such as the increased illuminance requirements for LATM devices, is prohibited. A consistency of assets on the network is preferred.

19. LUMINAIRES

The following LED minimum performance requirements are applicable to all new lighting installations and shall be read in conjunction with NZTA M30

QLDC Table 7 LED Minimum Performance Requirements

LED Minimum Performance Requirements	
Main Characteristics	
Colour Temperature	Not more than 3000K
CRI	≥ 70
Rated Optical Life	≥ 85,000 hours
Insulation Class	II
Protection Degree	IP66
Impact Protection	IK08
LED Modules	Removable
Luminaire Tilt Angle (when installed)	0º - 5º above the horizontal (Adjustable on site).
Weight	≤ 15kg
Mounting	Bracket attachment ø42mm to ø60mm
Temperature Range	-10º to +40º
Gear Tray	Removable plate
DALI	Dimmable driver
NEMA socket	7-Pin
Electrical Characteristics	
Rated Voltage	230V (50Hz)
Power Factor	>0.9 (at full load)
Integrated Surge Protection	Up 10kV/10kA
Total Harmonic Distortion	≤ 20%

All luminaires shall be designed to enable the LED light engine to be replaced and/or upgraded. The IP66 rating of the complete luminaire shall not be compromised as a result of either replacement or upgrade of the luminaire components.

The integral Surge Protection Device (SPD) shall be an electronic device capable of sustaining 5 strikes with automatic reset capability and must be of a type capable of protecting all electronic components within the luminaire. Varistor type SPD devices shall not be used as their operating times are not always fast enough to protect electronic components. Suppliers shall provide details of the SPD's characteristics and demonstrate that the installed device will protect all electronic componentry.

The 20-year design life applies to all component parts of the luminaire and includes the housing, lens, gaskets, LEDs, compartments, drivers, and control gear.

In addition to meeting the above minimum standards the LED manufacturer and/or supplier shall provide a 10-year performance warranty on the luminaire, based on normal LED operation within the QLDC district. The warranty must be in the name of QLDC, and details must be provided with As-built information.

The introduction of smart central management systems (CMS) can provide greater flexibility in how lighting systems are operated. Simple on/off functionality can now be replaced with a CMS which allows remote control and dimming functions to be implemented. QLDC requires each LED luminaire to be provided with a DALI dimmable driver and a 7-Pin NEMA socket (complying with ANSI C136.41) complete with Zodian SS6 20:20 photocell QLDC will advise each applicant of any other CMS requirements.

Refer to NZTA M30 Specification and Guidelines for Road Lighting Design for the acceptable LED testing procedures and methods of determining optical performance, production of photometric files (IES and CIE format) and method of measuring lumen depreciation.

NZTA M30 contains a list of accepted LED luminaires that have been assessed as meeting the M30 criteria.

QLDC are seeking to reduce the number of different luminaires and columns within the district with a view to improving the maintenance and renewal efficiency. Refer to the QLDC approved luminaire list for more detail.

QLDC varies from NZTA M30: where it is deemed more appropriate to apply a lower colour temperature. Specifically, 3000K is the colour temperature required for exterior lighting. Note that there may be some instances where a higher colour temperature (above 3000K) is justified subject to QLDC approval . These areas may include:

- Major transport hubs or outdoor areas where high-definition CCTV coverage is required
- Outdoor sports fields
- Outdoor work areas e.g., truck depots, materials handling facilities, freight hubs, public works infrastructure and facilities etc

20. LIGHTING COLUMNS

The new luminaires shall be mounted on any combination of the following configurations:

(a) New street lighting columns.
(b) Existing overhead power poles using suitable outreach arms mounted onto each power pole.
(c) Joint use mast arm (JUMA) or joint use signal (JUSP) lighting columns.
(d) Mounted directly onto buildings (or other infrastructure) using suitable mounting brackets and hardware.

All new lighting columns (and mounting hardware) shall comply with the relevant structural standards and the performance and durability requirements of NZTA M26 in addition to any local environmental conditions such as high wind and/or snow loadings and poor ground conditions.

In the case of any building mounted luminaires, permission from the building (or asset) owner is required prior to installation.

New Lighting Columns

Unless otherwise advised by QLDC all new lighting columns shall be octagonal steel (hot dip galvanised) ground planted poles complete with curved outreach arms.

The column shall be unpainted unless there are visual or environmental concerns that need to be addressed. QLDC shall approve the column via the QLDC Design checksheet found on the QLDC website, any deviations during implementation shall need to be resubmitted for approval. If painted, painting shall be carried out by the column manufacturer during fabrication and assembly.

All new octagonal lighting column shall be of the frangible type as a minimum requirement, however certain ground conditions or safety issues may require the columns are flange based (with either a stub base or concrete foundation). High speed areas exceeding 70kph may require use of shear-based columns where appropriate safe setbacks cannot be achieved. Specific design may also be required at locations that have particular environmental or physical constraints i.e., Bridges, retaining walls, gabion baskets, or other structural elements that may be present.

Decorative or heritage lighting columns and luminaries may be permitted on some P category residential streets, minor roads and in some intermediate roads as part of a new subdivision, or in amenity areas provided they meet all the performance requirements listed within this design guide and be on the QLDC approved list. It should be noted that decorative columns are not expected to meet the frangible criteria and therefore their use must be restricted to low speed (<50kph) environments and columns must be appropriately setback from the kerb (preferably back on the boundary). These must be approved by QLDC via the QLDC design checklist.

Lighting columns shall be positioned so that the gear doors are safely accessible to a maintenance operative or either handedness. Columns placed behind physical structures such as safety barriers or bridge railings will require special consideration to ensure that access to the gear compartment is not blocked and that the door is orientated correctly. This may lead to the bespoke requirement for a custom height door on bridge mounted columns for example, so that the gear compartment is accessible from the bridge deck without the need for an elevated work platform.

Column Numbers

All Columns must be fitted with a unique QLDC pole number. The pole numbers become a key reference for each asset and the location and details of these numbers must align to the asset data provided to Council as part of the 224c Application or any capital works.

The column numbers should meet the following specification.

S1343, Rotag Diamond Engraved anodised marine grade aluminium QLDC streetlight number; 175x25mm each. A cost will be charged for these.

Column numbers can be obtained by contacting QLDC at services@qldc.govt.nz.

These should be installed between 1.8-2 meters high from ground level.

Luminaire Mounting Parameters

New lighting columns shall be designed and constructed based on the luminaire mounting parameters, weights and sail areas specified in the following table.

Table 8 Luminaire Mounting Parameters

Luminaire Mounting Height (m)	Maximum Bracket Outreach (m)	Maximum Luminaire Weight (kg)	Maximum Luminaire Sail Area (m^2)
12.00	4	15	0.15
10.50	4	15	0.15
9.00	3	10	0.12
7.50	3	9	0.10
6.00	2	9	0.10

Where possible the above standard mounting heights shall be used, however there may be special circumstances where other mounting heights and/or outreach lengths are required, and in such cases compliance with the structural and durability requirements of NZTA M26 will need to be demonstrated in addition to obtaining QLDC approval prior to column selection.

Refer to Appendix for typical arrangement.

Bollards are not considered to provide adequate street lighting and will only be acceptable for amenity (Parks and Reserves) lighting, or for private lighting schemes that are not to be vested to QLDC. Bollards must meet the requirements for shielding of upward light. Approval for use of bollards from Property & Infrastructure Engineering Team from QLDC must be obtained at Engineering Acceptance.

Existing Power Poles

At locations where there are existing overhead power poles and it is not practical to install new street lighting poles, the luminaires may be able to be mounted onto the existing poles using suitable steel (hot dip galvanised) outreach arms, subject to approval from the local electricity distribution company.

All new outreach arms (and mounting hardware) shall comply with the relevant structural standards and the steel performance and durability requirements of NZTA M26.

Traffic Poles

Where new lighting is required at signalised intersections involving the addition of new signal poles the preference is to mount the luminaires onto Joint Use Signal Poles (JUSP) or Joint Use Mast Arm (JUMA) or poles. Refer to Appendix 6.3 and Appendix M – specification for Traffic Signals.

21. POWER SUPPLY AND CONTROL REQUIREMENTS

Power Supply and Electrical Requirements

The design and installation of power supplies to the new lighting, including alterations and extensions to the street lighting network (SLN), shall be undertaken by an experienced and competent engineer and/or contractor “approved” by the local electricity network company.

All work (including design and construction) shall comply with the Electricity Act 1992, the Electricity (Safety) Regulations 2010, the NZ Wiring Rules (AS/NZS 3000) and (as applicable) any electricity network company rules and procedures.

Works

Any work (including design and construction) associated with extending, modifying or establishing the SLN infrastructure shall be carried out by an experienced and competent contractor "approved" by the local electricity network company. The work shall be carried out in accordance with the requirements of the local electricity network company and any other relevant electrical regulations and standards including the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and NZECP 35.

Electrical Installation unmetered street lighting

For Street Lighting assets within the legal road reserve, the following applies.

All installation work associated with the internal wiring (excluding the SLN cabling works) shall be undertaken by a competent person in accordance with the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and the NZ Wiring Rules (AS/NZS 3000). The installation works shall include:

- Supply and installation of fuse panel board (made from non-conducting material such as Formica or similar electromechanical grade laminate) within the fuse panel cavity at the column base.
- Supply and installation of front wired 32A rated fuse holder (complete with 10A HRC fuse link) onto fuse panel.
- Supply and installation of earthing equipment including neutral and earth studs, neutral-earth link, earth electrode (driven earth rod) and all earthing conductors. Note that the connection onto the earth electrode shall be accessible for inspection either from within the column fuse panel or access pit adjacent the column.
- Supply and installation of luminaire and internal cable from the fuse panel to the luminaire. The internal cabling installation includes the earth and neutral conductors from earth/neutral studs and phase conductor from top (or exit) side of the main fuse holder and connection onto the luminaire terminals.

Refer to Appendix 6 for further details. Note that Appendix 6 provides typical details only and alternative equipment may be installed (e.g., miniature circuit breaker rather than fuse holder) provided the complete electrical installation complies with the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and the NZ Wiring Rules (AS/NZS 3000).

Electrical Installation – other

The application of this section applies in the following circumstances:

1. Public Street Lighting assets outside of the legal road reserve (e.g., Council Owned Parks and Footpaths), or a freehold situation, where an easement may be required for the electrical cabling.
2. QLDC owned Feature or Amenity Lighting assets.

Both installation types are to be serviced via a QLDC owned reticulation network and electrical cabinet with a metered utility supply. The designer shall be responsible for designing the electrical reticulation and associated control to the requirements of AS/NZS 3000.

The following minimum requirements (applying Sections 22 (a) and (b)) for the design of this new infrastructure shall be expected:

a. The designer shall ascertain the existing supply characteristics and details (e.g. transformer, etc.).
b. The designer shall ascertain any existing cabling networks' details (e.g. cable sizes, cable lengths, etc.) by checking the As-Built Documentation (e.g. drawings, schedules, etc.);
c. The above information shall be used by the designer for the calculations of the Voltage Drop, Earth Fault Loop Impedance and Fault Levels at the various new luminaire's locations – to prove compliance with the Mandatory Testing requirements of AS/NZS 3000, Section 8.

d. The designer shall check for and ensure that sufficient space can be utilised within the QLDC owned electrical cabinets:
   a. for the installation of the new meter c/w Current Transformers (where required) and
   b. that the point of Isolation for the new lighting circuits supply is agreed with QLDC.
e. The designer shall check and co-ordinate the new protection devices of the new lighting circuits with the protection (e.g. MCB, Fuse, etc.) placed on the QLDC owned cable – to prove discrimination.
f. For these design requirements the following shall be documented and submitted for approval:
   - Drawings and the detailing of the proposed lighting
   - New conduits / ducts routes c/w sizes shown on the drawings.
   - New or revisions to existing Lighting Controls schematic diagrams to be provided.
   - Schedules / drawings detailing new circuits' protection, cable sizes, controls, etc.
   - Specification details – proving compliance with AS/NZS standards.

a) Public lighting assets outside of the legal road reserve

Typically, these lighting installations (columns and streetlights) fall within QLDC parks, rights of way and recreational spaces where they are considered public lighting assets but are unsuitable for conventional utility unmetered street lighting arrangements due to being outside of the legal roading designation.

The Designer shall design a cable configuration along the pathway or area to fit the number and location of supply points. The design should have an objective of providing a cost-effective outcome with the least number of supply points along the route.

At each supply point establish a switchboard cabinet with a meter.

The number of lights connected to a single circuit shall be limited to ensure that the load is no more than 50% of the circuit protection rating and with no greater than 2.5% voltage drop from the point of connection to the network, at the furthest luminaire.

Preferably, run a three phase 4core 10mm^2 (minimum) Cu NS PVC/XLPE, with luminaires connected in alternating sequence to phase L1, L2 & L3.

b) Feature and amenity lighting assets

Where feature or amenity lighting is to be used, this typically requires luminaires of a non-standard street lighting type with varying size and application. For example, inground, bollard and under seat strip lights. Whether these assets are in a road reserve or non-road reserve area, they are unsuitable for utility un-metred street lighting supply arrangements. Therefore, a bespoke electrical reticulation installation (which shall be metered as described above) is required which the designer shall undertake to the requirements of AS/NZS 3000. Asbuilt details must be supplied indicating cable location.

In the case of 230V luminaires, use round 2core+ECC 2.5mm2 (minimum) Cu PVC/PVC cable in conduit in accordance with AS/NZS 3000. IP68 joint and tail down as required at each light (to suit the available cable entry and termination space for the luminaire). 230V rated supplies shall not be installed within benches, seating platforms, handrails, etc.

In the case of extra low voltage (ELV) luminaires, run 2core 1.5mm2 (minimum) Cu PVC/PVC cable in conduit. Remote drivers will be located in a suitable IP rated cabinet location, preferably at the point of supply and easily accessible.

c) Electrical installation – small connected non-street lighting loads

Where small quantities of lighting assets are required for the purposes of feature lighting or to illuminate short lengths of parkland footpaths, such as bollards in a sub-division – the dedicated supply points and associated meters required by the criteria above is not desirable, as this could lead to a proliferation of electrical meters on the network.

To offer flexibility, where small electrical loads (less than 100W) and less than 4 luminaires are required, a designed QLDC owned ‘sub service’ can be utilised from the nearest adjacent Street Lighting Asset. This approach **must** be agreed with QLDC prior to design taking place and approval will be given on a case-by-case basis. This approach is only acceptable for localised use within a project to address a limited number of lights, it would not be permitted across multiple clusters on the same Road or Development project. In that instance, the dedicated supply criteria above would apply.

The Street Lighting Asset feeding this arrangement will be required to have sufficient space within the gear area to house the additional fusing and control arrangement, normally a ‘double door’ column will be needed. The design of the electrical fuse board arrangement and control to accommodate the subservice will require detailing in the design submission and shall satisfy the requirements of AS/NZS 3000.

The preference is for this arrangement to be utilised in conjunction with 230V luminaires (integral gear) with wiring of round 2 core + Earth 2.5mm^2 (minimum) Copper PVC/PVC cable in conduit.

For Extra Low Voltage luminaires, the issue of restricted space associated with housing remote drivers within the adjacent lighting column may prove difficult to resolve and thus this is not preferred. The minimum wiring size shall be round 2 core 1.5mm^2 (minimum) Copper PVC/PVC cable in conduit.

For these design requirements the following reduced requirements shall be documented and submitted for approval:

- Drawings and the detailing of the proposed lighting
- New circuiting details provided on the drawings.
- New conduits / ducts routes c/w sizes shown on the drawings.
- Schedules / drawings detailing new circuits’ protection, cable sizes, controls, etc.
- Specification details – proving compliance with AS/NZS standards.

22. STREET LIGHTING CONTROL SYSTEMS

Road lighting control systems typically involve any combination of the following:

(a) Manual switching from a central location (area substation) supplying a group of luminaires.
(b) Photocell control from a central location supplying a group of luminaires or individual photocells mounted on each luminaire.
(c) Central Management System (CMS) or Supervisory, Control and Data Acquisition (SCADA) control using signals transmitted over a local network to remotely control and/or dim groups of lights.

As a minimum all new luminaires shall come with dimmable drivers in accordance with M30, refer to section 20 Table 7 above.

23. COMMUNITY SPECIFIC DESIGN GUIDELINES

This section draws attention to urban design, the QLDC District Plan, community specific requirements as well non roading related elements. It is important to adhere to the Southern Light Part One - A Lighting Strategy, the operative QLDC District Plan and the QLDC Urban Design Strategy which provides design guidelines and other urban design reference documents.

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Contact should be made to QLDC to ascertain current status of community specific plans.

24. DESIGN GUIDELINES FOR LIGHTING NOT COVERED IN AS/NZS 1158

AS/NZS 1158 provides minimum performance and design requirements for the lighting of roads and public spaces. However, there are other forms of outdoor lighting that are not covered within the AS/NZS 1158 series (or are included in other standards), and the following sections provide guidance to designers and others responsible for lighting schemes (permanent or temporary) that fall outside AS/NZS 1158.

As a minimum requirement all lighting listed within this section shall comply with the requirements of AS/NZS 4282 which covers the control of the obtrusive effects of the following outdoor lighting applications:

- For work or recreation (outdoor workplace lighting shall also comply with AS/NZS 1680.5)
- For safety or security
- For amenity
- For advertising or display

Vested infrastructure must be cost effective and should be a nationally and readily available product, approved by QLDC.

25. FEATURE LIGHTING (UP-LIGHTING AND FLOOD LIGHTING)

Adherence to the Southern Light Strategy and Technical Specifications gives the Council and private owners the opportunity to celebrate and highlight the special features in our community without over saturation of lighting. While some festive and feature lighting may contravene the upward waste light requirement, there are some circumstances where this will be allowed through both permanent and temporary installations. Special dispensation must be approved by QLDC, and consideration may reflect the communities' intention to seek accreditation for Dark Skies.

Feature lighting (including in-ground up-lighting, projectors, and above ground floodlighting) shall only be provided for specific locations that are of special or historical significance. There are no specific minimum or maximum illumination levels, however each individual design shall be submitted (for approval by Council) with accompanying calculations clearly showing the horizontal and/or vertical illuminance values corresponding to each feature being lit. Any design submitted shall identify the ambient light of the general area and calculated ratio of the illuminated feature against the background lighting. Recommended Ratios:

- 2:1 – To be visible.
- 5:1 – To 'Stand out'

In the case of a statue, tree, building façade or sign the vertical design area shall match (as closely as possible) the item being illuminated. Where multiple floodlights are required to illuminate the perimeter of a tree or statue a vertical calculation shall be required for each floodlight aimed at the item.

Any lighting installation, either temporary or permanent, that is installed within a QLDC tree or within the root zone of a QLDC tree shall be required to be assessed regarding any potential harmful or negative effect the installation may have on the wellbeing of the subject tree. This assessment shall be undertaken by the QLDC Arborist, and should it be considered that the installation will likely have a detrimental effect on the wellbeing of the subject tree, approval shall not be granted.

Should approval be granted, it will likely be subject to conditions to ensure that there is no subsequent detrimental effect on the subject tree, such conditions may include:

- The installation and removal of any decorative lighting within the crown of a QLDC tree shall be installed by a suitably qualified professional arborist
- Any works within the root zone of a QLDC tree (cable installation etc) shall be overseen and monitored by a suitably qualified professional arborist
- Only low wattage LED shall be installed in trees. Conventional incandescent light sources create excessive heat that can be harmful to the tree

All floodlights shall be directionally aimed and focused towards the items required to be illuminated, and in no case shall any up-light be aimed straight up into the atmosphere. The Council's preference is to have building or pole mounted floodlights aimed down (below the horizontal) towards the items being lit. The Council recognises that this may not always be practical and will allow in-ground floodlights to be used subject to their approval.

The Council reserves the right to withhold approval for any feature lighting in a public setting if the adverse lighting effects are deemed to be too excessive, and in such cases the lighting designer may be required to submit an alternative design using lower lumen output fittings.

All feature lighting equipment (i.e. luminaires, housings, columns, fixing brackets, etc) shall comply with the durability requirements in section 4. Any in-ground luminaires, located where vehicles may be active, shall have a maximum surface load capacity of 5,000 kg.

All feature lighting must be circuited and controlled by time clock/ control system to ensure that upward waste light is limited by way of part night switch off. Feature Lighting shall be subject to the following time restrictions:

- Monday to Thursday – Switch on at Dusk, Switch off at 11pm
- Friday to Sunday – Switch on at Dusk, Switch off at 2am (next day)

26. PARKS AND OPEN SPACES

Parks and Open Spaces must adhere to public spaces within AS/NZS 1158 where appropriate. Areas containing feature lighting (e.g., trees, shrubs, or monuments) are covered in Feature Lighting.

27. ILLUMINATED SIGNS

All illuminated signs shall adhere to QLDC Operative District Plan Section 18 and Proposed District Plan Section 31. Signs exceeding 150cd/m² of illumination require QLDC consent.

For externally illuminated signs it is preferential that the light source is positioned to point downwards towards the sign rather than upwards to minimise upward light pollution (sky glow). Refer to Feature Lighting for further details.

28. PRIVATE EXTERIOR LIGHTING – NON-DOMESTIC

Through the consenting process, QLDC seeks to limit the environmental impact of new artificial lighting by following the general intentions of this document. Private lighting installations contribute to upward waste light and are largely unregulated. The intent of the criteria below is to limit the use uncontrolled luminaires with high colour temperatures used in conjunction with excessive lighting design criteria. The following will apply to any consent application for non-domestic private development with respect to exterior lighting:

- Mandatory use of luminaires with a maximum CCT of 3000k (except Private Sports Fields or by QLDC granted exemption).

- Luminaires used for general area lighting, i.e. safe movement and security shall provide no more than 1% upward waste light ratio as installed.
- Feature lighting (such as building façade and inground luminaires) will require QLDC approval upon application and if granted will be subject to the operating times defined in Section 26.
- Lighting Levels shall be selected based on the Sub-Categories listed in the Tables in Sections 9, 10 and 11 for general area, security, and access lighting.
- Lighting Levels for specific exterior work tasks shall be selected based on (and not exceed) the guidance in AS/NZS 1680.5
- Lighting Levels for private sports fields shall be considered on application by QLDC with detail of the activity being required to assess suitability.
- All lighting must comply with the requirements of AS/NZS 4282.
- Lighting Design Results shall be reasonably close to the Light Technical Parameters utilised in the design to avoid excessive lighting. QLDC reserves the right to instruct any applicant to reduce designed lighting results if they are assessed to be excessive by our consents team or nominated technical review panel.

As part of any new consent application, the applicant must provide a design plan showing the proposed exterior lighting. The Plan and submission shall include the following as a minimum:

- General Site Layout.
- Luminaire Positions and Mounting Heights.
- Luminaire Datasheets for each selected type.
- Clarify Lighting Design Requirements utilised and the Results achieved.
- Show Calculation Results (points and Isolux lines) in a legible format.

QLDC has no interest in assessing the longevity or technical robustness of products selected.

QLDC accepts that some business activities may have bespoke requirements which do not align with some of the above criteria, in this event, it is requested that the applicant provides written justification and details of any proposed departure for QLDC consideration.

29. PRIVATE EXTERIOR LIGHTING - DOMESTIC

While the QLDC does not have a vested interest in domestic outdoor lighting installations, there must still be compliance with the District Plan rules.

Glare

(a) All fixed exterior lighting shall be directed away from the adjacent sites and roads; and

(b) No activity on any site shall result in greater than a 3.0 lux spill (horizontal and vertical) of light onto any other site measured at any point inside the boundary of the other site.

This document does not cover outdoor domestic lighting, however AS 4282 contains some informative text on good practice including the use of passive infra-red movement detectors or low brightness (dimmed) lighting when continuous (over-night) operation is required.

It is recommended that domestic development follows the criteria listed above for 'Private Exterior Lighting – Non-Domestic' in order to assist in the preservation of the dark sky amenity in the region.

30. OPERATIONAL POLICIES

31. STREET LIGHTING RENEWALS

QLDC's policy is to replace decorative poles and luminaires where possible with standard poles and luminaires.

This will not be the case in areas where there are specific design criteria or guidelines such as Arrowtown's Historic Precinct.

32. ATTACHMENTS ON LIGHTING POLES

Any attachment to be placed on to a Lighting Pole must go through an approval process prior to installation, this is to protect the structural integrity of the poles.

Examples of the attachments are as follows, but not limited to:

- Flags and banners

  There is existing FlagTrax infrastructure on lighting on Shotover Street, Queenstown and Ardmore Street, Wanaka) which facilitates flags and banners. Please refer to existing 'Banner and Event Signage Policy'.

  In special amenity areas such as the town centres or lake front, a decorative cover may be fitted to enable flags or banners. Applications to utilise these flag/banner locations must go through the QLDC Events team.

- Utility attachments such as communications, CCTV, traffic monitoring devices

Contact the QLDC Customer services team in the first instance, this will be referred to the QLDC Operations & Maintenance team for approval on a case-by-case basis and a charge may apply. Application for permanent infrastructure may take the form of a Licence to Occupy (LTO). Details of attachments must be provided as part of the application process.

It is essential that any attachments which connect to the streetlighting power supply must seek approval and provide details of any energy draw. Any such devices found on QLDC lighting infrastructure without written permission, may be removed at Council's discretion.

This does not apply to attachments on lights on the State Highway, please contact Waka Kotahi New Zealand Transport Agency for approval.

33. DATA PROVISION REQUIREMENTS SPECIFIC FOR LIGHTING AND ELECTRICAL INSTALLATIONS

The following documentation shall be provided by the installation contractor following completion:

- As built layout drawings. This can be the design with an 'As-built' statement. This is especially crucial where there is cabling or lighting that cannot be entered onto the RAMM sheet.
- Software design files
- QLDC RAMM Roading Asset Register (RAMM update sheets) – the latest version can be found on the QLDC website – please always download the latest version as these are being improved https://www.qldc.govt.nz/services/resource-consents/land-developments-and-subdivisions#code-of-practice
  - This information shall include column types and luminaire descriptions etc.~~,~~ The luminaire description shall include make, model, optic, LED count or module size, driver size and power rating e.g. OrangeTek TerraLED Mini 24 AP2 300mA 24W LED.
- Producer statement(s) for all columns installed.
- Luminaire 10-year supplier warranty statement.
- Signed and completed Electrical Certificate of Compliance (CoC) and Electrical Safety Certificate (ESC).
- Signed and completed Record of Inspection (RoI) form.
- Details of any warranties

Note: that the issuing of a 224c certificate (certifying that all subdivision conditions have been met) is conditional upon the electrical installer providing signed CoC/ESC and RoI forms as well as the completed RAMM data.

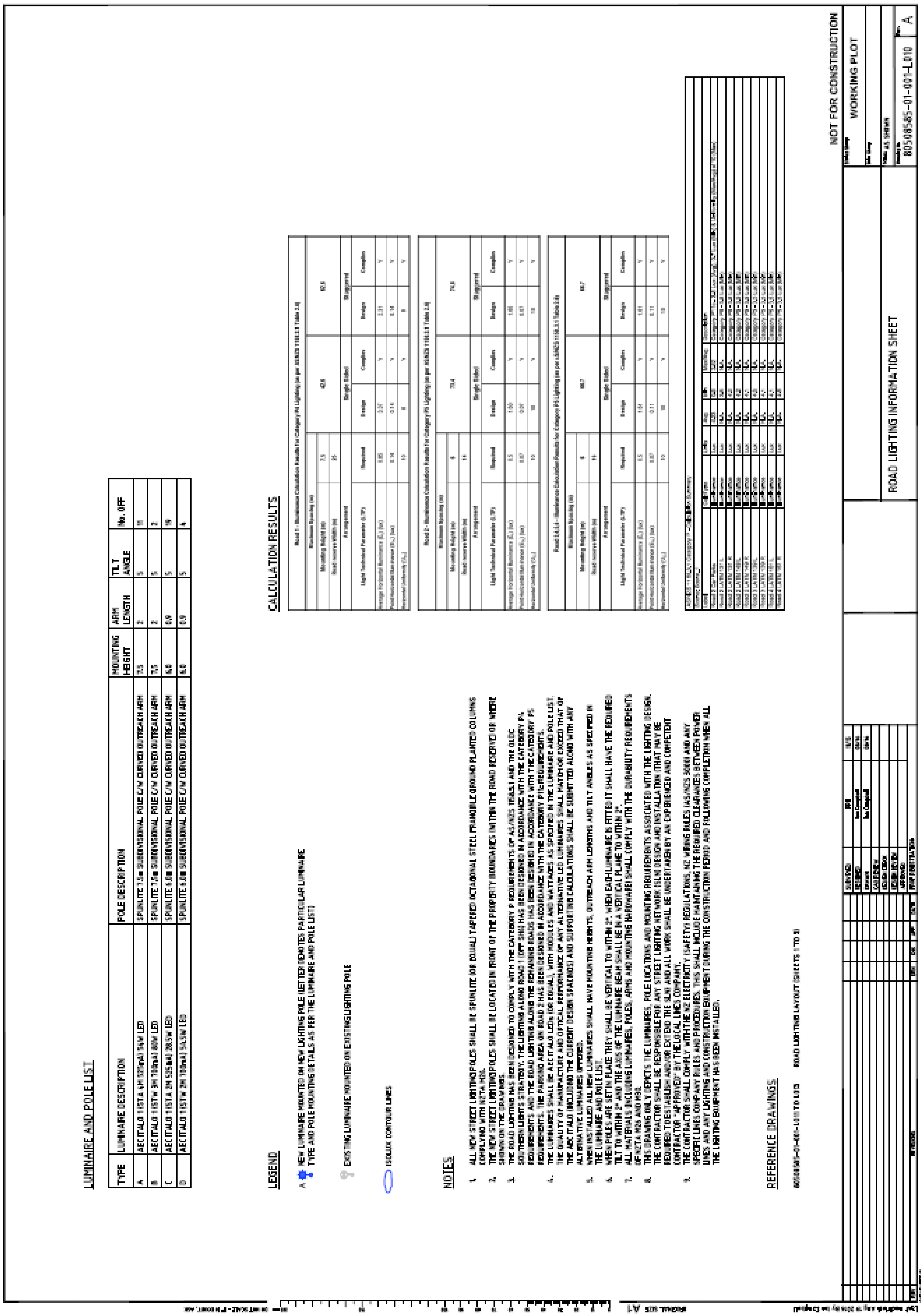
34. POST CONSTRUCTION REQUIREMENTS

Proof to be sent to QLDC on the following items:

- Street lights are livened
- Photocell switches function correctly-
- All columns are vertical, and all luminaires are installed with the correct tilt angles and orientation.
- Columns are labelled in accordance with QLDC requirements. Column numbers can be obtained from the QLDC Street Lighting Maintenance Contractor
- A label is attached to the underside of each luminaire describing the optic and wattage e.g., AP2 24W.

This is to be sent to the QLDC subdivision inspectors. QLDC may also require a visual inspection if deemed necessary.

APPENDIX 1 - TYPICAL INFORMATION SHEET DRAWING



APPENDIX 2 - TYPICAL DESIGN NOTES AND CALCULATION RESULTS

Drawing Notes (alternative to design report):

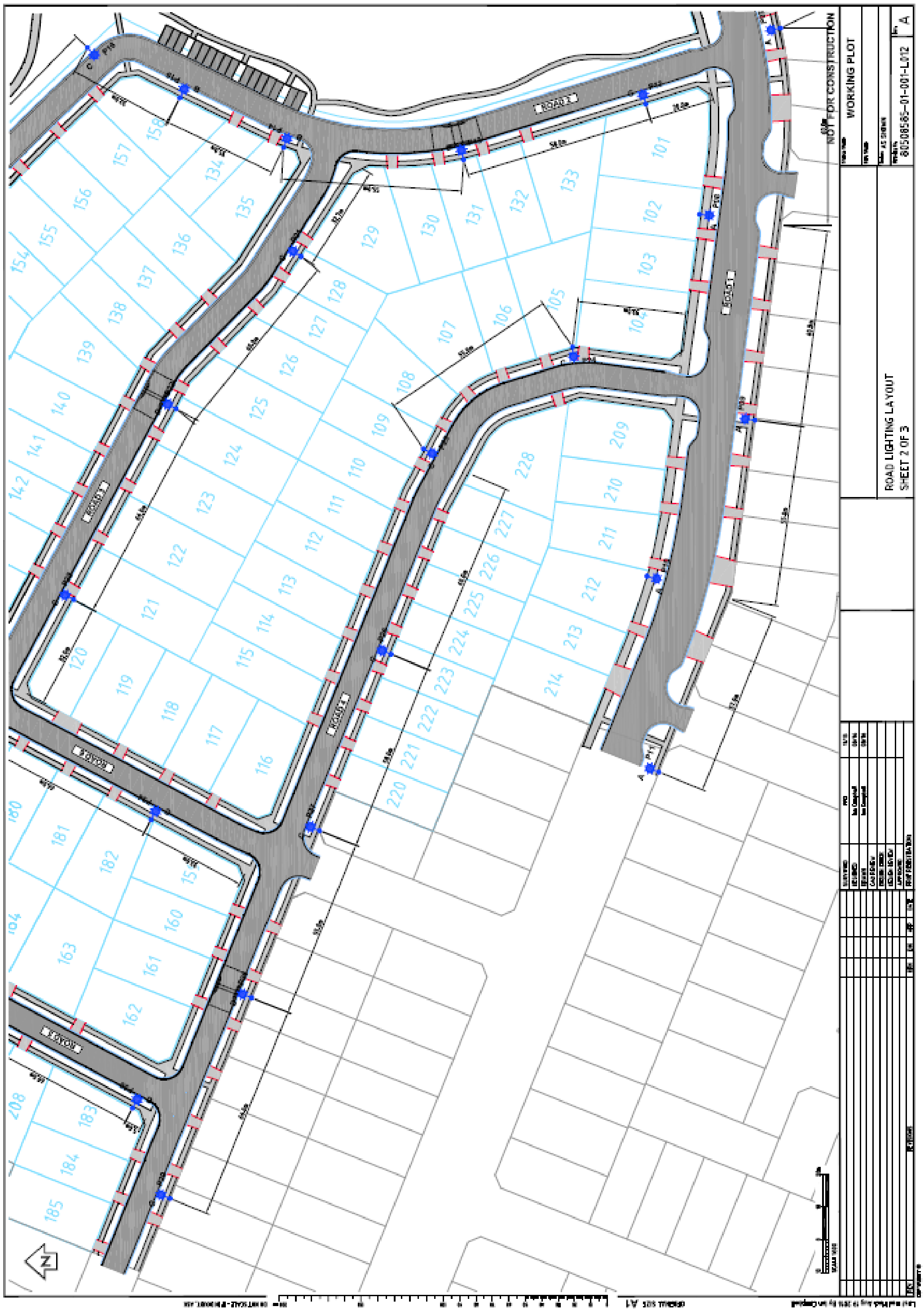
NOTES

1. ALL NEW STREET LIGHTING POLES SHALL BE SPUNLITE (OR EQUAL) TAPERED OCTAGONAL STEEL FRANGIBLE GROUND PLANTED COLUMNS COMPLYING WITH NZTA M26.
2. THE NEW STREET LIGHTING POLES SHALL BE LOCATED IN FRONT OF THE PROPERTY BOUNDARIES (WITHIN THE ROAD RESERVE) OR WHERE SHOWN ON THE DRAWINGS.
3. THE ROAD LIGHTING HAS BEEN DESIGNED TO COMPLY WITH THE CATEGORY P REQUIREMENTS OF AS/NZS 1158.3.1 AND THE QLDC SOUTHERN LIGHTS STRATEGY. THE LIGHTING ALONG ROAD 1 (OFF SH6) HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P4 REQUIREMENTS AND THE ROAD LIGHTING ALONG THE REMAINING ROADS HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P5 REQUIREMENTS. THE PARKING AREA ON ROAD 2 HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P11c REQUIREMENTS.
4. THE LUMINAIRES SHALL BE AEC ITALO LEDs (OR EQUAL), WITH MODULES AND WATTAGES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE QUALITY OF MANUFACTURE AND OPTICAL PERFORMANCE OF ANY ALTERNATIVE LED LUMINAIRES SHALL MATCH OR EXCEED THAT OF THE AEC ITALO (INCLUDING THE CURRENT DESIGN SPACINGS) AND SUPPORTING CALCULATIONS SHALL BE SUBMITTED ALONG WITH ANY ALTERNATIVE LUMINAIRES OFFERED.
5. WHEN INSTALLED ALL NEW LUMINAIRES SHALL HAVE MOUNTING HEIGHTS, OUTREACH ARM LENGTHS AND TILT ANGLES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST.
6. WHEN POLES ARE SET IN PLACE THEY SHALL BE VERTICAL TO WITHIN 2°. WHEN EACH LUMINAIRE IS FITTED IT SHALL HAVE THE REQUIRED TILT TO WITHIN 2° AND THE AXIS OF THE LUMINAIRE BEAM SHALL BE IN A VERTICAL PLANE TO WITHIN 2°.
7. ALL MATERIALS (INCLUDING LUMINAIRES, POLES, ARMS AND MOUNTING HARDWARE) SHALL COMPLY WITH THE DURABILITY REQUIREMENTS OF NZTA M26 AND M30.
8. THIS DRAWING ONLY DEPICTS THE LUMINAIRES, POLE LOCATIONS AND MOUNTING REQUIREMENTS ASSOCIATED WITH THE LIGHTING DESIGN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY STREET LIGHTING NETWORK (SLN) DESIGN AND INSTALLATION (THAT MAY BE REQUIRED TO ESTABLISH AND/OR EXTEND THE SLN) AND ALL WORK SHALL BE UNDERTAKEN BY AN EXPERIENCED AND COMPETENT CONTRACTOR "APPROVED" BY THE LOCAL LINES COMPANY.
9. THE CONTRACTOR SHALL COMPLY WITH THE NZ ELECTRICITY (SAFETY) REGULATIONS, NZ WIRING RULES (AS/NZS 3000) AND ANY SPECIFIC LINES COMPANY RULES AND PROCEDURES. THIS SHALL INCLUDE MAINTAINING THE REQUIRED CLEARANCES BETWEEN POWER LINES AND ANY LIGHTING AND CONSTRUCTION EQUIPMENT DURING THE CONSTRUCTION PERIOD AND FOLLOWING COMPLETION WHEN ALL THE LIGHTING EQUIPMENT HAS BEEN INSTALLED.

Illuminance Calculation results (exported from AGi32):

AS/NZS 1158.3.1 Category P - Calculation Summary						
Scene: Scene_1						
Label	CalcType	Units	Avg	Min	Max/Avg	Description
Road 2 Car Parks	Illuminance	Lux	4.23	0.9	2.62	Category P11c - 3.5 Lux (Avg), 0.7 Lux (Min) & Uniformity (Max/Avg) of 10 (Max)
Road 2 LATM 131 L	Illuminance	Lux	N.A.	3.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 131 R	Illuminance	Lux	N.A.	4.0	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 L	Illuminance	Lux	N.A.	4.2	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 L	Illuminance	Lux	N.A.	4.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 L	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 R	Illuminance	Lux	N.A.	4.5	N.A.	Category P5 - 3.5 Lux (Min)

APPENDIX 3 - TYPICAL LAYOUT DRAWING



APPENDIX 4 - TYPICAL PERFECT LITE CALCULATION RESULTS

```
                 Road 1_P4_SS 42m_7.5+2+5_Italo 1 STA 525mA 54W

                     P Category Lighting - AS/NZS 1158.3.1:2005
                     ******************************************


          I-table Filename: C:\Data\Road Lighting\Photometric Files\AEC\Italo
                            Range 2015-08-20\Italo 1\ITALO 1 OF2 STA 4.5-4M.ci
                            e

                  Job Name: Hanley Downs DP1 - Road 1

     Luminaire Description: IT1 OF2 STA 5-4M     5440 lms
       Lamp Wattage & Type: 54W
         Initial Lamp Flux: 5440 lms
        Maintenance Factor: 0.8
               Stores Code:
              Upcast Angle:  5 degrees
               Arrangement: Single Side
           Offset Distance: 2.56 m
 Upward Waste Light Ratio: .0 %
              Light Source: LED - Light Emitting Diode
 Luminaire Classification: Not specified

         Lighting Category: P4 (Local Area Roads - Tables 2.1 & 2.6)

     Illuminance Criteria:  Average Illuminance (Eav) >= 0.85 lx
     (Maintained values)    Minimum Illuminance (Eph) >= 0.14 lx
                          Illuminance Uniformity (Up) <= 10

         Calculation Grid: 20 x 11 points - Figure 3.7 of AS/NZS 1158.2

 @B Mounting                Maximum Spacing for different
 @B Height                       Road Reserve Widths
 @B --------                ----------------------------

         25.0
      +--------+
   7.5 |  42.6 |
      +--------+

   Value/s in above table are all in metres.
   The table contains maximum spacings which, for the specified luminaire
   and lamp combination, provide compliance with the light technical
   parameters (LTPs) of Table 2.6 of AS/NZS 1158.3.1:2005.

   Refer next page for list of LTP's at compliant maximum spacings.


 ---------------------------------------------------------------------------
 @IPlePcat - Vers 3.09 (Built: 18/10/12)          Run: 16/ 8/2016 at 16:38:41


             Light Technical Parameters at Maximum Spacing
             *********************************************

        Mounting Road     Maximum  Eav      Eph      Up        Emax
        Height   Reserve  Spacing                 (Emax/Eav)
        (m)      (m)      (m)      (lx)     (lx)               (lx)
        ----------------------------------------------------------

          7.5     25.0     42.6     3.37     0.14       6      20.42


 ---------------------------------------------------------------------------
 @IPlePcat - Vers 3.09 (Built: 18/10/12)          Run: 16/ 8/2016 at 16:38:41

                                 Page 1
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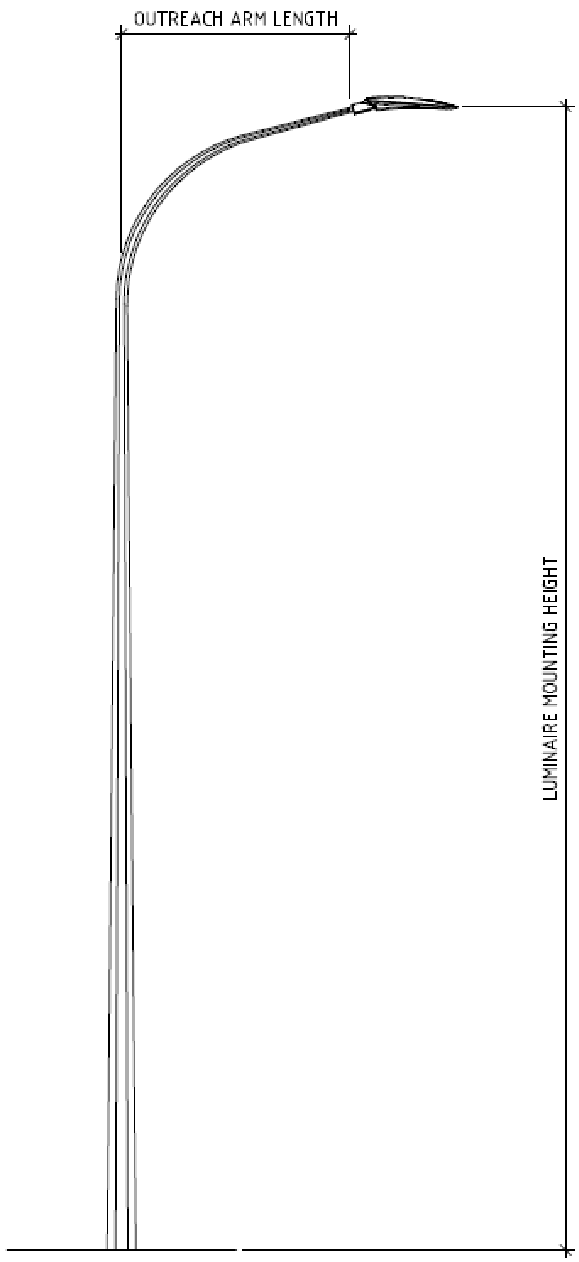
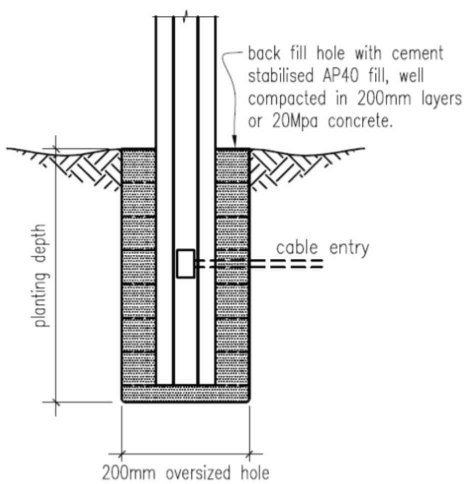
APPENDIX 5 - TYPICAL POLE DETAILS

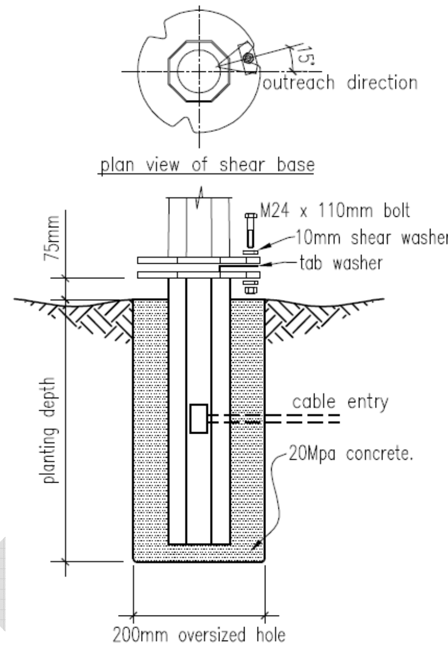
5.1 Tapered Octagonal Steel Lighting Pole c/w Curved Outreach Arm



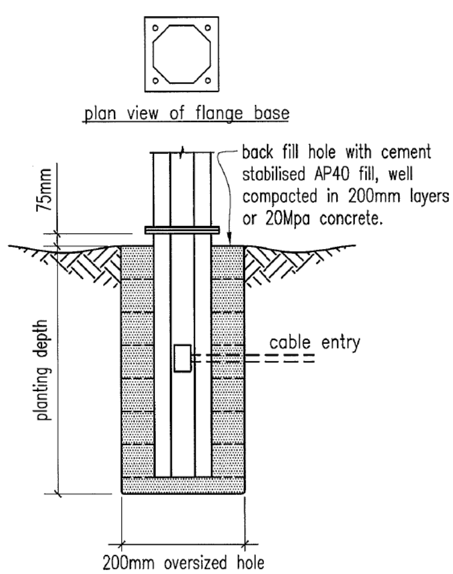
5.2 Typical Lighting Pole Foundation Details



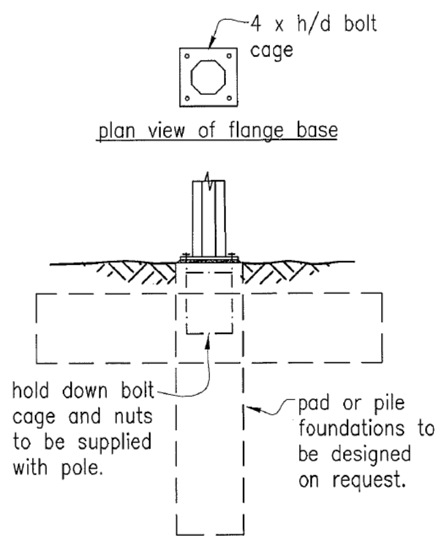
Typical Ground Planted Foundation



Typical Shear Based Stub Foundation



Typical Flange Based Stub Foundation

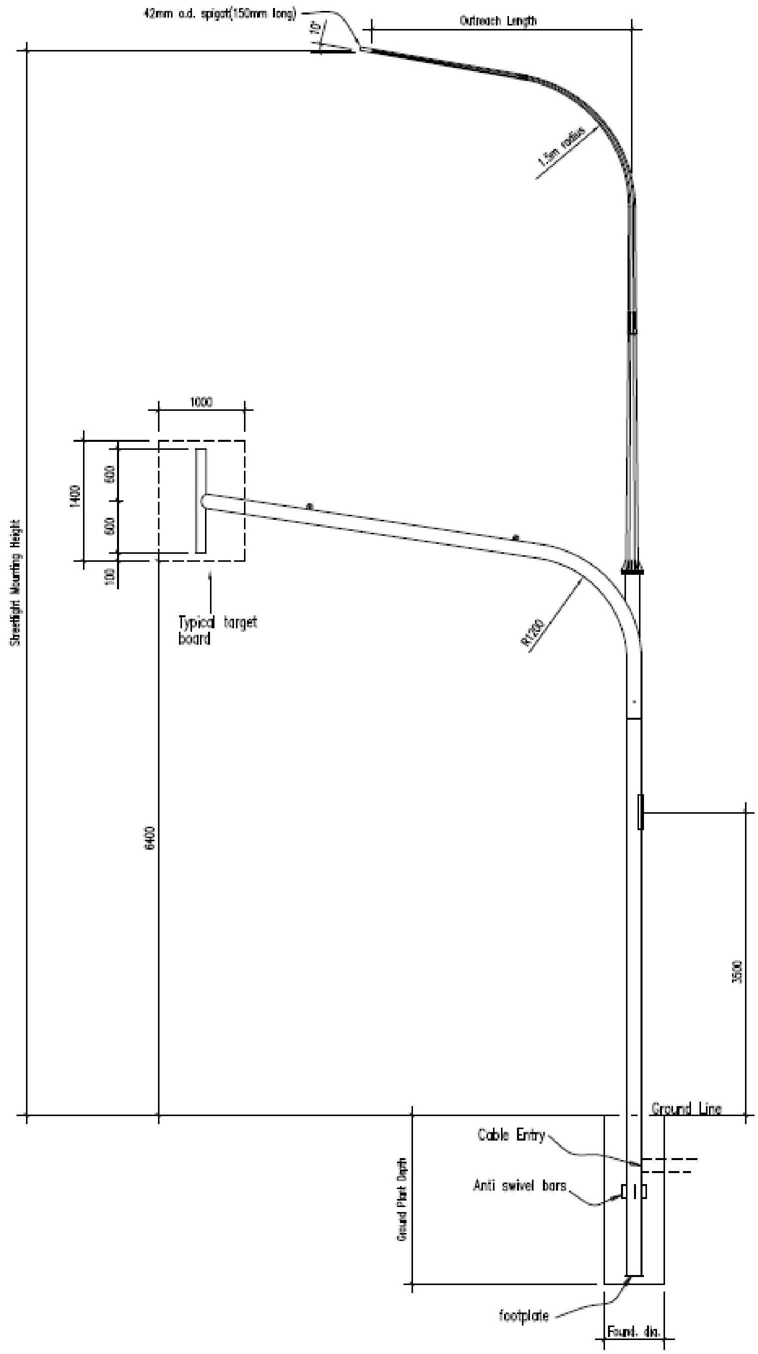


typical flange based foundation

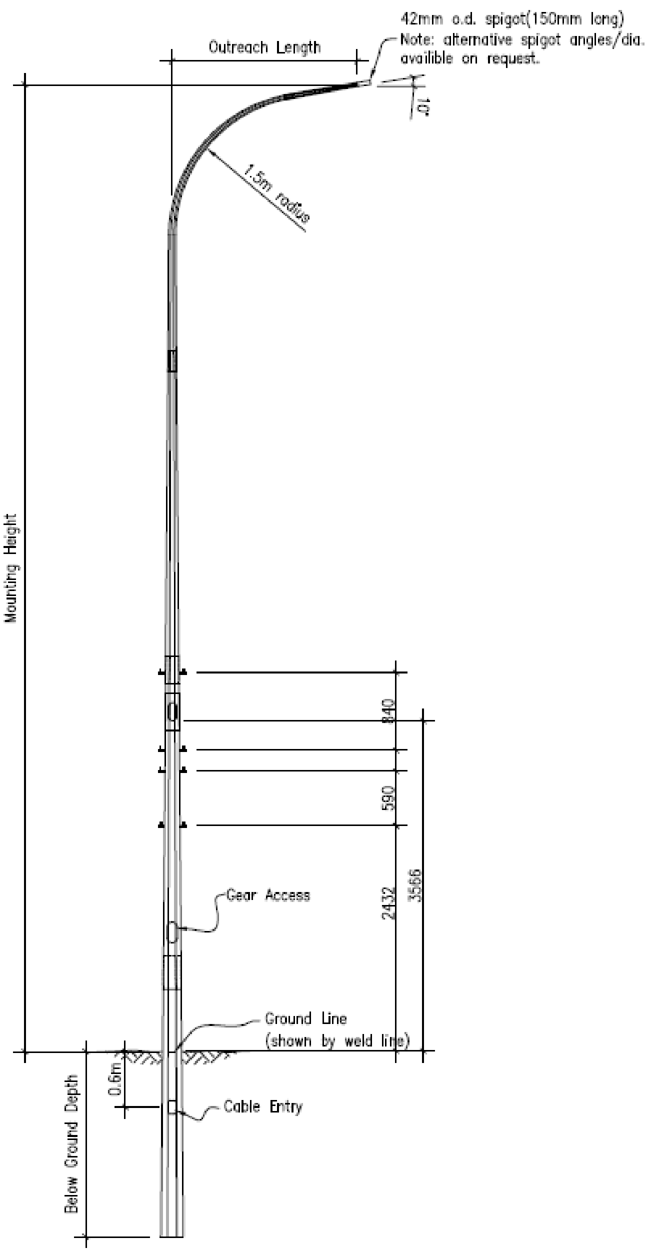
Note: The above arrangements depict typical details only and the actual mounting details may vary between pole suppliers. Specific design may also be required due to site specific ground conditions.

5.3 JUMA and JUSP Signal Poles

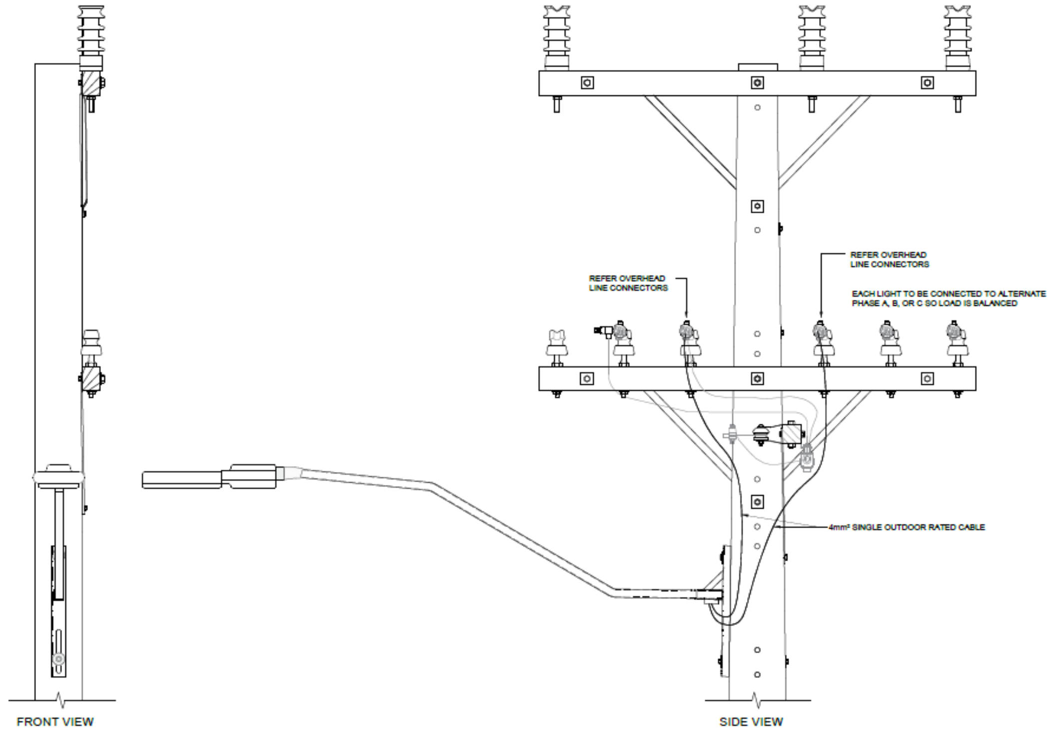
JUMA Signal Pole:



JUSP Signal Pole:



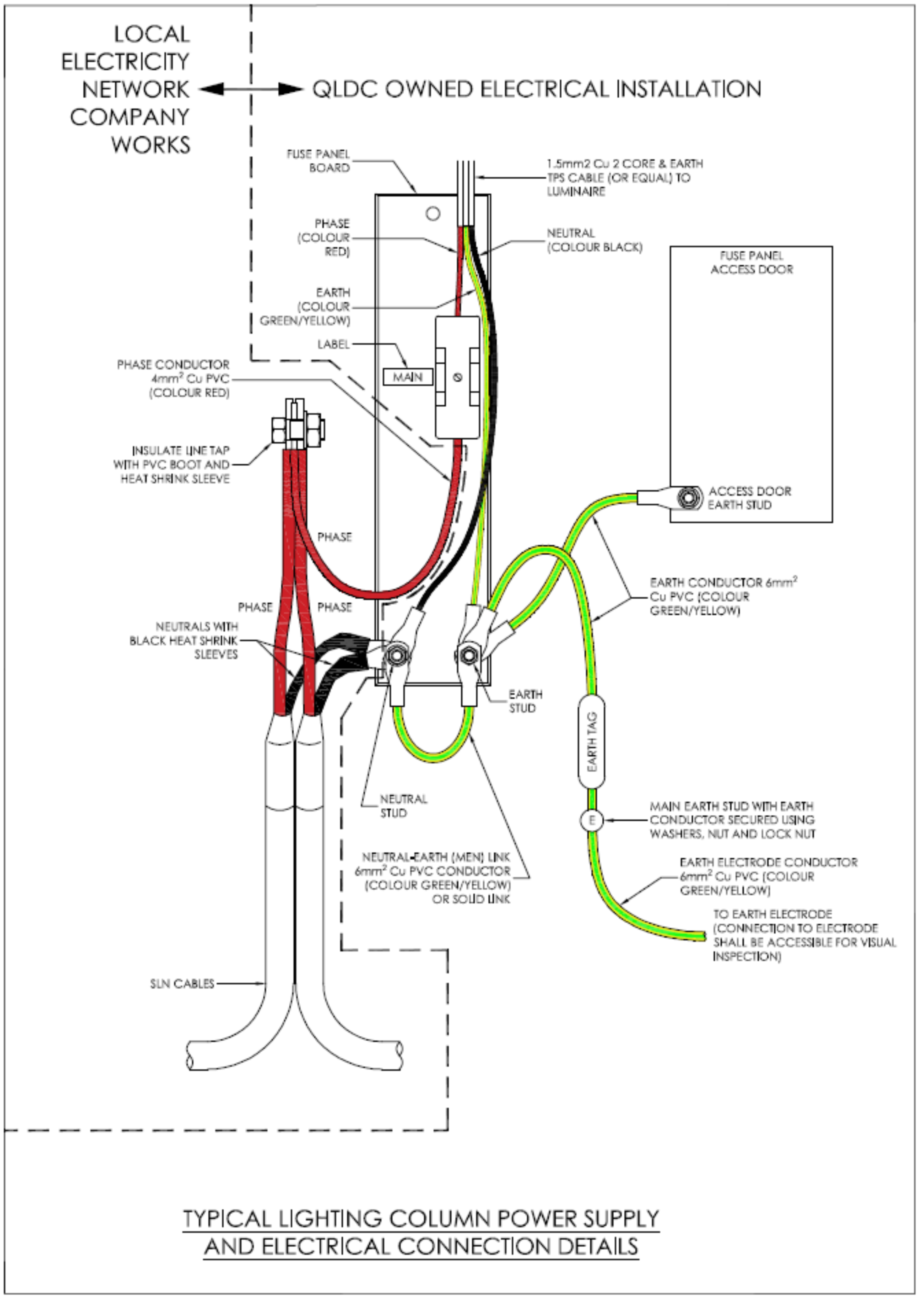
5.4 Typical Power Pole Mounting Details



Note: The above arrangement is typical only and any work on or near overhead lines shall be undertaken by the local electricity network company or a contrcator approved by the local electricity network company.

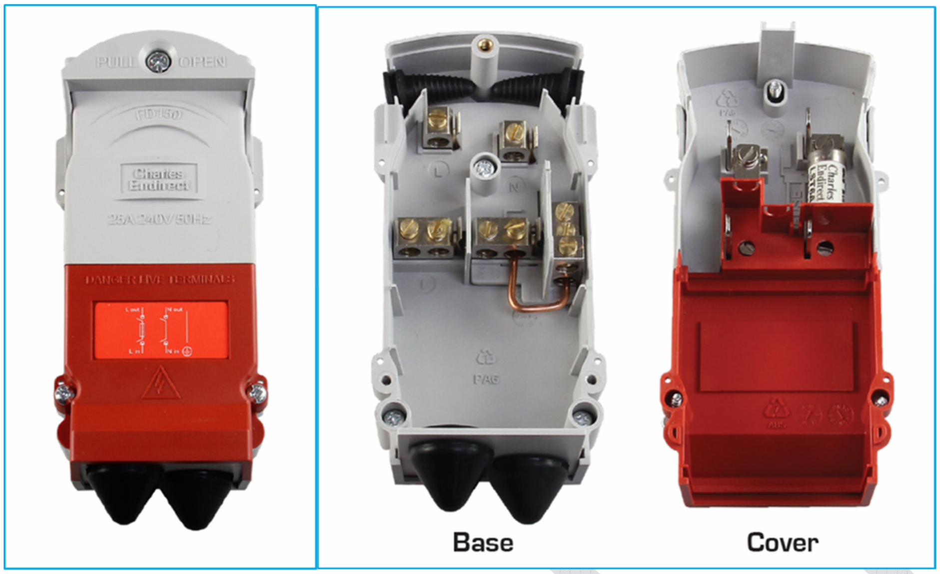
APPENDIX 6 – LIGHTING COLUMN POWER SUPPLY AND ELECTRICAL DETAILS

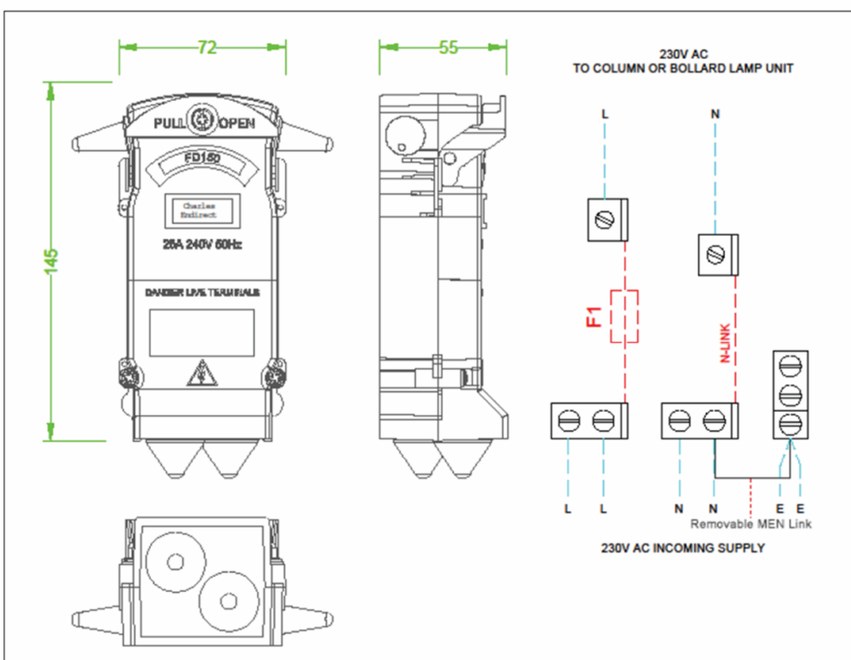
6.1 Typical Wiring showing Ownership Boundaries



TYPICAL LIGHTING COLUMN POWER SUPPLY AND ELECTRICAL CONNECTION DETAILS

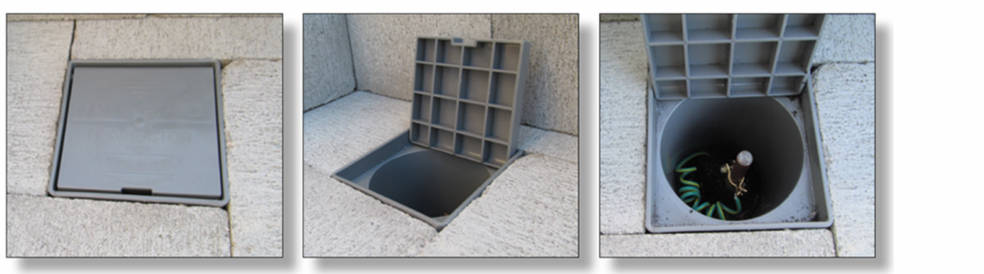
6.2 - Street Light FD150 Cutout Assembly

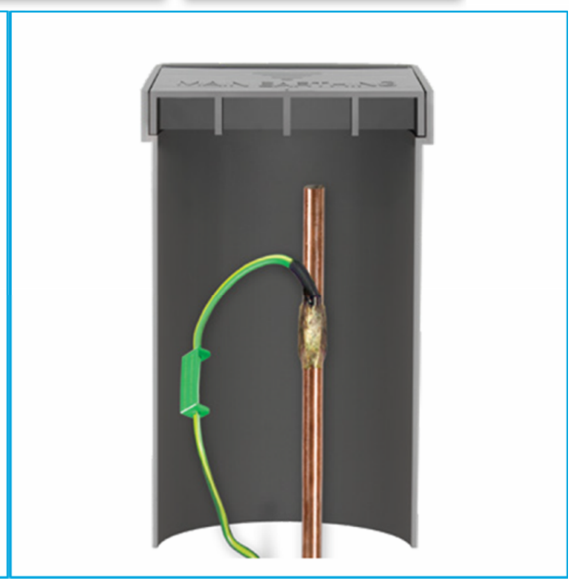




6.3 Fused Street Light Board

6.4 Typical Earth Rod Inspection Pit





APPENDIX 7 - EXAMPLE OF COMMUNITY SPECIFIC DESIGN (CARDRONA)

The following images have been presented as an example of a community specific design that was applied to a lighting upgrade at Cardrona where equipment (luminaires and poles) were selected to blend in with the historical context of the Cardrona Hotel and surrounding environment.

Image date December 2009 (before upgrade):

Image date July 2015 (after upgrade):

APPENDIX 8 – EXAMPLE FORMS

8.1 Electrical CoC and ESC Form

ELECTRICAL CERTIFICATE OF COMPLIANCE & ELECTRICAL SAFETY CERTIFICATE

REFERENCE/CERTIFICATE ID NO.:

This form has been designed to be used by licensed electrical workers to certify that installations or Part installations under **Part 1** or **Part 2 of AS/NZS 3000** are safe to be connected to the specified system of electrical supply.

Location Details:

Contact Details: (Name and address)

Name of Electrical worker: | **Registration/Practising licence number:**

Phone & email:

Name and registration number of person(s) supervised:

Certificate of Compliance

Type of work: ☐ Addition ☐ Alteration ☐ New work

The prescribed electrical work is: ☐ Low risk ☐ General ☐ High-risk (Specify):

Means of compliance: ☐ Part 1 of AS/NZS 3000 ☐ Part 2 of AS/NZS 3000

Additional Standards or electrical code of practice were required: ☐ No ☐ Yes (specify):

Date or range of dates that prescribed electrical work undertaken:

Contains fittings that are safe to connect to a power supply? ☐ Yes ☐ No

Specify type of supply system:

The installation has an earthing system that is correctly rated (where applicable) ☐ Yes ☐ No

Parts of the installation to which this certificate relates that are safe to connect to a power supply?

☐ All ☐ Parts (specify)

The work relies on manufacturers instructions: ☐ Yes ☐ No

If yes – identify the instruction manual including name, date and version. Also attach a copy of manufacturer's instructions to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The work has been done in accordance with a certified design: ☐ Yes ☐ No

If yes – identify the certified design including name, date and version. Also attach a copy of the certified design to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The work relies on a Supplier Declaration of Conformity (SDoC): ☐ Yes ☐ No

If yes - identify the SDoC including name, date and version OR EESS registration. Also attach a copy of the SDoC to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The installation has been satisfactorily tested in accordance with the Electricity (Safety) Regulations 2010 ☐ No ☐ Yes

Description of Work:

Test Results (provide values)		
Polarity (Independent earth):		
Insulation resistance:		Ohms
Earth Continuity:		Ohms
Bonding:		Ohms
Fault Loop impedance		Ohms
Other (specify):		

By signing this document I certify that the completed prescribed electrical work to which this Certificate of Compliance applies has been done lawfully and safely, and the information in the certificate is correct.

Certifier's signature: **Date:**

Electrical Safety Certificate

By signing this document I certify that the installation, or part of the installation, to which this Electrical Safety Certificate applies is connected to a power supply and is safe to use.

Certifier's name: | **Registration/Practising licence number:**

Certifier's signature: | **Certificate Issue Date:** | **Connection Date:**

CUSTOMER COPY – THIS IS AN IMPORTANT DOCUMENT AND SHOULD BE RETAINED FOR A MINIMUM OF 7 YEARS

This Electrical Safety Certificate also confirms that the electrical work complies with the building code for the purposes of Section 19(1)(e) of the Building Act 2004.

8.2 Electrical RoI Form

RECORD OF INSPECTION (ROI) OF HIGH- RISK PRESCRIBED ELECTRICAL WORK
PURSUANT TO THE ELECTRICITY (SAFETY) REGULATIONS 2010

Reference/Record ID Number:

Issuer (Inspector) details:

Name of Inspector: Registration #:

Email address: Telephone:

Location of installation:

Location details:

Location type: ☐ Domestic ☐ Non-Domestic Accommodation ☐ Industrial ☐ Commercial ☐ Educational ☐ Healthcare ☐ Miscellaneous (other)

Certifying Electrical Work and Certificate of Compliance (CoC) details:

Name of Electrical worker(s): Registration #:

CoC details: ☐ CoC(s) attached

Certifying Electrical Work and RoI details:

What was inspected:

Specify the regulation(s) and companion standard(s), or identify the certified design, followed when carrying out the inspection:

What are the results of the inspection:

High Risk Category:

☐ Not to AS/NZS 3000 Part 2 – 6A(2)(a)(i) ☐ Photovoltaic system – 6A(2)(a)(iv) ☐ Electrical medical area – 6A(2)(a)(vi)

☐ High voltage installation – 6A(2)(a)(ii) ☐ Hazardous area – 6A(2)(a)(v) ☐ Mains work – 6A(2)(b)

☐ Mains parallel generation – 6A(2)(a)(iii) ☐ Animal stunning or meat conditioning – 6A(2)(c)

☐ Other – please describe:

Declaration

I hereby confirm that the work described above has been done in accordance with the regulations; and the installation on which the work has been done is, and will be, when enlivened, electrically safe.

Signature: Date:

Record of Inspection (RoI) – Version: May 2014

WATER SUPPLY RESERVOIRS

Queenstown Lakes District Council Land Development and Subdivision Code of Practice Addendum

Date: February 2022

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

QUEENSTOWN LAKES DISTRICT COUNCIL

ABBREVIATIONS

ANSI	American National Standards Institute
AS	Australian Standard
ASME	American Society of Mechanical Engineers
ASNZS	Australian/New Zealand Standard
AWWA	American Water Works Association
BoD	Basis of Design
BWL	Bottom Water Level
CAD	Computer Aided Drafting
CCTV	Closed Circuit Television
CoP	(QLDC) Code of Practice 2020 including appendices
DWSNZ	Drinking Water Standards New Zealand
HAZOP	Hazard and Operability Assessment
NZBC	New Zealand Building Code
NZFS	New Zealand Fire Service
NZS	New Zealand Standard
NZSEE	New Zealand Society for Earthquake Engineering
ORC	Otago Regional Council
P&ID	Process (or piping) and Instrumentation diagram
QLDC	Queenstown Lakes District Council
TWL	Top Water Level
WSA03	Water Services Australia: Water Supply Code

QUEENSTOWN LAKES DISTRICT COUNCIL

GLOSSARY

Bottom Water Level	Level above datum at crest of outlet bell mouth – refer figure in Appendix D.
Datum	For QLDC projects the level datum shall be taken as: VD2016 (new national standard). This will replace current use of the Dunedin 1958 datum.
Dead Storage	Water stored below BWL – refer figure in Appendix D.
Designer	Suitably qualified and experienced professional design lead (as determined by Engineering New Zealand bearing a CPEng) for the reservoir facility. The Designer is responsible for the overall design of the reservoir facility including issue of instructions and specifications to the Tank Supplier. Where the tank is designed by a specialist supplier, the tank designer shall take on design responsibility for the components that they design.
Gross Capacity	Total capacity of the tank from floor level to Overflow weir.
Net capacity	Capacity between bottom water level and top water level.
Overflow Level	Level at the crest of the overflow weir, refer Appendix D.
Service Reservoir	DWSNZ terminology for drinking water storage associated with the water distribution system. For the purposes of this document shortened to reservoir or tank.
Tank Supplier	Designer and supplier of the steel tank and associated appurtenances to defined contractual limits.
Top water level	Refer figure in Appendix D. Same as High Operating Level, that is, the level at which pumps normally stop. Note that water levels can exceed this level if there is a system malfunction.

1.0. INTRODUCTION

1.1 SCOPE

This document records the QLDC requirements for the design of reservoir sites with bolted cylindrical steel tanks founded on cast in situ concrete bases.

1.2 RELEVANT APPLICABLE STANDARDS

The design shall be in accordance with the New Zealand Building Code and the following relevant standards:

The latest version of DWSNZ Guidelines Section 16.2.1 - design considerations for service reservoirs.

QLDC Code of Practice for Land Development and Subdivision

QLDC District Plan

QLDC AM3 Approved Materials

Drinking Water Standards NZ 2018

NZS3101	Concrete Structures
NZS3106	Concrete Structures for Storage of liquids
NZS3109	Concrete Construction
NZS3404	Steel Structures
NZS4219	Seismic performance of engineering systems
NZS4442	Welded Steel pipes and fittings for water
SNZ4509	NZFS Firefighting water supply CoP
NZSEE	Seismic Design for Storage Tanks (Red Book)
ASNZS1111/2	Nuts and Bolts
ASNZS1170	Structural Design Actions
ASNZS1252	High-strength Steel Bolts for structural engineering
ASNZS1319	Safety signage
ASNZS1477	uPVC Pipes
ASNZS1554	Structural Steel Welding
ASNZS1657	Platforms, walkways etc
ASNZS1664	Aluminium Structures
ASNZS1665	Welding of Aluminium Structures
ASNZS1768	Lightening Protection
ASNZS2280	Ductile Iron Pipes

ASNZS3894	Site testing of protective coatings
ASNZS4020	Products in Contact with Drinking Water
ASNZS4130	PE Pipes
ASNZS4600	Cold Formed steel
ASNZS4765	mPVC pipes
AS1252	SS Bolts
AS1275	Bolts Hot dip galvanised
AS1657	Ladders access and handrails
AS2239	Anodes for cathodic protection
AS2304	Fire Tanks
AS2129	Steel Flanges
AS4020	Drinking Water Products
AS4087	DI Pipe fittings and flanges
AS4100	Steel Structures
AS4158	Gibaults
AWWA D103-19	Factory Coated Carbon Steel Tanks for Water
ANSI/AWWA C652	Disinfection of water storage facilities
ANSI/AWWA D108	Aluminium Domed Roofs for Water Storage
ANSI/ASME B36.19	Stainless Steel pipe
API650/(NZSAPI)	Welded Steel Tanks
WSA-03	Water Supply Code of Australia
Water NZ	Hygiene practices to prevent water supply contamination
Building Act and code	Liquid retaining structures are buildings in terms of the Building Act 2004 and must therefore meet the performance requirements of the NZ Building Act and Code.

2.0. DESIGN CRITERIA

2.1 RESERVOIR USABLE STORAGE VOLUME CALCULATION

The minimum gross storage across each network shall be the greater of:
• 24 hours of average day demand • 12 hours of peak day demand • 6 hours of average day demand plus the greatest firefighting storage requirement for the network as defined by SNZ PSA 4509:2008

Flow rates for calculating the above shall be calculated by considering the current water demand usage with the consideration of water demand management over time. These are to be confirmed with QLDC.

2.2 DESIGN FOR DURABILITY

Component	Design Durability Life in Years	Comment
Tank steel walls, tank wall to concrete joint, tank roof	50	NB this relates only to durability and not return period for loading
Tank Concrete Foundations, Concrete valve pits, Concrete retaining structures	100	NZS 3101:2006 section 3 Durability
Site buildings	50	NZBC Clause B2 VM1 and NZS 3101:2006 section 3 Durability
Above and below ground pipelines including fittings	100	Relevant pipeline design standards
Mechanical components including valves	50	
Tank epoxy coatings	Design life 25 years Guaranteed life 2 years	All bolted tank plates must be factory epoxy coated in accordance with AWWA D103-19.
Tank sealants	Design life 25 years Guaranteed life 2 years	Joint sealant shall comply with the requirements of AWWA D103-19. Sealants shall be compatible with cathodic protection where fitted. Sealants shall be compatible with tank disinfection processes.
Cathodic protection (if required to provide design life of tank)	20	

Component	Design Durability Life in Years	Comment
Electrical assets	20	
Instrument and control assets	15	
Dissimilar metals	No situation where dissimilar metals may cause a galvanic cell to occur.	
Water quality testing	Designers must obtain an incoming water quality assessment to confirm the suitability of the tank proposed.	

2.3 DESIGN FOR ULTIMATE LIMIT STATE STRUCTURAL CAPACITY

Item	Design Life years	Importance Level	Standard
Tank superstructure and tank foundation	50	4	NZS 1170.0
Buildings, pits, and structures other than the tank	50	4	NZS 1170.0

Design working life	Importance level	Annual probability of exceedance for ultimate limit states		
		Wind	Snow	Earthquake
50 years	1	1/100	1/50	1/100
	2	1/500	1/150	1/500
	3	1/1000	1/250	1/1000
	4	1/2500	1/500	1/2500
100 years or more	1	1/250	1/150	1/250
	2	1/1000	1/250	1/1000
	3	1/2500	1/500	1/2500
	4	*	*	*

2.4 GENERAL REQUIREMENTS AND SERVICEABILITY

Element of Design	Requirement
Reservoir facility land status	Facilities shall be sited on freehold land vested to QLDC. Facilities within easements are acceptable but require approval from QLDC. Access roads and service/pipe alignments outside of the facility shall be within vested road reserve. Where this is impractical easements or vested freehold are acceptable alternatives. Leased land options are not acceptable.
Tank design standards - general	Bolted steel tanks to be designed to the *American Water Works Association Standard AWWA/ANSI D103-19: Factory Coated Bolted Steel Tanks for Water Storage*. Where applicable AS/NZS1170, NZS3101 and NZS 3404 must have precedence. Seismic design shall be in accordance with NZS 3106, and shall reference NZSEE Seismic Design of Tanks, 2009. The Designer shall refer to QLDC seismic design return period memo, refer to Appendix C. The design must consider the potential for wind and snow loading and ice formation in accordance with NZS 1170.2
Tank foundation and floor design standards.	The tanks shall be founded on an in-situ cast reinforced concrete floor designed in accordance with NZS 1170.0, NZS 3101, NZS 3106 and ANSI/AWWA D103-19, Section 13.4.6 Design of concrete structures for the storage of liquids. Use of post tensioned construction of the floor must be agreed with QLDC.
Underdrainage requirements	The concrete base of the tank shall have underfloor drains to assist with any leakage tracing. These drains shall be provided in at least 4 zones and shall discharge to a collection chamber where individual drain outlets can be identified – refer to figure in Appendix A. The drains shall be PVC of 50 mm diameter, set in no fines concrete and shall be configured to run within 1 m of any floor penetrations and otherwise equally spaced.
Liner forbidden	The tank must not have nor require a separate liner.
Minimise confined spaces	Facilities are to be designed to minimise or remove the need for any confined spaces.
Freeboard above top water level	Freeboard shall be sufficient for overflow to function and to contain sloshing caused by earthquake. If slosh mode contacts roof this is to be specifically identified in the design attributes report and to be allowed for in structural design.

Element of Design	Requirement
Number of reservoirs per site	Minimum two tanks and provision for at least one future tank. For sub-division reservoir facilities sufficient reservoir capacity must be delivered by the developer at the time the developer is seeking compliance for the sub-division. Determine the Total Gross Reservoir Storage required at each 10 year increment. Determine how delivery of the required storage can be staged. A minimum of 2 reservoirs are required at the 30 year primary design horizon. More than 2 reservoirs can be acceptable at the 50 year MPD horizon. Reservoirs to have a minimum of 6 m between each other. Reservoirs to have a minimum 4 m wide platform annulus around them. Above ground obstacles (excluding slopes) to be a minimum of 6 m from reservoirs. Where facilities do not meet the 6 m spacing, 4 m annulus or 6 m separation from obstacles must demonstrate appropriate constructability and long-term maintenance. The demonstration needs to include vehicle movements for maintenance and construction. Reservoir facilities that cannot demonstrate feasible long term constructability, and/or constrain the 3 Waters maintenance contractor to undertake regular or heavy maintenance are unacceptable.
Maximum tank height	Bottom water level to top water level shall not exceed 6 m.
Pipework arranged to allow for taking one tank offline	Pipework layout and valving to be arranged so that one of the tanks can be taken offline for maintenance and the other tank(s) are to be able to continue to function.
Flow shortcutting	Tank inflow and outflow to be designed to minimise the potential for shortcutting through the reservoir. This is normally achieved by having a high level inlet and low level outlet with at least 90° radial separation.
Protection of emergency and fire reserve	Reservoir systems must be designed to: • Prevent overflows. • Prevent drawdown of emergency/fire reserved storage except for those purposes.
Vermin and contaminant protection	Provide robust provision of screens to keep out birds, vermin, insects, and other pests from the tank. All permanent openings (not hatches) into the tanks including vents are to be protected

Element of Design	Requirement
	by 2 mm stainless steel insect mesh. No openings shall face upwards. Roof/wall joints shall be completely sealed to prevent dust, vermin, insects, rainwater penetration. The tanks shall be detailed to discourage any bird nesting.
Tank roof design	Provision of roof vents shall be compliant with AWWA D103-19.
Maximum valve and service chamber depth	Where chambers are required, they shall not be greater than 1.5 m deep. Control valves, flow meters and telemetry sensors shall be housed within in-ground chambers. However, the number of in-ground chambers needs to rationalised, made communal and wherever possible not needed to be trafficable, i.e. be at least 6 m from a reservoir. Above ground pipework or valves require specific approval. Trafficable chambers require specific approval.
Burst valves and earthquake, Altitude valve provisions	Burst valves, also known as earthquake isolation valves, shall be provided to preserve the tank contents in the event of an earthquake large enough to fracture the supply/falling main. It is essential that all reservoirs are able to withstand the design earthquake event without significant loss of stored water. • Each tank within the facility is to be fitted with its own EQ valve. • The designer is to consult QLDC to confirm manufacturer of the preferred burst valve. The burst valve shall be installed on the outlet main adjacent to the inside of the boundary fence. • Burst valve closure to be controlled by an overspeed function signal from each reservoir’s outlet main high flow trigger set point or triggered by a seismic alarm. • Discuss with QLDC arrangements to get water from the tanks to road tankers in post-earthquake conditions. It may be required to provide an emergency hose connection or tap array at or near to the boundary fence. If required, this hose position should have an access road layout to facilitate road tanker manoeuvring. • In a multi-tank facility one of the tanks can be set to not automatically close its EQ valve, this ensures continued supply for LoS and firefighting with a false positive EQ, or where fighting a fire takes precedence over water loss. Non-auto EQ tank can be remotely

Element of Design	Requirement
	operated/isolated by operator, similarly auto EQ tanks can be remotely operated/opened by operator. A communal altitude valve provides protection from overflow for all reservoirs. The altitude valve shall be activated by pressure via a signal pressure pipe connected to the reservoir. The balance pipework may be used as a tapping point for the pressure signal pipe. A flow meter and flow control valve may be required on the inlet of some reservoir facilities to control their fill rate.
Plinth height	Mechanical plant to be mounted on plinths 200 mm high.
Cable trays/conduits	Cables are to be installed below ground in covered ducts/conduits or fixed above head height on cable trays, or in vertically mounted galvanised steel conduits attached to the tanks.
Barriers and fall protection	Provide handrails/chains around potential falling hazards.
Cathodic Protection	Provide suitable cathodic protection to appropriately protect integrity of steel tank structure.

2.5 PIPEWORK REQUIREMENTS

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
Pipe materials	Below ground inlet and outlet pipework beyond the tank contractual limit shall be PE100 of a suitable pressure rating (PN16 minimum). PE pipe shall be suitably derated for fatigue and temperature as per PIPA guidance (POP0101). Above ground pipework within the tank shall be in accordance with QLDC AM3 approved materials document. All non-pressurised drainpipes shall be uPVC of a suitable class (minimum SN8). Flanges shall be to AS4087 of a suitable pressure class. Cast in concrete pipework shall be ductile iron or cement lined steel.
Internal pipework requirement	All above ground pipework shall be inside the tank and pass through the floor slab.

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
Dedicated rising main	Reservoirs are to be supplied via a dedicated rising main unless specifically approved by QLDC. Some existing reservoir facilities have Rising / Falling mains and some future facilities may also require Rising / Falling main functionality. This is detailed further below.
Water Stops	All pipework passing into or out of the tank (through the concrete base slab) must be provided with suitable water stops/water bars and hydrophilic seals at all places where potential leakage paths exist.
Provision for differential movement	Pipework connecting structures with ground or other structures shall be designed to withstand differential movement. Suitable self-restraining flexible connections shall be provided within 1 m of the external face of the tank foundation and can comprise of either rocker pipes, PE pipe lengths, mechanical couplings, and/or bellows with EPDM flexible components.
Tank inlet	Inlets shall be high level bell mouths above normal operating level and the overflow outlet to provide an air gap. The inlet pipework shall be sized based on the design flow rates to the tank. Designer to confirm the design inlet flow rate with QLDC. Inlet pipes above ground (inside the tank) shall be ANSI/ASME B36.19 stainless steel 316L to a suitable pressure Schedule. Inlet pipes below ground shall be DI PN16 minimum or PE100 PN16 minimum.
Scour Pipes	An internal scour sump and scour outlet pipe shall be installed in the tank base to allow the tank to be fully drained. The internal scour sump shall be square in plan and twice the size of the outlet diameter with a minimum size of 500 x 500 mm. The scour pipe shall be connected to an external pump out chamber designed to allow sucker truck intervention if sediments are present. The required pump out chamber volume shall be equivalent to 10 mm of depth of water in the reservoir, however shall have a maximum volume no larger than a commonly available sucker truck, i.e. 6-8 m^3, and be no smaller than 1.5 m^3. The pump out chamber shall be combined with the overflow discharge chamber. The outlet of the pump out chamber shall have a normally closed valve prior to any piped connection to the calamity basin SW discharge system. The closed valve shall be openable to allow the tank to discharge direct to the SW discharge system if deemed acceptable by the

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
	operator. However, the valve must normally be returned to a closed position.
Outlet Pipes	Outlet pipes shall be ductile iron or cement lined steel with bell mouth installed through the floor of the tank. They shall be sized to suit the maximum design outflow. Diameter may be locally reduced to allow an economical design of pipework, valve, and fittings. The outlet bell mouth shall be located within 2 m of the tank wall to minimise sub floor pipework. The outlet pipe arrangement must be arranged to ensure a minimum 100 mm dead zone above the tank floor to retain any accumulated sediment from being drawn into the outlet pipe. The Designer shall consider any requirement for an anti-vortex baffle.
Rising / Falling Main	If QLDC requires Rising / Falling main functionality then this must be achieved with separate inlet and outlet pipes as discussed above. A singular inlet / outlet pipe into a reservoir is not allowed. A non-return valve will be required to ensure turnover of the reservoir/s i.e. the reservoir is filled through the high-level inlet pipe and drained via the outlet pipe. A dedicated flow meter is still required on the outlet pipe to record flows and is linked to BCV operation. A flow meter is also required on the inlet pipe such that instantaneous demand can be deducted during reservoir filling. The inlet flow meter can be common to all reservoirs within the facility, similar to the installation of a common altitude valve. Although most flow meters have bi-directional capability they shall not be used where flow can be in both directions, i.e. on the Rising / Falling main, as this confuses processing of data provided by the meter.
Bypass valve between inlet and outlet	Some existing reservoir facilities have a by-pass pipe between inlet and outlet pipework. QLDC may require some future facilities to have this functionality The by-pass shall consist of a normally closed pipe, with a valve at each end and a means to purge the closed pipe from its end nearest the valve to the outlet pipe.
Internal overflow	The tank must be provided with an internal overflow pipe capable of taking maximum inflow without the water level reaching the roof structure. Maximum inflow to a single tank is calculated by dividing the maximum inflow into the reservoir facility divided by the

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
	number of tanks less 1, i.e. total inflow divided by 1 for 2 tanks, and divided by 2 for 3 tanks. The overflow shall be conveyed to the scour pump out/overflow inground chamber. The overflow will initially bubble up from the chamber and be obvious to the operator. Any overflow beyond the capacity of the calamity basin's SW discharge system shall intentionally flood the calamity basin. The overflow pipe shall have a non-return valve installed at the exit point to prevent vermin from entering the pipe.
Balance pipework	To allow for any differential filling or decanting between individual tanks a smaller diameter balancing pipe is to be provided between tanks, or as a manifold where there are more than 2 tanks. Balance pipe work shall have an isolation valve no further than 1 m from each tank circumference.
Pipe routes	Within the reservoir facility the designer must ensure the configuration of inlet, outlet, overflow and drainage pipe work minimises the number of pipe crossings and the need for multiple vertical separations. Where possible the inlet and/or outlet pipes shall run in the verge adjacent to the access road.
Service duct routes	The Designer shall run ducts for control cables alongside the inlet and/or outlet mains where practical. Control cable ducts may be in the same trench as the pipelines provided code of practice separation is maintained.
Sample points	Sample points shall be provided on the outlet pipework as per the QLDC Standard detail B2-10, refer to Code of Practice, Section 6.
Freezing protection	Appropriate freezing protection to above ground pipelines is required. This is to be assessed on an individual basis. This may apply to smaller pressure 'signal' and water sampling pipework.
Pipe restraints	All fixings shall be by bolts, cast in fixings or chemical bolts. Corrosion and bi metal effects must be considered and mitigated. Clamping and bolting preferred to welding.

2.6 POWER, CONTROL AND INSTRUMENTATION SYSTEM REQUIREMENTS

Element of Design	Requirement
Level sensors	Reservoir level is to be measured by dual transducers operating in a duty/standby configuration. Hydrostatic pressure transmitters installed via small bore penetrations at the tank base are preferred. The penetration shall include an isolation valve to allow for the safe removal of the level instrument while the tank is in service. Suitable mechanical protection shall be provided to protect the devices from damage. The duty level sensor shall be utilised to control the filling of the reservoir. The duty service device shall be selected by the operator and shall change automatically to the standby device in the event the duty instrument fails. Alarms shall be configured for Low, Low-Low, High, and High-High levels. In addition, an alarm shall be raised if the measured level on the two level sensors shows a difference exceeding 10%. The instrument make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Level Switches	A secondary level device is to be provided in the form of high and low float switches. Float switch positions are shown in Appendix D. Float switches to be installed close to main hatch for easy access. The instrument make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Flow Meters	An Electromagnetic flow meter is required to measure the flow leaving the reservoir site. The meter shall be mounted in a suitable lidded flow meter pit with good all-weather access and drainage. If the site includes multiple falling mains an individual flow meter shall be provided on each main. The flow meter make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Telemetry and SCADA	A Swampfox RTU shall be provided to enable communication and control through the QLDC SCADA system. Where practical, communications with the pump station filling the reservoir shall be via a hard-wired connection (copper, Ethernet, or fibre).
Electricity Requirements	Where practical all reservoir sites shall be provided with mains electricity. Where practical the electricity supply shall be brought to site underground and within the access road corridor. Where the

Element of Design	Requirement
	access road corridor is switchback or convoluted, a more direct route can be arranged. Where the provision of a mains connection is not possible or practical a solar array with suitably sized battery pack shall be provided.
Lightning Protection	Lightning protection risk assessment to AS/NZS 3000 shall be provided by the Designer.
Lighting	For sites with a mains power supply external security lighting with passive infra-red sensor shall be provided. The designer shall consider the requirements for task lighting provisions, to be agreed with QLDC on a site by site basis. All lighting shall be LED.
Security	Hatches and portholes shall be fitted with position switches to be linked to SCADA for monitoring and alarming.
Local Switchboard	A local Switchboard shall be provided and shall incorporate circuit breakers, level and flow monitoring transmitters and telemetry equipment. The board shall be constructed from stainless steel and rated for external conditions. The Designer shall confirm with QLDC their requirements for kiosks or small buildings to house the equipment.
Backup power generation	Electrically actuated burst control or EQ valves will require a sufficiently sized UPS allowing for a minimum of 2 actuations for each valve at the facility. The Designer shall discuss any requirement for a back-up generator or provision for a mobile generator with QLDC. Where a lift pump station is included at the facility to supply water to an upper pressure zone, it is likely that an on-site back-up generator will be required.

2.7 CIVIL AND SITE REQUIREMENTS

Element of Design	Requirement
Site signage	The site shall include the following signage: • Access gate sign showing name of site, QLDC contact details etc.

Element of Design	Requirement
	• H&S signs (chlorination related, no smoking, confined space, electricity, speed limit, hearing protection, visitor instructions, etc) refer to AS/NZS 1319. • Security Notices. • Face plate on each tank giving tank manufacturer, reservoir name, volume TWL and BWL.
Calamity basin	The designer must consider the consequences of a catastrophic failure of one of the tanks and incorporate mitigation strategies (such as a safe overland flow path or a calamity basin) into their design. A calamity basin shall comprise a bund surrounding the tanks with a volume capable of retaining the volume of one full tank. The bund shall be at least 4 m from the tank base and shall have a cross section with 1 in 3 slopes and a 1 m wide crest. The bund will be continuous apart from where the reservoir facility vehicle access track crosses the bund. The track forms an overflow weir and determines the TWL of the calamity basin. For clarity the volume of calamity basin is calculated by multiplying the area of the basin, less the footprint of intact tanks by the depth of water in calamity basin. Where the access track crosses the bund it shall have 1 in 5 ramps with suitable vertical curves to allow vehicles to transit over the crest. The calamity basin is to have a SW drainage system connected to a suitable watercourse or stormwater system. In the event of an overflow or tank rupture the discharge from the calamity basin will be intentionally and specifically limited to the capacity of the basin's SW drainage system and receiving environment. Should an overflow continue without intervention, or more than one tank rupture, then an overflow from the calamity basin may occur over the access track and be conveyed in a controlled manner as overland flow. It is unacceptable to have no designated overland flow path from the reservoir facility in the event of an overflow or tank rupture. Calamity basin reservoir depths to overflow exceeding 0.50 m, and facilities with lift pump stations and other electrical equipment within the basin, will require specific approval. Electrical switchgear shall be kept above the calamity basin TWL. Calamity basin reservoir depths to overflow exceeding 1.3 m are not acceptable.
Stormwater drainage	Reservoir site stormwater drainage shall be configured to prevent any standing water accumulating in a 10 year ARI storm event. The designer shall not create a large catchment for the calamity basin. Storm events in excess of a 10 year ARI may cause standing water within the calamity basin, but the designer must ensure that any

Element of Design	Requirement
	standing water up to a 250 ARI event will drain away in less than 8 hours. The designer shall also ensure that the maximum design volume of water in the calamity basin will drain completely within 12 hours. The stormwater discharge system shall connect to an appropriate receiving environment. Design of the facility platform (the invert of the calamity basin) should avoid excessive change in platform level, i.e. +/-250 mm maximum.
Access road	The access road shall provide for the following: • All roading shall be in accordance with the QLDC District Plan Decisions Document April 2021, Section 29. • The access road shall be compliant with the QLDC Code of Practice Section 3. The access road shall be minimum 4m wide and shall have a pavement design suitable for construction and maintenance traffic. • Maximum gradient shall be as follows: o Maximum extended grade 14% for straight lengths, hardfill surfacing as a minimum. o Maximum localised grade 16% (20m max extension) for straight lengths, concrete surfacing as a minimum. o Maximum grade for tight corners (>90 degrees) 12.5%, hardfill surfacing as a minimum. • Curve radii shall be sufficient to allow for construction and operational traffic. Refer to curve/turning circle figures in the above referenced document. A turning circle should always be achievable with a 4m wide annulus provided around each tank, unless the tanks are very small diameter. Utes should be able to turn around tanks larger than 6.0m diameter and 8.8m medium rigid vehicles should be able to turn around reservoirs larger than 12.0m diameter. At QLDC's discretion smaller reservoir facilities may not need a contiguous annulus around each tank, and a hammerhead design maybe acceptable, at QLDC's discretion. • The access road must have a safe flat section for vehicles to park while the driver unlocks the gates to the facility. This is to mitigate the risk of 'roll-back' events. The flat section should comfortably accommodate a Ute and allow for swinging of the gates. Flat sections for parking less than 8m long and/or with a gradient in any direction greater than 1v:33h (3%) will need specific approval.

Element of Design	Requirement
	• Road design shall provide for access in bad weather and shall have stormwater system designed to contain a 1 in 10-year event. • The access road shall be provided with signage. • A minimum 4 m wide unsealed annulus around each tank is required for access by ute, 8.8m medium rigid vehicle, or elevated work platforms (EWPs).
Access hatches	Permanent personnel access facilities to the roof are required. At a minimum the access facilities will comprise a platform beside the tank with a handrail at the tank gutter height. The platform is intended for accessing the roof top inspection hatch/s and is not intended for access on to the roof itself. Depending on the height of the tank wall above ground level (AGL) a lower intermediate platform may be required. Any fixed ladders shall not extend below 3.6 m AGL, or will require an infallible mechanism to prevent use by unapproved persons. Removable ladders shall extend no more than 6 m AGL and will require a proprietary ladder attachment system to ensure safe use. One access hatch on the roof is required to allow for monitoring, instrumentation, and drone access. This hatch shall have a clear opening of 600x600 mm. Two diametrically opposite access ces (porthole type), minimum 1000 mm clear diameter in the tank shell, just above floor level are required for internal tank inspections when the tank is empty. Portholes shall be hinged so they swing open and do not need to be lifted. Portholes shall be fully sealed, leak free and lockable.
Security, fencing and gates	The reservoir platform shall be surrounded by a security fence with chain link mesh a minimum of 2.2 m high with single barbed wire top line and additional rabbit proof fencing buried to 300 mm. Fences should be a minimum of 8 m horizontally from tanks to allow the operation of plant. Fences can be placed on slopes with a gradient in any direction not exceeding 1v:2h. The designer shall avoid having fences on top of berms or in other visually dominant areas. Compound access gates shall be double leaf with a minimum 4 m wide opening and a single barbed wire top line. Gates shall be the same height as the security fence and shall be provided with standard QLDC padlocks.

Element of Design	Requirement
Cut and fill batters	Cut batter slopes not exceeding 1v:2h are acceptable, however still need to be covered by the geotechnical advice for the site. The design shall contemplate the long-term erosion protection and general stability of the slope. 3 Waters maintenance contractors require landscaping to be low maintenance and should avoid lawns, or other plants needing seasonal maintenance. The maximum gradient for grass planting requiring mowing is 1v:3h. Slopes with a gradient in excess of 1v:3h require mass planting with shrubs/tussocks or a mechanical means to avoid erosion. Cut batter slopes with a gradient in excess of 1v:2h require a specific geotechnical assessment. Slopes with a gradient in excess of 1v:1h require alternate means to stabilise and/or promote fibrous plant stabilisation and also required specific approval. Cut-off drains above cut batter slopes may be required to mitigate the risk of erosion. Any cut slope requiring mechanical stabilisation will require specific approval. Any cut batter slope that offers a risk of falls to itinerate users of the land (approved access or otherwise) is unacceptable. Any cut batter slope that does not contemplate long term maintenance and erosion control is unacceptable. Fill batter slopes not exceeding 1v:2h are generally acceptable, however need to be covered by the geotechnical advice for the site. The design shall contemplate the long term erosion protection and general stability of the slope. Fill batter slopes with a gradient in excess of 1v:2h require a specific geotechnical assessment. Any fill area requiring mechanical stabilisation will require specific approval. Any fill batter slope that offers a risk of falls to itinerate users of the land (approved access or otherwise) is unacceptable. Any fill batter slope that does not contemplate long term maintenance and erosion control is unacceptable.
Rockfall protection	A formal assessment of the site is required by the designer in order to confirm the necessity, or otherwise, for rock fall or other

Element of Design	Requirement
	protection. If required, an appropriately qualified designer shall design the system.
Vehicle and foundation loading on pipes	All external below ground pipework shall be designed for at least HN loading. The Designer shall consider structural loading to AS/NZS 2566 where required but especially at road crossings and under any foundations.
Bollard protection	Valve groups and other non trafficable chambers shall be protected from traffic by bollards.
Landscape Design	A specific landscape design is required. Trees which may threaten the infrastructure are not to be included. Trees and planting shall be native species suitable for local conditions. Trees shall be planted on the outside faces of the calamity basin and not within the security fencing of the facility. The 3 Waters maintenance contractor will not accept maintenance of plantings. There may be situations where plantings within the security fencing of the facility are appropriate, this will need to be agreed with QLDC.

3.0. DESIGN DOCUMENTATION

3.1 PRELIMINARY PROJECT REQUIREMENTS AND CONSTRAINTS MEMO

The consultant shall prepare a preliminary Project Requirements and Constraints memo. The purpose of the memo is to specifically, clearly, and succinctly record the project requirements and constraints that the design will be prepared to address. Designer shall liaise with QLDC to confirm and specifically record the aspects below in a formal memo addressed to the QLDC project manager:

- Purpose of storage, e.g., potable water, raw water, or recycled water.
- Requirement for designations and designation boundary.
- Easement requirements.
- Land availability including legal boundaries.
- Any pre-existing ground/foundation information.
- Access road requirements, both for operation, maintenance and construction.
- Tank volume calculation.
- Tank operating levels.
- Location of existing rising and falling mains and connection to network.
- Water supply demand forecast.
- Relationship with, and operational requirements of, associated water treatment facilities.
- Details of consents and designations obtained and requirements for any new consents.
- Site specific planting and landscaping requirements.
- Specific requirements for electricity supply and back up generation.
- Any special security requirements.
- Any special hygiene, office, or other accommodation requirements.

3.2 CONCEPT DESIGN REPORT

To record how the design approach to address the project requirements and constraints recorded in the Preliminary Project Requirements Memo the designer shall develop a Concept Design Report.

The specifics of the design and the method of achieving the project requirements are to be recorded in this document. The purpose of the document is to agree the form of the solution prior to proceeding with detailed design and finalisation of the drawings and specification. As a minimum the document is to clearly identify the following items

- Site layout including topographic data, land boundaries, existing services and other land issues
- Consent constraints that may occur including stormwater discharge, resource consents etc
- Pipe layout including connection to the network and pipe layout within the site

- Tank layout and tank geometry and provision for future tanks
- Preliminary landscape layout
- Stormwater control within the site and stormwater from adjacent sites
- Requirement for retaining structures and earthworks
- Geotechnical information and geotechnical interpretation supporting the layout developed
- Site access layout
- Design requirements as listed in section 2 of this document

3.3 DETAILED DESIGN REPORT

To accompany the completed design documents (specification, drawings and other documents) the Designer shall prepare a Detailed Design Report. The purpose of the Detailed Design Report is to record the design inputs and solutions and the decisions and assumptions made. The Detailed Design Report is intended as the mechanism to record for future reference the design assumptions and design decisions and the intended operation of the facility. It is intended that the Detailed Design Report elaborate and expand on the items in the Concept Design Report and also record subsequent changes in assumptions or scope.

3.4 COMMISSIONING AND TESTING PLAN

The Designer shall prepare a Commissioning Plan for QLDC approval detailing how the filling, testing, cleaning and disinfection and commissioning of the tanks will be carried out.

The commissioning plan shall include for testing of alarms and super-chlorination as part of the commissioning.

Minimum requirements shall include.

- Stabilisation period and level monitoring requirements
- Leak testing of the roof shall be carried out in accordance with Section 13.9 in AWWA D103. This testing shall be carried out in the presence of QLDC staff or nominee.
- Test procedure to test the tank overflow operation
- Test procedure for scour operation
- Cleaning and disinfection requirements. Disinfection shall be to the Water New Zealand Good Practice Guide ‘Hygiene Practices to Prevent Water Supply Contamination, December 2019,’ The adopted disinfection method is to be discussed and agreed with QLDC operations staff.
- Bacteriological testing. Samples shall be taken and tested in line with the Water New Zealand Good Practice Guide and the Drinking-water Standards for New Zealand 2005 (Revised 2018) to demonstrate a successful disinfection procedure.
- Transducer testing. The pressure transducer and associated float switches shall be configured to stop the rising main pumps to prevent overflows. Switch levels and alarms

shall be provided as shown in Figure SK4 (Appendix D). Switch and alarm signals shall be tested as part of the commissioning plan.

- Holiday conductivity testing of all panels shall be completed in accordance with AWWA D103-19.

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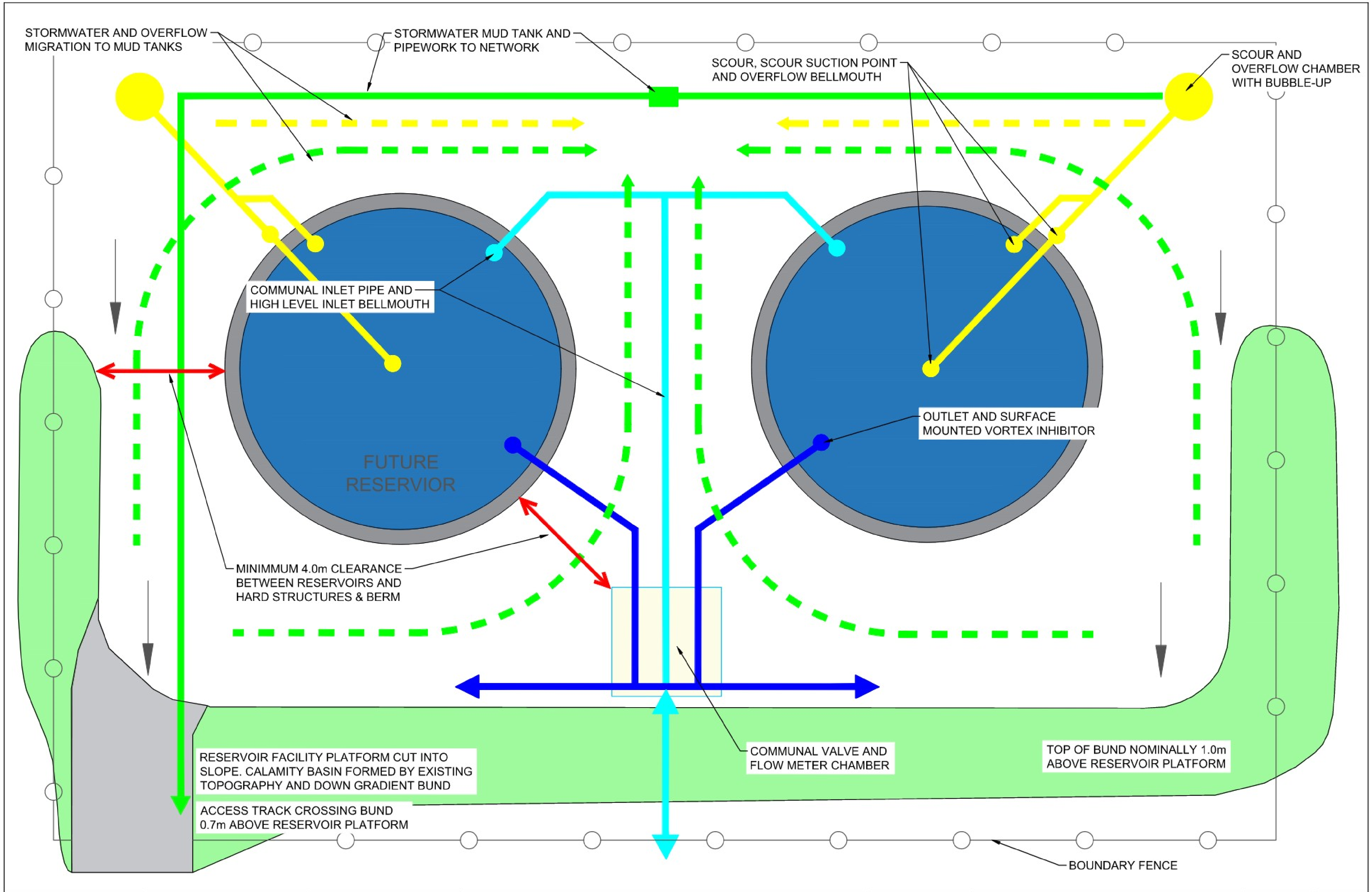
APPENDIX A TYPICAL SITE LAYOUT AND PIPEWORK DRAWINGS



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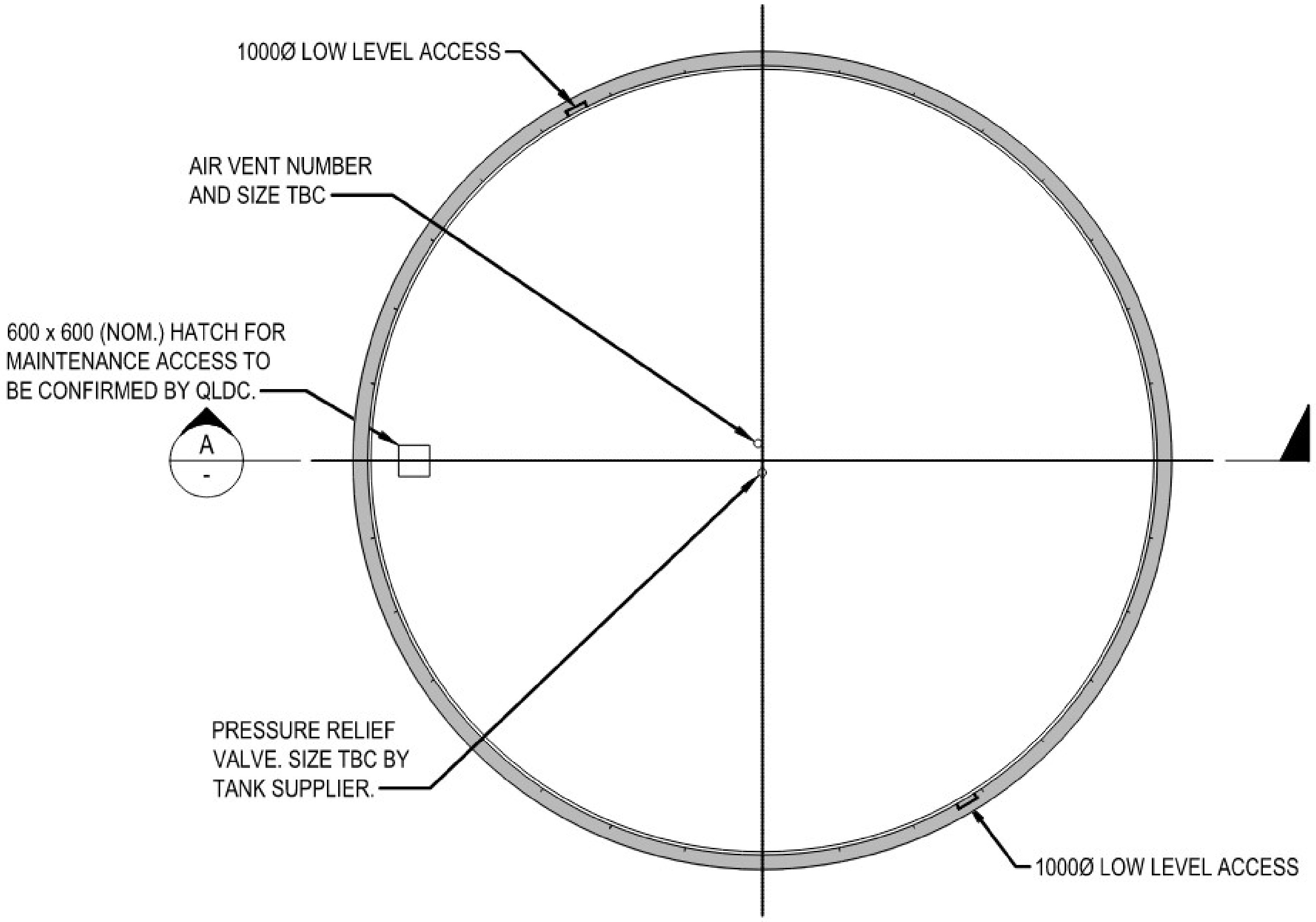
QUEENSTOWN LAKES DISTRICT COUNCIL

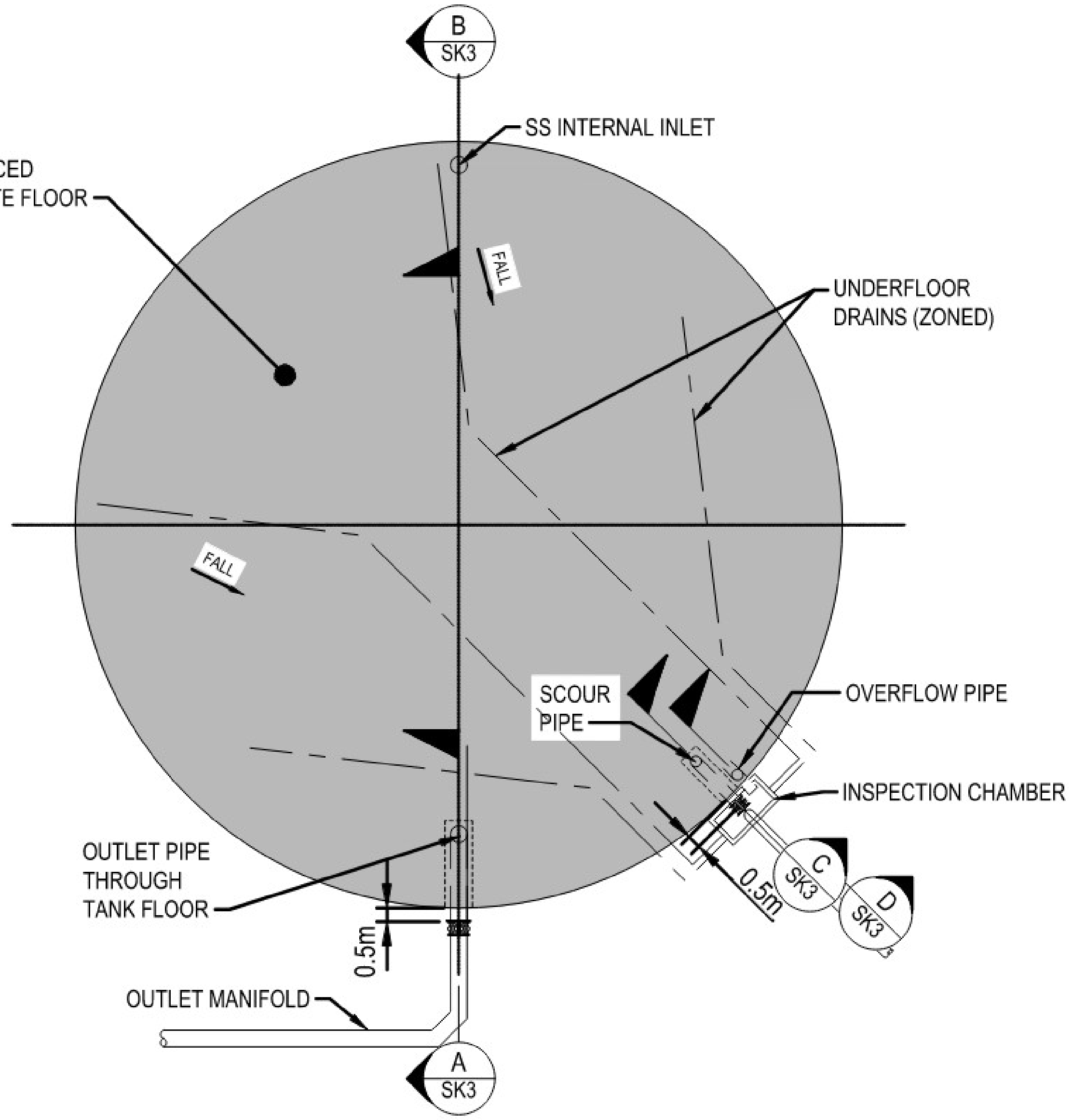
QLDC Wanaka Water Trunk Main
Engineering Design
Typical Reservoir Facility

DESIGN	JS				2-0343.01	FOR APPROVAL
DRAWN	BS				DWG No.	
APRVD	JS					
PROJECT #: 2-0343		A	Initial design	21/01/2022	N.T.S	A
		REV	DETAILS	DATE	SCALE	REVISION



RESERVOIR ROOF PLAN

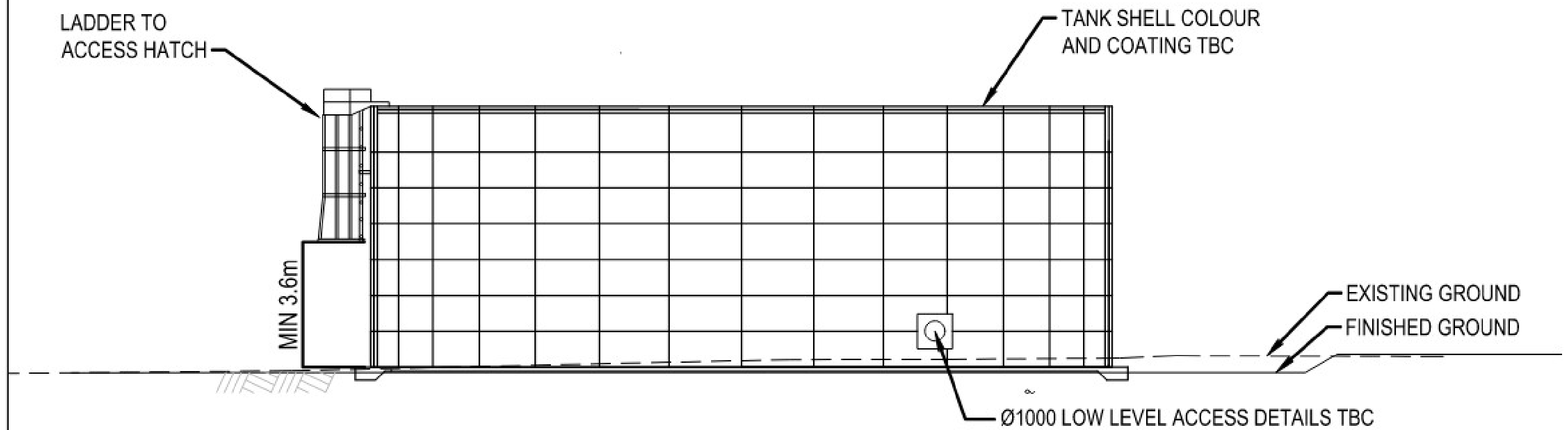
(TYPICAL)



RESERVOIR FLOOR PLAN

(TYPICAL)

REFER SK3 FOR PIPEWORK DETAILS.



ELEVATION

A
-

SCALE 1 : 250

INDICATIVE ONLY - REFER TO PRINCIPALS REQUIREMENTS

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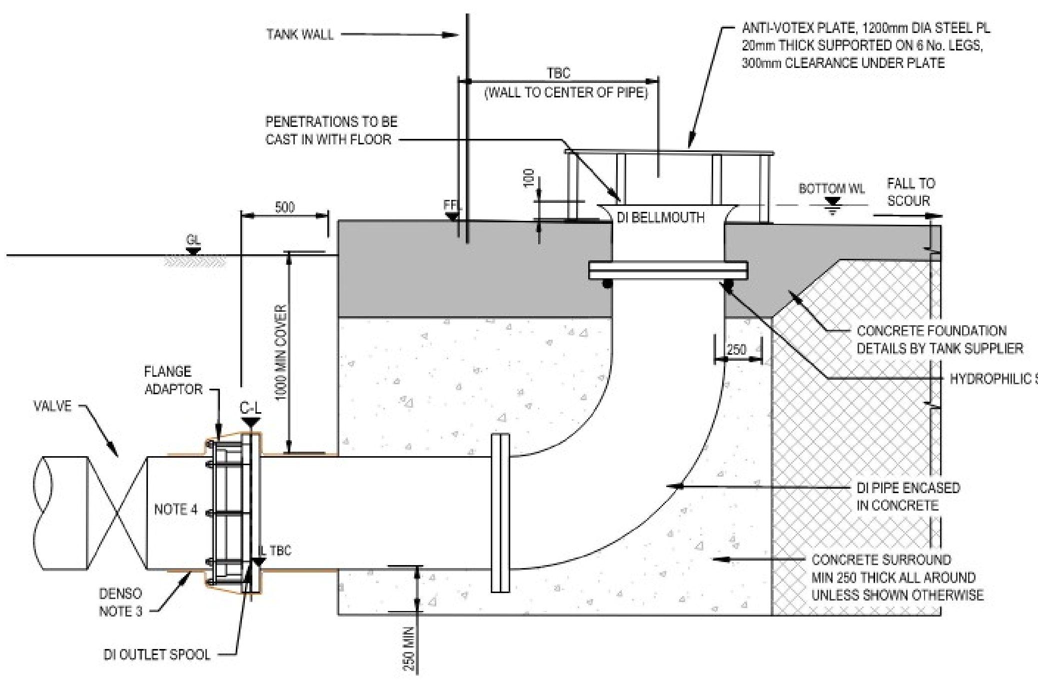
QUEENSTOWN LAKES DISTRICT COUNCIL

QLDC Wanaka Water Trunk Main
Engineering Design
Reservoir (Typical) Plan and Elevation

DESIGN	JS				2-0343.01	FOR APPROVAL
DRAWN	BS				DWG No.	
APRVD	JS					
PROJECT #: 2-0343		A	Initial design	23/08/2021	N.T.S	A
		REV	DETAILS	DATE	SCALE	REVISION

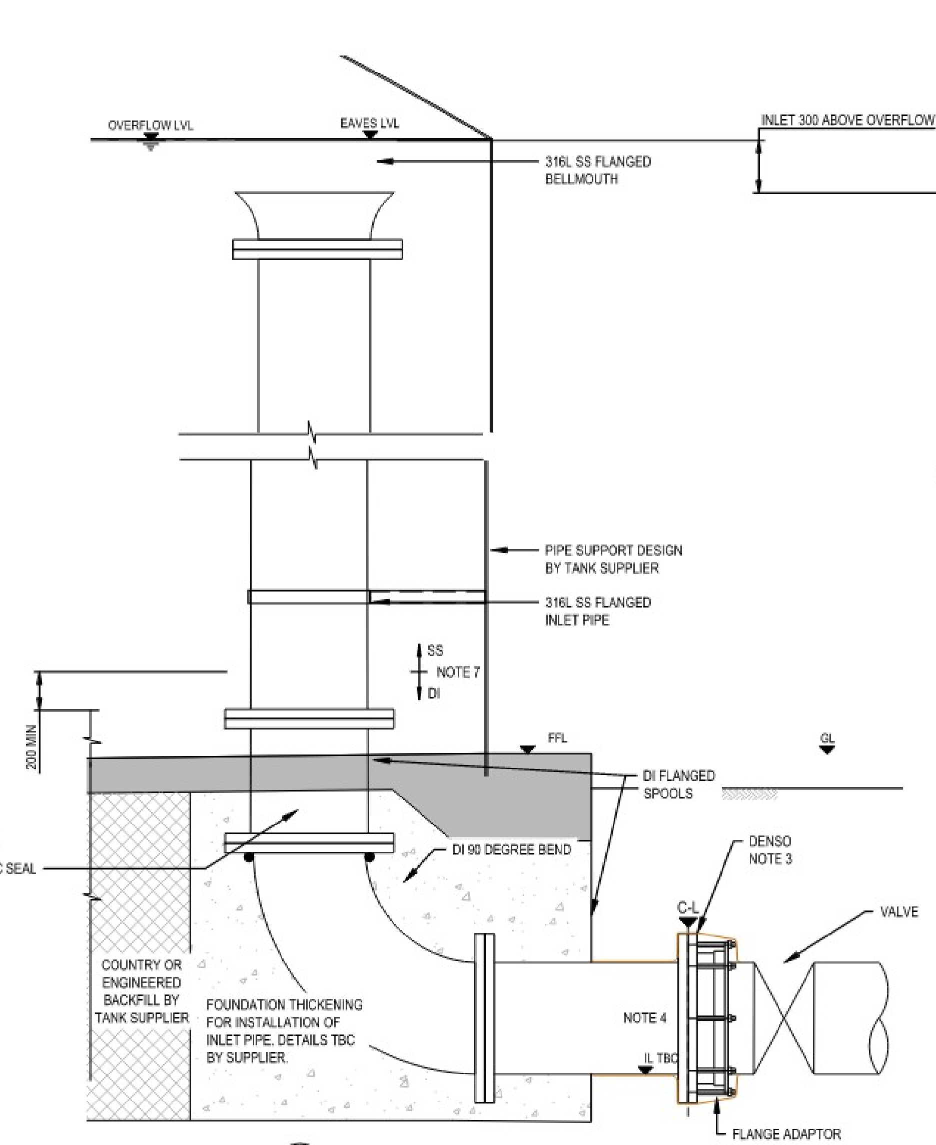
RESERVOIR CONNECTION NOTES

1. REFER TO QLDC DOCUMENT 'RESERVOIR PRINCIPALS REQUIREMENTS'.
2. ALL STAINLESS STEEL PIPE TO BE 316L STAINLESS
3. ALL MILD STEEL AND DUCTILE IRON BOLTED CONNECTIONS ARE TO BE WRAPPED USING FULL DENSO SYSTEM PRIMER, MASTIC FILL, PETROLEUM TAPE AND MPHD OUTER WRAP WHEN NOT CAST INTO CONCRETE.
4. PIPES TO BE CONNECTED TO A ROCKER PIPES TO TAKE ANGULAR DISPLACEMENTS OF AT LEAST 5 DEGREES.
5. BLANK FLANGES TO BE PROVIDED AT CONTRACTUAL LIMITS.
6. C-L = CONTRACTUAL LIMITS (TO BE CONFIRMED)
7. DESIGNER TO APPLY GALVANIC ACTION PREVENTION AT DISSIMILAR METAL INTERFACE.
8. INLET INVERT TO BE MINIMUM 100mm ABOVE TOP WATER LEVEL.
9. SIMPLE BELLMOUTH OR OVERFLOW SHOWN. DESIGNER TO CONSIDER WEIR TYPE OVERFLOW TO MINIMISE TANK HEIGHT.
10. DESIGNER TO CONSIDER REQUIREMENTS FOR THRUST BLOCKS.

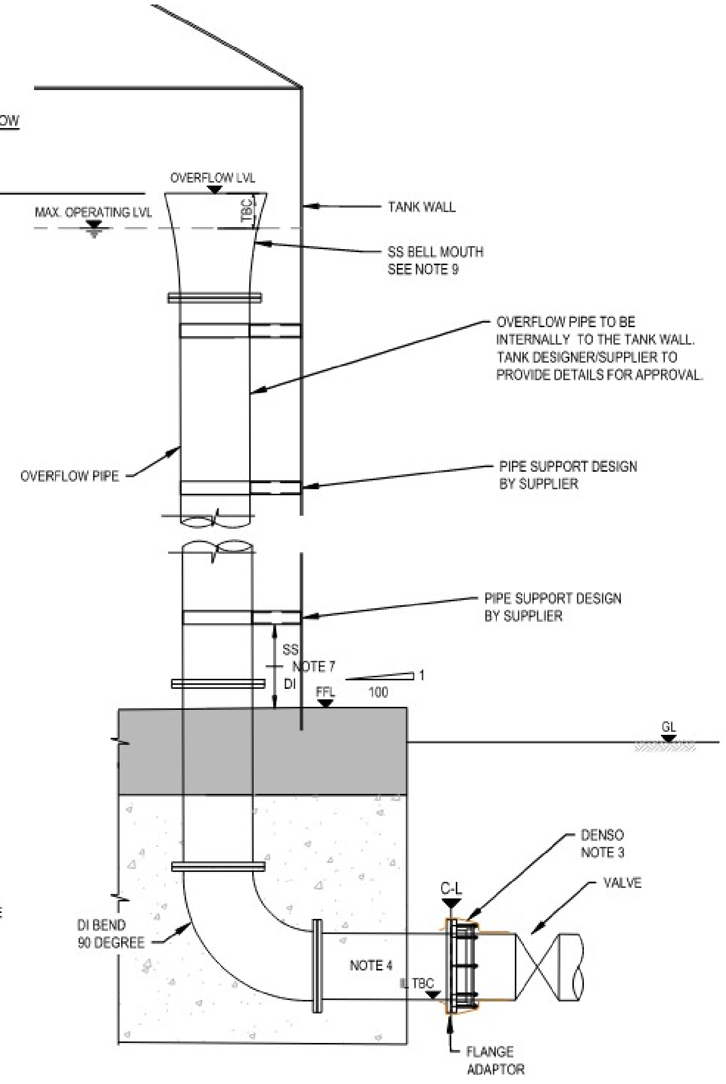


TYPICAL RESERVOIR OUTLET CONNECTION

SECTION A SK2
NOT TO SCALE

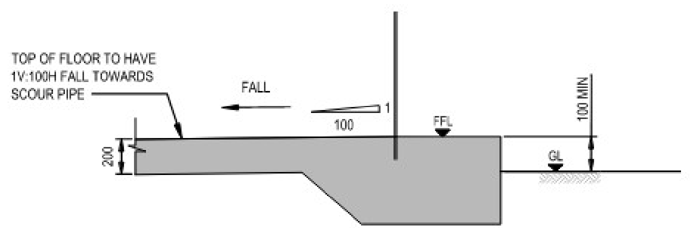


SECTION B SK2 RESERVOIR INLET CONNECTION
NOT TO SCALE

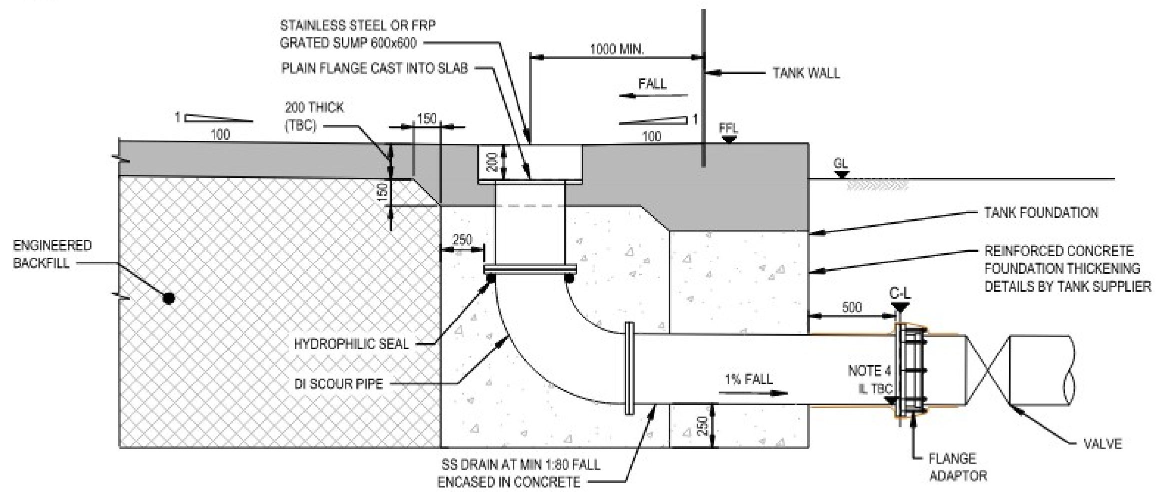


RESERVOIR DRAINAGE AND OVERFLOW (NOTE 4)

SECTION D SK2
NOT TO SCALE



TYPICAL FOUNDATION DETAIL
SCALE 1 : 20



SECTION C SK2 TYPICAL SCOUR PIPE OUTLET
NOT TO SCALE

NOTE:- ORIGINAL SIZE A1

Pinnacles Civil
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QLDC Wanaka Water Trunk Main
Engineering Design
Reservoir Pipework Detials

DESIGN	JS				2-0343.01	FOR APPROVAL
DRAWN	BS				DWG No.	
APRVD	JS				1:200 A3	A
PROJECT #: 2-0343		A	Initial design	23/08/2021		
		REV	DETAILS	DATE	SCALE	REVISION

QUEENSTOWN LAKES DISTRICT COUNCIL

APPENDIX B QLDC PREFERRED INSTRUMENTATION

Preferred instrumentation for the reservoir facility is as noted below:

Pressure Transducer	Endress and Hauser FMX21
Float Switch	Flygt ENM-10

APPENDIX C SEISMIC DESIGN MEMORANDUM

Memorandum

22 May 2019

To	QLDC		
Copy to			
From	Amy Williams	Tel	04 495 5833
Subject	Seismic Return Period Requirements - Water supply reservoir	Job no.	12506856//

1 Background

The following memo outlines the design philosophies used in determining design seismic loads for new freshwater reservoirs and how these are applied to QLDC.

The RFP documentation provided by QLDC outlines that the reservoirs are designed to Importance level 4 with a 100 yr design life.

The combination of a very high importance level and longer than 50 year design life puts the design seismic loading outside of the parameters typically set by the loading standard 1170.0 .

The following outlines the factors considered in determining the return period of design seismic loads. The combined effect of these factors can require a utility to be subject to a hazard analysis. The design recommendation are then considered in the context of other utilities throughout New Zealand and in the wider context of American Lifelines guidance.

2 Design Working Life

The concepts of "Design Working Life" used in determining loading and "Specified Intended Life" used when determining durability requirements. While they have separate meanings, both of these terms are often referred to as Design Life. AS/NZS 1170 outlines the design working life, in relation to determining design loads in commentary CL C3.3 below:

"The 'design working life' is a reference time period expressed in years. It is a concept used to select the probability of exceedance of different actions. This does not mean that when the design working life is reached the structure will fail; nor does it mean that the design working life has to correspond exactly with the intended useful life the designer has in mind or with the durability of the construction materials."

3 Importance Level

The importance level of a structure is related to the risk that its's loss of service poses to the community.

If the reservoir is the sole source serving an importance level 4 facility, such as fire services or emergency surgeries, the reservoir must also be treated as IL4.

GHD Limited
Level 2 Grant Thornton House 215 Lambton Quay Wellington 6011 PO Box 1746 Wellington 6140 New Zealand
T 64 4 495 5800 **F** 64 4 472 0833 **E** wgtnmail@ghd.com **W** www.ghd.com

Outside of this requirement, reservoirs typically fall between Importance level 3 (IL3) and importance level 4 (IL4). The distinction between the two levels can be effected by the levels of redundancy in the supply network or its requirement to provide service to post disaster services.

On this basis, the selection of IL4 as a design basis allows emergency services to rely on these facilities for post emergency functions.

4 Seismic Design Return Period

The importance level and design working life affect the magnitude of the seismic loading to be applied in the design (through the selection of Design Return Period).

Reprinted below is Table 4.1 from the NZS 1170. This table gives guidance on the appropriate return period to select based on the various design parameters, i.e. IL, design working life, and probability of exceedance.

QLDC has specified that all reservoirs be to be considered IL4 structures – appropriate for structures required for Post-Disaster functions. This requirement is set out in their RFP documents.

The importance level informs both the ultimate limit state (ULS) return period and the serviceability limit state (SLS) return period. For a standard 50 year design working life structure (Building Code), the required return periods for an IL4 structure will be 1/2500 and 1/500 respectively. However, because QLDC require the design life to be extended to 100 years, there is a need to review both the SLS and the ULS return periods.

Figure 1: Extract from AS/NZS1170

TABLE 3.3

ANNUAL PROBABILITY OF EXCEEDANCE

Design working life	Importance level	Annual probability of exceedance for ultimate limit states			Annual probability of exceedance for serviceability limit states	
		Wind	Snow	Earthquake	SLS1	SLS2 Importance level 4 only
Construction equipment, e.g., props, scaffolding, braces and similar	2	1/100	1/50	1/100	1/25	
Less than 6 months	1	1/25	1/25	1/25	—	
	2	1/100	1/50	1/100	1/25	
	3	1/250	1/100	1/250	1/25	
	4	1/1000	1/250	1/1000	1/25	
5 years	1	1/25	1/25	1/25	—	—
	2	1/250	1/50	1/250	1/25	—
	3	1/500	1/100	1/500	1/25	—
	4	1/1000	1/250	1/1000	1/25	1/250
25 years	1	1/50	1/25	1/50	—	—
	2	1/250	1/50	1/250	1/25	—
	3	1/500	1/100	1/500	1/25	—
	4	1/1000	1/250	1/1000	1/25	1/250
50 years	1	1/100	1/50	1/100	—	—
	2	1/500	1/150	1/500	1/25	—
	3	1/1000	1/250	1/1000	1/25	—
	4	1/2500	1/500	1/2500	1/25	1/500
100 years or more	1	1/250	1/150	1/250	—	—
	2	1/1000	1/250	1/1000	1/25	—
	3	1/2500	1/500	1/2500	1/25	—
	4	*	*	*	1/25	*

* For importance level 4 structures with a design working life of 100 years or more, the design events are determined by a hazard analysis but need to have probabilities less than or equal to those for importance level 3.

Design events for importance level 5 structures should be determined on a case by case basis.

QLDC'c requirement for water reservoirs (IL4 structures) is that at ULS the structure is to be designed for a 1/2500 year return period earthquake and that at SLS2 the structure is to be designed for a 1/500 year event. This requirement is appropriate for structures that must function following a major event where they must provide the necessities of life. The loading code requires hazard analysis for such structures, when the design working life is extended beyond 50 years, but notes that loadings must not be less than for IL3 structures with a 100 year design life.

5 Hazard Analysis

A hazard analysis is required for the combination of IL4 and 100 year Design working life in order to determine the seismic loading. This type of analysis is highly specialised and typically only delivered by GNS. Preliminary discussions with GNS indicate that these studies can take month with a cost of 50-70K per site. Current indications are that they do not have the capacity to commence any new studies until August 2019.

6 Context of return periods

GHD have looked at the design decisions in the context of the decisions made in the design of similar facilities

6.1 New Zealand Context – return periods

We have found the combination of IL4 and 50 Year Design Working life to be adopted in the following situations:

Wellington Water Limited – New Reservoir Design

Wairoa District Council – Wairoa Reservoir

WaterCare Auckland – design of new Hunua pipe lines & supply reservoirs

QLDC – Glenorchy Reservoir

6.2 International Context – return periods

Further to this, the 1/2500 return period for ultimate limit state design is in line with the American Life lines guidance documents.

7 Required Clarification

We propose to design the reservoirs to seismic loads based on the following criteria:

Table 1: Seismic Loading Cases for IL4 Structures

Load Case	Performance Requirement	Annual Exceedance Probability (AEP)
Serviceability Limit State 2 (SLS2)	No loss of service (operational continuity). Repairable damage. Interpreted: No loss of water-tightness / tolerable water ingress permitted.	1/1000
Ultimate Limit State (ULS)	No loss of life, no collapse. Damage may be uneconomic to repair. May lose water-tightness.	1/2500
Maximum Considered Earthquake (MCE)	No collapse. Damage likely to be uneconomic to repair.	N/A

The return periods above are based on and IL4 structure with a 50 year Design Working Life. As outlined previously, this approach is in line with the return periods used in other parts of New Zealand and also agrees with the American Life lines guidance documents.

The alternative, is to instigate a 100 year Design Working Life, and commission site specific seismic hazard study. This will have significant impacts on both the programme and budget of this project.

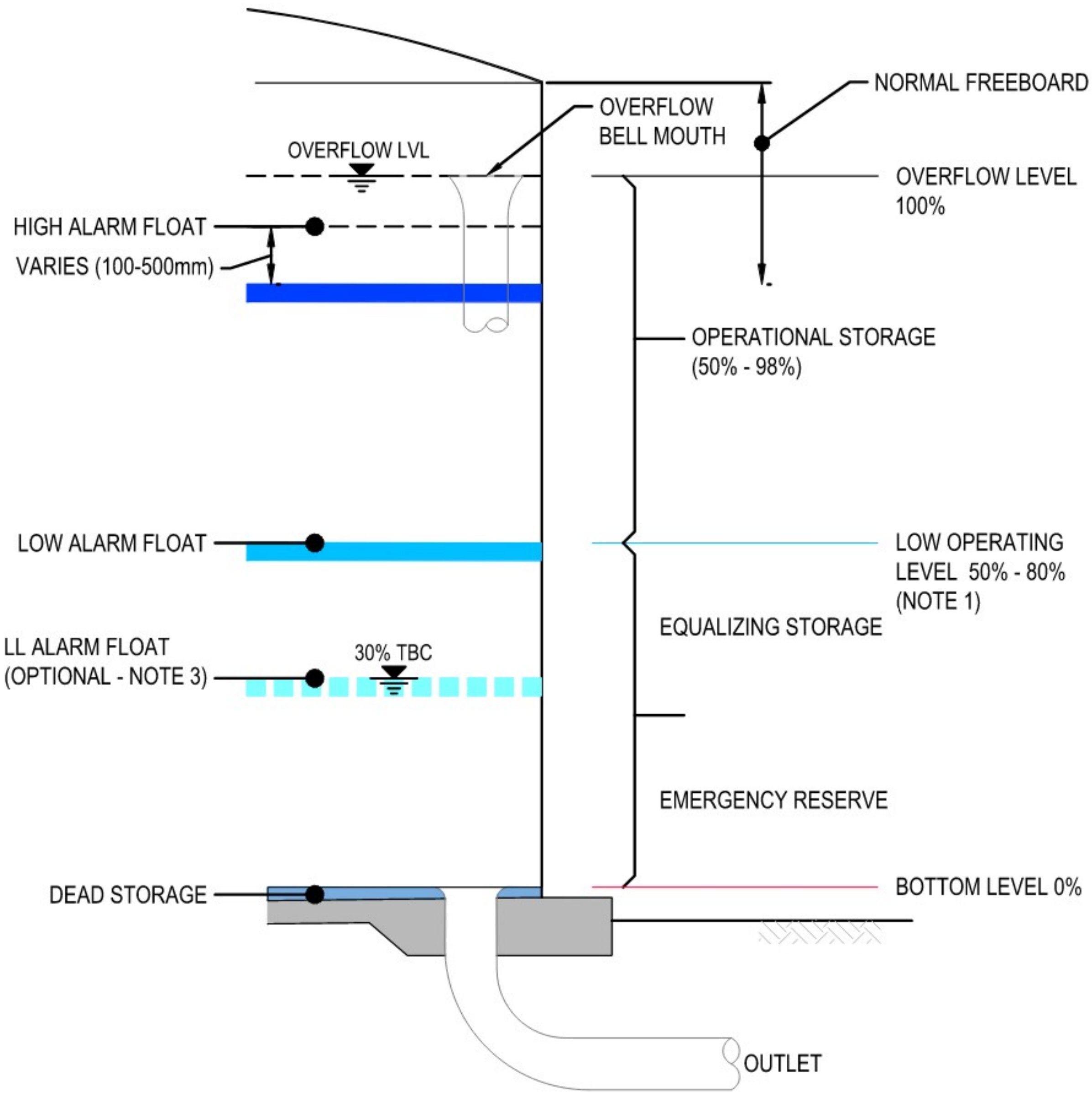
Please advise if QLDC agree with the recommendation to adopt the return periods in Table 1.

Regards

Amy Williams
Structural Team Leader

QUEENSTOWN LAKES DISTRICT COUNCIL

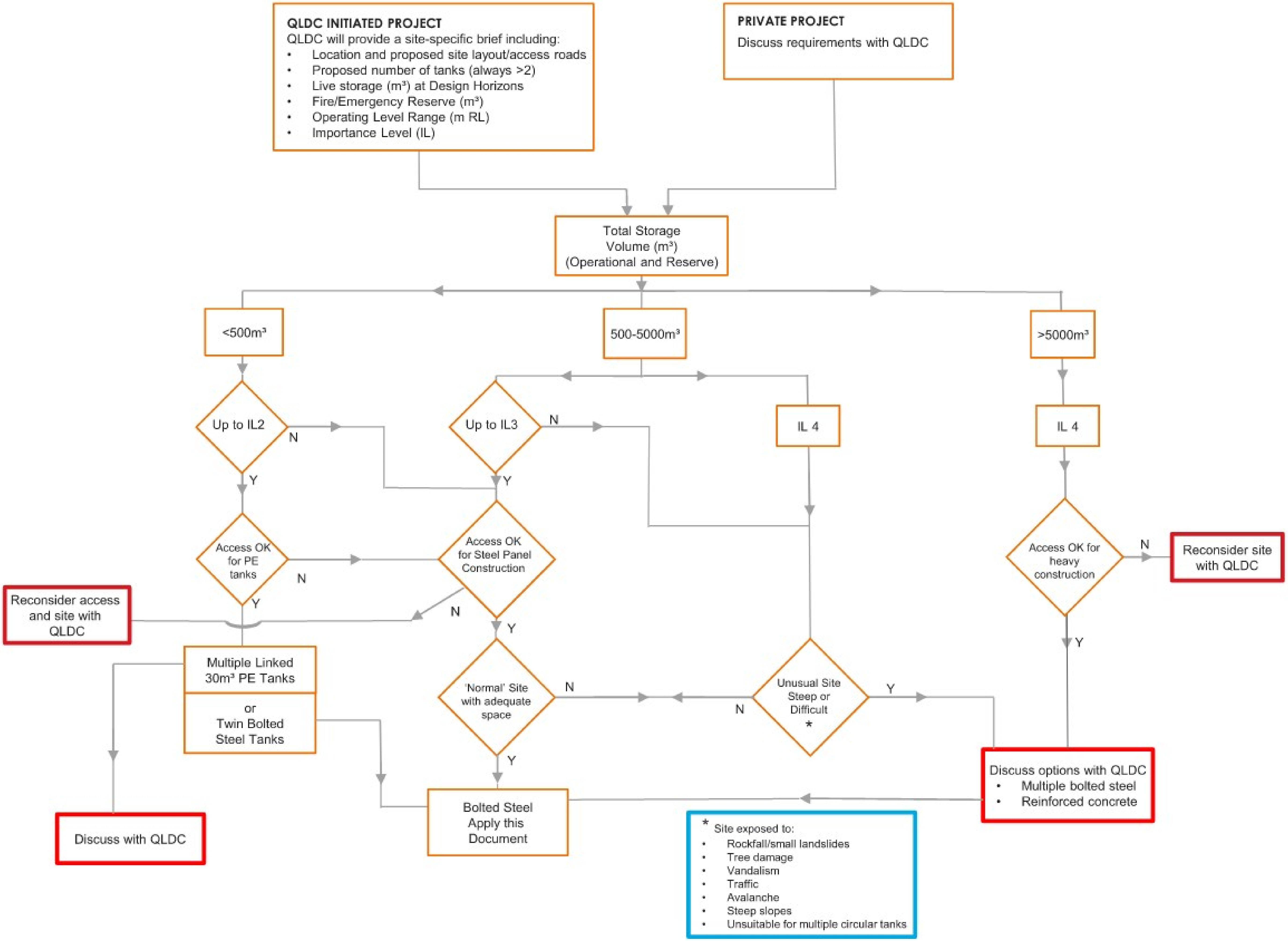
APPENDIX D RESERVOIR LEVELS



NOTES

1. LOW OPERATING LEVEL IN A RANGE FROM 50% TO 80% DEPENDING ON LOCATION / OTHER TANKS / REMOTENESS / SEASON.
2. SCADA ANALOGUE FROM HYDROSTATIC-PRESSURE LEVEL TRANSDUCER. TO BE MOUNTED WITH GUIDE/ OR STILLING WELL.
3. LL ALARM DESIRABLE - POSITION DEPENDS ON SAME CRITERIA AS NOTE 1 ABOVE.
4. OPERATING LEVELS CAN CHANGE SEASONALLY.

APPENDIX E TANK FLOW CHART


QLDC INITIATED PROJECT
QLDC will provide a site-specific brief including:
• Location and proposed site layout/access roads
• Proposed number of tanks (always >2)
• Live storage (m³) at Design Horizons
• Fire/Emergency Reserve (m³)
• Operating Level Range (m RL)
• Importance Level (IL)
PRIVATE PROJECT
Discuss requirements with QLDC
Total Storage Volume (m³) (Operational and Reserve)
<500m³
500-5000m³
>5000m³
Up to IL2
Up to IL3
IL 4
IL 4
N
Y
Access OK for PE tanks
Access OK for Steel Panel Construction
Access OK for heavy construction
Reconsider site with QLDC
Reconsider access and site with QLDC
Multiple Linked 30m³ PE Tanks
or
Twin Bolted Steel Tanks
'Normal' Site with adequate space
Unusual Site Steep or Difficult *
Discuss options with QLDC
• Multiple bolted steel
• Reinforced concrete
Discuss with QLDC
Bolted Steel Apply this Document
* Site exposed to:
• Rockfall/small landslides
• Tree damage
• Vandalism
• Traffic
• Avalanche
• Steep slopes
• Unsuitable for multiple circular tanks

Water Supply Trunkmains

Queenstown Lakes District Council Land Development and Subdivision Code of Practice Addendum

Date: February 2022

QUEENSTOWN LAKES DISTRICT COUNCIL

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

INTRODUCTION

1.1. SCOPE

This document forms an addendum to the Queenstown Lakes District Council's (QLDC) Land Development and Subdivision Code of Practice (CoP) to cover specific requirements relating to the design and construction of bulk supply mains for potable water. These are referred to as trunkmains or falling mains throughout this document. The distinction between a trunkmain and a falling main is:

- **Falling Main** – Pipeline from the reservoir feeding into the **trunkmain.** The falling main may be above or below level of service pressure (300 kPa – 900 kPa) and shall have no offtakes.
- **Trunkmain** – Pipeline that is within the level of service window (300 kPa- 900 kPa) and may have offtakes for water supply. May be supplied via a **falling main**.

This addendum is not intended as a standalone document and must be used in conjunction with the QLDC CoP and standard design/project management practices. Unless otherwise specifically noted within this document all trunkmain designs must comply with the requirements outlined in the most up to date version of the QLDC CoP. Water supply requirements are outlined in Section 6 of the CoP.

For ease of reference the headings in this document have been amended to reflect the corresponding sections of the QLDC CoP.

Where smaller infrastructure is directly associated with a transmission system it must be completed to the transmission standards of the larger infrastructure that is connected to, e.g. the smaller sizes of a trunkmain system such as bypasses around line valves or the supply to a bulk supply point.

This addendum includes considerations for:

- Criticality and resilience
- Hydraulic design
- Location, layout and clearances of pipelines and associated infrastructure
- Pipe structural design

This addendum excludes specific requirements for:

- Pump stations
- Treatment plants and processes
- Structural design of associated structures such as bridges or buildings that are covered by the New Zealand Building Act
- Electrical and control/automation design
- Reservoir facilities – these are covered in a separate addendum

1.2 REFERENCED STANDARDS

This addendum must be read in conjunction with the Queenstown Lakes District Council's *'Land Development and Subdivision Code of Practice',* national, and international standards listed below. Where conflict or ambiguity exists this addendum shall take precedence. Where this is conflict between referenced standards, the higher level of standard shall take precedence.

1.2.1 NATIONAL AND INTERNATIONAL STANDARDS

NZS 1170 Structural design actions
Part 5 Earthquake actions – New Zealand
Part 5 Supp 1 Earthquake actions – New Zealand – Commentary

AS/NZS 4219 Seismic performance of engineering systems in buildings

AZ/NZS 2566 Buried flexible pipelines
Part 1 Structural design
Part 1 Supp 1 Structural design – Commentary

1.2.2 OTHER PUBLICATIONS

Menon, E Shashi, 2015. Transmission pipeline calculations and simulations manual

American Lifelines Alliance, 2005. Seismic Guidelines for Water Pipelines

NICEE, 2007. Guidelines for Seismic Design of Buried Pipelines

Opus International Consultants, Water NZ, 2017. Underground Utilities – Seismic assessment and design guidelines

Roberts, R, New Zealand Geotechnical Society, 2017, New Zealand Ground investigation specification, Volume 0, 1, 2 and 3

Moore, I.D, 1993. Structural design of profiled polyethylene pipe

Gumbel, J.E and Wilson J, 1981. Interactive design of buried flexible pipes – a fresh approach from basic principles, V14 No.4

Mott, R L, 1994. Applied fluid dynamics, 4th Ed.

1.2.3 WATERCARE STANDARDS

DP - 10 Safety in Design guide

DP - 11 Watercare, 2017. Health and Safety in Facility Design DP-09 Electrical design standard

CG - General civil construction standard

ME - General mechanical construction standard

MS - Material supply standard 7363 - Watercare CAD manual

AI - Data and Asset Information standard

DW05 - Access structure drawings for wastewater infrastructure DW06 - Access structure drawings for water infrastructure

DW07 - Access structures general drawings for public and non-public areas

DW10 - pipelines for water greater than 250mm diameter drawing set DW11 - Valve chamber detail drawings for transmission water

DW12 - Water stand-alone sampling and rainfall metering COP-03 Code of Practice for commissioning

COP-04 Code of Practice for disinfection of water systems

1.3 EXISTING INFRASTRUCTURE

Replacing existing or installing new trunkmain infrastructure will typically involve connecting to or undertaking work on existing infrastructure. The age and operational changes to its original design may impact on the new infrastructure connecting to it. The designer shall include in their design appraisal of the following factors and information (to be provided by QLDC):

- As-built drawings
- Existing calculations
- Site testing records
- Field investigations
- Commissioning records
- Geotechnical reports
- Operation and Maintenance manuals
- Standard operating procedures

2 SCOPE

The following section contains notes for existing clauses; amendments to existing clauses; or additions to clauses of the QLDC CoP. For ease of reference, the numbering of clauses are consistent with those within the 2020 QLDC CoP. Where a clause is not listed in this addendum, the design guidance noted in the CoP shall be used.

6 WATER SUPPLY

6.2 General requirements

6.2.1 Objectives

(a) and (b) are not applicable to trunkmains.

6.2.2 Reference documents and relevant guidelines

Additional reference documents are noted in Section 1.2 of this document.

6.3 Design

6.3.4 System design

Water demand shall be specified by QLDC for all trunkmain infrastructure. The designer shall be responsible for requesting this information from Council.

6.3.5 Design criteria

6.3.5.2 Network analysis

Network analysis is required for all trunkmain infrastructure.

6.3.5.5 Minimum flows

Trunkmains shall not have maximum flow velocities less than 0.5 m/s.

6.3.5.6 Minimum water demand

Minimum water demand is to be discussed and confirmed with QLDC for each trunkmain project.

6.3.5.7 Sizing of mains

Sizing of mains are to be determined based on the trunk main's function and confirmed with QLDC for each trunkmain.

The sizing should consider:

- If the trunkmain is upstream or downstream from the reservoir
- The zoning of area that it services (commercial, industrial, residential)

The flow rates for calculating the size of the trunk main shall be calculated by considering the current water demand usage with the consideration of water demand management over time.

6.3.5.8 Pressure zones

Pressure zone requirements are to be discussed and confirmed by QLDC for each trunkmain project.

6.3.5.9 Maximum pressure requirements

Maximum pressure requirements are to be discussed and confirmed by QLDC for each trunkmain project.

6.3.7 Flow velocities

6.3.7.1 Surge analysis

A surge analysis shall be undertaken for all trunkmain projects. The source of any significant pressure surges or high-pressure areas shall be identified and remedial measures to minimise pressure surges designed and specified.

6.3.8 System Layout

6.3.8.1 General

Trunkmain layout shall consider the road layout and existing services. Layout of the trunkmain must be demonstrated to be the most appropriate option for the road category, and agreed with the Chief Engineer.

6.3.8.2 Reticulation layout

Not applicable for trunkmain projects.

6.3.8.4 Water mains in private property

No trunkmains or critical infrastructure are to be installed in private property.

6.3.8.6 Water mains near trees

No trunkmains are to be installed within the root zone of trees.

6.3.8.7 Shared trenching

No trunkmains are to be installed in a shared trench.

6.3.8.8 Rider mains and duplicate mains

Outside the scope of this document

6.3.9 Clearances

6.3.9.2 Clearance from structures

No trunkmains are to be installed in the 'zone of influence' of any building foundations. Trunkmains must have a minimum clearance to a wall or building of 3m (retaining walls or roading ancillary structures only).

6.3.9.4 Deviation of mains around structures

Trunkmains shall normally follow the road layout. Deviation of a pipeline to follow the road can be achieved by deflection of the pipeline at joints, to the angular deflection limits stated by the pipe joint manufacturer and with suitably restrained fitting bends. Permitted angular deflection varies with pipe material, pipe wall thickness, pipe PN class, joint type, design, and geometry. Some joint types are specifically designed to accommodate angular deflection. PE pipes may also be curved along the pipe barrel, between joints, to a minimum radius of curvature not less than that stated by the pipe manufacturer.

6.3.10 Pipe selection

6.3.10.1 Standard pipe sizes

This clause is not applicable for trunkmains. The trunkmain is to be sized appropriately for the network requirements, and specific pipe ordered for the project.

6.3.10.3 Pipe PN class (pressure rating)

The minimum pipe and fittings PN to be used for trunkmains shall be PN 16 unless proof can be provided that PN 16 is unnecessary.

6.3.12 Structural design

6.3.12.2 Seismic design

All trunkmains shall be of pipe function class '3 – Critical' and shall be designed in accordance with the design safety factors set out in Table 1 below:

Table 1. Design Safety Factors

Pipe Function Class	Description	Design Safety Factors				Seismic return period factor (NZS1170) R_u
		Peak ground acceleration	Liquefaction /subsidence	Landslide /lateral movement	Surface loading	
3 Critical	Pipelines servicing larger numbers of customers (>10,000 people) that if lost causes significant economic impact or hazard to human life, the natural environment and properties.	**1.8**	**1.35**	**1.6**	**1.5**	**1.8**

6.3.12.8 Above ground water mains

This clause is not applicable for trunkmains. No trunkmains are to have above ground infrastructure.

6.3.12.9 Trenchless technology

Trenchless technology requires specific discussion with QLDC.

6.3.12.10 Embedment

6.3.12.10.1 Minimum pipe cover

All trunkmains shall have minimum 1.0 m cover. This depth may need to be increased for larger pipe diameters (typically over 800 mm) where impediments such as air valves or utility services exist. The pipe depth shall also consider existing and future connections to the trunkmains.

6.3.12.10.2 Minimum trench width

Pipe trench width design considerations shall be based on the minimum side clearances detailed in Appendix A**.**

6.3.12.11 Pipeline restraint

6.3.12.11.3 Restrained joint water mains

These systems are not appropriate for trunkmains. Refer to requirements outlined in 6.3.12.11.1 and 6.3.12.11.2.

Additional clauses as below:

6.3.12.12 Buoyancy prevention

(a) Buried structures and pipelines susceptible to hydraulic uplift shall be designed with buoyancy prevention to a safety factor of 1.5.

(b) The designer shall consider that filled pipes may require emptying for maintenance purposes. Hydraulic uplift shall consider all structures and pipelines in an empty state.

(c) The effects of liquefaction on filled, partially filled, and empty structures and pipes shall also be considered when determining suitable weighing or anchoring solutions.

6.3.13 Reservoirs and pumping stations

Design and construction of reservoirs and pumping stations fall outside the scope of this document. Refer CoP addendum for Reservoirs.

6.3.14 Valves

6.3.14.1 General
In addition to the CoP the following requirements apply to trunkmains:

If actuator valves are installed, these must be connected to SCADA for monitoring. If no actuator is being installed there is no requirement for a SCADA connection.

For trunk mains over 600 mm (ID), the isolation valve shall include an isolation bypass to allow for recharge and/or draining. Where an isolation valve is at a low point of the trunkmain, a double isolation bypass setup is required to allow drainage of either side of the isolation valve. Otherwise, only a single isolation bypass is required.

Gate/sluice valves are to be used for pipe sizes up to 300 mm and geared butterfly valves for larger sizes (note that these require chambers).

For trunk mains larger than 600 mm (ID) the trunk main pipe diameter may be locally reduced for the economic benefit of a smaller isolation valve **if** hydraulically feasible.

Valve trains in sequence shall be of the same size.

Bypass valves are typically smaller than the main isolation valve to facilitate mainline charging and drainage. Bypass pipework shall be PE100.

Where the supplier does not have a standard valve set with a built in bypass, the horizontal clearance between the main line and bypass shall be 300 mm minimum at the closest point.

Handwheels shall be at least 300 mm clear of obstacles.

Where pipe reducers are used they shall be eccentric reducers tapering down from the bottom of the pipe.

Drain/charge points shall be provided at each end of the trunkmain installation, the valves may be direct buried outside the chamber.

Pipework shall be designed to allow for vertical lifts on equipment that requires ongoing maintenance.

Above ground isolation valves on control valve trains shall be fitted with handwheels.

6.3.14.2 Siting of valves
In addition to the requirements outlined in the CoP, the following requirements apply to trunkmains:

(e) Mainline isolation (line valves) are to be spaced to provide drain down time within 6 hours. Some standard spacings are shown below in Table 2.

(f) Mainline isolations are to be installed at bulk supply points to maintain continuity of water supplies and good locations for discharge of pipe drainage to stormwater or permeable ground.

(g) Isolation valves are to be installed in dry chambers or direct buried. The installation location must be demonstrated to be the best practicable option with consideration to:

- The need for ancillary equipment such as actuators.
- The type of valve being installed. Typically gate valves are best suited for buried applications.
- The whole of life cost benefit for the proposed installation method.

6.3.14.3 Gate valves
Valves 80≤ DN ≥300 shall be gate valves.

6.3.14.3.5 Valves
Butterfly or gate valves shall not be used for flow or pressure modulation. Fit for purpose control valves shall be used.

Control valves shall typically be SCADA monitored and may require to be fitted with an actuator for remote operation. All control valves shall be connected to RTU via fibre network if available.

Control valves shall be installed in an above ground building or dry chamber (dry chambers must include a drain to remove any moisture or water leaks). The installation location must be demonstrated to be the best practicable option.

Valve trains installed in sequence shall be of the same diameter, however where it may be considered that a future upgrade will require the valve train to be up-sized the isolation valves may be selected to be greater in diameter.

6.3.14.5 Pressure reducing valves
All pressure reducing valves are to have bypasses installed.

PRV bypass pipework shall be designed for the maximum ultimate flow rate in the pipeline at the projected minimum pressure differential.

6.3.14.6 Air valves

6.3.14.6.1 Installation design criteria
In addition to the requirements of the CoP, the following applies:

(a) Air valves shall be installed in dry chambers

(b) Air release valves shall be installed with eccentric reducer at the pipe soffit. The eccentric reducer shall be sized for optimal collection.

(c) Air valves shall be fitted with an isolation valve to allow the valve to be removed or replaced without isolating the main. Isolation must be below ground if the air valve is above ground.

(d) The air release valve vent shall be above the groundwater and 100 year flood levels. Direct connection to a surface vent may be required, or the valve must be vented through a flood-safe valve.

(e) Where air valves are installed underground within chambers the lid arrangement does not typically allow for adequate air flow rate. An air vent is required to be installed in the back berm and connected to the underground air valve chamber.

(f) Where the flow velocity in the pipeline is more than 2.4 ms-1 the air valve shall be fitted with an anti-slam device/feature.

6.3.14.7 Scours and pump-out branches
Change (a) to:

Scours shall drain the water main by gravity or have provision for pump-out within a period of 6 hours.

6.3.14.7.1 Scour Sizes

Scours must be sized appropriately to provide drain down time within 6 hours. Example spacings and sizes are shown below in Table 2.

Table 2. Minimum Scour Diameter for Trunk Mains

Trunk Main Diameter, mm	Minimum Scour Pipe Internal Diameter, mm	Maximum Pipe Length, m
DN $\leq$ 450	80	5000
450 < DN $\leq$ 630	100	4000
630 < DN $\leq$ 800	150	3000

Notes:
1. This table provides guidance for sizing scour points on trunk mains to comply with the maximum allowable drain time noted in clause 6.3.14.2 and 6.3.14.7.1. The table values have been calculated using an indicative initial 10 m hydraulic head above the scour point. Designers should satisfy themselves that any significant deviations from these guidance parameters in their design do not incur an exceedance of the maximum drain time. Any deviation from the guidance parameters will require validation with QLDC.
2. The calculation parameters assume pipe friction and turbulence are negligible
3. Maximum pipe length is the length of pipe that will drain through the scour should it be opened, i.e. the length between significant high points either side of the scour point.
4. Trunk main diameters are based on PE100 PN16 pipes.
5. Scour diameters based on standard DI fittings.
6. The draining pipe is assumed to operate under atmospheric pressure, noting air valves will be open when draining.

6.3.14.7.2 Scour locations
Replace (c) to (f) with:

(c) Scour design to flush mains and remove sediment shall be in a suitable location for high velocity discharge at a minimum mainline velocity of 0.8 ms^{-1}. Scour valves selected shall be suitable for the design target velocity.

(d) The scour discharge shall allow for adequate attenuation of the discharge energy such as rip-wrap or a stilling chamber. The location shall be suitable for the maximum volume to be discharged.

(e) Scour points for treated water shall consider de-chlorination requirements and provide a suitable mixing point or structure.

(d) Access to scour valves shall be off the carriageway and footpath.

(e) Scour valves are to be installed on lines greater than 300 mm.

6.3.14.8 Non Return Valves

(a) Non-return valves shall be installed as part of an isolation valve train to allow the valves to be taken out of service for maintenance.

(b) Where reverse flow in the main may occasionally be required, an unobstructed bypass around the NRV may be installed and isolated during normal flow direction.

(c) The design shall consider the need for an anti-slam device.

6.3.16 Connections

The water bulk supply point shall be located at a mainline isolation point for bi-directional feed from the bypass pipework to provide security of supply.

Where there is a take-off from the trunk main, each side of the 'T' shall have a valve installed to allow for future connections. Each take-off location shall include one hydrant in between the three-valve setup.

6.3.18 Water Meters and Backflow Prevention

All pressure zones within the network must include source totalling meters installed as appropriate to quantify the zone flows.

(a) The meter must be selected at a suitable flow velocity for optimal accuracy (to be confirmed with QLDC). This often requires that the pipeline be reduced in diameter. Reducers shall be concentric.

(b) Meters for trunkmains shall be electromagnetic type.

(c) The meter manufacturer's clear upstream and downstream diameter to length ratio shall be observed, taking into account the effect of reducers which may require greater clearance than valves and other fittings.

(d) Valve trains installed in sequence, including meters and strainers, shall be of the same diameter. However, where it may be considered that a future upgrade will require the valve train to be up-sized the isolation valves may be selected to be greater in diameter.

(e) Meters are to be installed in a dry chamber or above ground building.

6.3.19 Building over Council Infrastructure

This clause is not applicable for trunkmains.

6.5 Construction

6.5.2 Embedment

Embedment detail shall be as per Appendix A.

6.5.3 Backfilling and reinstatement

6.5.3.2 Berms
Trunkmains are not to be laid in berms.

6.5.5 Disinfection of water mains

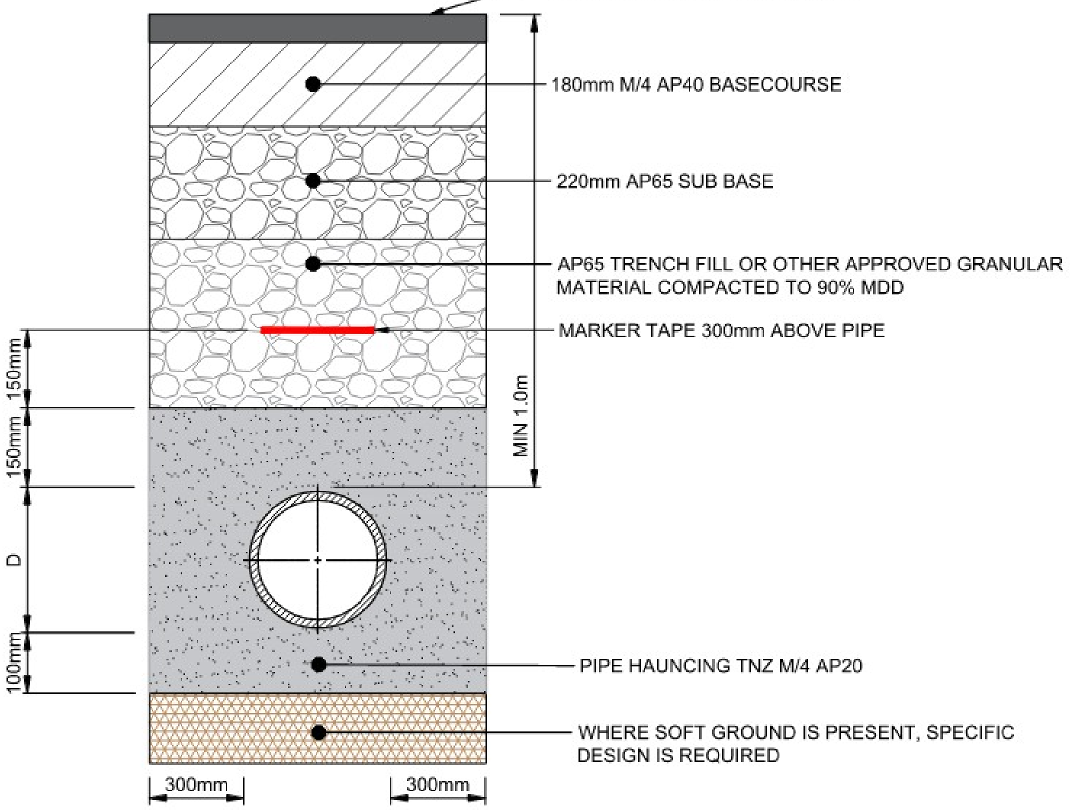
Disinfection of all trunkmains shall be in accordance with the QLDC Land Development and Subdivision Code of Practice:2018 Appendix D – Water Supply Disinfection Specification.

6.5.8 Pipe trench dewatering

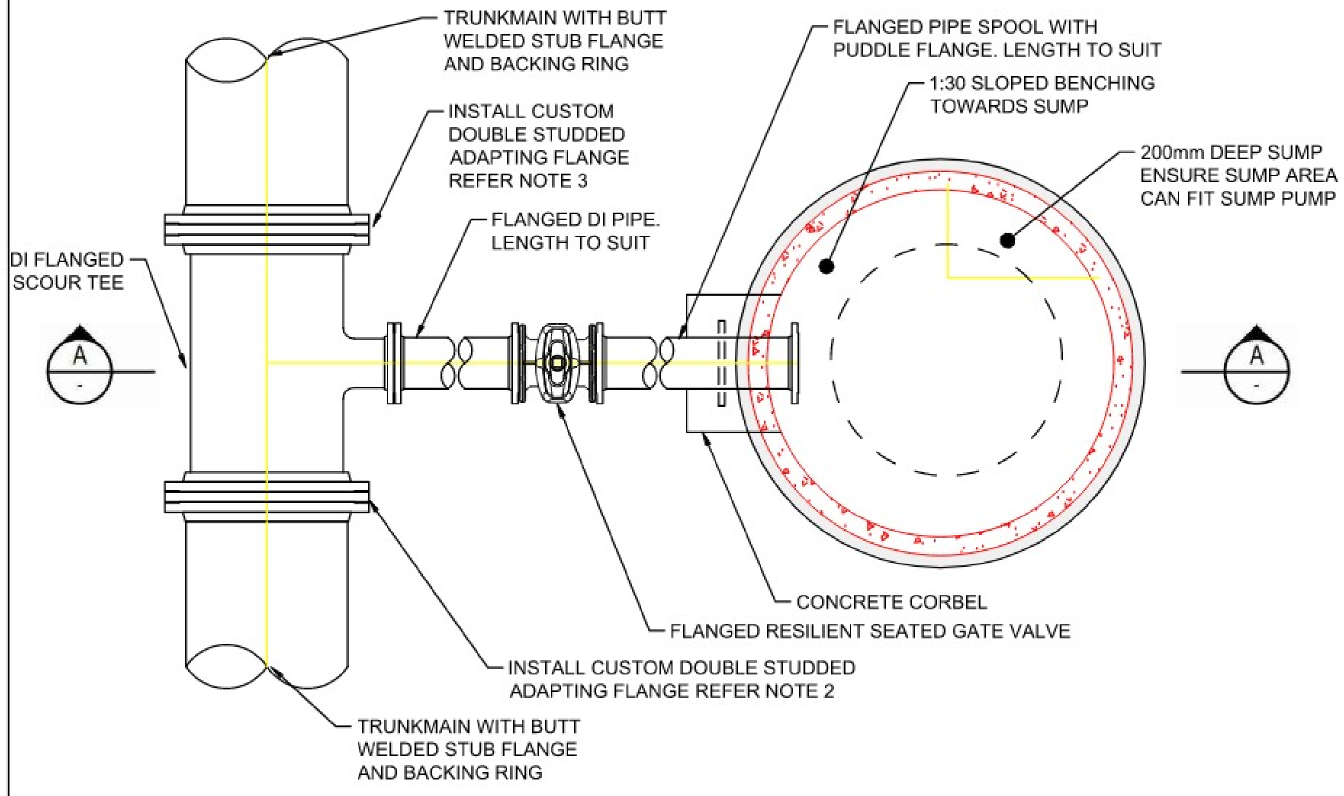
(a) Where the pipe runs along a steep slope ($\geq$15°) or where there is a high water table, the use of trench stops with suitable draining solutions must be considered.

(b) Where dewatering is not practical, alternative solutions (such as specific trench design with suitable geotextile lining or pipe anchorage) for effects of hydraulic uplift must be addressed in the design

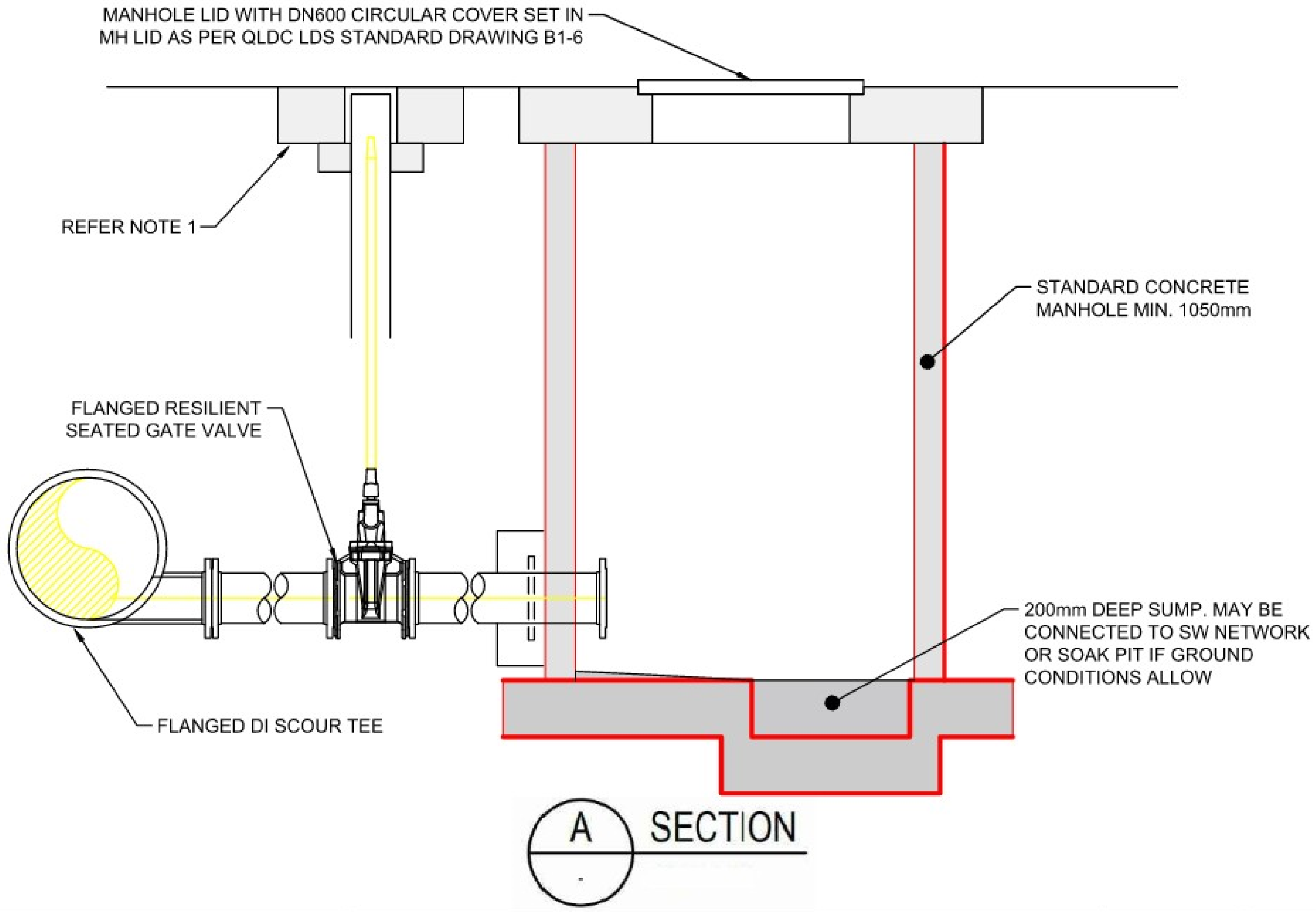
APPENDIX A. TYPICAL DETAILS



TRENCH EMBEDMENT DETAIL



TYPICAL SCOUR VALVE DETAILS



A - SECTION

Pinnacles Civil
Design | Build | Asset Management

QUEENSTOWN LAKES DISTRICT COUNCIL

QLDC Water Supply Trunk Main
Typical Scour Valve and Trench Embedment Details

DESIGN	JS
DRAWN	BS
APRVD	JS

PROJECT #: 2-0343

REV	DETAILS	DATE
A	Initial design	21/01/2022

DWG No.	2-0343.01
SCALE	N.T.S
REVISION	A

FOR APPROVAL