3. CEMENT STABILISED PAVEMENTS

3.1 Cement stabilised Pavement Layers shall be constructed at the locations and with the parameters as shown in Table 501A4:

TABLE 501A4 CEMENT STABILISED PAVEMENTS

Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Cement Content (% by dry mass of Pavement Layer)
From	To			
Sub-Base Layers				
Basecourse Layers				

4. LIME STABILISED PAVEMENTS

4.1 Lime stabilised Pavement Layers shall be constructed with the parameters as shown in Table 501A5:

TABLE 501A5 LIME STABILISED PAVEMENTS

Section		Depth of Stabilisation (mm)	Width of Stabilisation (m)	Equivalent Pure Hydrated Lime Content (% by dry mass of Pavement Layer)
From	To			
Sub-Base Layers				
Basecourse Layers				

5. DRAINAGE LAYER

5.1 GEOTEXTILE

TABLE 501A6 MECHANICAL PROPERTIES

	Subsoil Drains	Drainage Blanket	Test Method
Minimum G Rating as defined in AUSTROADS Guide to Geotextiles #			AS 3706.4 & AS 3706.5

Note 1: # Burst Strength (CBR Plunger Method) shall be the 5th percentile value determined in accordance with A S3706.1 & AS 3706.4 and Puncture Resistance (Drop Cone Method) shall be the 5th percentile value determined in accordance with AS 3706.1 & AS 3706.5.

TABLE 501A7 HYDRAULIC PROPERTIES

	Subsoil Drains	Drainage Blanket	Test Method
Maximum Equivalent Opening Size (EOS) (μm)			AS 3706.7#
Minimum Q_{100} (L/m²/sec)			AS 3706.9#

Note 1: # Maximum Equivalent Opening Size (EOS) and Minimum Q100 are mean values.
Note 2: Q_{100} = Flow rate under 100mm constant head determined using the Perpendicular Flow Test.

5.2 DRAINAGE LAYER SAND

Drainage Layer sand shall comply with the requirements shown in Table 501A8, and shall have linear shrinkage not exceeding 1.0% when tested in accordance with Test Method WA 123.1.

TABLE 501A8 PARTICLE SIZE DISTRIBUTION

AS Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits
37.5	90 - 100
2.36	30 – 100
0.075	< 1%

ANNEXURE 501 B

CEMENTITIOUS MATERIALS FOR CONCRETE

REQUEST FOR REGISTRATION BY MANUFACTURER

Cement or Blend Details	
Product Name	
Type	
Proportions	
Manufacturer	
Place of Manufacture	
Source of Constituent Materials	
Cement Clinker	
Fly Ash	
Slag	
Limestone	
Gypsum	
Grinding Aids	
Supply Details	
Dispatching Supplier	
Contact Name	
Contact Phone No.	
Contact Address	
Suppliers ABN	

Send this form with the sample to:

RMS Russell Vale Laboratory

Attn: Laboratory Officer

21 York Place
Russell Vale, NSW 2518

For RMS Laboratory Use Only:

Date of Registration:

Registration No:

GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to downloaded Specifications shall be made using *Track Changes*, to clearly show added/deleted text.

2. If **all** information relating to a clause is deleted, the clause number should be retained and the words "**NOT USED**" should be inserted.

3. The proposed documents with tracked changes shall be submitted to the Project Manager for review, prior to printing the final batch of documents. When this final printing is carried out, the tracked changes option is to be turned off.

4. Before printing accept all changes in the document, turn off Track Changes and refresh the Table of Contents.

5. The Custodian of this specification is Manager Materials Engineering.

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1. PAVEMENT MATERIAL SPECIFICATIONS

1.1 BASECOURSE

(1) For roads with a design traffic loading of less than 1.0×10^7 ESA, the applicable Gravel Basecourse Particle Size Distribution Table 501.G01 and Consistency Limits Table 501.G02 may be selected. Delete the Tables not required.

(2) For roads with a design traffic loading of less than 1.0×10^7 ESA, the MDCS criteria in Table 501.G02 Other Acceptance Limits (Gravel Basecourse) may be reduced from 2.3 MPa to 1.7 MPa. Delete note from the Specification.

(3) For roads with a design traffic loading of less than 1.0×10^7 ESA, the applicable Ferricrete basecourse Particle Size Distribution Table 501.G01 and Consistency Limits Table 501.16 may be selected. Delete the Tables not required.

(4) For roads with a design traffic loading of less than 1.0×10^7 ESA, the MDCS criteria in Table 501.16 Other Limits Ferricrete may be reduced from 2.3 MPa to 1.7 MPa. Delete note from the Specification.

(5) Ferricrete Basecourse is not suitable for use in freeways and asphalt surfaced highways with design traffic greater than 1.0×10^8 ESA.

TABLE 501.G01 PARTICLE SIZE DISTRIBUTION (GRAVEL BASECOURSE AND FERRICRETE BASECOURSE)

(Suitable for design traffic < 1.0 x 10^7 ESA)

As Sieve Size (mm)	% Passing by Mass Target Grading	% Passing By Mass Minimum and Maximum Limits
37.5	100	100
19.0	86	71 100
9.5	66	50 – 81
4.75	51	36 – 66
2.36	39	25 – 53
1.18	31	18 – 43
0.425	22	11 – 32
0.075	12	4 – 19
0.0135	6	2 – 9

TABLE 501.G02 OTHER ACCEPTANCE LIMITS (GRAVEL BASECOURSE)

(Suitable for design traffic < 1.0 x 10^7 ESA)

Test	LIMITS	Test Method
Liquid limit	25.0% Maximum	WA 120.2
Linear Shrinkage	3.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3MPa Minimum	WA140.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

1.2 SUBBASE

Modification of the gravel Subbase specification for design traffic less than 1.0 x 10^7 ESA may also be considered in accordance with 1.1 Basecourse above.

(1) The applicable CBR criterion depends on traffic loading and drainage environment. In lower traffic more arid zones 30% CBR is generally adequate. However in localities with high traffic loading and/or less favourable drainage CBR values of up to 60% may be applicable.

(2) For very heavy traffic routes the specified density for gravel subbase may be increased from 94% to up to 96%. The density criterion applicable to Crushed Limestone subbase is 94%.

1.3 GRAVEL REWORK (refer Clause 501.26)

The Clause below may be required for inclusion in Clause 501.26 for Basecourse material with gravel particles prone to excessive wear during mixing and compaction. A high Los Angeles Abrasion value or past experience of excessive breakdown during construction with similar material would justify the use of this clause to limit rework of gravel Basecourse.

(1) Gravel Basecourse material is prone to breakdown under the action of construction plant. The Contractor shall compact any lot using this material for Basecourse only twice. Any Basecourse that requires rework after having been already compacted twice shall be removed and replaced at no cost to the Principal.

Gravel Basecourse Rework

1.4 CONSTRUCTION OF PLASTIC MATERIALS (refer Clause 501.26)

For construction of plastic materials, the following clause should be included in Clause 501.26 for gravel Basecourse or gravel Sub-Base materials.

(1) All gravel Basecourse or Sub-Base materials shall be mixed to a uniform moisture content in the range of 90% to 110% of Optimum Moisture Content and left to “cure” for at least 24 hours prior to compaction commencing. Compaction shall be carried out within 72 hours of the time of gravel curing commencing.

Gravel Material Curing

2. REGIONAL SUBBASE AND BASECOURSE GRAVEL SPECIFICATIONS

If regional natural gravel specifications are different from Clause 501.07 GRAVEL SUBBASE and Clause 501.10 GRAVEL BASECOURSE, those specifications are provided below. It should be noted that Test Methods AS 1141.26 and AS 1141.29 are only applicable to basic igneous rock such as Basalt. For all other materials Test Methods AS1141.26 and AS 1141.29 requirements should be deleted from the materials specifications.

The basecourse and subbase materials specification tables in the Guidance Notes have been named 501.G04 etc to identify them as Guidance Notes Tables. The contents of relevant tables in the body of the specification will need to be over-written with these regional documents to maintain Table Number referencing in the Specification.

The relevant Materials Manager should be consulted before adopting regional materials specifications.

2.1 SOUTH-WEST REGIONAL GRAVEL SPECIFICATION

2.1.1 GRAVEL SUBBASE

For South-West Regional roads with a design traffic loading of less than or equal to 5.0 x 10^6 ESA, specification for Gravel Subbase remains the same as in Clause 501.07 GRAVEL SUBBASE SUPPLIED BY THE CONTRACTOR with the following exceptions:

The portion of the sample passing the 0.425mm sieve shall conform to the following:

a. Liquid Limit WA 120.2 - not greater than 25.0%
b. Linear Shrinkage WA 123.1 - not greater than 3.0%

2.1.2 GRAVEL BASECOURSE

For South-West Regional roads with a design traffic loading of less than or equal to 5.0 x 10^6 ESA, Gravel Basecourse shall meet the grading requirements in Table 501.G03 and comply with the other requirements in Table 501.G04.

TABLE 501.G03 PARTICLE SIZE DISTRIBUTION (SOUTH-WEST GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
37.5	100
19.0	71 – 100
9.5	50 – 81
4.75	36 – 66
2.36	25 – 53
1.18	18 – 43
0.425	11 – 32
0.075	4 – 19
0.0135	2 – 9

TABLE 501.G04 OTHER ACCEPTANCE LIMITS (SOUTH-WEST GRAVEL BASECOURSE)

Test	LIMITS	Test Method
Liquid Limit	25.0% Maximum	WA 120.2
Linear Shrinkage	3.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3MPa Minimum	WA140.1

California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

2.2 WHEATBELT REGION GRAVEL SPECIFICATION

2.2.1 NATURAL LATERITE PEDOCRETE GRAVEL – UNALTERED BASECOURSE

For Wheatbelt Region roads the natural laterite pedocrete gravel Basecourse in Wheatbelt Region shall be un-altered in any way and shall meet the grading requirements in Table 501.G21 and comply with the limits in Table 501.G22. Should the material be altered through crushing, screening or blending then the material shall comply with the Limits in Tables 501.07 and 501.08.

Natural Laterite Pedocrete Gravel-Unaltered Basecourse shall be compacted at 100% of OMC and shall achieve Characteristic Density no less than:

- 96% of MDD for Design Traffic < 1.0×10^6 ESA;
- 98% of MDD for Design Traffic ≥ 1.0×10^6 ESA.

Table 501.G21 PARTICLE SIZE DISTRIBUTION (WHEATBELT REGION NATURAL LATERITE PEDOCRETE GRAVEL – UNALTERED BASECOURSE)

AS Sieve Size (mm)	% Passing by mass Minimum and Maximum Limits
37.5	100
19.0	72 - 100
9.5	50 - 88
4.75	36 - 58
2.36	18 - 44
1.18	14 - 35
0.600	13 - 28
0.425	11 - 25
0.300	9 - 22
0.150	6 - 17
0.075	4 - 13

Table 501.G22 OTHER ACCEPTANCE LIMITS (WHEATBELT REGION NATURAL LATERITE PEDOCRETE GRAVEL-UNALTERED BASECOURSE)

Test	Limits	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Linear Shrinkage	3.5% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3 MPa Minimum	WA140.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 100% of OMC and 96% of MDD	80% Minimum	WA 141.1

2.2.2 NATURAL LATERITE PEDOCRETE GRAVEL – UNALTERED SUBBASE

For Wheatbelt Region roads the natural laterite pedocrete gravel Sub-base in Wheatbelt Region shall be un-altered in any way and shall meet the grading requirements in Table 501.G21 and comply with the limits in Table 501.G23. Should the material be altered through crushing, screening or blending then the material shall comply with the Limits in Tables 501.01 and 501.02.

Natural Laterite Pedocrete Gravel – Unaltered Subbase shall be compacted at 100% of OMC and shall achieve Characteristic Density no less than:

- 94% of MDD for Design Traffic < 1.0 x 10^6 ESA;
- 96% of MDD for Design Traffic ≥ 1.0 x 10^6 ESA.

Table 501.G23 OTHER ACCEPTANCE LIMITS (WHEATBELT REGION NATURAL LATERITE PEDOCRETE GRAVEL-UNALTERED SUBBASE)

Test	Limits	Test Method
Liquid Limit	35.0% Maximum	WA 120.2
Linear Shrinkage	4.0% Maximum	WA 123.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 100% of OMC and 96% of MDD	60% Minimum	WA 141.1

2.3 GOLDFIELDS ESPERANCE REGION GRAVEL SPECIFICATIONS

For Goldfields Esperance Region roads the following specification requirements in Tables 501.G41 and 501.G42 for Basecourse and 501.G43 and 501.G44 for Subbase are suitable for all roads. These specifications has been developed from the Spargoville pit on Coolgardie Esperance Highway and Great Eastern Highway pits at 376.5, 506.5 and 519 SLK.

TABLE 501.G41 PARTICLE SIZE DISTRIBUTION (GOLDFIELDS ESPERANCE GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
37.5	100
19.0	72 - 100
9.5	50 - 78
4.75	32 - 58
2.36	23 - 44
1.18	19 - 35
0.425	11 - 25
0.075	4 - 13
0.0135	2 - 9

TABLE 501.G42 OTHER ACCEPTANCE LIMITS (GOLDFIELDS ESPERANCE GRAVEL BASECOURSE)

Test	LIMITS	Test Method
Liquid Limit	25.0% Maximum	WA 120.2
Plasticity Index	9.0% Maximum	WA122.1
Linear Shrinkage	4.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	1.7 MPa Minimum	WA 140.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1

TABLE 501.G43 PARTICLE SIZE DISTRIBUTION (GOLDFIELDS ESPERANCE GRAVEL SUBBASE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
37.5	100
19.0	71 - 100
9.5	50 - 100
4.75	36 - 81
2.36	25 - 66
1.18	18 - 53
0.425	11 - 39
0.075	4 - 23
0.0135	2 - 11

TABLE 501.G44 OTHER ACCEPTANCE LIMITS (GOLDFIELDS ESPERANCE GRAVEL SUBBASE)

Test	LIMITS	Test Method
Liquid Limit	35.0% Maximum	WA 120.2
Plasticity Index	15.0% Maximum	WA122.1
Linear Shrinkage	5.0% Maximum	WA 123.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	30% Minimum	WA 141.1

2.4 KIMBERLEY REGION GRAVEL SPECIFICATION

The material specification requirements outlined in tables 501.G61 and 501.G62 for subbase and tables 501.G63 and 501.G64 for basecourse are suitable for use on all roads in Kimberley Region. These specifications have been developed from material sourced from the Robb Hill pit on Gibb River Road.

TABLE 501.G61 PARTICLE SIZE DISTRIBUTION (KIMBERLEY GRAVEL SUBBASE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
53	100
37.5	80 - 100
19	50 - 100
9.5	36 - 90
4.75	25 - 62
2.36	18 - 50
1.18	13 - 47
0.425	8 - 44
0.075	3 -16

TABLE 501.G62 OTHER ACCEPTANCE LIMITS (KIMBERLEY GRAVEL SUBBASE)

Test	LIMITS	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Plasticity Index	10.0% Maximum	WA122.1
Linear Shrinkage	4.0% Maximum	WA 123.1
California Bearing Ratio (Soaked 4 days with 6.75kg Surcharge) at 96% of MDD and 100% of OMC	30% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

TABLE 501.G63 PARTICLE SIZE DISTRIBUTION (KIMBERLEY GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
53	100
37.5	95 - 100
19	63 - 100
9.5	45 - 90
4.75	32 - 62
2.36	26 - 50
1.18	21 - 47
0.600	17 - 46
0.425	15 - 44
0.300	13 - 43
0.150	10 - 30
0.075	7 - 16
0.0135	2 - 9

TABLE 501.G64 OTHER ACCEPTANCE LIMITS (KIMBERLEY GRAVEL BASECOURSE)

Test	LIMITS	Test Method
Liquid Limit	25.0% Maximum	WA 120.2
Linear Shrinkage	2.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3 MPa Minimum	WA 140.1
California Bearing Ratio (Soaked 4 days with 6.75kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26

Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

2.5 PILBARA REGION GRAVEL SPECIFICATIONS

The material specification requirements outlined in tables 501.G81 and 501.G82 for subbase and tables 501.G83 and 501.G84 for basecourse are suitable for use on all roads in Pilbara Region. These specifications have been developed from material sourced from the pit at approximately 356 SLK on Marble Bar Road.

TABLE 501.G81 PARTICLE SIZE DISTRIBUTION (PILBARA GRAVEL SUBBASE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
75	100
37.5	80 - 100
19	50 - 100
9.5	36 - 81
4.75	25 - 66
2.36	18 - 53
1.18	13 - 43
0.425	8 - 32
0.075	3 - 16

TABLE 501.G82 OTHER ACCEPTANCE LIMITS (PILBARA GRAVEL SUBBASE)

Test	LIMITS	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Plasticity Index	15.0% Maximum	WA 122.1
Linear Shrinkage	6.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3 MPa Minimum	WA 140.1

California Bearing Ratio (Soaked 4 days with 6.75kg Surcharge) at 96% of MDD and 100% of OMC	50% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

TABLE 501.G83 PARTICLE SIZE DISTRIBUTION (PILBARA GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
75	100
37.5	80 - 100
19	60 - 100
9.5	36 - 78
4.75	25 - 58
2.36	18 - 44
1.18	13 - 35
0.600	10 - 28
0.425	8 - 25
0.300	7 - 22
0.150	4 - 17
0.075	3 - 16
0.0135	2 - 9

TABLE 501.G84 PARTICLE SIZE DISTRIBUTION (PILBARA GRAVEL SUBBASE)

Test	LIMITS	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Plasticity Index	12.0% Maximum	WA 122.1
Linear Shrinkage	5.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3 MPa Minimum	WA 140.1
California Bearing Ratio (Soaked 4 days with 6.75kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

2.6 MID WEST GASCOYNE REGION GRAVEL SPECIFICATIONS

The basecourse material specification requirements outlined in tables 501.G101, 501.G102 and 501.G103 are suitable for use on all roads in Mid West Gascoyne Region. The *Other Acceptance Limits* in Table 501.G103 are applicable to the Particle Size Distributions in Tables 501.G101 and 501.G102 These specifications have been developed from material sourced from a range of established pits on GNH between 350 and 900 SLK.

TABLE 501.G101 PARTICLE SIZE DISTRIBUTION (MWGR GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
53	100
37.5	85 - 100
19	75 - 100
9.5	60 - 90
4.75	39 - 72
2.36	20 - 40

1.18	14 - 34
0.600	12 - 28
0.425	11 - 25
0.300	9 - 22
0.150	6 - 17
0.075	4 - 13
0.0135	2 - 9

TABLE 501.G102 OTHER ACCEPTANCE LIMITS (MWGR GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing By Mass Minimum and Maximum Limits
53	100
37.5	85 - 100
19	62 - 100
9.5	50 - 78
4.75	48 - 82
2.36	33 - 58
1.18	22 - 43
0.600	16 - 34
0.425	13 - 31
0.300	10 - 29
0.150	6 - 21
0.075	4 - 14
0.0135	2 - 9

TABLE 501.G103 OTHER ACCEPTANCE LIMITS (MWGR GRAVEL BASECOURSE)

Test	LIMITS	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Plasticity Index	10.0% Maximum	WA 122.1
Linear Shrinkage	4.0% Maximum	WA 123.1

California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26
Accelerated Soundness Index by Reflux	94% Minimum	AS 1141.29

2.7 GREAT SOUTHERN REGION

1. The material specification requirements outlined in tables 501.G121, 501.G122, 501.G123 and 501.G124 for subbase and basecourse are suitable for use on all roads in the Great Southern Region.

2. Gravel subbase and basecourse material shall consist of durable pebble in soil mortar. The material shall be free from particles having any dimension greater than 75mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials.

3. The Particle Size Distribution shall be determined in accordance with Test Method WA 115.1. The particle size distribution of the portion passing a 75.0mm AS Sieve shall conform to the grading limits shown in Table 501.G121 and 501.G123. The grading of material passing the 75.0mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size, and shall conform as closely as possible to the specified target grading.

4. The material shall also comply with the limits shown in Table 501.G122 and 501.G124. The Secondary Mineral Content in Basic Igneous Rock test is only applicable to basic igneous rock.

TABLE 501.G121 PARTICLE SIZE DISTRIBUTION (GSR GRAVEL SUBBASE)

AS Sieve Size (mm)	% Passing by mass Minimum and Maximum Limits
75.0	100
37.5	80 - 100
19.0	50 - 100
9.5	36 - 81
4.75	25 - 66
2.36	18 - 53
1.18	13 - 43
0.425	8 - 32
0.075	3 - 19

TABLE 501.G122 OTHER ACCEPTANCE LIMITS (GSR GRAVEL SUBBASE)

Test	Limits	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Plasticity Index	8.0% Maximum	WA 122.1
Linear Shrinkage	3.0% Maximum	WA 123.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	60% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26

TABLE 501.G123 PARTICLE SIZE DISTRIBUTION (GSR GRAVEL BASECOURSE)

As Sieve Size (mm)	% Passing by Mass Target Grading	% Passing by Mass Minimum and Maximum Limits
75.0	100	100
53.0	98	95 - 100
37.5	92	87 - 98
19.0	76	70 - 90
9.5	64	50 - 76
4.75	47	36 - 58
2.36	35	25 - 44
1.18	27	18 - 35
0.600	21	13 – 28
0.425	18	11 - 25
0.300	16	9 – 22
0.150	12	6 – 17
0.075	9	4 - 13
0.0135	6	2 - 9

TABLE 501.G124 OTHER ACCEPTANCE LIMITS (GSR GRAVEL BASECOURSE)

Test	Limits	Test Method
Liquid Limit	30.0% Maximum	WA 120.2
Linear Shrinkage	2.0% Maximum	WA 123.1
California Bearing Ratio (Soaked 4 days with 4. 5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Secondary Mineral Content in Basic Igneous Rocks	25% Maximum	AS 1141.26

2.8 METROPOLITAN REGION

3. GRAVEL BASECOURSE – OVERSIZE MATERIAL (refer Clause 501.10)

3.1 An alternative paragraphs 1 to 4 in Clause 501.10 is provided where it is considered necessary to ensure the removal or treatment of oversize material in excess of 300mm in size.

3.2 If applicable, insert the alternative paragraphs 1 to 4 in Clause 501.10 provided below (and remove grid lines)

1. Gravel Basecourse material shall consist of durable pebble in soil mortar. The material shall be free from particles having any dimension greater than 37.5mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials. ***Component***

2. The Contractor shall remove all oversize material with any dimension greater than 300mm and this material shall not be delivered to the pavement construction area. This material and all other oversize material are to be included in the measurement of the stockpile for determining the volume of material used. ***Removal of materials > 300mm***

3. All other oversize material shall be crushed by rolling with a minimum of six (6) passes of a grid roller as specified in the "Compaction: Principal's Method Specification" Clause 302.54 of Specification 302 EARTHWORKS. ***Rolling Crush***

4. After the initial crushing, any material having any dimension greater than 50mm shall be deemed to be oversize and shall not be used in pavement construction. Additional crushing shall then be undertaken until the pavement material does not contain more than 20% by mass of material retained on a 37.5mm sieve.

Additional Crushing

4. PRINCIPAL SUPPLIED MATERIALS (refer Clause 501.91)

4.1 Materials are normally required to be supplied by the Contractor. Where supply is by the Principal (for example, gravel in stockpiles), Clause 501.91 in the section CONTRACT SPECIFIC REQUIREMENTS (or a suitably edited version of this clause) is applicable.

4.2 Amend this clause as shown to indicate whether the material is supplied at a cost to the Contractor, or is supplied free of charge. Applying a charge may conserve material where there is a limited supply, but appropriate supervision and a suitable means of measurement must be established.

4.3 Insert details of any other Principal supplied materials as required.

5. OPTIONAL PAVEMENT MATERIALS (refer Clauses 501.92 to 501.94)

5.1 The section PRODUCTS AND MATERIALS includes commonly used pavement materials. Other pavement materials should be included under CONTRACT SPECIFIC REQUIREMENTS and selected as required.

5.2 Pavement materials not listed should be researched and approved as required before inclusion.

6. DRAINAGE LAYER (refer Clause 501.32

6.1 GEOTEXTILE

1. Where a drainage layer is required, it is usually constructed immediately below the lower Pavement Layer.

2. A Geotextile may or may not be required as part of the drainage layer. Typical details of Geotextile are as follows

TABLE 501.G07 MECHANICAL PROPERTIES

	Subsoil Drains	Drainage Blanket	Test Method
Minimum G Rating as defined in AUSTROADS Guide to Geotextiles #	1700	1000	AS 3706.4 & AS 3706.5

(NOTE: Typical G Rating values only are shown - insert appropriate values to suit specific conditions)

TABLE 501G08 HYDRAULIC PROPERTIES

	Subsoil Drains	Drainage Blanket	Test Method
Maximum Equivalent Opening Size (EOS) (μm)	200	200	AS3706.7#
Minimum Q_{100} (L/m²/sec)	50	50	AS3706.9#

(NOTE: Typical EOS and Q_{100} values only are shown - insert appropriate values to suit specific conditions)

6.2 SAND FOR DRAINAGE LAYER

1. Bassendean Sand is commonly used as a drainage layer in the Metro area, with the grading limits following Table 501A8.

2. Insert appropriate details of the specified drainage layer material.

7. PAVEMENT COMPACTION

7.1 Where a range is given for the minimum characteristic dry density ratio in Table 510 A1, the higher value in the range should be selected unless there is evidence that the Basecourse properties will be damaged by so doing (e.g. if a higher compactive effort causes breakdown of the stone and adversely affects the grading or the linear shrinkage of the Basecourse).

A higher compactive effort will reduce the risk of post construction wheel path rutting under traffic loading.

A more uniform Pavement Layer can be expected when a higher minimum characteristic dry density ratio is specified. To achieve the higher density, the Contractor will need to exercise greater control over the uniformity of the mixing and compaction processes (e.g. especially over the amount and uniformity of moisture in the Pavement Layer during compaction).

7.2 Plastic pavement materials should be moist cured for at least 24 hours before compaction takes place if the in situ or imported Basecourse is in a dry condition. Refer Guidance Note 1.4

7.3 Compaction testing is normally completed prior to final trim and the layer may be marginally above the upper bound of level tolerance at that time. Final trim is required to be carried out while the pavement is still “green”, otherwise the layer needs to be reworked to achieve level, shape, compaction and surface finish requirements.

8. DRYBACK OF PAVEMENT AND SUBGRADE LAYERS

8.1 The dry back criterion of 85% for Basecourse with a spray seal surface is usually suitable however; consideration should be given to adjusting the criterion, if required, to reduce aggregate embedment and the risk of subsequent seal flushing. The risk is higher when commercial vehicle numbers are high.

9. DIEBACK CONTROL

9.1 Insert as a CONTRACT SPECIFIC REQUIREMENT if dieback controls should be included in pavement construction.

9.2 Refer to any general requirements shown in Specification 204 ENVIRONMENT.

10. CEMENT STABILISED PAVEMENTS (refer Clause 501.30)

10.1 Cement stabilisation can be applied to any Pavement Layer. Type LH cement is specified in construction to ensure there is sufficient working time to achieve, density, shape and level compliance. In the laboratory Type GP, cement is used to accelerate the curing and therefore testing process. Early age strength development is slower for Type LH cement but it is anticipated that strength development will be similar to Type GP cement at 28 days.

The working time of 6 hours specified in Specification 201 is suitable for all conditions, however in mild conditions the setting time will be slower and may exceed 6 hours. In very mild conditions Type GB cement may be preferred for work constructed under traffic.

10.2 If cement stabilisation of the Basecourse is specified (e.g. at floodways), determine the following and insert into Annexure 501A (in addition to required Compaction):

a. Depth of stabilisation - typically 150mm to 200mm.

b. Cement content - typical values are 1.0%, 1.5% or 2% by dry mass of the Basecourse material.

c. The cement content required, will be determined by the unconfined compressive strength (UCS) of the material when tested in accordance with WA 143.1. The UCS specimens shall be compacted using General Purpose (Type GP) cement, cured for seven (7) days in a controlled environment and immersed in water for four (4) hours prior to compression testing. The specimens are to be compacted at the specified density and 100% of OMC. The 7-day UCS must be in the range of 0.6 – 1.0MPa.

10.3 The minimum practical spread rate that can be achieved by most cement spreaders is 3kg/m^2, which equates to approximately 1% cement for a laterite gravel stabilised to a depth of 150mm.

10.4 The mandatory use of padfoot rollers for initial compaction is recommended in the following circumstances:

a. When the section length is 100m or more.

b. The depth of material to be stabilised is 175mm or more.

Padfoot rollers are more efficient in achieving density but trimming out the padfoot marks is difficult in short sections and those with coarse material that could tear the surface.

Delete Clause 501.30.07.1 if padfoot rollers are not required.

10.5 Check clause cross reference number “302.44.4”in Clause 501.30.07 is still current as any revision to Specification 302 could affect the clause numbering of that specification and is not automatically picked up in this specification

11. LIME STABILISATION (refer Clause 501.95)

11.1 If lime modification is specified, determine the following and insert into Annexure 501A (in addition to required compaction):

a. Depth of stabilisation – (typically 150mm to 250mm).

b. Lime content is determined by laboratory testing. Because lime varies in purity (depending on manufacture) and strength (depending on whether it is quicklime or hydrated lime), the optimum lime content must be expressed as a percentage of equivalent pure hydrated lime (calcium hydroxide) by dry mass of the pavement material

11.2 The process for determining whether Lime modification is appropriate and the required % of pure hydrated Lime for pavement modification is;

a. Refer to section 4.9 Preliminary Binder Selection of the Austroads Guide to Pavement Technology- Part - 4D: Stabilised Materials to determine if Lime is a suitable additive for the selected pavement material.

b. Determine the UCS of the modified material in accordance with Main Roads Test Method WA 143.1. The test specimens are to be compacted at the specified density and 100% of OMC and must be 28 day cured.

c. The optimum Lime content of the soil for modification produces a 28-day UCS in the range 0.6MPa to 1.0MPa.

11.3 The minimum practical spread rate that can be achieved by most lime spreaders is 3kg/m^2, which equates to approximately 1% lime for a laterite gravel stabilised to a depth of 150mm.

11.4 The safety aspects of lime stabilisation are referred to in Clause 501.95.02.

12. DURABILITY OF BASIC IGNEOUS ROCKS

Tests (AS1141.26 & AS1141.29) have been included for the purpose of excluding material that has the potential to degrade in service when used as Sub-Base and Basecourse. The colour of the rocks may be green, grey or black, but the basaltic rocks that most commonly present a risk of degradation are often dark green. Standard classification and strength tests are not suitable to identify the presence of material prone to degradation. Vic Roads Code of Practice RC 500.00 provides additional guidance on this topic.

13. HYDRATED CEMENT TREATED CRUSHED ROCK BASE (HCTCRB) (refer Clause 501.12)

13.1 A Geotextile Reinforced Seal must be specified whenever HCTCRB Basecourse is used. The GRS must comprise a double/double seal (14mm/7mm with heavy grade fabric) in accordance with the requirements in Specification 503 or Specification 509 as applicable.

The purpose of the GRS is to maintain a waterproof seal on the HCTCRB Basecourse.

HCTCRB should not be specified for pavements with a sprayed seal wearing course or pavements at intersections.

14. CRUSHED RECYCLED CONCRETE SUBBASE (refer Clause 501.92)

Crushed Recycled Concrete Subbase in accord with Clause 501.92 is suitable to be used as the Subbase layer for Full Depth Asphalt pavements. The CRC Subbase material specification is available from the Materials Engineering Branch for approved projects. In addition suppliers need to comply with the Roads to Reuse product specification which is administered by the Waste Authority.

15. RESILIENT MODULUS

The basecourse vertical modulus adopted in the pavement design should be inserted in the relevant Table. Refer to the pavement design for the appropriate criterion. The criterion will typically be in the range 500 MPa – 700 MPa in accordance with Engineering Road Note 9 and Austroads Guide to Pavement Technology Part 2 Pavement Structural Design.

The moisture and density conditions applicable in the test procedure are the density and dry back criteria specified in the Contract. Typically, the criteria are 99% of MDD and 60% of OMC for CRB and 98% of MDD and 70% of OMC for other basecourse materials.

Resilient Modulus testing is not normally specified for pavements with a spray seal surfacing because vertical modulus is not a design input in the empirical process used to design spray seal surfaced pavements.

16. RECLAIMED PAVEMENT SUBBASE

If it is likely that existing pavement material will be reused as Subbase compliance to the appropriate Sub-Base specifications is applicable.

17. PAVEMENT MATERIAL SELECTION

In addition to material specifications, product cost and lead to project site, other factors to consider in selection are;

- Crushed Rock Base Basecourse (CRB) requires a prime.
- Achieving CRB dry back and prime curing in cool conditions may be problematic
- CRB is normally unsuitable to be constructed under traffic because it is prone to ravelling
- Bitumen Stabilised Limestone can tolerate light traffic while drying back
- Cement stabilised or Lime Stabilised Basecourse must not be used under asphalt wearing courses unless approved by the Manager Materials Engineering.

18. CONTRACT SPECIFIC REQUIREMENTS

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS, as required. After inserting the clause, change the clause number and heading to style “H2 SP” so it appears in the Table of Contents.

501.91 PAVEMENT MATERIALS – PRINCIPAL SUPPLIED

1. Where pavement materials are supplied by the Principal, details of such materials are provided in Specification 100 GENERAL REQUIREMENTS Annexure 101E.

2. Pavement material will be made available to the Contractor free of charge / at a specified cubic metre rate * (measured in the stockpile) from stockpiles located as described in Specification 100 GENERAL REQUIREMENTS Annexure 101E. The material shall be extracted from the stockpiles without contamination from the underlying strata and shall be free from boulders, clods, stumps, roots, stocks, vegetable matter or other deleterious material prior to loading and carting. ***Availability***

   (* Authors – select as applicable)

3. If the pavement material is made available from borrow pits, any removed vegetation or material that is discarded may be stockpiled separately and ***Vegetation***

used later in pit reinstatement in accordance with Specification 303 PITS AND QUARRIES.

4. When the stockpiled subbase material contains oversize material, the Contractor shall screen the stockpiles to ensure that the pavement material does not contain more than 20% by mass of material retained on a 75mm sieve. The screen aperture shall be selected so that only the minimum quantity of material is removed from the existing stockpile to satisfy this requirement. Subbase material having any dimension greater than 100mm shall be deemed oversize and shall not be used in pavement construction

Subbase Oversize Material

5. When the stockpiled basecourse material contains oversized material, the Contractor shall screen the stockpiles to ensure that the pavement material does not contain more than 20% by mass of material retained on a 37.5mm sieve. The screen aperture shall be selected so that only the minimum quantity of material is removed from the existing stockpile to satisfy this requirement. Basecourse material having any dimension greater that 50mm shall be deemed oversize and shall not be used in pavement construction.

Basecourse Oversize Material

6. Any oversize material discarded in the stockpile area or any oversize material discarded from the pavement shall be removed to be stockpiled in borrow pits and respread evenly over the pit excavation area prior to the rehabilitation of the Pit.

7. Access tracks to pavement material stockpiles and pits shall be constructed and maintained in accordance with Specification 303 PITS AND QUARRIES.

Access Tracks

501.92 [CRUSHED RECYCLED CONCRETE SUB-BASE SUPPLIED BY THE CONTRACTOR] – contact Materials Engineering Branch

501.93 FERRICRETE BASECOURSE SUPPLIED BY THE CONTRACTOR

1. Ferricrete Basecourse shall predominantly consist of crushed indurated ferricrete and may include natural fragmented ferricrete and lateritic gravel. For blended materials the proportion of crushed material shall not be less than 33%. The material shall be generally free from organic matter and other deleterious materials.

General

2. The source rock shall also conform to the following limits shown in Table 501.14.

Source Rock Acceptance Limits

TABLE 501.14 SOURCE ROCK ACCEPTANCE LIMITS (FERRICRETE BASECOURSE)

Test	Limits	Test Method
Los Angeles Abrasion Value	60% Maximum	WA 220.1

3. The Particle Size Distribution of the material when tested in accordance with Test Method WA 115.1 shall comply with the requirements shown in Table 501.08 PARTICLE SIZE DISTRIBUTION (GRAVEL BASECOURSE) or Table 501.G01 PARTICLE SIZE DISTRIBUTION (GRAVEL

Particle Size Distribution

BASECOURSE) (Suitable for design traffic <1.0 x 10^7 ESA). The grading of material passing the 37.5mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size, and shall conform as closely as possible to the specified target grading.

4. The Dust Ratio, defined as the ratio of the percentage passing by mass the 0.075mm sieve to the percentage passing by mass the 0.425mm sieve, shall fall within the range 0.3 to 0.7.

Dust Ratio

5. The material shall also conform to the following limits shown in Table 501.15 and Table 501.16.

Other Acceptance Limits

TABLE 501.15 OTHER ACCEPTANCE LIMITS (FERRICRETE BASECOURSE)

(Ferricrete Basecourse is not suitable for use in freeways

Test	Limits	Test Method
Liquid limit	25.0% Maximum	WA 120.2
Linear Shrinkage	2.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3MPa Minimum	WA 140.1
Maximum Dry Density	2.0 t/m^3 Minimum	WA 133.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Flakiness Index	20% Maximum	WA 216.1
Resilient Modulus (Additional requirement if specified in Pavement Design) at 98% of MDD and 70% of OMC	See Guidance Notes and delete this note	AG:PT/T053 & WA 142.2

TABLE 501.16 OTHER ACCEPTANCE LIMITS (FERRICRETE BASECOURSE)

(Suitable for design traffic < 1.0 x 10^7 ESA)

Test	Limits	Test Method
Liquid limit	25.0% Maximum	WA 120.2
Linear Shrinkage	3.0% Maximum	WA 123.1
Maximum Dry Compressive Strength	2.3MPa Minimum	WA 140.1
Maximum Dry Density	2.0 t/m^3 Minimum	WA 133.1
California Bearing Ratio (Soaked 4 days with 4.5kg Surcharge) at 96% of MDD and 100% of OMC	80% Minimum	WA 141.1
Flakiness Index	20% Maximum	WA 216.1
Resilient Modulus (Additional requirement if specified in Pavement Design) at 98% of MDD and 70% of OMC	See Guidance Notes and delete this note	AG:PT/T053 & WA 142.2

501.94 NOT USED

501.95 LIME STABILISED PAVEMENTS

501.95.01 MATERIALS

Lime

1. Lime for stabilisation of any Pavement Layer shall comply with the requirements of AS 1672. The lime shall be sufficiently dry to flow freely during application.

Delivery

2. The Contractor shall arrange lime delivery and have on site bulk storage facilities. The Contractor shall be responsible for all arrangements in regard to the transfer of lime between delivery vehicles, on site bulk storage facilities and lime spreaders.

501.95.02 GENERAL

1. The pavement material shall be stabilised with lime for the sections and to the compacted depths shown either in Annexure 501A or as shown on the Drawings.

2. Stabilisation shall include preliminary loosening of the Pavement Layer, mixing and compacting the pavement material as necessary, spreading lime over the area to be treated, and the thorough blending of in-situ pavement material, lime and water as required to produce a homogeneous stabilised layer over the specified lengths and widths.

Safety Requirements

3. The Contractor's shall handle and use the quicklime/slaked lime in a safe manner, and shall provide adequate protection to the workforce, the public, stock and property.

501.95.03 PLANT AND EQUIPMENT

Lime Spreader

a) Lime Spreader

1. The spreading equipment shall be a mechanical stabilising agent spreader that has been specifically designed for such work. The spreader shall be capable of uniformly distributing lime and accurately controlling the spread rate such that when mixing is complete the lime content shall be in accordance with the requirements of Clause 501.95.05.

2. The spreader shall be equipped with gates to vary the width of spread and with electronic weigh scales to give daily totals of product use.

Stabilising Machine

b) Stabilising Machine

1. Cutting, pulverising, mixing, adding water and spreading of blended material shall be accomplished using a machine specifically designed for pavement recycling. The stabilising machine's rotor action shall be such that the rotor revolves in an upwards and forwards cutting direction. The rotor shall be of the recycler type and fitted with bullet teeth cutting tips.

2. Rotary hoes and other implements normally used for agricultural work shall not be used. The stabilising machine shall also satisfy the following requirements:

    i. Be capable of producing a uniformly mixed material throughout the specified depth of the work.

    ii. Be equipped with a variable depth of cut control, and an accurate gauge to measure depth of cut which is readily visible to the operator.

    iii. Have provision for adding water automatically through a system comprising a pump, flow meter, variable control valve and full width spray bar. Each nozzle on the spray bar shall be fully and independently adjustable and the water pump shall have the capacity to supply a minimum of 900 litres per minute.

501.95.04 PRELIMINARY TREATMENT

1. It shall be the Contractor’s responsibility to determine whether pre loosening and mixing of the in situ material is necessary.

2. Under no circumstances shall the first loosening and mixing operation of the Pavement Layer exceed the final stabilised depth.

501.95.05 SPREADING OF LIME

1. Lime shall be spread uniformly at a controlled rate over the area to be stabilised using a suitable lime spreader.

Composition

2. The lime stabilised Pavement Layer shall contain an average of not less than the equivalent percentage of hydrated lime (calcium hydroxide) as stated in Annexure 501A. The percentage stated is a percentage of the dry mass of the Pavement Layer material. The Contractor shall keep daily records of the amounts of lime used and actual spread rates achieved per section treated and shall make such records available to the Superintendent upon request.

3. The actual spread rate of lime achieved shall be determined by either:

   i. placing three trays each of approximately one third of a square metre in area in front of the lime spreader and measuring the mass of lime deposited on the trays for each lot, or

   ii. by the use of an on-board electronic weigh scale system.

4. The percentage lime (P%) shall be calculated thus:

$$P = \frac{M \times 100}{A \times T \times MDD}$$

Where M = total mass of lime (kg) as determined by one of the following methods:
a) on each tray
b) on-board electronic weight scale system.

A = method (a) total area of the trays (m²)
method (b) total measured area spread (m²)

T = Thickness to be stabilised (mm) (including allowances for tolerances and trimming)

MDD = Maximum Dry Density of the pavement material without the addition of lime (kg/m³)

5. The percentage lime determined for each tray in accordance with this clause shall be maintained within ± 10% by mass of the specified lime content throughout the stabilisation works.

6. The use of method (b) in determining the values 'M' and 'A' is subject to satisfactory calibration of the measuring device and the production of associated certification in accordance with the Contractor's Quality System. Audits on this method shall be carried out using the measuring tray method.

7. Once the lime has been spread, no other plant other than that needed for spreading, or for mixing and spreading the mixed material, shall be permitted to travel over the area to be stabilised.

501.95.06 INCORPORATION OF LIME

1. The spreading of lime shall not proceed when rain is imminent. The spread lime shall be incorporated into the Pavement Layer immediately following the spreading operation. All spread lime shall be incorporated into the Pavement Layer within the same working day. Lime shall not be spread when the prevailing wind velocity is sufficient to make the lime particles airborne.

2. Cutting, pulverising, mixing, adding water and spreading of mixed material shall take place as a single operation within the stabilising machine.

3. Cutting, pulverising, mixing, adding water and spreading of mixed material shall continue until the maximum size of all material (other than rock) is not greater than 25mm, and the lime and water are uniformly incorporated into the mixed material without streaks or pockets of lime.

501.95.07 MOISTURE CONTENT

1. Compaction shall be carried out at a moisture content at any point in the Lot that is within the range 90% – 110% of the Optimum Moisture Content.

2. The Contractor shall be responsible for achieving and maintaining the required moisture content by controlling the amount of water added during the mixing process within the stabilising machine.

501.95.08 COMPACTION

1. Compaction and trimming of the mixed material to shape and level shall be completed within the same working day that the lime is incorporated into the Pavement Layer. The mixed material shall be compacted to the Characteristic Dry Density Ratio as shown in Annexure 501A, or greater.

2. The Contractor shall be responsible for any additional stabilising, including the supply and incorporation of additional lime, required as a result of non-compliance with this clause as directed by the Superintendent.

501.95.09 REWORK

Rework

1. If a completed layer of lime stabilisation does not satisfy all of the requirements of the Specification and has to be reworked, the Contractor shall repeat all the requirements for Lime Stabilisation without the addition of lime at no cost to the Principal.

2. Rework shall include any disturbance to the surface of the lime stabilized layer during trimming to meet shape or level requirements that is undertaken after the working day that the lime is incorporated into the Pavement Layer. The rework depth shall not be less than the full depth of the affected layer.

501.95.10 CONSTRUCTION JOINTS

1. When the stabilising work cannot be completed in one continuous operation, the Contractor shall provide construction joints at each discontinuity in the operation.

2. Construction joints shall be made transverse to and/or parallel to the direction of the stabilising run, and shall be made just prior to the commencement of the next stabilising run.

3. The joints shall be formed by cutting back into the compacted stabilised material to form a vertical face. The loose trimmed material shall be removed from the joint before the next section is mixed and compacted and shall be disposed of to the Contractor's spoil area.

501.95.11 PRELIMINARY TRIAL

1. The Contractor shall carry out a preliminary trial of the proposed stabilising operations. The trial shall determine:

   i. The effectiveness of the plant.

   ii. The number of passes of the stabilising machine necessary to achieve the specified mixing.

2. The trial section shall be located within the Works area.

3. **Prior to conducting such a trial the Contractor shall agree with the Superintendent the location, length and width of trial section(s) within the Works.** ***HOLD POINT***

AMENDMENT CHECKLIST

Specification No. **501** Title: **PAVEMENTS** Revision No: _____

Project Manager: _____ Signature: _____ Date: _____

Checked by: _____ Signature: _____ Date: _____

Contract No: _____ Contract Description: _____

ITEM	DESCRIPTION	SIGN OFF
Note: All changes/amendments must be shown in Tracked Changes mode until approved.		
1.	Project Manager has reviewed Specification and identified Additions and Amendments.	
	CONTRACT SPECIFIC REQUIREMENTS addressed? Contract specific materials, products, clauses added? (Refer Specification Guidance Notes for guidance).	
	Any unlisted materials/products proposed and approved by the Project Manager? If "Yes" provide details at 16.	
	Standard clauses amended? **MUST SEEK** approval from Manager Contracts.	
	Clause deletes shows as **"NOT USED"**.	
	Appropriate **INSPECTION AND TESTING** parameters included in Spec 201 (Text Methods, Minimum Testing Frequencies verified).	
	ANNEXURES completed (refer Specification Guidance Notes).	
	HANDOVER and **AS BUILT** requirements addressed.	
	Main Roads QS has approved changes to **SMM**.	
	Project Manager certifies completed Specification reflects intent of the design.	
	Completed Specification – independent verification arranged by Project Manager.	
	Project Manager's review completed.	
	SPECIFICATION GUIDANCE NOTES deleted.	
	TABLE OF CONTENTS updated.	
	FOOTER updated with Document No., Contract No. and Contract Name.	
	Supporting information prepared and submitted to Project Manager.	
Further action necessary:		

Signed: _____ *(Project Manager)* Date: _____

mainroads WESTERN AUSTRALIA

SPECIFICATION 511

MATERIALS FOR BITUMINOUS TREATMENTS

REVISION REGISTER			
Clause Number	**Description of Revision**	**Authorised By**	**Issue Date**
Table 511.2	First sentence in Note 2 on supplier of crumb rubber deleted	MME	24/02/2020
511.16	Updated to require a supplier of crumb rubber be accredited or approved		
511.02	AS 1152 removed	BPC	19/08/2019
Table 511.1	AS methods now published as AS/NZS		
Table 511.1A	Deleted and inserted into Table 511.1		
511.06.03(1)	Rolling average clarified as being for the month of bitumen supply		
511.08.01	Amended plant requirements and added testing		
Tables 511.2 & 3	Updated as per Austroads T190 update		
511.08.05(2)	First sentence amended		
Table 511.7	New requirements for Flakiness Index		
511.11 &.12	Evotherm PC 1770 added		
511.15	Clause on anti foaming agent deleted		
Table 511.14	Format of limits amended from Max/Min to a range		
Whole document	Reformatted	SCO	23/05/2017
511.02 511.06.01(2) Tbl 511.1 511.10.01 & 511.10.05	Included AS 1289.3.4.1 and WA 123.1 Conformance requirements for blended bitumen Split into 2 tables, one with test methods and the other with limits Included natural sand for intermediate course	BPC	14/04/2016
511.09.01 Tables 511.11 & 511.12 511.17	Amended RAP source wording Added new adhesion agent Deleted dense graded	BPC	02/11/2015
511.02 511.20	Four methods referenced for geotextile fabric New clause with requirements for geotextile fabric for sealing	BPC	20/08/2015
511.01 511.02 511.13.03(1) 511.13.03(2) 511.13 511.17	Removed reference to cold mix Updated title of AAPA Advisory Note No. 7 Quantity of adhesion agent required now 1000mL Clarification of who does which testing Rhodoval DA410 added and Rhodoval DA 510 removed from list of adhesion agents Red oxide allowed only in laterite dense graded asphalt	BPC	07/07/2015
511.02 511.06.01 511.07.01 511.08.01 511.06.03(1)	AS 2008 removed as it no longer has a sampling method Limit for rolling average durability amended to 9 days	BPC	10/09/2014

CONTENTS

SPECIFICATION 511

MATERIALS FOR BITUMINOUS TREATMENTS

GENERAL

511.01 SCOPE

1. The work under this specification consists of the supply and use of materials for sprayed bituminous surfacings and asphalt. Materials used for microsurfacing are addressed in Specification 507 MICROSURFACING and materials used for the enrichment of seals are addressed in Specification 506 ENRICHMENT.

2. The works shall include the supply, storage, transport and handling of materials.

511.02 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

Acts and Regulations

Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007 (WA)

Australian Standards

AS 1141	Methods for Sampling and Testing Aggregates
AS 1160	Bituminous Emulsions for the Construction and Maintenance of Pavements
AS 1289.3.4.1	Determination of the linear shrinkage of a soil – Standard method
AS 1672.1	Limes for Building
AS 1726	Geotechnical Site Investigations
AS 2008	Bitumen for Pavements
AS 2106	Determination of the Flashpoint of Flammable Liquids (Closed Cup)
AS 2341	Methods of Testing Bitumen and Related Road Making Products
AS 2809	Road Tank Vehicles for Dangerous Goods
AS 3706	Geotextiles – Methods of Test

ASTM Test Methods

ASTM D445	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids
ASTM D1319	Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
ASTM D86	Distillation of Petroleum Products
ASTM D276	Standard Test Methods for Identification of Fibres in Textiles
ASTM D6140	Standard Test Method to Determine Asphalt Retention of Paving Fabrics Used in Asphalt Paving for Full-Width Applications

Other Standards and Publications

AUSTROADS Bitumen Sealing Safety Guide

Australian Asphalt Pavement Association Advisory Note No. 7 – Guide to the Heating and Storage of Binders for Asphalt Manufacture

Rock Colour Chart	Rock Colour Chart Committee, Geological Society of America, 2009.

MAIN ROADS Test Methods

WA 123.1	Linear Shrinkage
WA 200.1	Sampling Procedures for Aggregates
WA 201.1	Sampling and Preparation of Granulated Rubber
WA 210.1	Particle Size Distribution of Aggregate
WA 212.1	Aggregate Moisture Content: Convection Oven Method
WA 212.2	Aggregate Moisture Content: Microwave Oven Method
WA 215.1	Average Least Dimension
WA 216.1	Flakiness Index
WA 220.1	Los Angeles Abrasion Value
WA 223.1	Crushing Test Value
WA 235.1	Bulk Density of Granulated Rubber
WA 236.1	Particle Size Distribution of Granulated Rubber
WA 237.1	Steel Content of Granulated Rubber
WA 238.1	Rubber Content of Bitumen/Rubber Blends
WA 250.1	Colour of Aggregate

WA 700.1	Sampling Procedures for Bitumen and Oils
WA 716.1	Bitumen Durability Dynamic Shear Rheometer Method
WA 720.1	Assessment of Liquid Adhesion Agents
WA 730.1	Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil: Centrifuge Method
WA 756.2	Stone Coating and Water Resistance Test - Cationic Bitumen Emulsions

AUSTROADS Test Methods

AG:PT/T101	Method of Sampling PMBs, Polymers and Crumb Rubber
AG:PT/T103	Pre-treatment and Loss on Heating of Bitumen and Multigrade
AG:PT/T108	Segregation of Polymer Modified Binders
AG:PT/T111	Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)
AG:PT/T112	Flash Point of Polymer Modified Binders
AG:PT/T121	Elastic Recovery, Consistency & Stiffness of PMBs
AG:PT/T122	Torsional Recovery of Polymer Modified Binders
AG:PT/T131	Softening Point of Polymer Modified Binders
AG:PT/T132	Compressive Limit of Polymer Modified Binders
AG:PT/T142	Rubber content of digested crumb rubber binders - Trichlor bath method
AG:PT/T143	Particle Size and Properties of Crumb Rubber
AG:PT/T144	Morphology of crumb rubber - Bulk Density Test

MAIN ROADS Specifications

Specification 201	QUALITY SYSTEMS
Specification 504	ASPHALT WEARING COURSE
Specification 506	ENRICHMENT
Specification 507	MICROSURFACING

511.03 DEFINITIONS

1. The terms “seal” and “reseal” have the same meaning except where the context of any particular passage indicates otherwise. ***Seal and Reseal***

2. **Durability Value** is defined as the time in days to reach the specified apparent viscosity level when determining the “Long term effect of heat and air” in accordance with AS 2341.13 or WA 716.1. ***Durability***

3. **Rolling Average Durability Value** for a source of bitumen supply is defined as the average of all durability values determined over the previous 12 calendar months OR the average of the previous six ship loads of imported bitumen, determined in accordance with Clause 511.06.03. ***Rolling Average Durability Value***

4. **Reclaimed Asphalt Pavement (RAP)** is surplus plant mix or the material reclaimed from an asphalt wearing or intermediate course by cold planing, which is re-processed by crushing and/or screening for recycling into new asphalt. ***RAP***

5. **Polymer Modified Binder (PMB)** refers to polymer modified bitumen including crumb rubber modified bitumen. ***PMB***

511.04 – 511.05 NOT USED

PRODUCTS AND MATERIALS

511.06 BITUMEN

511.06.01 GENERAL

1. All bitumen used or for manufacturing cutback bitumen, polymer modified bitumen, multigrade bitumen or bitumen emulsion shall be a straight run, slightly blown or blended product prepared by distillation from crude bituminous base oils. The bitumen shall be homogeneous. It shall not foam when heated to 205°C. The formation of a thin layer of bubbles will not be regarded as foaming. Bitumen shall be sampled in accordance with WA 700.1.

2. Where Class 320 or Class 600 bitumen is produced by the blending of a low and high viscosity bitumen the following process shall be completed to verify conformance of the blend formulation ***Blended Bitumen***

   - The Viscosity at 60°C and other properties as required of the low and high viscosity bitumen shall be determined.
   - A blend formulation shall be determined to manufacture Class 320 or Class 600 bitumen.
   - The blend formulation shall be assigned a unique identifier.
   - A unique formulation shall be applicable to the batch of each of the two, or more, constituent materials used to manufacture the Class 320 or Class 600 bitumen.
   - When a blend formulation is determined a laboratory or plant batch shall be manufactured. The batch shall be tested for all properties shown in Specification 201. Manufacture of Class 320 or Class 600 bitumen using the new blend formulation shall not be undertaken until testing confirms the blend complies to all specified requirements.
   - Bitumen manufactured using the blend formulation shall be sampled and tested for Viscosity at 60°C at the frequency in Specification 201 QUALITY SYSTEMS.
   - When a batch of one of the constituent materials changes a new blend formulation shall be determined.

511.06.02 PROPERTIES

Properties

1. Class 170, Class 320 and Class 600 bitumen shall conform to the properties shown in Table 511.1 at the time of manufacture and at any time until the bitumen is used.

TABLE 511.1 PROPERTIES OF BITUMEN

Property	Method Of Test	Class 170		Class 320		Class 600	
		Min	Max	Min	Max	Min	Max
Viscosity at 60°C, Pa.s	AS/NZS 2341.2 or AS 2341.3	160	230	260	380	550	650
Viscosity at 135°C, Pa.s	AS/NZS 2341.2 or AS 2341.3 or AS/NZS 2341.4	0.30	0.50	0.40	0.65	0.60	0.85
Penetration at 25°C, (100g, 5s), pu (1 pu = 0.1 mm)	AS 2341.12	55	78 (Note)	40	-	20	-
Density at 15°C, kg/m³	AS 2341.7	1000	-	1000	-	1000	-
Flash Point, °C	AS 2341.14	250	-	250	-	250	-
Matter insoluble in toluene (%)	AS/NZS 2341.8	-	1.0	-	1.0	-	1.0
Rolling Thin Film Oven Test (AS/NZS 2341.10)							
Viscosity of residue at 60°C as percentage of original	AS/NZS 2341.2 or AS 2341.3	-	300	-	300	-	300
Ductility at 15°C, mm	AS 2341.11	400	-	Not Applicable			
Durability Value	AS/NZS 2341.13 or WA 716.1	Refer Clause 511.06.03		Not Applicable			

Note: The Penetration value can exceed the maximum limit of 78 if the result for Viscosity at 60°C has been verified by a second laboratory to the laboratory that did the initial testing.

511.06.03 BITUMEN DURABILITY

Durability

1. In addition to the properties specified in Table 511.1 Class 170 bitumen shall conform to the following requirements. The Rolling Average Durability Value for the month of bitumen supply shall be 9 days or greater. The method for determining the Monthly Average Durability Value is detailed below.

a. **Bitumen Produced Outside of Western Australia**

Where supply is from a bulk storage depot with bitumen sourced from outside of Western Australia, at least one sample shall be taken from any delivery to the bulk depot. The sample shall be tested in full to demonstrate compliance with the properties shown in Table 511.1 including a durability test. A Rolling Average Durability Value shall be determined for each bulk storage depot.

The rolling average is the mean of all durability values reported during the previous 12 calendar months including values reported by both the bitumen supplier and Main Roads Western Australia. The rolling average value shall be calculated on the first day of each month by determining the average of ALL durability values reported during the preceding 12 calendar months. The average is the sum of all of the durability values divided by the number of reported values during the 12 month period.

The Durability Values used to determine the Rolling Average Durability Value must be traceable to all batches of Class 170 bitumen. The rolling average shall be determined on the first day of each month as a single value rounded to the nearest 0.1 day.

511.06.04 HANDLING AND TRANSPORT

1. In respect to the loading, transporting, heating, circulation, blending, transfer and sampling of bitumen and cutback bitumen, procedures as detailed in the AUSTROADS publication "Bitumen Sealing Safety Guide" shall be followed. The supplier and carrier shall also observe the provisions and be licensed to perform delivery and heating in accordance with the D*angerous Goods Safety (Storage And Handling Of Non-Explosives) Regulations 2007* (WA) in respect to the transport of Dangerous Goods including Flammable Liquids.

2. Bitumen shall be loaded into road tankers at temperatures between 185°C and 205°C or in accordance with the safe loading requirements of the facility at which the bitumen is being loaded.

511.07 BITUMEN EMULSION

511.07.01 GENERAL

1. The bitumen used for the manufacture of the bitumen emulsion shall comply with the requirements of Clause 511.06. Bitumen to be used to manufacture bitumen emulsion shall be sampled in accordance with WA 700.1.

511.07.02 PROPERTIES

1. Bitumen emulsion shall be manufactured as specified in AS 1160 and conforms to the properties in AS 1160. In addition where CRS/170-60 emulsion is specified for primerseal or seal works it shall meet or exceed the following criteria when tested in accordance with WA 756.2.

Dry Aggregate	80% coated
Wet Aggregate	60% coated

2. Bitumen emulsion shall be sampled in accordance with AS 1160, except that only one sample shall be taken from a prepared batch. The single sample shall be representative of the properties of the emulsion in the storage tank. Samples shall be collected in appropriately sized and clean containers that will not alter or interfere with the properties of the emulsion.

511.07.03 DILUTION OF BITUMEN EMULSION

1. Water used to dilute bitumen emulsion shall be compatible with the emulsion. The water shall be added to the emulsion at a suitable temperature. Emulsion SHALL NOT be added to the water.

511.07.04 HANDLING AND TRANSPORT

Road Tanker

1. Bitumen emulsion shall be loaded into road tankers at a temperature that ensures the product remains stable and in accordance with the manufacturer's written instructions. Road tankers shall be lagged and shall have thermometers suitably located to give a representative temperature reading of the product in the tanker. The tanker shall be provided with facilities to enable circulation and mixing of bitumen emulsion prior to unloading.

2. Bitumen emulsion is not classified as a Dangerous Good, however, it should be transported and handled only by competent and experienced personnel, preferably in possession of a current Dangerous Goods licence.

511.07.05 HEATING AND CIRCULATION

1. Operations involving heating and circulating of bitumen emulsion shall be done by appropriately trained personnel. The circulating rate and heating rates shall be such that no premature breaking of the bitumen emulsion occurs. Circulating shall be continuous while heating is in progress.

2. Circulating shall continue for at least ten minutes after heating ceases. Burners shall not be used unless the level of the material in the heating tank is at least 150 mm above the tops of the heating tubes. The circulatory pipework shall be such that no foaming or air entrapment occurs during circulation.

3. Any bitumen emulsion heated in excess of 80°C (60% or 70% standard emulsion) or 100°C (PMB emulsion), after leaving the place of manufacture, shall not be used and shall be removed from site. The quantity of bitumen emulsion heated shall be that quantity that is to be applied to the pavement within six (6) hours of the heating being carried out. If bitumen emulsion is held in site storage for prolonged periods, then such heating as may be necessary to prevent the bitumen emulsion temperature falling below 10°C shall be permitted.

4. A record of the heating locations and times is to be recorded by the driver on the delivery or despatch documentation or other traceable documentation.

511.08 POLYMER MODIFIED BINDERS

511.08.01 GENERAL

1. The bitumen used for the manufacture of polymer modified binders (PMB) shall comply with the requirements of Clause 511.06. Bitumen to be used to manufacture PMB shall be sampled in accordance with WA 700.1. PMB shall be sampled in accordance with AG:PT/T101.

2. Crumb rubber modified binders shall be manufactured in a facility in a manner that the stiffness of the binder shall be less than 180 kPa for every batch. The Contractor shall provide evidence that the facility can manufacture the binder to the specified requirements prior to use of the binder. Processing oils shall not be added to the binder.

Crumb rubber modified binder

3. The Contractor shall test the PMB for conformance to the properties in Clause 511.08.02 and at the testing frequency shown in Specification 201 QUALITY SYSTEMS. Testing shall be undertaken in a laboratory accredited by NATA. Tests required for each production batch shall be completed before release of the PMB for transport to its site of use.

511.08.02 PROPERTIES – SPRAYED SEALING BINDERS

1. Polymer Modified Binders (PMB) for use in sprayed sealing shall conform to the properties shown in Table 511.2.

TABLE 511.2 PROPERTIES OF PMB FOR SPRAYED SEALING

Binder Property	Test Method	Binder Class				
		S10E	S20E	S25E	S35E	S45R (Note 2)
Stress ratio at 10 °C Minimum	AG:PT/T125	Report	Report	Report	Report	Report
Consistency 6% at 60°C (Pa.s) Minimum	AG:PT/T121 (Note 1)	300	500	900	250	800
Stiffness at 15°C (kPa) Maximum	AG:PT/T121	140	140	95	180	180
Compressive Limit at 70°C, 2kg mm (minimum)	AG:PT/T132	NA	NA	NA	NA	0.2
Viscosity at 165°C (Pa.s) Maximum (Note 3)	AG:PT/T111 or AS/NZS 2341.4	0.55	0.55	0.8	0.55	4.5
Flash Point (°C) Minimum	AG:PT/T112	250	250	250	250	250
Loss on Heating (% mass) Maximum	AG:PT/T103	0.6	0.6	0.6	0.6	0.6
Torsional Recovery at 25°C, 30s (%)	AG:PT/T122	22 - 50	45 - 74	54 - 85	16 - 40	25 – 55
Softening Point (°C)	AG:PT/T131	48 - 64	62 - 88	82 - 100	48 - 66	55 - 65
Segregation Value (%) Maximum	AG:PT/T108	8	8	8	8	8

Note 1: Consistency 6% at 60 °C of S10E and S35E shall be determined using mould B (breakpoint of 5 mm and a test speed of 1.5 mm/s). Other classes shall be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).

Note 2: To assist users in determining the quantity of added cutter oil required for spraying, the manufacturer shall report on the concentration and type of process oil used in the formulation.

Note 3: L series Brookfield is recommended together with spindle SC4-31, except in the case of S45R where spindle SC4-29 is recommended. The shear rate involved in determining viscosity by AS/NZS 2341.4 and AGPT/T111 shall be calculated and recorded. AGPT/T111 has been retained to allow laboratories sufficient time to adopt AS/NZS 2341.4.

511.08.03 PROPERTIES – ASPHALT BINDERS

1. PMB for use in hot mixed asphalt shall conform to the properties shown in Table 511.3.

TABLE 511.3 PROPERTIES OF PMB FOR ASPHALT

Binder Property	Test Method	Binder Class				
		A10E	A15E	A20E	A35P	A25E
Polymer Type		Not specified			EVA	Polybutadiene Only
Consistency 6% at 60°C (Pa.s) Minimum	AG:PT/T121 (Note 2)	1000	900	500	1000	400
Stiffness at 25°C (kPa) Maximum	AG:PT/T121	30	30	35	120	45
Stress ratio at 10 °C Minimum	AG:PT/T125	Report	Report	Report	Report	Report
Viscosity at 165°C (Pa.s) Maximum	AG:PT/T111 (Note 1) or AS/NZS 2341.4	1.1	0.9	0.6	0.6	0.6
Flash Point (°C) Minimum	AG:PT/T112	250	250	250	250	250
Loss on heating (% mass) Maximum	AG:PT/T103	0.6	0.6	0.6	0.6	0.6
Torsional Recovery at 25°C, 30s (%)	AG:PT/T122	60 - 86	55 - 80	38 - 70	6 - 21	17 - 30
Softening Point (°C)	AG:PT/T131	88 - 110	82 - 105	65 -95	62 - 74	52 - 62
Segregation Value (%) Maximum	AG:PT/T108	8	8	8	8	8

Note 1: L series Brookfield is recommended together with spindle SC4-31.

Note 2: Consistency 6% of A25E shall be determined using mould B (breakpoint of 5mm and a test speed of 1.5mm/s). Other classes shall be tested using mould A (breakpoint of 10mm and a test speed of 1mm/s).

511.08.04 HANDLING AND TRANSPORT

1. In respect to the loading, transporting, heating, circulation, blending, transfer and sampling of PMB, procedures as detailed in the AUSTROADS publication "Bitumen Sealing Safety Guide" shall be followed. The supplier and carrier shall also observe the provisions and be licensed to perform delivery and heating in accordance with the *Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007* (WA) in respect to the transport of Dangerous Goods including Flammable Liquids.

2. PMB shall be loaded into road tankers, isotainers or sprayers at temperatures not exceeding 195°C or the manufacturer's recommended maximum temperature, whichever is the lower. Road tankers shall be equipped with internal tank circulation. The binder shall not be heated above the manufacturer's recommended maximum temperature at any time. The binder shall be delivered at a temperature suitable for its application at the time of delivery.

511.08.05 HEATING AND CIRCULATION

1. The binder shall be kept at the lowest practical temperature during transport and shall not be heated to spraying or asphalt mixing temperatures until the time it is to be used.

2. The heating and circulating of binder shall be done only by trained personnel in accordance with a documented process. The circulating rate shall not be less than 450 litres per minute for hot PMB but may be circulated at a lesser rate for emulsified PMB. Circulating shall continue for at least twenty minutes after heating ceases. The heating rate shall not exceed 20°C per hour at any stage during the heating process. Burners shall not be used unless the level of the material in the heating tank is at least 150 mm above the top of the heating tubes.

3. When binder is heated on site the temperature shall not be heated to a temperature greater than the maximum of the manufacturer's recommended temperature range or 195°C, whichever is the lower value. Any binder that has been reheated to a temperature greater than the manufacturer's recommended maximum temperature, or has been otherwise contaminated, shall not be used. A record of the heating locations and times is to be recorded by the driver on the delivery or despatch documentation or other traceable documentation.

4. Guidance on the storage of PMB at elevated temperatures is provided in AAPA Advisory Note No. 7. PMB used as an asphalt binder when stored in a fixed or mobile tank at an asphalt plant shall comply with the requirements of AAPA Advisory Note No. 7. Binder held at the mixing temperature for periods of time longer than those shown in Advisory Note No. 7 shall not be used for the production of asphalt.

511.09 RECLAIMED ASPHALT PAVEMENT

511.09.01 PROPERTIES

1. RAP shall be obtained from surplus plant mix or the material reclaimed from an asphalt wearing or intermediate course by cold planing. RAP shall not contain any of the following materials:

a. Granular pavement materials, clay, soil or organic matter

b. Bricks, concrete, glass or building materials

c. Laterite asphalt, tar based products, geotextile fabrics, raised pavement markers or road surface treatments such as high friction surfacings or coloured pavement markings.

511.09.02 PROCESSING AND STORAGE

1. RAP shall be maintained in a separate stockpile prior to processing for use in asphalt. RAP shall be crushed and screened to produce a nominal 7mm or 10mm sized material incorporating fines with 100% of the material passing a 9.5mm sieve. RAP material of a nominal 14mm size may be crushed and screened but shall not incorporate fines. The processed 14mm RAP shall have 100% of the material passing a 13.2mm sieve and less than 2% of the material passing a 6.7mm sieve. The processed RAP shall be free flowing and consistent in appearance. Where the stored RAP is not free flowing it shall be screened and/or crushed again. ***Size***

2. All processed RAP shall be stored under cover until it is used in asphalt production. The storage facility must be covered on the top and at least three sides and not allow rainfall or other sources of moisture to wet the RAP after screening. The floor of the storage facility shall be concrete sloping down to a drain to allow removal of excess moisture. ***Storage Facility***

511.09.03 STOCKPILE MANAGEMENT AND TESTING

1. Processed RAP shall be maintained in lots to ensure traceability. A Management Plan shall be prepared detailing amongst other things the stockpiling, processing, storage and testing of RAP. A minimum of three samples are to be taken for every 1000 tonne in each lot of processed RAP and tested for particle size distribution and bitumen content in accordance with WA 730.1 and moisture content in accordance with WA 212.1 or 212.2.

511.10 AGGREGATES

511.10.01 GENERAL

1. The specification for aggregates is divided into five headings.
   a. Source rock for aggregate used for sprayed sealing and asphalt works.
   b. Crushed aggregates used for sprayed sealing works including handling and transport of aggregate.
   c. Crushed aggregates used for asphalt works including handling and transport of aggregate.
   d. Natural sand for intermediate course asphalt.
   e. Properties of crusher dust and sand for primersealing.

511.10.02 SOURCE ROCK FOR CRUSHED AGGREGATE

1. Source rock shall be selected from an approved quarry site such that the feed to the primary crusher is fresh, hard and durable rock, free from clay, organic matter, weathered (except as allowed below) or friable material, and

is consistent in appearance. A classification system for rock material weathering is defined in Table A9 of AS 1726. The proportions of weathered rock material in the source rock shall not exceed the following limits by mass:

Slightly weathered rock	10% maximum
Distinctly weathered rock	0.1% maximum
Extremely weathered rock	0.1% maximum
Residual soil	0% maximum

2. Selection of source rock shall be such that the requirements shown in Table 511.4 are satisfied. This property is not applicable for aggregate used for primerseals with a life less than 2 years or for Intermediate Course asphalt.

TABLE 511.4 SOURCE ROCK PROPERTIES

Property	Limit	Method of Test
Pendulum Friction Test (PAFV)	45 min	AS 1141.40 or AS 1141.41

511.10.03 CRUSHED AGGREGATE FOR SPRAYED SEALING WORKS

1. Source rock shall be processed to produce crushed and/or screened aggregate suitable for sprayed sealing works and shall conform to the requirements shown in Table 511.5. The aggregate shall be of uniform quality, clean, hard and durable and shall be free from clay, organic matter and elongated particles. The aggregate shall be of a uniform colour and appearance for the whole of the application. Other than for Flakiness Index, Moisture Content and Average Least Dimension, testing for conformance shall only be undertaken on either 10 mm or 14 mm sized aggregate.

TABLE 511.5 CRUSHED AGGREGATE PROPERTIES - SPRAYED SEALING

Property	Requirement	Test Method
Moisture Content	Dry (free of visible surface moisture)	WA 212.1 or WA 212.2
Los Angeles Abrasion Value (Note 2)		
Granite and other rock types	35% maximum	WA 220.1
Basalt	25% maximum	WA 220.1
Flakiness Index (Note 2)	35% maximum (Note 4)	WA 216.1
Average Least Dimension (Note 3)	Report	AS 1141.20.1 or WA 215.1
Water Absorption	2% maximum	AS 1141 6.1
Wet Strength	100kN minimum	AS 1141.22
Wet/Dry Strength Variation	35% maximum	AS 1141.22
Stripping Test Value (Note 1)	10% maximum	AS 1141.50
Degradation Factor	50 minimum	AS 1141.25.2
Secondary Mineral Content (Note 5)	25% maximum	AS 1141.26
Petrographic Examination	Statement of suitability for use as a sealing aggregate	

Note 1: The aggregate shall be tested in a clean dry condition without precoating. The binder shall include 0.5% by volume of one of the approved adhesion agents listed at Clause 511.13.

Note 2: Not applicable for crusher dust, sand, 7 mm and 5 mm aggregate.

Note 3: ALD is the mean of three samples from a roadside stockpile used in calculating the Binder Application Rate as referenced in the Contract specification. Where the aggregate is supplied direct from a quarry the size of a lot for the purpose of testing must not exceed 1000 m^3.

Note 4: Applicable to the mean of three results for each lot.

Note 5: This test is only applicable to basic igneous rock.

2. The particle size distribution of the crushed aggregate shall conform to the requirements shown in Table 511.6. The specification applies to the mean of three PSD results determined for each lot.

TABLE 511.6 PARTICLE SIZE DISTRIBUTION (PSD)

Sieve Size (mm)	Percentage by mass passing each sieve for each nominal size of aggregate						
	20 mm	16 mm	14 mm	10 mm	7 mm	5 mm (Note 1)	3 mm
26.50	100						
19.00	80 - 100	100					
16.00	0 - 20	80 - 100	100				
13.20	0 - 2	0 - 20	80 - 100	100			
9.50		0 - 2	0 - 20	80 - 100	100		
6.70			0 - 2	0 - 20	80 - 100	100	
4.75				0 - 2	0 - 25	80 - 100	100
2.36					0 - 2	0 - 30	80 - 100
1.18	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5	0 – 1.0	0 - 30
0.60							0 - 5

Note 1: Where 5mm aggregate is not available from a regional quarry it can be produced by screening conforming 7mm sized aggregate to remove retained 6.7mm size and passing 2.36mm sizes.

511.10.04 CRUSHED AGGREGATE FOR ASPHALT WORKS

1. Source rock shall be processed to produce crushed and/or screened aggregate suitable for asphalt works. The aggregate shall be of uniform quality, clean, hard and durable and shall be free from excess dust, clay, organic matter and elongated particles. The aggregate shall be of a uniform colour and appearance for the whole of the application. Coarse aggregate is defined as the material retained on a 2.36 mm sieve. Physical properties of crushed aggregates shall conform to the requirements of Table 511.7. Other than for Flakiness Index testing for conformance shall only be undertaken on either 10 mm or 14 mm sized aggregate.

Coarse Aggregate

2. In addition to the properties in Table 511.7 the following colour requirements shall apply to all wearing course asphalt mixes produced in the Perth metropolitan area. The coarse aggregate shall be uniform in colour, and shall not contain diorite stones. When tested in accordance with WA 250.1 no more than 15 % by mass of the aggregate shall be darker than value (lightness) 3 on the neutral grey axis scale of the Rock Colour Chart. The value (lightness) of the aggregate after removal of the stone darker than value 3 shall not be darker than 5 on the neutral grey axis of the Rock Colour Chart.

Coarse Aggregate

TABLE 511.7 CRUSHED AGGREGATE PROPERTIES - ASPHALT

Property	Requirement	Test Method
Los Angeles Abrasion Value (Note 2)		
Granite and other rock types	35% maximum	WA 220.1
Basalt	25% maximum	WA 220.1
Flakiness Index (Note 2)		WA 216.1
Specifications 502, 504 and 510	35% maximum (Note 3)	
Specifications 514, 516 and 517	25% maximum (Note 3)	
Water Absorption	2% maximum	AS 1141 6.1
Wet Strength	100kN minimum	AS 1141.22
Wet/Dry Strength Variation	35% maximum	AS 1141.22
Stripping Test Value (Note 1) Only applicable to *regional plants*	10% maximum	AS 1141.50
Degradation Factor	50 minimum	AS 1141.25.2
Secondary Mineral Content (Note 4)	25% maximum	AS 1141.26
Petrographic Examination	Statement of suitability for use as an asphalt aggregate	

Note 1: The aggregate shall be tested in a clean dry condition without precoating. The binder shall include 0.5% by volume of one of the approved adhesion agents at Clause 511.13.

Note 2: Only applicable to 10, 14 and 20 mm aggregate.

Note 3: Applicable to the mean of three results for each lot.

Note 4: This test is only applicable to basic igneous rock.

3. Fine aggregate is defined as all material retained on a 75 micron Australian Standard Sieve and passing a 2.36 mm Australian Standard Sieve and shall consist of clean, tough, durable grains, free from clay, loam or other foreign matter. Fine aggregate shall only consist of crushed rock material. When the fine aggregate is tested in accordance with AS 1141.5 the water absorption shall not exceed 2%. ***Fine Aggregate***

4. Local granite aggregates shall be used for asphalt produced in the Perth metropolitan area, with the following requirements applying to all wearing course asphalt mixes. Fine aggregate shall be uniform in colour and shall not contain excessively coloured or stained material. When tested in accordance with WA 250.1 the value (lightness) of the granite shall not be darker than 5 on the neutral grey axis of the Rock-Colour Chart. Aggregate sources shall be kept constant throughout the period of works. ***Fine Aggregate***

5. Screened or crushed laterite aggregate used for coloured mixes shall conform to the following requirements. Screened laterite aggregate when tested in accordance with WA 223.1, the percentage of stones crushed shall not exceed 5% and the percentage of stones cracked shall not exceed 5%. Crushed laterite aggregate when tested in accordance with WA 223.1, the percentage of stones crushed shall not exceed 10% and the percentage of stones cracked shall not exceed 10%. When tested in accordance with AS 1141.42 the PAFV of the laterite aggregate shall be a minimum of 40%. ***Laterite Aggregate***

6. Aggregate shall be loaded, transported and stockpiled in such a manner so as not to cause contamination, loss of material or deterioration of properties. Any aggregate that is considered contaminated or otherwise non-conforming or unsuitable for use at any stage prior to use shall not be used. Aggregates are to be stockpiled only in agreed suitable areas that are free draining and do not allow contamination with other stockpiles or surrounding or floor materials. ***Handling and Transport***

511.10.05 NATURAL SAND FOR INTERMEDIATE COURSE ASPHALT

1. Natural sand shall be clean, hard, durable, non-plastic, free from clumps or other aggregations, not contain any organic matter or other deleterious material.

2. The sand shall have a water absorption value of no more than 1.5% when determined in accordance with AS 1141.5. ***Water absorption***

3. The sand shall have a linear shrinkage value of no more than 1.5% when determined in accordance with AS 1289.3.4.1 or WA 123.1. ***Linear shrinkage***

511.10.06 CRUSHER DUST OR SAND FOR PRIMERSEALING

1. Crusher dust or sand use as cover material for primersealing shall meet the requirements of Table 511.8 and shall be free of clay or silt.

TABLE 511.8 PROPERTIES OF CRUSHER DUST OR SAND

Property	Requirement	Test Method
Moisture Content	Dry (free of visible surface moisture)	WA 212.1 or 212.2
Water Absorption of Fine Aggregate	2% maximum	AS 1141.5
Particle Size Distribution (Grading)	See below	WA 210.1

2. Crusher dust or sand shall have properties not less than the following requirements. ***Grading***

   a. Material shall be coarse, with a $D_{80} > 0.60$mm and $C_u\,(Coefficien\ t\ of\ Uniformity\,) > 4$,

      Where D_{80} is the particle size in millimetres at which 80%, by mass of the sample, is smaller in size and $C_u = \frac{D_{60}}{D_{10}}$,where D_{60} and D_{10} are respectively equal to the particle size in millimetres at which 60% and 10%, by mass of the sample, is smaller in size.

   b. The maximum particle size shall be 4.75 mm. Oversize material shall be removed by screening.

   c. Shall not have more than 4% by mass passing the 0.075 mm sieve.

511.11 CUTTING OILS

511.11.01 GENERAL

1. Oils used for reducing the viscosity of bituminous binders shall comply with the properties shown below at any stage after manufacture and until the cutting oil is used. Products such as high flash point cutter shall not be used.

511.11.02 MEDIUM CURING CUTTING OIL

1. Medium curing cutting oil shall be a petroleum product conforming to the requirements shown in Table 511.9. Supply of certified Aviation Turbine Fuel-Jet A1 with a statement that it had been denatured and supplied without other change as Medium Curing Cutting Oil is acceptable.

TABLE 511.9 PROPERTIES OF MEDIUM CURING CUTTING OIL

Property	Requirements	Test Method
Distillation		ASTM D86
Initial Boiling Point	132 - 160°C	
Final Boiling Point	265°C maximum	
Temperature at 50% Recovery	220°C maximum	
Flash Point (Pensky Martin Closed)	35°C minimum	AS 2106
Viscosity at 40°C	1.0 - 1.4 mm²/s	ASTM D445
Density at 15°C	780 - 820 kg/m³	AS 2341.7
Miscibility with Equal Parts of Class 170 Bitumen	Complete No Precipitation	
Water Content	0.05% maximum	AS 2341.9
Percentage Aromatics	15% minimum (Vol)	ASTM D1319

511.11.03 SLOW CURING CUTTING OIL

1. Slow curing cutting oil shall be the recognised petroleum product distillate fuel oil conforming to the requirements shown in Table 511.10. Supply of certified Automotive Distillate, with a statement that it had been supplied without change as SC Cutting Oil, is acceptable.

TABLE 511.10 PROPERTIES OF SLOW CURING CUTTING OIL

Property	Requirement	Test Method
Distillation		ASTM D86
Initial Boiling Point	170 - 195°C	
Final Boiling Point	360 - 400°C	
Temperature At 50% Recovery	250 - 290°C	
Flash Point (Pensky Martin Closed)	65°C minimum	AS 2106
Viscosity At 40°C	2.0 - 4.0 mm²/s	ASTM D445
Miscibility With Equal Parts Of Class 170 Bitumen	Complete No Precipitation	
Water Content	0.05% maximum	AS 2341.9

511.12 PRECOAT FLUID

511.12.01 GENERAL

1. Unless otherwise specified Distillate Precoating Fluid shall be used for works using hot bitumen. Crushed aggregate used for bitumen emulsion surfacing work shall not be precoated with distillate or bitumen based precoating fluids. For emulsion sealing or primersealing the aggregate shall be prewetted with water to assist adhesion of the binder.

511.12.02 DISTILLATE PRECOATING FLUID

1. Unless otherwise specified the standard Precoating Fluid shall be Slow Curing Cutting Oil with 0.5% by volume of an approved adhesion agent for sprayed sealing works.

511.12.03 BITUMEN BASED PRECOATING FLUID

1. Where specified bitumen based Precoating Fluid shall be a blend of Slow Curing Cutting Oil, Class 170 Bitumen and an approved adhesion agent for sprayed sealing works. The blend may contain between 15 and 30% by volume of bitumen and shall contain 0.5% by volume of adhesion agent. The volume of slow curing cutter must be adjusted dependent upon the proportion of bitumen within the blend. The fluid shall not contain any other materials, whether they are bituminous materials, fuels, solvents, water or oils.

511.13 ADHESION AGENT

511.13.01 ADHESION AGENT FOR SPRAYED SEALING WORKS

1. Adhesion agent shall be added to bitumen, rubberised binders and polymer modified binders used for primerseals, seals or reseals in the proportion given in the contract specification using an adhesion agent from the list of approved adhesion agents shown Table 511.11.

TABLE 511.11 ADHESION AGENTS FOR SPRAYED SEALING WORKS

Bitumite Concentrate
Redicote BE
Diamin TO-L
Rhodoval DA 410
Aggrebond PC
Evotherm PC 1770

511.13.02 ADHESION AGENT FOR ASPHALT WORKS

1. Adhesion agent for asphalt mixes shall be hydrated lime conforming to AS 1672.1. For mixes produced in rural regions where the inclusion of hydrated lime may be impractical an approved liquid adhesion agent, shown in Table 511.12, shall be added to the asphalt binder to promote adhesion. When liquid adhesion agents are used, the concentration of adhesion agent in the binder tank at any time during production shall be between 0.5 to 1.0% by mass of the binder. The adhesion agent shall have been added to the binder no more than 48 hours before production of the asphalt.

TABLE 511.12 ADHESION AGENTS FOR REGIONAL ASPHALT MIXES

Bitumite Concentrate
Redicote BE
Diamin TO-L
Rhodoval DA 410
Aggrebond PC
Evotherm PC 1770

511.13.03 SPECIFICATION AND APPROVAL PROCESS FOR ADHESION AGENTS

1. Adhesion agent shall be a clear liquid product with no sediments, readily miscible with bituminous binders, easy to pour and does not deteriorate in storage. The adhesion agent shall be a concentrate without addition of diluents or other materials. Suppliers seeking approval of an adhesion agent must submit the following to the Materials Engineering Branch, 5-9 Colin Jamieson Dve, Welshpool WA 6106.

   (i) Letter showing the details of the supplier and the product and an intent to supply the product into the WA industry.

   (ii) Sample of the adhesion agent in a solid container applicable for the material. The sample is to be no older than 30 days with a minimum quantity of 1000 mL.

   (iii) A complete Materials Safety Data Sheet (MSDS) for the product being assessed.

2. When assessed in accordance with WA 720.1 the adhesion agent shall meet the requirements shown in Table 511.13. The Materials Engineering Branch shall undertake assessment of the adhesion agent for visual assessment, pourability and stripping consistency. The Supplier shall provide a NATA endorsed test report for the flashpoint of the adhesion agent.

TABLE 511.13 PROPERTIES OF ADHESION AGENT

Property	Requirement
Visual Assessment	The adhesion agent shall remain clear and not segregate or separate during storage, shall show no signs of crusting, hardening or formation of a crystalline appearance
Pourability	The adhesion agent shall be fluid and pour readily at the test temperature of 5°C
Stripping Consistency	The maximum % stripping for each of the three conditioning periods shall not be greater than 10%.
Flashpoint	The flashpoint shall be greater than 100°C

511.14 FIBRES

1. Fibres for use in Stone Mastic Asphalt shall be Viatop or Topcell cellulose fibre.

511.15 NOT USED

511.16 CRUMB RUBBER

1. Crumb rubber for use in crumb rubber modified binders shall consist of either natural or synthetic rubber processed from tyres or other suitable rubber products. Crumb rubber shall be sourced from a Tyre Stewardship Australia accredited tyre recycler or a Main Roads approved supplier. Crumb rubber shall be supplied in a dry condition, shall be protected against moisture ingress, and shall be stored undercover to ensure the product remains dry. Crumb rubber shall be sampled and prepared for testing in accordance with Austroads test methods AG:PT/T101 and AG:PT/T143 and Main Roads test method WA 201.1.

2. Crumb rubber shall meet the requirements shown in Table 511.14. Crumb rubber shall not contain any foreign material such as sand, fibres or aggregate. Crumb rubber shall not contain more than 20% of elongated particles. An elongated particle is one where the length of the major axis of the particle is more than double the length of the minor axis.

TABLE 511.14 PROPERTIES OF CRUMB RUBBER

Property	Requirement	Test Method
Bulk Density	< 350 kg/m³	AG:PT/T144 or WA 235.1
Iron or Steel Content	≤ 0.1% by mass	AG:PT/T143 or WA 237.1
Particle Shape	Mean of measured particles Maximum 3mm	AG:PT/T143
Moisture Content	Maximum 1%	AG:PT/T143
Particle Size Distribution Sieve Size (mm)	Percentage Passing (by Mass)	AG:PT/T143 or WA 236.1
2.36	100	
1.18	100	
0.60	60 -100	
0.30	0 - 22	
0.075	0 - 2	

511.17 PIGMENT

1. Red iron oxide pigment shall be incorporated into laterite asphalt mixes. The Contractor shall use an appropriate type, quantity and process for the incorporation of red iron oxide pigment to meet the requirements of Specification 504. ***Oxide***

511.18 MINERAL FILLER

1. Mineral filler shall be defined as all material passing a 75 micron Australian Standard Sieve and shall consist of dry mineral dust. Where hydrated lime is used as filler in asphalt, it shall conform to AS 1672.

511.19 PROTECTIVE PAPER

1. A heavy-duty protective paper, such as a bitumen-laminated paper, shall be used for all start, finish and taper operations on sprayed sealing works. The paper shall be held securely in place during spraying operations, and shall be of sufficient width and strength to prevent overspray and spillage during removal. A suitable minimum standard is Sisalkraft 310 with a minimum width of 900 mm.

511.20 GEOTEXTILE FABRIC

1. The geotextile fabric shall be non-woven needle punched fabric manufactured from polyester. The fabric shall be free of any flaws that may impact upon performance of the fabric. Geotextile fabric used for sprayed seal applications shall comply with the requirements of Table 511.15. ***Properties***

TABLE 511.15 PROPERTIES OF HEAVY GRADE GEOTEXTILE FABRIC

Test Property (Note 3)	Test Method	Requirements
Wide strip tensile strength (kN/m)	AS 3706.2	≥ 9.0
Mass per unit area (g/m^2)	AS 3706.1	170 - 200
Maximum Elongation (%)	AS 3706.2	40 - 60
UV Stabilisation - Retained Strength (Note 2)	AS 3706.11	At least 50%
Melting Point (°C)	ASTM D276	≥ 200
Bitumen Retention at 160°C (L/m^2) (Note 1)	ASTM D6140	0.9 – 1.4
Thickness (mm)	AS 3706.1	1.6 – 2.0

Note 1 – test shall be completed using Class 170 bitumen as per AS 2008. The sample of bitumen shall be reheated only once.

Note 2 – results are to be reported for both fabric directions. Test specimens are to be exposed for a period of 500 ± 50 hours with a total exposure of 630 KJ/m^2.

Note 3 – geotextile fabric shall be dry conditioned prior to testing.

2. A roll of geotextile fabric shall: ***Geotextile Roll***

    a. Be rolled on to a rigid PVC tube

b. Be evenly wound on to the tube to create square ends with the roll varying no more than 40mm in rolled width

c. Be within 50mm of the ordered width for the full length of the roll

d. Not be shorter than the ordered length and be no more than 1m longer.

3. When stored Geotextile fabric shall be: ***Storage***

a. wrapped with a waterproof opaque material including the ends of rolls

b. stored in a shed away from direct sunlight and rain

c. kept off the ground and away from any source of moisture.

4. Rolls of Geotextile fabric shall show the manufacturer's name, batch number and date of manufacture. ***Labelling***

5. Geotextile fabric shall be used within 2 years of the date of manufacture. ***Age***

6. The Contractor shall test the geotextile fabric for conformance to the properties in Table 511.15 and at the testing frequency shown in Specification 201 QUALITY SYSTEMS. Testing shall be undertaken in a laboratory accredited by NATA or a laboratory accredited by a body that is signatory to the ILAC Mutual Recognition Agreement. ***Compliance Testing***

511.21 – 511.80 NOT USED

AS BUILT AND HANDOVER REQUIREMENTS

511.81 – 511.90 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

511.91 – 511.99 NOT USED

GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to downloaded Specifications shall be made using *Track Changes*, to clearly show added/deleted text.

2. If **all** information relating to a clause is deleted, the clause number should be retained and the words **"NOT USED"** should be inserted.

3. The proposed documents with tracked changes shall be submitted to the Project Manager for review, prior to printing the final batch of documents. When this final printing is carried out, the tracked changes option is to be turned off.

4. Before printing accept all changes in the document, turn off *Track Changes* and refresh the Table of Contents.

5. The Custodian of this specification is Bituminous Products Consultant.

CONTRACT SPECIFIC REQUIREMENTS

The following clauses are to be placed under the CONTRACT SPECIFIC REQUIREMENTS, as required. After inserting the clause, change the clause number and heading to style “H2 SP” so it appears in the Table of Contents.

XXX.XX SUB HEADING (H2 SP)

1. Insert text (Main Table SP) ***Keyword SP***

2. Insert text (Main Table SP)

XXX.XX SUB HEADING (H2 SP)

1. Insert text (Main Table SP)

2. Insert text (Main Table SP)

AMENDMENT CHECKLIST

Specification No. **511** Title: **Materials for Bituminous Treatments** Revision No:_____

Project Manager:_____ Signature:_____ Date:_____

Checked by:_____ Signature:_____ Date:_____

Contract No:_____ Contract Description:_____

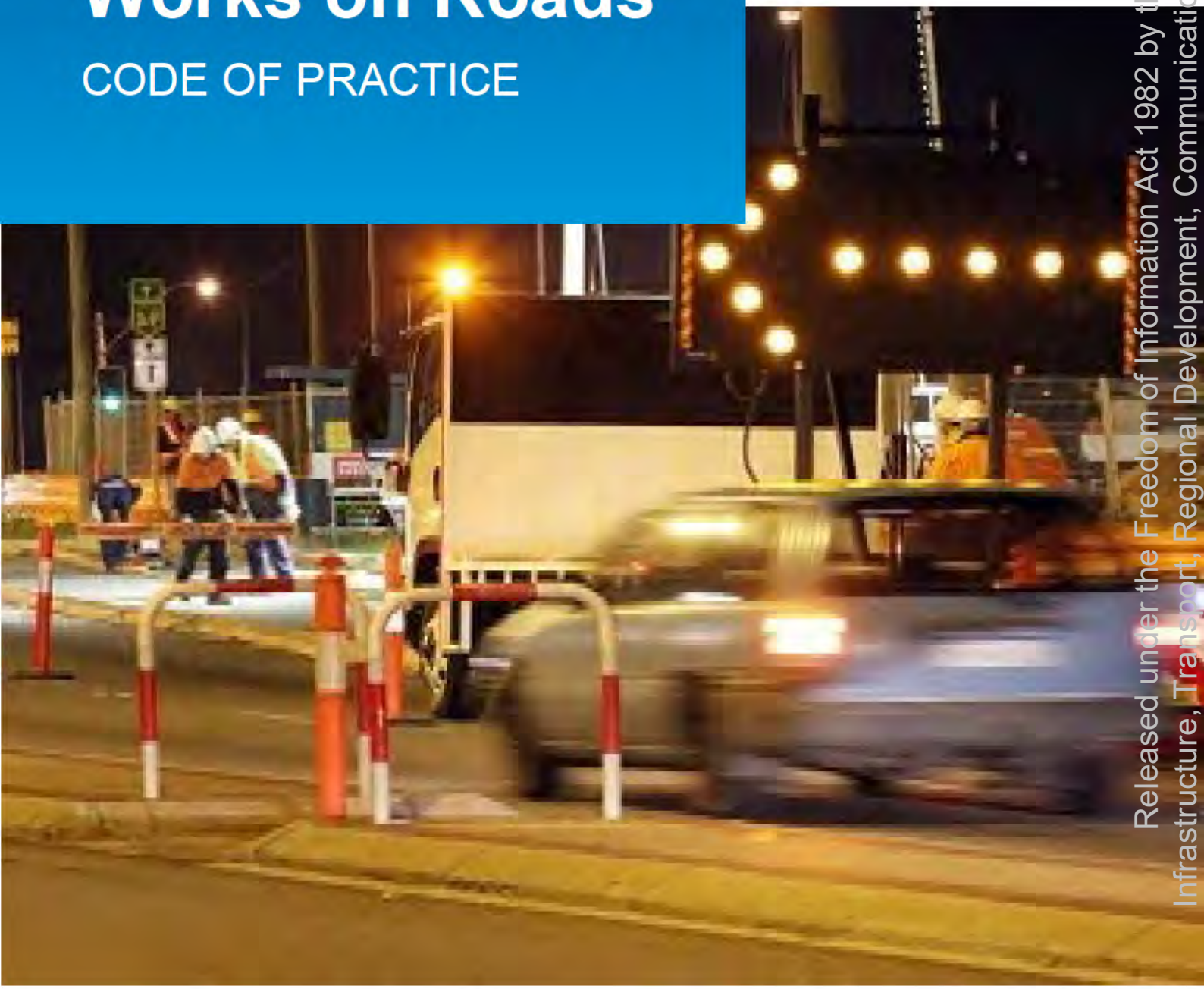
ITEM	DESCRIPTION	SIGN OFF
Note: All changes/amendments must be shown in Tracked Changes mode until approved.		
1.	Project Manager has reviewed Specification and identified Additions and Amendments.	
2.	**CONTRACT SPECIFIC REQUIREMENTS** addressed? Contract specific materials, products, clauses added? (Refer Specification Guidance Notes for guidance).	
3.	Any unlisted materials/products proposed and approved by the Project Manager? If "Yes" provide details at 16.	
4.	Standard clauses amended? **MUST SEEK** approval from Manager Commercial.	
5.	Clause deletes shows as **"NOT USED"**.	
6.	Appropriate **INSPECTION AND TESTING** parameters included in Spec 201 (Text Methods, Minimum Testing Frequencies verified).	
7.	**ANNEXURES** completed (refer Specification Guidance Notes).	
8.	**HANDOVER** and **AS BUILT** requirements addressed.	
9.	Main Roads QS has approved changes to **SMM**.	
10.	Project Manager certifies completed Specification reflects intent of the design.	
11.	Completed Specification – independent verification arranged by Project Manager.	
12.	Project Manager's review completed.	
13.	**SPECIFICATION GUIDANCE NOTES** deleted.	
14.	**TABLE OF CONTENTS** updated.	
15.	**FOOTER** updated with Document No., Contract No. and Contract Name.	
16.	Supporting information prepared and submitted to Project Manager.	
Further action necessary:		

Signed:_____ *(Project Manager)* Date:_____

mainroads WESTERN AUSTRALIA

Traffic Management for Works on Roads

CODE OF PRACTICE



JULY 2020

TRAFFIC MANAGEMENT FOR WORKS ON ROADS
CODE OF PRACTICE

All printed copies are uncontrolled

Main Roads Western Australia
Planning and Technical Services Directorate
Road Safety Branch

July 2020

This document was originally endorsed by the Traffic Management for Works on Roads Advisory Group on 3 March 2004. Revisions are endorsed by the Advisory Group and approved by MRWA Executive Director Planning and Technical Services. The Advisory Group consists of members from Main Roads Western Australia (MRWA), Australian Institute of Traffic Planning and Management (WA division) (AITPM), Civil Contractors Federation (CCF), Institute of Public Works Engineering Australia (WA division) (IPWEA), Traffic Management Association of WA (TMAWA), WA Local Government Association (WALGA), WA Police (WAPOL), Traffic Management Training Providers, Utility Providers and Engineers Australia (WA division).

A specialist Technical Committee comprising members from MRWA, IPWEA (WA division) and WALGA has provided technical advice in regard to various sections of this document.

Amendments to this document may be made from time to time reflecting the changes in technology, standards or legislation as well as the feedback from the industry, subject to endorsement by the Advisory Group. Users of this document are warned to make sure that they are using the current document which is available on MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Workzones on Roads'.

AMENDMENT / REVISION STATUS RECORD

Date	Section	Amendment / Revision Description
July 2020	Appendix 4	Main Roads WA regional contacts updated Notification of Roadworks Form Distribution List updated
	Appendix 5	MMS-ADV-83 and MMS-ADV-84 signs added
May 2020	Section 3.3; 4.5; 5.2.3; and 6.8.1	All traffic control procedures at permanent traffic signals relocated to the Temporary Traffic Management: Traffic Signal Approval Policy
	Section 9.1	Adoption of the AGTTM in Western Australia postponed to February 2021.
January 2020	Section 3.1.1	Traffic Management at Roadworks on State Roads Policy and Application Guidelines updated
	Section 3.1.3	New Section – Works on MRWA Roads in the Metropolitan Area
	Section 5.2.2	New section - Generic TMPs; Generic TMP Checklist updated; TGS selection process added
	Section 5.2.3	RTM site visit exception added
	Section 5.4	Section renamed Consultation, Communication and Notifications of Roadworks; requirements added for Transperth approval; amendments to Notification of Approved Roadworks amended
	Section 5.5	Requirement for Daily Diary to be based on template; clarification to record implemented TGS.
	Section 6.3.4	Additional requirement added for using core flute MMS
	Section 6.5.4	Requirements updated for Delineation of Temporary Road Safety Barriers
	Section 6.8.2	Railway Crossing requirements updated
	Section 6.13	New section - Traffic Control; Avoiding End of Queue Collisions requirements added
	Section 6.15	Securing signs section relocated
	Section 6.16	Covering Speed Limit Road Marking relocated and renamed to Covering Regulatory Road Marking
	Section 7.6	New section – Speed Feedback Signs

	Section 8.1	Clarification – Traffic Controller tasks include operating portable traffic control devices
	Section 8.5	AWTM accreditation – removed RIIWHS201D and RIIGOV401D
	Section 8.7	RTM pre-requisites amended
	Section 9	New section – Austroads Safety at Road Worksites
Sep 2018	Section 3.1	Additional text added regarding planning works.
	Section 5.6	Table 4.9 of AS1742.3 added to traffic flow variations.
	Section 6.8.1	Reference to Traffic Operations Centre (TOC) replaced with Road Network Operations Centre (RNOC). Spelling error amended.
	Appendix 4	TOC replaced with RNOC and email address updated.
	Appendix 5	Signs MMS-ADV-4, MMS-ADV-5, MMS-DIV-6 or MMS-DIV-7 not to be used in conjunction with a regulatory sign. Text added for use of MMS-REG-4. MMS example configurations amended.
March 2018	Whole Document	Terminology Change - Traffic Guidance Scheme to replace Traffic Control Diagram
	Section 4.5	New section – Authorising Traffic Management Plans
	Section 5.2.1	Requirement to use the Main Roads TMP template
	Section 5.2.2	Complex traffic arrangements updated; complex TMPs prepared by RTMs to be endorsed by another RTM
	Section 5.2.3	Requirements for Temporary Road Safety Barrier Details updated
	Section 5.3	Risk Management requirements updated
	Section 5.6	Amendments to Variation to the code and standards requirements
	Section 5.7	More details added for reviewing, auditing and approving traffic management
	Section 6.1.8	New sign – Narrow Temporary Hazard Marker
	Section 6.1.9	New sign – STOP HERE WHEN DIRECTED
	Section 6.3.2	MMS amendments – allowing Lane Status and Road Condition signs to have more than 2 Panels the same colour

Section 6.5.4	Amendments to delineation of temporary barriers
Section 6.8.1	Amendments to requirements at traffic signals
Section 6.8.2	Amendments to requirements at railway crossings
Section 6.11	Adoption of the Guidelines for the use of TMAs in WA
Section 7.5	New section – Securing signs
Section 7.6	New section – Innovative traffic control devices
Section 8.2	BWTM accreditation – allowing BWTM to directly supervise implementation of signs on low speed local roads
Section 8.5	AWTM accreditation - Addition of one year experience added to prerequisites
Appendix 2	New appendix – Traffic Risk Classification
Appendix 4	Inclusion of HVS requirements in Notification of Roadworks form
Appendix 5	Signs added – MMS-ADV-79; MMS-ADV-80; MMS-ADV-81; MMS-ADV-82. MMS combination examples added

Foreword

Western Australia has over 170 000 kilometres of roads, which periodically require re-construction, maintenance or work on services within their road reserve. Unfortunately these tasks have the potential to create hazardous situations for both road workers and users that may produce serious or even fatal consequences.

Main Roads Western Australia has adopted the Safe System approach to managing the road network. This Code provides mechanisms to protect all road users (including road workers), acknowledging that people are fallible and have limited tolerances to force.

I have authority under Regulation 297 of the Road Traffic Code 2000, to erect, establish or display, alter or take down any road sign or traffic control signal. With this comes a duty of care to facilitate the safe and appropriate use of road signs and devices. These requirements have been developed in conjunction with key stakeholders in recognition of this obligation.

The requirements promote safe and consistent traffic management practice at work sites on roads in accordance with state legislation and national standards. They require general compliance with the Australian Standard 1742.3 - 2009, provide details of additional requirements necessary to meet Western Australian requirements and advise of variations to the requirements of the Australian Standard that I am prepared to allow on Western Australian roads. The requirements also outline the competency requirements for personnel responsible for managing traffic on work sites and the need to hold a qualification relevant to the specific task in traffic management.

This document, initially released in March 2004, supersedes the MRWA 'Traffic Management for Roadworks Code of Practice. It has been prepared following extensive consultation with Local Government, industry and other stakeholders through Advisory Group meetings, Technical Committee meetings, a technical workshop and other forums.

I encourage all persons involved in managing traffic at work sites on roads to fully familiarise themselves with these requirements, to apply them with due consideration to the situations that present to them and to carefully comply with the mandatory requirements. This will result in safer work sites for yourselves, your fellow workers and all road users.

Richard Sellers
COMMISSIONER OF MAIN ROADS

Contents

1. INTRODUCTION

Roadworks can create potential hazards that can give rise to injury or damage resulting in loss, litigation or prosecution, if reasonable care is not taken to protect both road users and road workers.

Road users are not limited to motorists - they include pedestrians, such as school children and people with disabilities, cyclists and emergency vehicles. Management of work on roads requires consideration of all road user needs and obligations and attention should not focus just on the management of vehicular traffic through, past or around the work site.

Main Roads has adopted the Safe System approach to the management of the road network, recognising that humans make mistakes which can lead to death or serious injury. The Safe System philosophy demands that we make changes to the road network to prevent road trauma and reduce crash forces to survivable limits.

This Code of Practice (herein after referred to as the 'Code') describes the Main Roads Western Australia's (MRWA) requirements for managing traffic at work sites on roads. It requires traffic management for works on roads to be based on AS 1742.3 – 2009, unless otherwise specified by a requirement in this Code. In the event that there is a conflict between this Code and AS 1742.3 – 2009, the Code shall take precedence.

The purpose of this Code is to specify any variations or additional requirements to AS 1742.3 – 2009 which are required at works on roads in Western Australia. The underlying principles of this Code are to:

- Ensure the safety of all road users and road workers in line with the safe system principles.
- Minimise the disruption and inconvenience to all road users resulting from works on roads and;
- Establish uniform procedures for traffic management at work sites that can be easily recognised and understood by road users.

The prescribed practices are the minimum requirements, on which the Traffic Management Plans (TMPs) for all Western Australian roads shall be based. MRWA recognises that situations sometimes arise where application of these requirements is not appropriate and that variation to these requirements will be necessary. When it becomes apparent that deviation is necessary from the requirements of this Code, persons arranging the works should carefully consider all possible options, using common sense and judgment based on 'risk management' carried out in accordance with sections 5.3 and 5.6. Further, they shall ensure that their actions are consistent with related legislation.

Practitioners should be aware of the document titled Traffic Management for Events Code of Practice that has been placed on Main Roads' website - see 'Our Roads' > 'Temporary Traffic Management' > 'Events on Roads'. This document has been designed to complement the Traffic Management for Works on Roads Code of Practice in respect to the various traffic management issues that are common to works on roads and to events, particularly in respect to the design and implementation of Traffic Management Plans.

2. SCOPE

This Code applies to all work conducted within all road reserves throughout Western Australia and the planning of any proposed works. Definitions of terms such as ‘work’ and ‘road reserve’ are provided in Appendix 1.

3. APPROVAL TO WORK WITHIN ROAD RESERVES

Prior to commencing works, approval shall be obtained from the agency responsible for the care, control and management of the relevant roads. Care should also be taken to ensure that all other required authorisations are obtained prior to the commencement of works. These might include agreement to any variations to the application of this Code of Practice and/or Australian Standards, as well as any development, heritage, environmental, and cultural clearances. Lengthy delays may be experienced if all necessary approvals are not obtained, increasing the risk of undesired traffic incidents.

In addition to obtaining approval to work within the road reserve from the relevant Road Authority, other agencies such as emergency services, Police, public transport etc. in the area may need to be notified in advance of the impending works as detailed in section 5.4.

All approvals to conduct works on roads issued by MRWA, Local Governments or other Authorities responsible for roads, shall be suitably noted on the Traffic Management Plan. A mandatory condition requiring traffic management to be carried out in accordance with the requirements of this Code, subject to any agreed variations, shall be included with the approval.

3.1 ROADS FOR WHICH MRWA IS RESPONSIBLE

The Commissioner of Main Roads (CMR) is responsible for the care, control and management of the land over which any declared 'highway' or 'main road' exists. Any party intending to conduct work on any 'highway' or 'main road' reserve shall obtain prior approval from MRWA.

MRWA has developed comprehensive guidelines and an application kit for those intending to undertake work within any 'highway' or 'main road' reserve in regard to 'complex works', 'low complexity works' or 'utility service works'. These guidelines including contact details and the application kit are available on Main Roads website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Conducting Works on Roads' > 'Applications to Undertake Works'.

To facilitate prompt approval of applications to work on roads, persons arranging works should contact the relevant MRWA Regional Office at an early stage, to obtain traffic information, the level of service required on the road during the works and details of any other requirements that need to be considered whilst preparing their Traffic Management Plans (TMPs).

Typically the proposed works and staging should be determined and approved in principle prior to any TMP being produced. Once in principle approval for the works has been obtained, the TMP designer should gain a comprehensive understanding of the project staging and then an appropriate TMP can be produced. The TMP should be reviewed by the construction / project manager for suitability prior to being submitted to Main Roads to review and authorise. Depending on the complexity of the project, the time allowed for Main Roads to review should be approximately 15 working days. For works at traffic signals refer to section 6.8.1.

Further information on preparing TMPs is provided in section 5.2.

MRWA requires submission of a TMP with all applications to work within its road reserves. TMPs for metropolitan area shall be sent to enquiries@mainroads.wa.gov.au.

If the works are occurring outside the metropolitan area TMPs shall be submitted to the relevant regional office using the generic email address in Appendix 4.

MRWA will, as it considers necessary, conduct audits of TMPs and refer those that do not comply with the requirements of this Code, back to the proponent for submission of an acceptable TMP prior to allowing commencement of works.

Any organisations with statutory authority to enter MRWA road reserves in emergency situations shall advise the MRWA Customer Information Centre (Ph. 138 138) of their work either prior to, or as soon as possible after commencing any emergency service.

3.1.1 Main Roads WA Policy for Works on High Volume Roads

Main Roads requires roadworks on its high volume roads to be managed with due consideration to traffic efficiency. A policy has been established which puts in place elevated standards of traffic management on high volume roads. This Policy and Application Guideline is titled Traffic Management at Roadworks on State Roads. The policy can be found on Main Roads' website www.mainroads.wa.gov.au go to 'Building Roads' > 'Road and Traffic Engineering' > 'Standards and Technical' > 'Traffic Management' > 'Temporary Traffic Management'

The policy sets controls on speed limits, lane closures, merges, emergency lanes, Smart Freeways, worksite access and work times for planned maintenance works. Further advice, tools and recommendations are provided, such as real time traffic monitoring and a congestion calculator for traffic management planners.

3.1.2 Traffic Management Company Registration Scheme

Any party implementing temporary traffic management on MRWA controlled roads shall be registered with MRWA. The Traffic Management Company Registration Scheme applies to all parties, including Local Governments and Authorised Bodies. The guidelines including contact details and the application kit are available on Main Roads website at www.mainroads.wa.gov.au ; go to 'Our Roads' > 'Temporary Traffic Management' > 'Company Registration'.

3.1.3 Works on MRWA Roads in the Metropolitan Area

Implementing approved traffic management on the MRWA road network can often cause congestion that may be flagged by the Road Network Operations Centre (RNOC) as an incident.

To avoid any confusion with RNOC, and potential delays to works, it is recommended that immediately prior to implementing approved traffic management on Main Roads WA controlled roads in the metropolitan area, the traffic management personnel onsite contact the MRWA Road Network Operations Centre (RNOC) on 138 111.

3.2 ROADS FOR WHICH LOCAL GOVERNMENT OR OTHERS ARE RESPONSIBLE

Any party including utility service providers who are Authorised Bodies intending to conduct works on a road reserve that is not a declared 'highway' or 'main road', shall prior to commencing the works, contact the relevant Local Government or the other Authority that is responsible for the care, control and management of the road to confirm their requirements.

Location	Contact
Main Road reserve in Perth Metropolitan Region	enquiries@mainroads.wa.gov.au
Main Road reserve outside Perth Metropolitan Region	The relevant MRWA Regional Office - see Appendix 4
Local Government road reserve	The relevant Local Government
Other road reserves	The Authority responsible for the road

Table 1 - Where to obtain approval to work in road reserves

3.3 WORKS AFFECTING TRAFFIC SIGNAL OPERATION

Where the proposed traffic management involves modification to existing signal phasing, number of traffic lanes and / or timing on local OR state roads; the proposed changes to these devices are to be submitted to Main Roads WA accordance with the Temporary Traffic Management: Traffic Signal Approval Policy available on the Main Roads website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications' > 'Publications'.

4. AUTHORITY TO ERECT TRAFFIC CONTROL DEVICES

4.1 MRWA

The CMR has authority under the Road Traffic Code, to erect, establish or display and alter or take down any road sign or traffic control signal (subsequently referred to herein as 'to utilise traffic signs and devices'). The CMR has delegated specified officers of MRWA to administer the utilisation of traffic signs and devices in accordance with the MRWA Delegation of Authority Manual.

4.2 MRWA AGENTS

MRWA agents or contractors shall, subject first to the approval of their MRWA Contract Manager, utilise traffic signs and devices in accordance with this Code for the purpose of managing traffic at works on roads. MRWA Contract Managers will comply with the MRWA Delegation of Authority Manual in regard to providing such approvals.

4.3 AUTHORISED BODIES AND THEIR AGENTS

The CMR authorises Authorised Bodies and their agents, in accordance with the provisions of the Road Traffic Code, to utilise traffic signs and devices subject to any conditions attached to their Instrument of Authorisation. An example of a typical 'authorisation' is contained in Appendix 3.

A register of Authorised Bodies is available on MRWA's website at www.mainroads.wa.gov.au; go to 'Our Roads'> 'Temporary Traffic Management' > 'Workzones on Roads'> 'Authorised Bodies'.

4.4 OTHERS NOT PARTY TO AN INSTRUMENT OF AUTHORISATION

Others that are not party to an Instrument of Authorisation but need to utilise traffic signs and devices for the purpose of managing traffic for works on a road, shall first contact the Authority responsible for the care, control and management of the road to confirm their requirements.

If the Authority responsible for the care, control and management of the road is an Authorised Body, it will determine the requirements and approval process for others not party to an Instrument of Authorisation. Unless advised otherwise by such Authority, the responsibility for ensuring signs and devices are erected and maintained in accordance with this Code will, at all times, remain with the party undertaking the works.

If the Authority responsible for the care, control and management of the road is not an Authorised Body, authority to utilise traffic signs and devices either by such Authority itself, its agents or contractors or, by a third party, shall be obtained from MRWA with the concurrence of such Authority.

4.5 AUTHORISING TRAFFIC MANAGEMENT PLANS

General Requirements
By signing the 'Road Authority Authorisation' section of a Traffic Management Plan (TMP) the Road Authority (Main Roads and/or LGA) is endorsing the implementation of temporary traffic management on that road. The Road Authority is not responsible for ensuring every aspect of the TMP is compliant with AS1742.3-2009, this code and/or the Traffic Management for Events Code of Practice (Events Code).

It is the responsibility of the TMP designer (AWTM or RTM), the person who checks the TMP and the RTM who reviews and endorses (if applicable) the TMP to ensure that the plan is compliant with AS1742.3-2009, this code and/or the Events Code. The Road Authority also has a duty of care to the safety of road users and road workers within their jurisdiction, and as a result their review focuses on the TMP's suitability in catering for all road users, speed zone appropriateness, traffic efficiency and ensuring after care and staging Traffic Guidance Schemes (TGS) are provided.

Traffic Management on Roads Controlled by Main Roads
Main Roads, or Main Roads contractors with an Instrument of Authorisation, shall review and authorise the plan as per the general requirements above.

Traffic Management on Local Government Roads
The Local Government Authority shall review and authorise the plan as per the general requirements section above.

At permanent traffic signals on local government roads Main Roads will review and authorise the required changes to the Main Roads Traffic Signals only (see the Temporary Traffic Management: Traffic Signal Approval Policy). Additionally, where works are on local government roads but it is identified that there may be an impact to nearby roads that are controlled by Main Roads, then Main Roads shall review and authorise the TMP as per the general requirements section above.

5. PLANNING THE WORKS

5.1 DUTY OF CARE

Any party who undertakes work on a road that is open to traffic, by law has a 'duty of care' to take all steps that are reasonably necessary to prevent any person being injured or damage being caused to the property of others while carrying out those works.

The Occupational Safety and Health Act specifically requires:

- An employer to provide a safe place of work for its employees and
- Any person in control of a workplace, to take measures to ensure persons who have access to that workplace (including road users in case of a roadworks site) are not exposed to hazards.

5.2 TRAFFIC MANAGEMENT PLANS

5.2.1 General

Any party undertaking work on a road shall prepare a Traffic Management Plan (TMP) that adequately provides for the safety of workers and road users while maintaining an adequate level of service to road users. The amount of details and information to be provided in a TMP can vary depending upon the nature and complexity of the project. To ensure a consistent approach is taken when developing a TMP one of the Main Roads WA TMP templates[1] (see here) shall be used as a basis for the development of the plan. Any section headings that are not applicable to the TMP being developed shall be kept in the document and noted as not applicable (with the intent of keeping the TMP section numbers the same throughout all TMPs). The Guide to the Preparation of Traffic Management Plans provides details on the preparation of TMPs and is available on MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation'.

All TMPs shall be prepared by a person holding Main Roads accreditation in Advanced Worksite Traffic Management (AWTM). A person holding Main Roads accreditation in Worksite Traffic Management (WTM) may make on-site adjustments to the TMP in accordance with its scope and objectives (following any adjustment the residual risk shall not be higher to workers or road users). Further information regarding requirements for WTM / AWTM tasks and accreditation is provided in section 8.

TMPs shall be signed by the person that prepared them, along with his/her name in block print, AWTM certificate number and the date of endorsement of the plan. In addition, the person preparing a TMP shall also include a statement on the plan confirming that a site visit[2] was undertaken by him/her or another person under his/her direction, prior to preparing the plan (not required for Generic TMPs, see 5.2.2).

With the exception of repositioning of traffic control devices within the allowable tolerances specified in AS1742.3 - 2009, where any on-site changes to a TMP are proposed, such changes shall be endorsed by a person holding current WTM or AWTM accreditation. A copy of all documentation relating to the endorsement of the changes shall be held on-site by the person managing the works.

[1] Note: the basic TMP template may be used when conditions in the Basic TMP checklist (section 5) are met. Go to www.mainroads.wa.gov.au > 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation' > 'How to prepare a traffic management plan'

[2] It is good practice to include photographs as evidence that the site visit was undertaken.

All TMP's must contain a contingency plan for fatality and serious injuries which must detail arrangements for preserving the worksite. See section 6.10.

All Traffic Guidance Schemes (TGSs) shall be signed and dated by the person that prepared the TMP and be appropriately labelled so that those implementing the TGSs implement the correct Traffic Management for the particular work situation (Labelling example: 'when clearance to traffic is less than 1.2 m'). It is recommended that all Site Specific TGSs contain the days and times the TGS is to be implemented.

Where a TMP is to be used on more than one occasion or at a number of generic locations, continuous improvement must be considered. This will ensure the quality of traffic management is maintained or improved where required. The process should include debrief meetings to discuss any issues or risks associated with the plan. TMP's must be kept up to date taking into account changes in: traffic volumes, vehicle types, the road environment, work practices, legislation and/or standards. As a minimum, TMPs should be reviewed at least once in any 12 month period.

5.2.2 Generic TMPs

For routine/repetitive type works such as minor pavement maintenance, a generic TMP may be appropriate. The person preparing the TMP shall refer to the Generic/Site Specific TMP Checklist to assist in determining whether the traffic management setup can use a generic or site specific TMP, this is available on the Main Roads WA website www.mainroads.wa.gov.au ; go to 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation' > 'How to Prepare a Traffic Management Plan'.

For Generic TMPs a site visit by the AWTM that prepared the TMP[3] is not required, however the person responsible for implementing the TMP shall be aware of the scope of situations covered in the TMP and ensure it is applicable for the site[4]. The person implementing the TMP shall complete the Generic/Site specific TMP checklist, see below process for TGS selection. Where the generic TMP is not a suitable a site specific TMP shall be developed.

Process for TGS Selection

Generally, Generic TMPs will contain Generic TGSs with no specific location information and may be applicable for use at a number of locations. It is recommended a selection procedure is defined within the TMP to assist the onsite BWTM in the selection of the correct TGS for the road type, road environment and the type and location of works to be undertaken (for example on shoulder or in lane). An example TGS selection checklist is located on the Main Roads WA website, see here.

A TGS is defined as 'Site Suitable' once a Generic TGS has been selected using the defined selection procedure, a site visit or investigation of the site is conducted and it has been confirmed that the selected TGS is appropriate for use for the works at that site.

All Generic TGS shall be confirmed as a Site Suitable TGS prior to commencement of works. Once the Generic TGS is confirmed as suitable for use, location information is added to the Generic TGS. Confirmation that a Generic TGS is site suitable shall be performed and signed off by a BWTM, WTM or AWTM, details shall be recorded in the daily diary.

[3] RTMs may endorse Generic TMPs that do not involve 'complex traffic arrangements' without undertaking a site visit, see section 5.2.3.
[4] The TMP shall be authorised for implementation by the relevant road authority, see section 4.

5.2.3 Traffic Management Plans Involving 'Complex Traffic Arrangements'

'Complex traffic management arrangements' are those activities and traffic management arrangements that include any of the following:

i. Any plan assessed as having a residual risk-rating of H (high-risk) or greater as a result of a risk assessment undertaken during the planning stage.

ii. Any plan that meets all of the following:
   1. Occurs on a multilane road in the metropolitan area; and
   2. Closes or diverts one or more lanes (includes emergency lanes); and
   3. Occurs on any Freeway OR road with a permanent speed limit of 90 km/h or more (or a section of these roads reduced to 80km/h due to traffic signals); and
   4. Has a traffic volume of 15,000 vpd or more.

iii. Any plan at permanent traffic signals that requires:
   1. Alteration to the function of the traffic signals or signal display (e.g. flashing yellow, masking displays, modifying movements or phasing); or
   2. Closure of a traffic lane (including tapers or road closures):
      a. within a signalised intersection, or
      b. within 30 m of the stop line on the approach, or
      c. within 30 m of the adjacent stop line on the departure, or
   3. Closure of any part of a signalised dedicated turning lane;

   See the Temporary Traffic Management: Traffic Signal Policy for more details.

iv. Any Traffic Management arrangement involving Temporary Road Safety Barriers.

v. Any plan that involves the removal or replacement of permanent road safety barriers that are preventing a potentially catastrophic outcome, e.g. commuter rail or freeway barriers.

vi. Temporary diversion of traffic into the opposite lane of a multilane road creating a free flowing contra-flow situation (does not apply to contraflow implemented at overtaking lanes).

vii. Plans that will redistribute traffic, significantly lowering the level of service and safety of the surrounding road network, including isolated intersections.

viii. Any other situation where the road authority or authorised body consider the traffic arrangement sufficiently complex to warrant RTM review and endorsement.

TMPs for works involving 'complex traffic arrangements' shall be reviewed and endorsed by a Roadworks Traffic Manager (RTM) in the form of his/her signature, the date, block printed name and RTM accreditation number. Further information regarding requirements for RTM accreditation is provided in section 8.

TMPs for works involving 'complex traffic arrangements' that have been prepared by a person holding RTM accreditation shall be reviewed and endorsed by another person with RTM accreditation.

RTMs shall only endorse finalised Traffic Management Plans[5] that include a documented risk assessment of the proposed works in accordance with AS/NZS ISO 31000, Risk Management – Principles and Guidelines – Risk Management (2009) and Appendix 2 of this Code, during the planning stage. A TMP shall not contain a residual risk rating VH (very high-risk) for any proposed traffic management treatment. A TMP involving a residual risk rating H (high-risk)[6] shall be reviewed and endorsed by a RTM.

Regardless of whether a particular TMP involves 'complex traffic arrangements' or not, the Road Authority/Authorised Body that grants approval for the works to proceed may determine that the TMP requires to be endorsed by a RTM.

With the exception of repositioning of traffic control devices within the allowable tolerances specified in AS1742.3 - 2009, where any on-site changes to a TMP involving 'complex traffic arrangements' as determined in the planning stage are proposed, such changes shall be subject to a risk assessment using the same methodology documented in the TMP (unless an alternative methodology has been specified in the TMP). The risk assessment shall be undertaken by a person holding current Worksite Traffic Management or Advanced Worksite Traffic Management accreditation. These changes shall be within the scope and objectives of the TMP (see table 5), anything outside this will need to be endorsed by the RTM and authorised by the relevant road authority.

A copy of all documentation relating to the risk assessment shall be held on-site by the person managing the works. Additionally, following the on-site implementation of the changes, a copy of this documentation shall be referred back to the Roadworks Traffic Manager that endorsed the design of 'complex traffic arrangements', as soon as practicable for review and feedback to the person/contractor managing the works.

Roadworks Traffic Managers must abide by the Code of Conduct in discharging their professional duties at all times. The Code of Conduct for Roadworks Traffic Managers is available on MRWA's website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Roadworks Traffic Managers'.

As per the RTM Code of Conduct, RTMs are required to make at least one site visit prior to endorsing a Traffic Management Plan. However, in regional areas that do not have access to RTMs based within 200km of the site, RTMs may endorse complex TMPs without the need to undertake a site visit when all the following criteria is met:

- The works associated with the TMP will be completed in less than 5 shifts (5 days);
- The TMP does not include any risks that have a residual risk rating of High or greater;
- The TMP does not involve Temporary Road Safety Barriers;
- A person with AWTM accreditation undertakes a site visit after they have consulted with the RTM to determine what information is required (video, photos, measurements, etc.).

It is important that the RTM collects and maintains photographic and video evidence provided by the AWTM undertaking the site visit. Regardless of the above, a Road Authority / Authorised Body reserves the right to request that an RTM undertakes a site visit in person, in accordance with the RTM Code of Conduct.

[5] The endorsement shall be of the entire TMP not just the parts that are considered 'complex'
[6] Traffic flow may be exempted, traffic flow less than 135 % of the allowable capacity as detailed in AS1742.3 may be endorsed by a person with AWTM accreditation as part of a variation to standards form, see section 5.6.

5.2.4 Temporary Road Safety Barrier Detail in TMPs

As required in section 5.2.3 of this code any TMP involving Temporary Road Safety Barriers shall be reviewed and endorsed by a RTM. It is the responsibility of the RTM to ensure the TMP contains adequate barrier detail. Where temporary barriers are required these shall be designed in accordance with manufacturer's requirements, Austroads and MRWA technical guidelines. Calculations shall be appended to the TMP.

TGSs shall provide sufficient detail so that installers can determine offset from traffic lanes, worksite length/width, deflection distances required, containment fences (if required), start and finish points of the barrier, flare rates (if any) and necessary end treatments. Temporary barriers must be rated at the appropriate test level and be an approved barrier type listed on the MRWA Website (Go to www.mainroads.wa.gov.au "Building Roads" > "Standards and Technical" > "Road & Traffic Engineering" > "Roadside Items" > "List of Approved Road Safety Barrier Systems").

Where temporary barriers are required, implementation methods should be detailed in the TMP and TGSs should be prepared.

5.3 RISK MANAGEMENT

Management of risk is central to a TMP.

This involves the identification and analysis of all risks likely to arise during works on roads including during the setting up, operating, changing and ultimate dismantling of traffic guidance schemes, followed by the determination of appropriate measures to mitigate those risks. The process is applicable at all levels of planning and operation.

The risk assessment shall be undertaken in accordance with AS/NZ ISO 31000:2009 and Appendix 2 of this Code and included within the TMP.

5.4 CONSULTATION, COMMUNICATION AND NOTIFICATION OF ROADWORKS

Roadworks have the potential to cause significant delays or access problems, or create adverse impacts on existing road infrastructure such as traffic signals, railway crossings, bridges, etc. Stakeholder consultation and/or communication is an essential part of preparing a TMP. For example, the relocation or diverting of traffic using lane closures or detours can change loading dynamics or introduce additional loadings on nearby bridges to the extent that bridge capacities and load restrictions may be exceeded.

Information and procedures for providing notification to the relevant rail infrastructure manager about works impacting on railway crossing operations, is given in section 6.8.2.

It is important that where traffic is to be detoured via an existing road network, the road authority responsible for roads forming the detour is notified of the traffic arrangements during the planning of the works, i.e. when preparing the Traffic Management Plan (see section 5.2).

It is the responsibility of the individual or organisation proposing to undertake works to ensure all relevant stakeholders are appropriately notified of the works and subsequent impacts on traffic conditions.

5.4.1 Consultation

Consultation is an essential part of the preparation of a TMP, including consultation with the road authority. It is also important to consult with any stakeholders who have an understanding of site features and constraints, and who will be impacted by the implementation of the traffic management plan. Examples of stakeholders to be consulted include:

- road authorities
- residents and land owners
- local businesses
- schools
- public transport providers:

  If planned road works are impacting Transperth bus services or bus stops* approval must be obtained from a member of the Transperth Service Disruption Team (Transperth.ServiceDisruptions@pta.wa.gov.au) ensuring they are satisfied with proposed detours and bus stop closure or relocations. The PTA will require a minimum of 5 working days' notice to review any plans or traffic guidance schemes. A TGS indicating the bus detour and/or bus stop relocations shall be provided.

  ** Transperth approval is not required for any road works occurring on residential streets for a short duration (less than two hours and outside of peak times); however they will still require of Notification of Roadworks form.*

5.4.2 Notification of Approved Roadworks

Notification of approved Roadworks shall be sent using the form in Appendix 4 at least seven (7) days prior to works commencing, in the following situations.
Note: the notification form does not replace the need to consult with relevant stakeholders.
(a 'Word' document version of the Notification of Roadworks Form is available on MRWA's website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'.) There may be other stakeholders that require notification that aren't listed. Only stakeholders impacted should be sent the form:

- Works involving the complete closure of any road (may not apply to access roads, however residents shall be notified).

- Works on primary and district distributor roads of more than four (4) hours duration where it is expected that traffic delays and congestion will occur.

- Traffic management activities involving the establishment of a contra-flow.

- Traffic management activities resulting in any direct or indirect changes to traffic flows and/or traffic composition on bridges, including situations where such changes are a result of lane closures or traffic detours.

- Works on any primary or district distributor road where construction activities will make it difficult or impossible for the passage of general access or oversize vehicles, and traffic control devices cannot be easily shifted on a temporary basis to allow the vehicle to pass.

- Traffic management activities that prohibit turning movements at signalised intersections.

- Works occurring through any Crossing Attended Warden controlled children's crossing.

- Any other activities where major impact on stakeholders are expected.

It is essential that the relevant road authority is informed of all communications or notifications planned and/or executed to support the implementation of traffic management.

For all works requiring the complete or partial closure of a road, an outline of the planned communications should accompany the Notification of Roadworks form. Where applicable, contact details for the communications coordinator (or equivalent) should also be provided.

5.5 TRAFFIC MANAGEMENT RECORDS

It is a requirement that any party undertaking work on or alongside a road, shall keep a copy of the current approved TMP onsite. Daily records of the sign arrangement or traffic guidance scheme shall be kept in a diary in accordance with Appendix A of AS1742.3-2009. As a minimum, the Daily Diary shall be based on the Daily Diary Template on the MRWA website www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation' > 'How to Prepare a Traffic Management Plan'.

Any changes to traffic control device placements shall be recorded in the TMP (e.g. TGSs, risk assessment, daily diary, etc.) including the name and accreditation number of the person who approved the change in accordance with Appendix A of AS 1742.3 - 2009. It may become necessary to produce these records in evidence at legal proceedings at a future time. The records can greatly assist all parties to ascertain pre-existing site conditions on which claims for damages are usually based. Good records can save considerable investigation resources, and assist in deciding the most appropriate response to a claim.

Claims for damages are often made a considerable time after an incident. Under the Limitation Act (WA), claims for negligence must be commenced within six (6) years. However, a defendant may be unaware that an action has commenced for a further year as the plaintiff has this time in which to serve the writ.

MRWA recommends that traffic management records be securely stored for a period of not less than seven (7) years from the date of completion of the works. The Authorised Body that grants approval to a Traffic Management Plan should keep a copy of the approved Traffic Management Plan and any daily records of their supervisory staff that capture the on-going implementation of the Traffic Management Plan.

In case of all works undertaken for or on behalf of MRWA, the persons arranging the traffic management works shall keep their own daily records in addition to a copy of the approved TMP together with any other relevant records.

For all other works the requirements for record keeping in relation to traffic management shall be determined by the Authorised Body responsible for or authorising the work.

5.6 VARIATION TO THE CODE AND STANDARDS

Where compliance to this Code or the recommendations of AS1742.3 - 2009 cannot be satisfied e.g. due to the physical road environment (i.e. a building or fence close to the road or minimal existing road width), legislative constraints (i.e. environmental, cultural or heritage constraints), etc., a variation to this Code, or standards will be required. Approval for the variation shall be obtained from each relevant Road Authority responsible for the care and control of the road on which the placement of traffic control take place.

Before seeking the Road Authority's approval it is imperative that a risk analysis of the variation be carried out. Where the variations result in a traffic management treatment of lesser standard, it shall be based on risk management undertaken by a Roadworks Traffic Manager in accordance with AS/NZS ISO 31000:2009 and Appendix 2 of this Code. The details of the risk assessment process shall be documented in the Traffic Management Plan with RTM endorsement in the form of his/her signature, the date, block printed name and RTM accreditation number.

A person with Advanced Worksite Traffic Management (AWTM) accreditation is permitted to endorse a traffic management plan where vehicles per hour are less than 135% of the allowable traffic volume detailed in tables 4.9 or 4.10[7] of AS1742.3 - 2009 (i.e. RTM endorsement is not required). This shall still be treated as a variation to standard, with risk assessment process completed by the AWTM, as outlined above. Vehicles per hour equal to or greater than 135% of allowable traffic volume will require a variation to standard with RTM endorsement. Approval for any variation to table 4.9 or 4.10 of AS1742.3 - 2009 shall be obtained from the relevant Road Authority.

Note: Table 4.10 of AS1742.3 - 2009 gives guidance on the number of lanes required at short term works and long term works of up to 7 days duration. For longer term works, precise calculation of capacity may be necessary to ensure that traffic demand can be met.

A risk assessment in accordance with AS/NZS ISO 31000:2009 and Appendix 2 of this Code shall also be carried out if any party considers that additional measures above and beyond the minimum requirements of the Code are necessary.
Where the local road authority had not been granted an Instrument of Authorisation, pursuant to Regulation 297(2) of the Road Traffic Code 2000 relating to Traffic Management for Roadworks, approval shall be obtained from Main Roads WA.

For activities undertaken on a State road or on behalf of Main Roads WA, the approval for the variation shall be obtained from the appropriate Main Roads WA' Officer using the Variation to Standards Application Form available from the Main Roads WA website www.mainroads.wa.gov.au; go to 'Our Roads' > Temporary Traffic Management' >'Forms and Publications' > 'Forms'
The approved variation form or a letter from the local road authority approving the variation shall be provided as an attached supplement to the traffic management plan.

[7] The word intersection within table 4.10 of AS1742.3 - 2009 relates only to considered directions of a road that have a control device/s (e.g. traffic signals)

5.7 REVIEWING, AUDITING AND APPROVING TRAFFIC MANAGEMENT

5.7.1 Auditing

Auditing processes may be applied at the planning and implementation phases of temporary traffic management. The extent and timing of the auditing will be influenced by the size, scope and complexity of the project as well as the TMP and the TGS that is developed.

Like any audit process, the findings and recommendations should be fed back into the TMP risk management process so that appropriate changes can be considered and then applied to improve worker and road user safety.

There are a number of different audits, reviews, inspections and checks that can be done of a TMP or Traffic Guidance Scheme.

Road Safety Audit
Austroads Guide to Road Safety Part 6: Road Safety Audit states road safety audits can be conducted for roadwork traffic management during construction of significant projects.

A road safety audit is a formal examination of the proposed traffic scheme in which an independent qualified team reports on potential crash occurrence and severity which may result from the introduction of the project.

Any road safety audit conducted on a Main Roads project shall comply with the Main Roads Policy and Guidelines for Road Safety Audit, see here. Road safety audits conducted on a Local Government project should comply with the relevant Local Government's road safety audit policy where applicable or otherwise the *Austroads Guide to Road Safety Part 6: Road Safety Audit*.

Suitability Audit
A Suitability Audit is a systematic and independent examination of the extent to which the proposed Traffic Management Plan addresses specified requirements and provides a measure of the project's capability in meeting those requirements. This audit is conducted by an RTM prior to the implementation of the TMP. The RTM:

- audits the entire TMP and all TGSs;
- audits against contractual requirements;
- considers all safety issues related to the traffic management including crash risks;
- considers traffic flow and efficiency;
- inspects the site;
- writes an audit report, see template here;
- holds a completion meeting with relevant site personnel, e.g. project manager, traffic manager, etc.

Compliance Audit
A Compliance Audit is a systematic and independent examination of the extent to which a project fulfils its traffic management requirements (including the Traffic Management Plan) and provides a measure of the project's performance in meeting specified requirements. This audit is conducted by an RTM after a TMP/TGS has been implemented and may be conducted at various stages of the project. The RTM:

- audits the entire TMP and all TGSs (may only be able to cover off the implementation of the TGS in place at the time of the audit);
- audits against contractual requirements;
- considers all safety issues related to the traffic management including crash risks;
- considers traffic flow and efficiency;

- inspects the site;
- writes an audit report, see template here;
- holds a completion meeting with relevant site personnel, e.g. project manager, traffic manager, etc.

Suitability Review and Compliance Inspection
A Suitability Review or Compliance Inspection are the same as the Suitability/Compliance audit except these are conducted by a person with AWTM accreditation and it does not result in a full report being produced (can also be undertaken by an RTM).

It is recommended practice to have project managers, work supervisors or other site staff that hold AWTM accreditation conduct regular Suitability Reviews or Compliance Inspections of the traffic scheme at long term works. However, compliance with an approved TMP or standard does not necessarily mean it is safe for all road users, which is the primary objective of a road safety audit.

It should be noted that someone that holds AWTM accreditation may not have the required experience in road safety auditing, road safety engineering or temporary traffic management to identify crash potential or other issues related to the scheme.

5.7.2 Field Operation

Supervisory personnel should establish a daily routine that ensures the below checks and inspections are undertaken at appropriate intervals during the project.

Operational Check
An operational check involves an onsite drive through and check of the operation of the traffic management scheme, ensuring it is operating as intended at all times of the day (particularly at peak times). This check focuses on road efficiency, traffic delays, road user compliance/provisions and any incorrect visual cues. This should be done by the project team to ensure the TMP is operating safely and efficiently as intended, this is particularly important when the traffic management schemes change (e.g. different stages and/or after care).
An operation check should be:

- Conducted by AWTM or WTM (or person within road authority with equivalent level of knowledge and experience)
- Have a site inspection and drive through.
- Conducted post TMP implementation.

Findings should be reported back to the project manager or traffic manager.

Onsite Inspection
An onsite inspection is a frequent inspection of the traffic management once it has been implemented onsite. This inspection entails checking the signs, devices, method statements, and workers accreditation have been correctly applied onsite. This ensures the TMP has been correctly implemented. Onsite inspections:

- Are conducted by BWTM or WTM onsite.
- Should be conducted before work starts, during works; when changes are made to the scheme; and when closing down at the end of the shift in accordance with Appendix A of AS1742.3 - 2009.

5.7.3 Road Authority Reviewing and Authorisation

Before authorising any traffic management to be implemented the road authority should ensure they are fulfilling their duty of care as outlined in section 4.5. Undertaking a suitability check will help ensure this duty of care is met:

Suitability Check
A suitability check is a check of the traffic management plan to ensure it addresses the specified requirements of the works, all types of traffic and the road environment. This includes a check of compliance with standards and the identification and mitigation of all site specific and operational risks.

This check ensures the TMP is appropriate prior to being implemented.

- Conducted by AWTM or WTM (or person within road authority with equivalent level of knowledge and experience).
- Conducted prior to implementation.
- Does not require a report to be written.
- Desktop check that does not require a site visit.

Note: it is good practice for traffic planners have someone undertake this type of check before submitting the TMP to the road authority.

5.7.4 Review, Audit and Authorisation Summary

Checklists have been developed to assist personnel to prepare, review, audit, approve and / or authorise traffic management plans. The checklists are located on the Main Roads WA website at www.mainroads.wa.gov.au: 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation' > 'Reviewing and Auditing Traffic Management'

Task	When undertaken	Required MRWA Accreditation
Suitability Check	Desktop review prior to the road authority authorising the TMP.	*Advanced Worksite Traffic Management; or* *Worksite Traffic Management; or* *Person within road authority with equivalent level of knowledge and experience*
Onsite Inspections	Before work starts, during works; when changes are made to the scheme; closing down at the end of the shift.	*Minimum - Basic Worksite Traffic Management* *Desirable – Worksite Traffic Management*
Operational Check	Conducted onsite post implementation; when significant changes are made to the scheme; and/or during peak periods.	*Worksite Traffic Management or* *Advanced Worksite Traffic Management* *(may be conducted by someone in the road authority with equivalent level of knowledge and experience)*
Suitability Review	Prior to implementation (site visit required).	*Advanced Worksite Traffic Management*
Compliance Inspection	Post implementation and/or when significant changes occur to the scheme (site visit required).	*Advanced Worksite Traffic Management*
Suitability Audit	Prior to implementation of traffic management plans involving 'complex traffic arrangements', as may be specified for works undertaken for or on behalf of MRWA; or when the project manager or road asset manager determines it is required.	*Roadworks Traffic Manager*
Compliance Audit	Post implementation of traffic management plans involving 'complex traffic arrangements', as may be specified for works undertaken for or on behalf of MRWA; or when the project manager or road asset manager determines it is required.	*Roadworks Traffic Manager*
Road Safety Audit	Any stage of the project where changes to the road layout or traffic scheme may introduce a potential for crashes.	*Senior Road Safety Auditor*

Table 2 – Auditing and Field Operation Tasks

6. VARIATIONS FROM AS 1742.3 AND ADDITIONAL REQUIREMENTS

The following variations to the requirements of AS 1742.3 – 2009 and additional requirements are to be applied when managing traffic for works on roads in Western Australia.

6.1 TEMPORARY SIGNAGE

6.1.1 General

Any roadworks signage that is not within the AS 1742 series needs to be approved by Main Roads WA before it can be implemented on the road network. All Main Roads approved signage is on the Main Roads WA website at www.mainroads.wa.gov.au; go to 'Using Roads' > 'Standards and Technical' > 'Road and Traffic Engineering' > 'Traffic Management'. Warning and regulatory signs should not be altered or modified; particularly regulatory signs which may become unenforceable.

6.1.2 REDUCE SPEED Signs

AS 1742.3 – 2009 makes no provision for the use of temporary REDUCE SPEED signs (G9-9) at roadwork sites. However, from experience it has been found beneficial to erect REDUCE SPEED signs where the approach speed of traffic is high and vehicles must slow down. Australian Standard sign G9-9, normally recommended for permanent installation, should be used at temporary roadworks as described below. Details of the sign are in AS 1742.1 and AS 1742.2.

The use of REDUCE SPEED signs is not mandatory in built-up-areas where the posted speed limit is 60 km/h or less. When used, MRWA recommends they be placed on both sides of the carriageway, 0.5 D metres, (where D is the distance in metres determined in accordance with Clause 4.1.5 of AS1742 .3 – 2009), or 25 metres, whichever is the longest, in advance of the start of the lowest speed zone at a work site. They should be positioned so that the reason for the reduction in speed is apparent and the signs are simultaneously visible to approaching drivers.

For worksites on a road normally posted with a speed of more than 60 km/h and is subject to a temporary speed limit of 40 km/h during working hours only, outside of working hours the REDUCE SPEED signs should be placed in advance of the 60 km/h sign, being the lowest speed that would apply after-hours. This is on the condition that the 60 km/h sign is required to be in place because of residual hazards for motorists at the worksite after-hours preventing reinstatement of the normal higher speed limit.

When used in conjunction with a temporary speed limit sign in a multi-message sign arrangement (see section 6.3), the REDUCE SPEED panel should be placed within the same multi message frame.

REDUCE SPEED signs used for works on roads shall always be used in conjunction with all other advance warning devices and signs required by AS 1742.3 - 2009. They shall not be used in place of any other required warning sign.

G9-9

6.1.3 NEW WORK NO LINES MARKED Signing

Clause 4.7.2(b) of AS 1742.3 – 2009 provides for the mandatory display of ROADWORK AHEAD (T1-1) signs for situations where road users will experience changed road conditions, including the absence of line marking. Clause 3.7.4 of AS1742.3 – 2009 describes the use of NEW WORK NO LINES MARKED (T3-11) and NO LINES DO NOT OVERTAKE UNLESS SAFE (T3-12) signs that are required to be installed in advance of locations where pavement markings normally required for driver guidance have been removed or have not been placed on new surfacing work.

In many cases the road works, including road surfacing, have been completed to the extent that all workers, plant and equipment, and temporary roadside hazards, as well as related traffic control devices, are no longer present at the worksite. In these situations where pavement markings have not yet been installed, it would be expected that the NEW WORK NO LINES MARKED and NO LINES DO NOT OVERTAKE UNLESS SAFE signs, as appropriate, would provide sufficient warning about the road conditions ahead without the need for ROADWORK AHEAD signing to also be displayed.

T3-11

T3-12

6.1.4 ROAD INSPECTION Sign

The below ROAD INSPECTION sign can be displayed on vehicles which are used for road inspections. The signs shall be located on the roof or rear of the vehicle and shall not obscure vehicle mounted warning devices.

MR-TVM-15

6.1.5 Signs for Managing Pedestrians

To help prevent signs from obstructing paths Main Roads WA permits the below Pedestrian Series signs to be used as stand-alone signs to manage pedestrians.

MMS-PED-1

MMS-PED-2

MMS-PED-4

MMS-PED-6

6.1.6 Labelling Ownership of Signs

The rear of temporary signs (MMS or Standard signs) may be marked to identify the owner of the sign, subject to the following conditions:

a) the rear marking may consist of a logo and/or lettering indicating the owner only;

b) the logo and/or lettering shall not exceed a total of 200 mm square;

c) the logo and/or lettering shall be black in colour and applied either by adhesive material or paint.

6.1.7 CYCLIST DISMOUNT Sign

Prior to undertaking any works that impact on bicycle paths this Code and AS 1742.3 require these works to be planned to ensure cyclist safety whilst minimising disruption and inconvenience. Bicycle paths should be provided with the same scale and width as existing facilities. However, it is acknowledged that sometimes when conducting short term maintenance works on shared paths and bicycle paths it may not be practical to provide a surface that is suitable for all bicycles.

In the first instance other warning signs to warn riders of the surface condition and the need to reduce speed shall be displayed.

As a last resort, where cyclists cannot physically traverse the surface, the CYCLISTS DISMOUNT sign may be used. Therefore any use of the CYCLIST DISMOUNT sign will only be for short durations and with the approval of the relevant road authority.

Note: The inappropriate use of this sign will result in riders failing to dismount where instructed.

MMS-PED-7

6.1.8 Temporary Hazard Marker

MR-TAW-39

The Temporary Narrow Hazard Sign MR-TAW-39 should only be used to delineate hazards and non-trafficable work areas adjacent to the travelled path in the following situations:

- Used to indicate the beginning of a line of traffic cones or bollards where the devices themselves may not be sufficiently visible to approaching traffic.
- Used to supplement cones or bollards when closing traffic lanes to reassure traffic of the correct side (where there is insufficient width for T series).

All other situations shall use T-Series Hazard Markers.

6.1.9 STOP HERE WHEN DIRECTED Sign

MMS-ADV-82

The STOP HERE WHEN DIRECTED sign may be used at roadworks during traffic controller operations when vehicles may be required to stop at a particular point in advance of the traffic control position.

6.2 COVERING EXISTING SIGNAGE

In accordance with Clause 2.4.4 of AS 1742.3 - 2009 “Existing signs and traffic control devices which are inappropriate to, or conflict with, the temporary worksite situation shall be covered, obliterated or removed”.

Where it is necessary to cover a sign face temporarily, caution must be exercised as some coverings will cause permanent damage to the sign face following exposure to moisture and sunlight e.g. plastic materials, especially black, is forbidden as it is known that these materials are responsible for severe and permanent damage within 24 hours.

Specifications for covering existing signage can be found in Main Roads WA Specification 601 – Signs, located on the MRWA website at www.mainroads.wa.gov.au; go to ‘Building Roads’ > ‘Tender Preparation’ > ‘Specifications’ > ‘600 Series – Traffic Facilities’

6.3 GUIDELINES FOR MULTI-MESSAGE SIGNS

6.3.1 Introduction

This section describes the permitted uses of multi-message (3-panel) signs at Roadworks and Events sites on roads.

Multi–message signs are an alternative to stand-alone signs. They are usually more conspicuous than stand-alone signs because of the striking colour combination, and they make the task of signings easier and cheaper due to the lightweight compact sign material.

Multi–message signs may be used in conjunction with stand-alone signs as required.

6.3.2 Guidelines for Use

1) The use of multi-message signs shall comply with the following requirements.

   a) Only Main Roads WA approved message plates or signs shall be used and shall only be placed in the panel as shown in Appendix 5 - Multi-message sign inventory and application schedule.

      For sign specification refer to the Main Roads WA website www.mainroads.wa.gov.au ('Building Roads' > 'Standards and Technical' > 'Road and Traffic Engineering' > 'Traffic Management').

   b) Regulatory control message plates, where used shall always be positioned closest to traffic and reflect conditions.

   c) Regulatory signs shall not be used in-conjunction with the NEXT 'x' km or 'x' km AHEAD message plates.

   d) Lane status 600 x 600 message plate shall only contain two lane instruction (arrow) messages. Lane status 1200 x 600 message plates may contain up to 4 lane instruction messages.

   e) Multi–message sign assembly should, where practical, be duplicated on both sides of the road or carriageway, of the road to which the signs apply or as recommended by Australian Standards.

   f) Signs shall be positioned in accordance with the requirements of Australian Standards - Manual of uniform traffic control devices AS1742.3.

   g) All sections of the frame assembly shall be filled with an approved sign. Messages should be logically linked and conflicting messages should not be used.

      i. Except as noted in the schedule, where used, at least one of the 600 x 600 panels must be symbolic. *

      ii. Only 2 panels shall consist of a similar background colour. *

      iii. Colour combination for sign legend and background to match existing practices included colour and reflectivity;

iv. Have high contrast between panels when used as a multi-message sign (i.e. if possible close colouring should be avoided on adjacent panels) *.

v. Duplication of the same messages on the same multi-message sign shall be avoided.

Otherwise stand-alone signs, as recommended by Australian Standards shall be used.

* Items i, ii and iv do not apply to signage used exclusively for control of pedestrian traffic. Item ii and iv do not apply to the following signs:
  - Lane Status Series Signs;
  - Road Condition Series Signs;

h) Excluding 6.1.6 (above), no company names, advertising or any other words, symbols or markings shall be displayed on the front or rear of the multi-message frame or panels.

i) Rear of the message plate shall be non-reflective.

6.3.3 Frames for Multi-Message Signs

a) The frame for the multi-message sign assembly should be capable of holding two 600 x 600mm sign panels along the top and one 1200 x 300mm sign panel along the bottom and or one 1200 x 600mm sign panel along the top and one 1200 x 300mm sign panel along the bottom.

b) The frame panel should be capable of holding back-to-back mounting of message plates.

c) For frame specifications refer to the Main Roads WA website www.mainroads.wa.gov.au ('Building Roads' > 'Standards and Technical').

d) The frame should comply with the requirements of Australian Standards AS 1742.3, Clause 3.3.1 – Sign Mounting General.

6.3.4 Substrates for Multi-Message Signs

A variety of different materials can be used for the sign substrates including the following:

- 5 mm core flute
- Aluminium
- UV stabilised plastic

The substrates for the signs shall be of sufficient thickness and rigidity to prevent the signs being blown out of the frame.

The rear of the sign substrate shall be non-reflective.

When using core flute multi-message signs at worksites where the signs will be operating both day and night or the signs will be left unattended, there shall be at least two (2) 5 mm thick core flute signs back to back in the multi-message frame to help prevent the sign from blowing out (if back to back messages are not required the rear of the panels shall show the blank/rear plate).

6.4 SPEED LIMIT ZONES

6.4.1 General

A temporary speed limit at roadworks is a compromise between a speed that maximises the safety of workers and traffic, but permits an acceptable traffic flow that does not unnecessarily impede road users. Guidance on appropriate temporary speed limits is provided in Clause 4.9 of AS 1742.3 – 2009.

A roadwork speed limit shall only apply while the condition warranting it exists.

Temporary speed zones established in accordance with the above requirements will be enforced by Police in the same manner as normal speed zones.

6.4.2 Temporary Speed Limit Signs

All temporary speed limits shall be displayed in accordance with Clause 4.9 of AS1742.3 – 2009.

Where speed limit signs are displayed to change the speed limit from that which existed up to that point, signs shall be displayed on both sides of the carriageway. Repeater signs do not have to be displayed on both sides of the carriageway.

MRWA recommends against displaying speed limits on unsealed roads because the road surface condition may not always be appropriate for the displayed speed limit. However, if a temporary speed zone is considered necessary on an unsealed road and frequent monitoring and maintenance of the surface condition can be maintained, the departure speed limit sign shall be the appropriate 'End speed limit' sign (R4-12).

R4-1

R4-12

6.4.3 Approval of Temporary Speed Limit Signs

Authorised bodies are permitted to erect temporary speed limit signs without approval from MRWA. Where temporary speed limits other than 40 km/h, 60 km/h, or 80 km/h are necessary, prior approval from the relevant road authority under a variation shall be obtained.

All temporary speed limit signs on State Roads shall be approved by MRWA prior to their use, approval shall come from the authorised officer listed in section 13.1, Traffic Signs, of the MRWA Delegation of Authority (note this applies to all traffic signs and devices).

6.4.4 Offset Speed Zones on Undivided Roads

Offset speed zones result in more credible worksite speed limits, subsequently increasing driver compliance in locations where speed reductions are actually warranted. This results in a safer worksite for road users and workers.

The use of offset speed zones on divided roads and within buffer zones on undivided roads as specified in AS1742.3 - 2009 Clause 4.9.9 is supported and strongly encouraged.

Additionally offset speed zones on an undivided carriageway through worksites are permissible where all the following conditions are met:

- works are being undertaken off the carriageway, and;
- the conditions for which the lower speed limit is required are confined to the applicable direction of travel only, and;
- any multilane undivided road that has more than one lane travelling in the same direction past the worksite and no intersections or direct property access **OR** the road is an Access Road.

Offset speed zones may present risks at particular worksites; these risks need to be examined prior to adding offset speed zones to the TMP.

6.4.5 Mobile Temporary Speed Zones

Clause 4.6.5 of AS 1742.3 – 2009 specifies a mandatory requirement for mobile temporary speed zones to be used at mobile work sites if there are workers on foot or using small items of plant on the roadway or shoulder/parking lane, and the workers are working closer than 1.2 m to moving traffic.

Previously, the Road Traffic Code 2000 made no provision for mobile speed limits; as speed limit signs were required to be “erected near the boundary of a carriageway.” Therefore operationally Police could not legally enforce such mobile temporary speed limits.

However, the wording in Road Traffic Code 2000 has now been changed so that speed limit signs can be “displayed or erected on or near a carriageway.” Therefore as mobile temporary speed signs will be erected on a carriageway, Police can now legally enforce the displayed speed limit.

Note: The regulatory speed restriction signs (R4-1) must be displayed. The temporary speed limits must be terminated, with end speed limit signs (R4-12) being recommended for mobile works.

6.4.6 Advanced Warning of Temporary Speed Zones (Buffer Zones)

Clause 4.9.5 of AS 1742.3 – 2009 specifies advance warning of temporary speed zones (buffer zones) shall be provided by means of; (a) Speed limit Ahead sign in advance of the start of the lower speed zone; or (b) Comprising of a speed zone of intermediate value. It is desirable to reduce speed limits in 20km/h steps. However, where the prevailing site conditions are appropriate, entry speed zone may be reduced in a single step from 110km/h to 80km/h, from 90km/h to 60km/h or from 70km/h to 40km/h.

Speed signs at the commencement of a buffer zone shall be accompanied by or preceded by advance warning 'Ahead' signage such as BRIDGEWORKS AHEAD, DETOUR AHEAD, EVENT AHEAD, GRADER AHEAD, ROAD CLOSED AHEAD, ROADWORK AHEAD or ROAD PLANT AHEAD signs as appropriate.

Where a buffer zone had been provided in accordance within Clause 4.9.5 (b) (AS1742.3 - 2009), traffic leaving the lower speed limit shall not be subject to a buffer speed zone merely because the limit applies to the opposing direction of traffic.

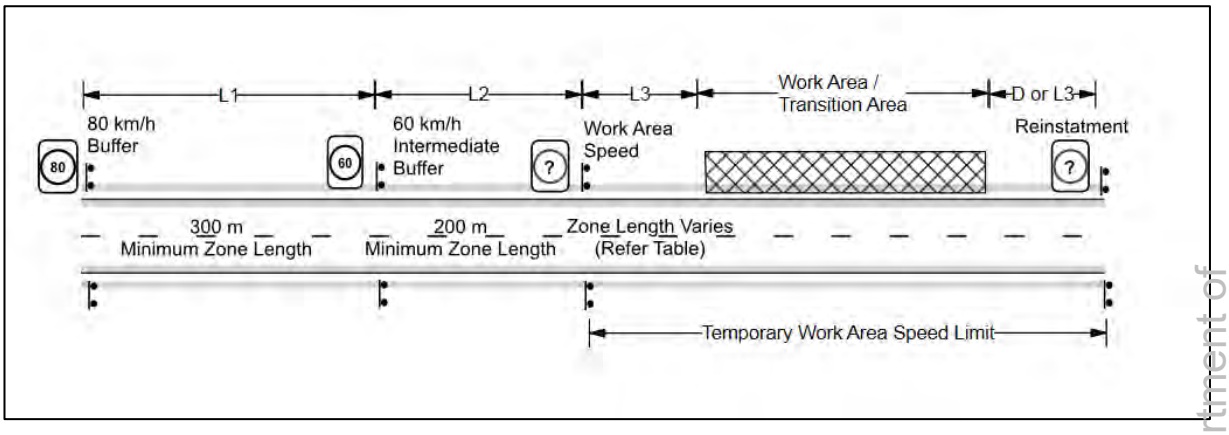
6.4.7 Setting out Temporary Speed Zones (Buffer Zones)

This section has been prepared to give guidance to roadworks and events traffic management planners, and others, in the placement of temporary speed zones.

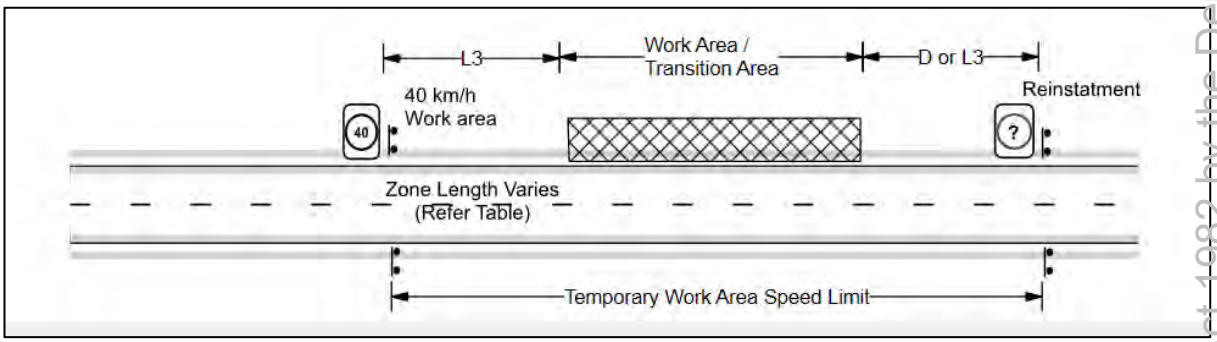
The objective of this section is to:

- Establish a consistent and uniform approach in the placement of temporary speed zones.
- Reduce avoidable delay to road users due to excessive and/or unnecessary temporary speed zone lengths.
- Encourage better compliance by road users to temporary speed limited areas.
- Educate road users by the standardised placement of speed zone signs.

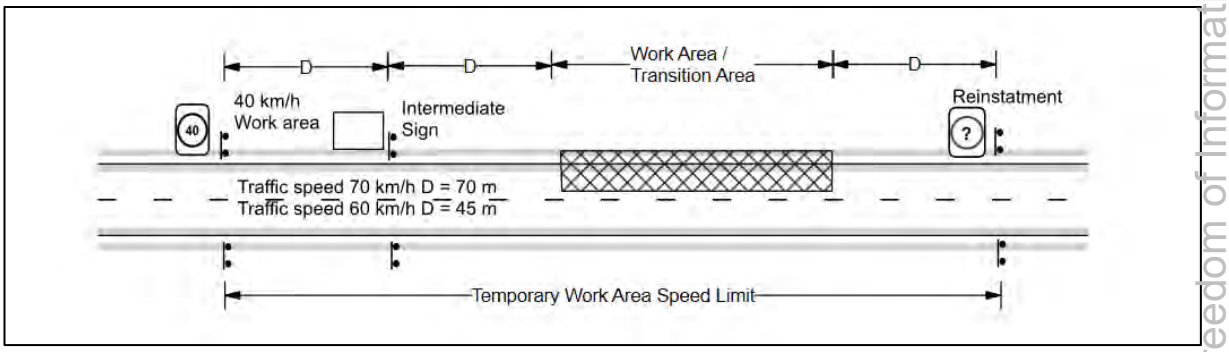
Main Roads WA requires the values (listed in Table 3) be used whenever temporary speed zones are required, unless a site specific hazard is identified and a risk assessment determines the need to extend the sign placement. This shall be documented in the risk assessment and response table of the TMP.



(a) Buffer zones



(b) No buffer zone required with 40 km/h work area speed limit (where posted speed limit less than 80 km/h).



(c) L3 length extension due to intermediate advance signs (e.g. Prepare to Stop).

Notes:

1. Work Area / Transition Area may include safety buffer, taper and/or traffic controllers position;
2. Illustrations do not show all of the signs and devices that will be required at the worksite.
3. The speed limit reinstatement signs should be placed on the back of the first signs after the worksite. This will either be D m or L3 (refer table) depending on the worksite. Note: where there are no signs in the opposite direction or the work area speed zone is becoming too long; the speed limit should be reinstated D m from the last point impacted by the works.

Figure 1: Temporary Speed Signs

Approach Speed (km/h)	Works Area Speed (km/h)	80 km/h Speed Buffer Required	L1 (80km/h buffer) (m)	L2 (60km/h buffer) (m)	L3[8] (m)
110	80	No			220
	60	Yes	300		160
	40	Yes	300	200	90
100	80	No			200
	60	Yes	300		160
	40	Yes	300	200	90
90	80	No			180
	60	No			180
	40	No		200	90
80	60	No			160
	40	No		200	90
70	60	No			90
	40	No			90
60	40	No			45

Table 3 - Placement of temporary speed limit (buffer zone) signs[9]

Notes:

The locations of temporary speed limit signs shown in Table 3 have been primarily based on the requirements of AS1742.3 - 2009 with some adjustment to increase safety and consistency of application.

These spacings are required for the majority of scenarios. However, where a risk assessment determines that spacings need to be changed they shall be changed in line with AS1742.3 - 2009. When referring to Table 4.6 of AS 1742.3 - 2009 to determine taper lengths at traffic control; the speed of traffic will be determined by the free flowing traffic speed at the traffic control location (this shall always be ≤ 60km/h).

The table takes into account the requirement that the 60km/h speed zone length (L2) must not be less than 150m to ensure that adequate time is given to road users to adjust to the temporary speed zone before introducing an additional (lower) temporary speed limit.

The table also takes into account Clause 4.1.5(a) and (b) of AS1742.3 - 2009 for the positioning of temporary signs related to the speed of traffic in the speed zone immediately preceding the zone in which the temporary sign occurs.

To ensure uniformity and consistency a value of 200m for Zone Length (L2) and 300m for Zone Length (L1) has been adopted.

To terminate a Temporary Speed limit, Speed Restriction (R4-1) signs indicating the speed limit existing beyond the Traffic Management site shall be placed at the end of the termination area (where normal traffic conditions resume) as specified in Clause 4.9.7, AS1742.3. ***Note: It is a legal requirement that a speed zone be terminated either by another regulatory speed control sign, or end speed limit sign (refer to the road***

[1] Advanced warning signs placed within L3 may result in a longer L3 than is stated here (this will often be the case when reducing speeds from 60 km/h to 40 km/h). Additionally AS 4.7.8 (b) requires PTS to be relocated or repeated so that they are visible minimum of 'D' m from the end of queue, which in most cases will result in an extended L3.
[2] Advanced warning signs installed within zones shall be spaced at D distance for that zone (refer to AS 1742.3, 4.1.5) A safety buffer of 20 – 30 m shall be provided in all speed scenarios (refer to AS 1742.3, 4.1.4 C for where this can be extended).

traffic code).

Where it is unsafe for the buffer speed zones to be applied (e.g. unsealed roads) 'speed limit ahead' signs shall be used in place of the buffer speed zones (see AS 1742.3).

The spacings shown in Table 3 have been applied within the MRWA Generic Workzone Traffic Guidance Schemes on the MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Plan Preparation' > 'Generic Workzone Traffic Control Diagrams'

6.4.8 Dimension *D*

Australian Standards AS1742.3-2009 does not provide specific guidance as to the selection criteria to be used to determine the dimension of 'D' at low speed environments 45 km/h or less.

To ensure that a safe work environment shall be maintained and to make certain that the positioning of devices are within the line of sight of the intended road users. The value of dimension 'D' shall be determined as shown in Table 3.

Speed of Traffic km/h	Dimension 'D' m
55 or less	15
56 to 65	45
Greater than 65	Equal to speed of traffic, in Km/h

Table 4 - VALUE OF DIMENSION *D*

The speed of traffic shall be taken in accordance with the requirements of item 4.1.5(a) of Australian Standards AS 1742.3 - 2009.

6.5 EXCAVATIONS AND OTHER HAZARDS

All work sites are individual and persons preparing TMPs need to carefully design treatments taking into consideration the specific characteristics of each site. Excavations require special consideration to ensure their structural integrity and to minimise the risk of vehicles driving into them and losing control. Above ground hazards also need to be considered. This section of the Code details the protective treatments required at excavations and other hazards.

Definition of 'excavation' is provided in Appendix 1.

6.5.1 Planning Works Involving Excavations

As there is an increased risk of motor vehicles driving into excavations during the hours of darkness, where practicable, works should be planned so that the excavations are to be backfilled and compacted by the end of each working day. On sections where excavations cannot be backfilled and compacted, delineation and other requirements shall be provided during the hours of darkness in accordance with Clause 2.4.3 of AS 1742.3 - 2009.

6.5.2 Protective Treatments for Above Ground Level Hazards

It may be necessary due to site constraints during the course of the works, to place non-frangible objects such as construction equipment and materials close to the path of traffic or re-route traffic in close proximity to existing non-frangible objects such as power poles or trees.

These hazards need to be recognised when planning works and where possible, equipment and material should be located at a distance beyond the distance indicated in for excavation hazards in Table D1 of AS1742.3 - 2009 (distance from closest edge of hazard to closest edge of nearest traffic lane) and the type of protective treatment should be decided based on a risk management approach considering the number of vehicles that are likely to be exposed to the hazard, type and extent of the hazard, likely severity of any vehicle impacting the hazard, and severity of damage that might result to a vehicle colliding with the protective treatment etc.

Similarly when planning side-tracks and detours, care should be taken to locate them with adequate separation from any existing non-frangible objects.

6.5.3 Safety Objectives for Steep Slopes

The safety objectives for addressing the potential hazards created by steep slopes (on batters, embankments, etc.), as described in Austroads' Rural Road Design Guide – A Guide to the Geometric Design of Rural Roads, should be taken into account when determining the requirements for temporary protective treatments.

6.5.4 Temporary Road Safety Barrier Systems

The use, selection and location of temporary barriers should be in accordance with the Main Roads WA Guide to the Design of Workzone Barriers, located on the MRWA website at www.mainroads.wa.gov.au; go to 'Building Roads' > 'Standards and Technical' > 'Road & Traffic Engineering' > 'Roadside Items' > 'Workzone Barriers'

Only Main Roads WA approved road safety barrier systems shall be used; a list is located on the MRWA website at www.mainroads.wa.gov.au; go to 'Building Roads' > 'Standards and Technical' > 'Road & Traffic Engineering' > 'Roadside Items' > 'List of Approved Road Safety Barrier Systems'

Delineation of Temporary Road Safety Barriers

Temporary Road Safety Barriers help protect road workers and road users from hazards, however the barriers themselves can also present a hazard to road users. Barriers must be adequately delineated with raised retroreflective pavement markers (RRPMs) complying with AS 1906.3 or temporary RRPMs (flaps) with retroreflective tape (class 1A minimum) to ensure road users are aware of their presence.

The Pavement Markers providing delineation shall be located on top of or on the traffic side of the barriers (< 300mm from the top), spaced at ≤12 m intervals along the barrier. Where used on curves with a radius up to 200 m the spacing shall be reduced to 6 m on the outside of the curve.

The retroreflector or tape may either be yellow double sided* on all barrier applications or the following colours may be used:

a) Single sided red on barriers installed on the left hand shoulder or verge.
b) Single sided yellow on barriers installed in the median of a divided road

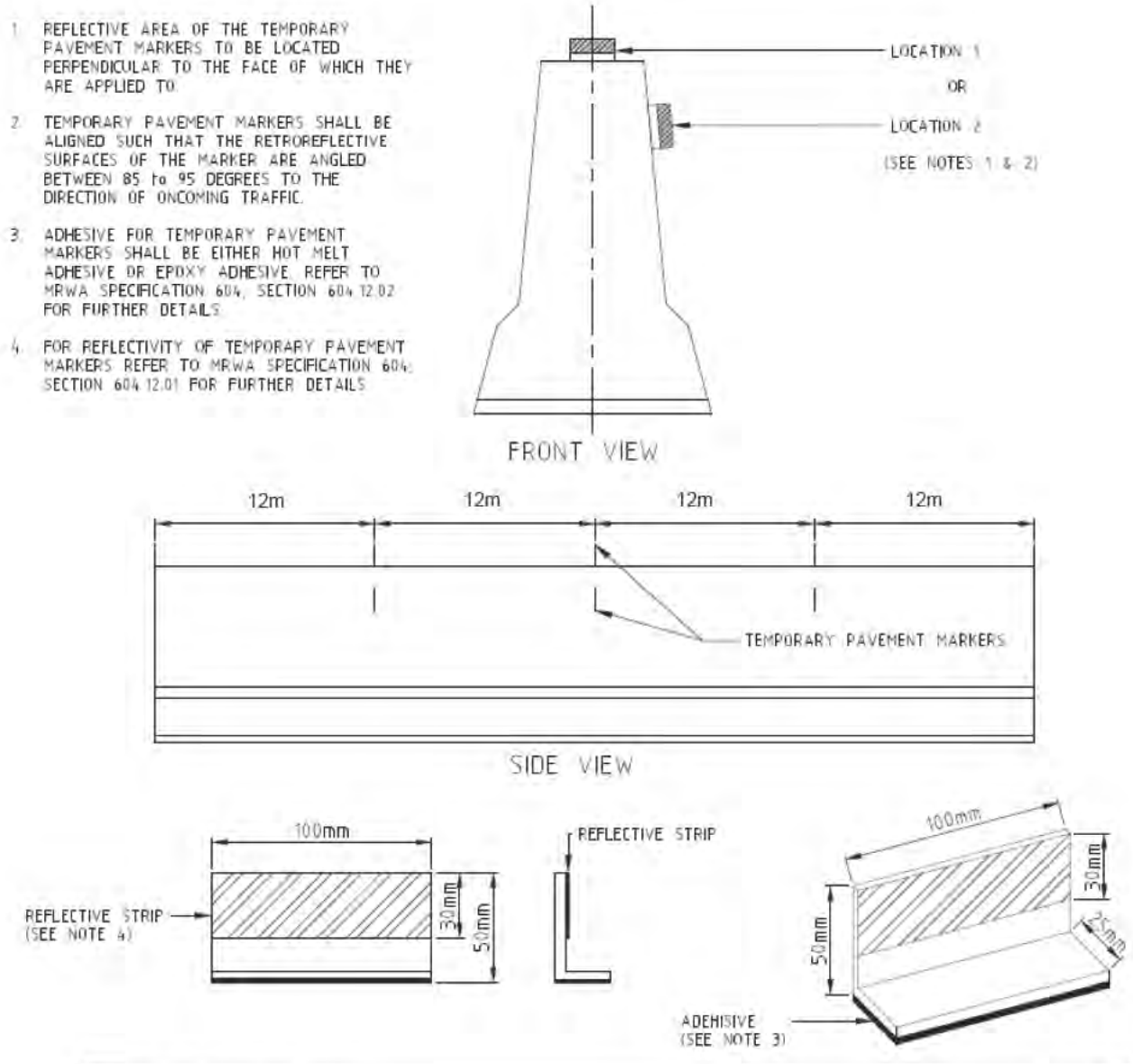
c) Double sided yellow where the barrier is positioned in between opposing direction of travel and delineator is placed on the top of the barrier
d) Single sided white on barriers installed between lanes in the same direction of travel (rare scenario).

* The use of all yellow retroreflectors must be risk assessed prior to deployment, particularly on 2-way single carriageway applications.

Note: the above does not replace the need to provide temporary delineation of the travelled path in accordance with AS1742.3. This temporary barrier delineation is considered a replacement for guide post delineation where the location of the barrier is close enough to the edge of the road.

Temporary Pavement Markers Material Specifications:
- Extrusion. Polyurethane, 80 shore A
- Cover. PVC Flexible. Clear.

For further details on specifications for the adhesive and reflectivity properties of the Temporary Pavement Markers, see MRWA Specification 604, located on the MRWA website at www.mainroads.wa.gov.au; go to 'Building Roads' > 'Tender Preparation' > 'Specifications' > '600 Series – Traffic Facilities'



6.5.5 Overhead Works on or Near Roads

The Occupational Safety and Health Regulations 1996 do not permit loads to be suspended over, or travel over, a person (see regulation 4.53). This means, that any work occurring using cranes or other overhead equipment shall, as far as practical, not occur over live traffic lanes or footpaths.

6.6 PEDESTRIAN PROTECTION IN CONTRA-FLOW SITUATIONS

Whilst performing works on divided roads, it is sometimes necessary to divert traffic onto the adjoining carriageway so that vehicles temporarily travel in both directions on that adjoining carriageway. This can create a risk to pedestrians who may not think to look in both directions before crossing the affected carriageway. The following options shall be considered to reduce this risk during contra-flow operations.

(a) Channelling Pedestrians to Safe Crossing Points

The locations in the vicinity of the works where pedestrians are most likely to need to cross the carriageway should be identified. Containment fencing in accordance with Clause 3.10 of AS 1742.3 – 2009 should be installed to channel pedestrians to defined crossing points. Appropriate signing (in accordance with Clause 4.14.8 (c) (iii) of AS1742.3 – 2009) and a pedestrian maze should be provided to make pedestrians aware of the changed traffic direction.

(b) Warning Signs for Motorists

Signs to slow motorists approaching the diversion and pedestrian warning signs (MR-TAW-31) at regular intervals to warn motorists to watch for pedestrians should be provided.

MR-TAW-31

(c) Dedicated Personnel

Dedicated personnel should be provided to patrol the site watching for pedestrians to ensure that they cross safely.

Additional information for meeting the requirements of pedestrians and cyclists can be found in Austroads Guide to Traffic Management publication.

6.7 CHILDREN'S CROSSINGS AND SCHOOL ZONES

Where works are located within a School Zone, consideration should be given to undertake the works outside the period indicated on the school zone sign. Where this cannot be done OR where a children's crossing is located within a roadwork's site, the following actions shall than be taken:

- The Western Australian Police Children's Crossing Unit (or their designated representative) shall be consulted at the planning stage to finalise arrangements for the safe passage of school children and pedestrians.

- Ensure that the speed shown on the temporary speed zone and termination signage shall be less than or equal to the value shown on the School Zone sign during the School Zone period. In cases where the worksite extends beyond the school zone, termination signage shall reflect the posted speed applicable to that section of road.

- Where the children's crossing stop line and side bollard have been removed as part of the roadworks, traffic controllers shall be positioned at the location of the children's crossing stop line(s) to give guidance to vehicles where to stop on the approach side of the children's crossing.

- Where as a result of roadworks, normal traffic paths are altered at a controlled children's crossing. Crossing attendant wardens shall be deployed to stop traffic at the direction of the traffic controllers. If a crossing attendant warden is not available a Main Roads WA accredited traffic controller shall ensure the safe passage of pedestrians at the children's crossing.

  Main Roads WA accredited traffic controller shall be deployed to assist pedestrian to cross safely at uncontrolled pedestrian crossing located within a school zone.

- Provisions for pedestrian and bicycle facilities in accordance with Clause 2.3.7, AS1742.3 - 2009.

6.8 TRAFFIC CONTROL PROCEDURES AT PERMANENT TRAFFIC SIGNALS AND RAIL CROSSINGS

6.8.1 At Permanent Traffic Signals

Any plan at permanent traffic signals that meets the requirements of section 5.2.3 (iii) shall be submitted to Main Roads for approval as per the Temporary Traffic Management: Traffic Signal Approval Policy, available on the Main Roads website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications' > 'Publications'

6.8.2 Railway Crossings (Including Crossings without Flashing Signals)

Any works within the distances from a railway level crossing given in Table 5 and are likely to result in realignment of a road section or intersection impacting on the railway level crossing or significantly affect the existing traffic flow through a railway level crossing, the relevant Rail Infrastructure Manager shall be notified at least two (2) weeks prior to the works by the party arranging the works. The Rail Infrastructure Manager may determine a Rail Safety Management Plan (RSMP) is required for road works which impact on the safe operation of the railway.

Speed limit (km/h)	Distance from railway (m)
<70	150
70 to 90	200
>90	300

Table 5 - Distances from railway level crossings where significantly impacting crossing

Traffic Controllers need to be aware that motorists will generally follow their directions when they differ from other signals, signs and devices on the road. They need to take special care at railway crossings to ensure they do not direct traffic through signals requiring vehicles to stop, unless it is clearly safe for vehicles to proceed through them.

Where a railway level crossing exists within a section being controlled by a Traffic Controller, a flag person with the relevant Track Access Permit should be stationed at the traffic stop line of the railway crossing at least 3m from the nearest rail, equipped with a two way radio, to watch for trains and advise the Traffic Controllers to stop traffic in time for train movements through the level crossing.

The flag person should make sure that the relevant Rail Infrastructure Manager has been notified before he/she commences work. On each day, prior to the commencement of works, the Rail Infrastructure Manager should be advised of the works that will be proceeding on that day, so that train drivers can be warned of the works and advice can be received on the times that trains are expected to use the crossing (this will be determined by the relevant Rail Infrastructure Manager).

If the section of road under traffic control is to one side of the railway level crossing, but within the distances in Table 5, the flag person stationed at the railway level crossing shall be stationed on the same side of the crossing as the section under traffic control, at the traffic stop line or at least 3m from the nearest rail. The flag person stationed at the railway level crossing shall be equipped with a hand-held STOP/SLOW sign that has the rear 'SLOW' sign covered. This is to prevent vehicles approaching the other side of the railway level crossing following the SLOW instruction and ignoring other signs or flashing signals.

Traffic Controllers shall also ensure that vehicles stopped do not queue back over a railway level crossing. If there is a chance of this happening, vehicles should be stopped prior to the railway level crossing.

Refer to the Railway Crossing Control in Western Australia Policy and Guidelines on the Main Roads WA website at www.mainroads.wa.gov.au > 'Building Roads' > 'Traffic Management' > 'Railway Crossing Control'

6.9 WORKS ON RESIDENTIAL ACCESS ROADS

Works on any residential roads where the traffic speeds have been reduced to 60 km/h or less and where the volume of traffic does not exceed 1500 vpd, may be undertaken in accordance with the provisions of Clause 4.13.5 and/or Clause 3.5.3 of AS 1742.3 – 2009 except that where the length of shuttle is less than 20m, the requirement for clear visibility beyond the work area may be reduced from 75m to 40m provided appropriate advanced warning signs are erected and the speed is not more than 40km/h.

6.10 FATALITY OR SERIOUS INJURY AT WORKSITE

Where a fatal or serious injury occurs at a worksite, it is imperative that evidence of all aspects of the incident is preserved until police have had an opportunity to complete a forensic examination.

Where a fatal or serious injury has occurred, contamination of the site shall only occur for the purpose of saving life or rendering assistance. The site must not be cleaned or tampered with (including all traffic management devices) and crash debris shall be left in situ until police and/or Worksafe arrive.

Guidance for Emergency and Unplanned Works is provided in AS1742.3 - 2009 in Appendix B. These procedures can be applied in the event of a fatality or serious injury occurring at a worksite. However, preserving evidence takes precedence over traffic access. Therefore additional lane closures or complete road closure may need to be applied in order to achieve this. Guidance on partially or fully closing a site to traffic should be sought from the TMP closure/detour contingency plan specific to that site (general requirement of TMP's see Clause 5.2.1)

6.11 TRUCK MOUNTED ATTENUATORS

The Guidelines for the use of Truck Mounted Attenuators (TMAs) in WA have now been adopted as a minimum requirement in WA. A copy is available on the MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'.

Trailer Mounted Attenuators are not permitted in WA.

Refer to section 8.3 for TMA operator training requirements.

6.12 LANE WIDTHS AND EDGE CLEARANCES

6.12.1 Lane Widths

Clause 4.13.3 of AS1742.3 - 2009 specifies minimum lane widths of 3.5 m for worksites with speeds 61 - 80 km/h. Studies have shown that reduced road width results in lower speeds. Implementation of minimum lane widths is encouraged at worksites that require significant speed reductions.

This code allows for a minimum lane width of 3.2 metres for speeds 61 - 80 km/h (Note: the exceptions listed in Clause 4.13.3 of AS1742.3 still apply). Additionally, where minimum lane widths are being proposed a site specific risk assessment shall be undertaken examining whether variables such as vehicle types, traffic volumes and worker offset safety support this measure.

Other visual stimulus that gives the impression of reduced road width is also encouraged (such as additional guide posts, bollards, traffic cones or diagonal gore marking).

6.12.2 Edge Clearances

Clause 4.13.4 of AS 1742.3 - 2009 specifies the minimum clearance between the edge of traffic lane and delineating devices or road safety barrier systems. However, it has been found to be impractical to follow the clearances given. This is particularly evident when used in conjunction with the required lane widths in Clause 4.13.3 of AS 1742.3. When a site specific risk assessment has been conducted that supports the reduced clearance the below will be permitted:

(a) Edge of traffic lane to line of traffic cones, bollards or longitudinal channelizing barricades—

(i) traffic speed up to 60 km/h—0.3 m; and

(ii) traffic speed above 60 km/h—0.5 m.

(b) Edge of traffic lane to roadworks delineators or temporary hazard markers—

(i) traffic speed up to 80 km/h – 0.5 m; and

(ii) traffic speed above 80 km/h – 1.0m.

(c) Edge of traffic lane to road safety barrier system—

(i) traffic speed 40 km/h or less—0.2 m;

(ii) traffic speed 41 to 60 km/h—0.3 m;

(iii) traffic speed 61 to 80 km/h—0.5 m; and

(iv) traffic speed greater than 80 km/h—1.0 m.

When using a road safety barrier system the above reduced clearance does not apply to the leading edge of the barrier system, Clause 4.13.4 of AS 1742.3 - 2009 will apply. This will reduce the risk of errant vehicles colliding with the end treatment of the barrier.

6.13 TRAFFIC CONTROL

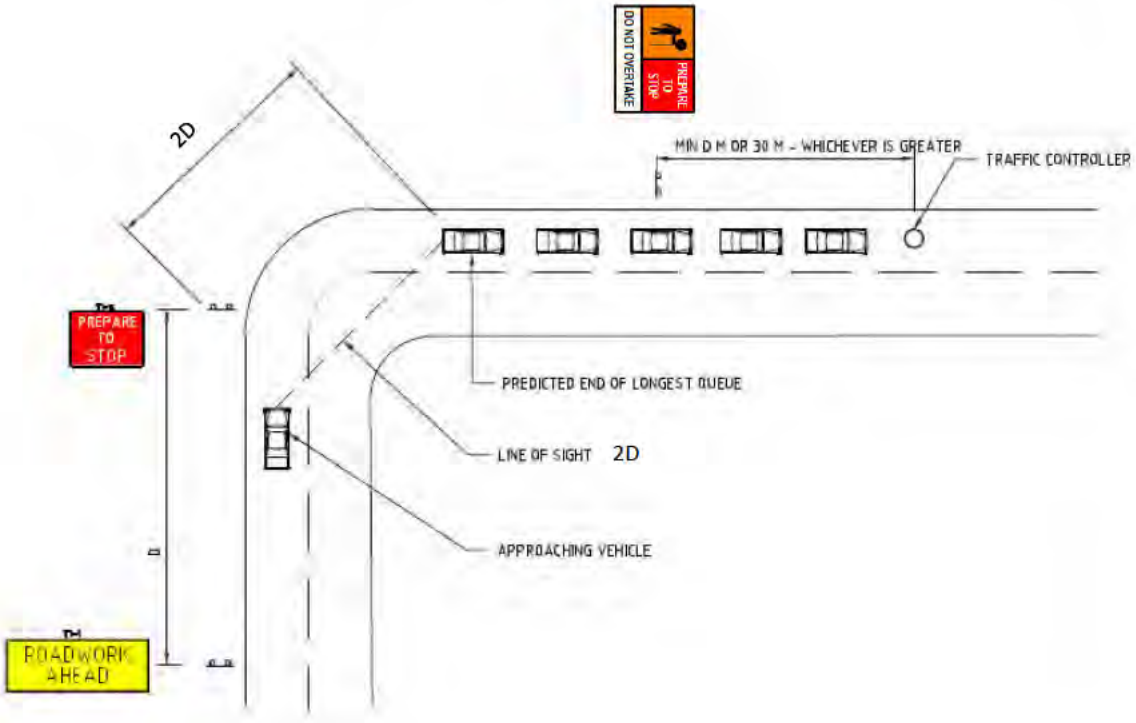
6.13.1 Advanced Warning Signs

Where traffic may be required to stop due to traffic control, the PREPARE TO STOP sign shall be used in conjunction with the Traffic Controller (Symbolic), Signals Ahead or Boom Barrier sign (depending on the method of traffic control). Where possible the signs should be positioned side by side with the PREPARE TO STOP sign closest to the travel way.

The position of the PREPARE TO STOP sign and Traffic Controller (Symbolic), Signals Ahead or Boom Barrier sign shall be according to the local prevailing conditions, it is recommended they be placed a minimum of D metres, or 30 metres, whichever is greater, in advance of the Traffic Controller.

In situations where it is not possible for the signs to be placed side by side the distance of the PREPARE TO STOP sign for speeds less than 55 km/h may be reduced to 15 metres (D) in advance of the traffic control position provided the Traffic Controller (Symbolic), Signals Ahead or Boom Barrier sign is positioned 15 metres (D) in advance of the PREPARE TO STOP sign. For approach speeds greater than 55 km/h the distance between signs shall remain at D metres.

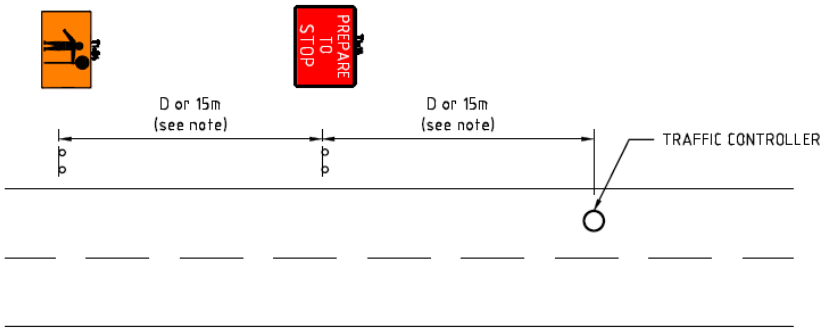
Note: Section 4.13.2, below, shall be followed to avoid end of queue collisions.



Notes:

1. Does not include all required signs and devices
2. Signs may need to be placed on both sides of the carriageway.

Figure 2: Placement of Traffic Controller Warning Signs (when using side by side)



Notes:
1. For speeds less than 55 km/h spacing is 15 m, for speeds greater than 55 km/h spacing is 'D' m.
2. Does not include all required signs and devices.
3. Signs may need to be placed on both sides of the carriageway.

Figure 3: Placement of Traffic Controller Warning Signs (in situations where signs cannot be used side by side)

It is recognised that there is often limited space on some local roads due to things such as parked cars, footpaths, works occurring close to intersections, etc. The Worker (symbolic) and Traffic Controller (symbolic) signs may be used in the same MMS panel where all of the following requirements are met:

- The road is a low speed local road (permanent speed 60 km/h or below);
- There are site constraints which do not allow the signs to be separated;
- The signs are used with the MMS-ADV-26 PREPARE TO STOP sign;
- The Traffic Controller (symbolic) sign (MMS-ADV-47) shall be positioned closest to the traffic;
- The signs shall be duplicated on both sides of the road or carriageway;
- The signs shall only be displayed when the need exists and removed or replaced when workers are not visible and/or there is no Traffic Controller requiring road users to stop.

6.13.2 Avoiding End of Queue Collisions

Queueing and delay is an expected consequence when any roadworks require the use of traffic control. Before implementing any type of traffic control it is the responsibility of the traffic management designer to consider the following:

- The speed of traffic
- The road environment (e.g. horizontal and vertical curves, road surface, road grade[10])
- The sight distance road users will have to the traffic control position
- Driver reaction times (general case assumption = 2.5 sec)
- The traffic volume (including determining the peak traffic volumes within the proposed work period)

[10] Downgrades may require greater stopping sight distance.

- The traffic composition (e.g. large vehicles may require greater stopping sight distance)
- Work times and duration
- Expected time traffic will be stopped
- Worksite length (see table 4.9 of AS1742.3 - 2009 for maximum length of single lane section)
- Personnel available

Once the traffic management designer has gained the above information the expected queue length can be predicted using the following steps:

1. Determine the hourly traffic volume in the direction of travel at the time of the works[11];
2. Divide the hourly traffic volume by 60 to determine the vehicles expected every minute;
3. Determine the length of time to the nearest minute that vehicles will be required to stop (this includes stop time for work reasons and clearance times);
4. Multiply this number by the vehicles expected per minute (i.e. vehicles per minute X number of minutes);
5. Determine the types of vehicles that will be using the road and multiply its length by the number (include a 3 m space between each vehicle):

Vehicle Type	**Approximate length**
Car	5.5 m
Truck / Bus	19 m
Trucks (RAV 2-4)	27.5 m
Road Train / B Double	36.5 m
Triple Road Train / Large Combination	53.5 m

End of Queue Protection

Clause 4.7.8 of AS1742.3 - 2009 requires the PREPARE TO STOP sign to be a minimum of D meters in advance of the end of the queue when the speed is greater than 70 km/h[12] or the sight distance of approaching traffic to the end of the queue is:

- less than two times the speed limit in open road areas
- less than 1.5 times the speed limit in built-up areas.

It is important to ensure adequate Stopping Sight Distance is provided to the PREPARE TO STOP sign and the end of queue. This is the distance required to allow a driver to react and stop their vehicle, this is generally around 2D (for more details on Stopping Sight Distance see Austroads Guide to Road Design Part 3).

[11] Traffic volumes can be provided by the relevant road authority. Where no traffic volumes are available the person preparing the plan should attend the site and count vehicles for a 5 minute period. Note that growth rates need to be considered when using data older than 12 months.
[12] This shall be taken as the permanent posted speed limit.

The diagrams below depict how these signs should be laid out to ensure adequate advanced warning to road users (note this exceeds distances given in AS1742.3).

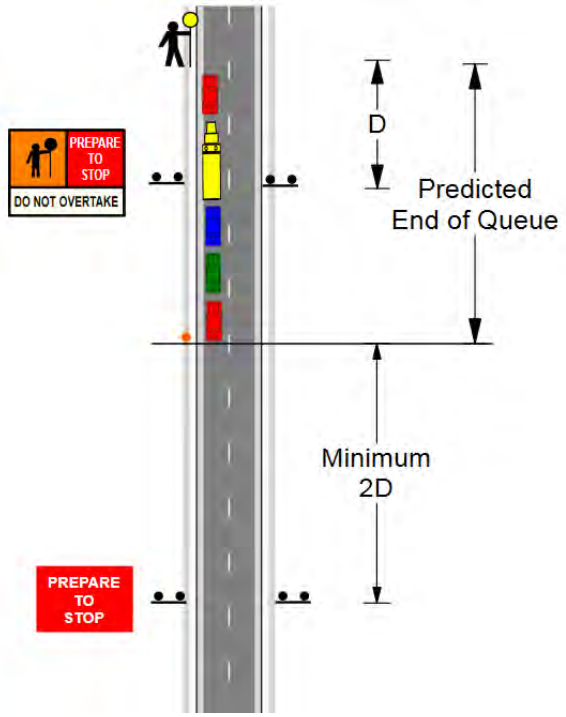


Figure 4: Predicted Queue Length <4D

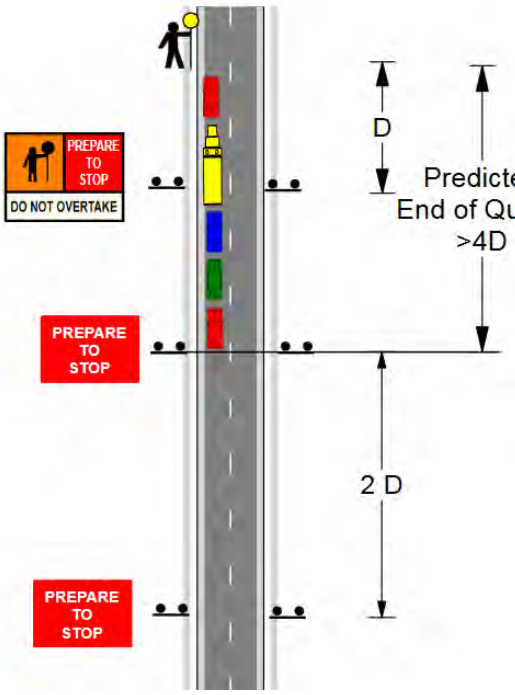


Figure 5: Predicted Queue Length >4D

Diagram notes:

- The diagrams do not depict speed reduction and advanced warning signage which must be included. Advance warning signs shall be at least D m in advance of the PREPARE TO STOP sign.
- The additional PREPARE TO STOP sign should be installed at least 2D from the end of the queue.
- It is recommended the PREPARE TO STOP sign T1-18B is used in advance of the end of queue.
- Provide PREPARE TO STOP and symbolic warning sign D m from the control point.
- Sight distance to the end of queue should be a minimum of 2D from the predicted end of queue for the peak period.
- Where the queue is expected to be more than 4D provide additional PREPARE TO STOP sign at the predicted end of queue (figure 5).

For further guidance see Traffic Control - Avoiding End of Queue Collisions on High Speed Roads Fact Sheet, go www.mainroads.wa.gov.au > 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'

6.13.3 Temporary Portable Traffic Signals

All portable temporary traffic signals shall be used in accordance with Clause 4.11 of AS 1742.3. AS 1742.3 states portable traffic signals are intended for traffic control applications of a relatively short duration and primarily for shuttle control.

A risk assessment shall be conducted prior to considering the use of portable traffic signals. This should examine what would happen in the event of failure assessing available sight distances, traffic volumes, traffic speeds and duration of operation. Mitigating factors may include regular inspections, having good sight lines for opposing traffic and/or having back up traffic controllers.

6.13.4 Traffic Controllers

General

Traffic Controllers are primarily used to manage, control and stop traffic where other signs and devices are considered insufficient. Accredited Traffic Controllers (see section 8) are required to operate in compliance with the guidelines contained in the Traffic Controllers' Handbook available on the MRWA website at: www.mainroads.wa.gov.au go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'

Generally, a Traffic Controller should control traffic in only one lane, therefore when manual traffic control is required on multi-lane carriageways, merge/s should be introduced upstream of the Traffic Controller so that the Traffic Controller is only managing one lane.

Traffic Controllers Working at Night

Compared to works during day time, night-works are significantly more hazardous.

Where Traffic Controllers are required to work at night care shall be taken to ensure all signs, devices and clothing are appropriately reflective in accordance with standards.

At all times Traffic Controllers must be well illuminated by portable floodlights, street lighting, car headlights etc. The light source must be angled or shielded to minimise glare to approaching traffic. Additionally, Traffic Controllers shall use a luminous wand when controlling traffic at night.

6.14 ILLUMINATED FLASHING ARROW SIGN

Clause 4.8.3 of AS1742.3 - 2009 requires a vehicle or trailer mounted illuminated flashing arrow sign to be used when closing lanes where the traffic volume is 1500 vpd or greater and the approach speed of traffic is 70 km/h or greater. However, to provide adequate advanced warning to road users it is common practice to use illuminated flashing arrow signs when closing lanes on multilane roads with a permanent posted speed limit of 60 km/h or more.

Therefore, in addition to the requirements in AS1742.3 a vehicle- or trailer-mounted illuminated flashing arrow sign shall be used when closing lanes on multilane roads with a traffic volume of 1500 vpd or greater and a permanent posted speed of 60 km/h or greater, to assist traffic in negotiating the taper.

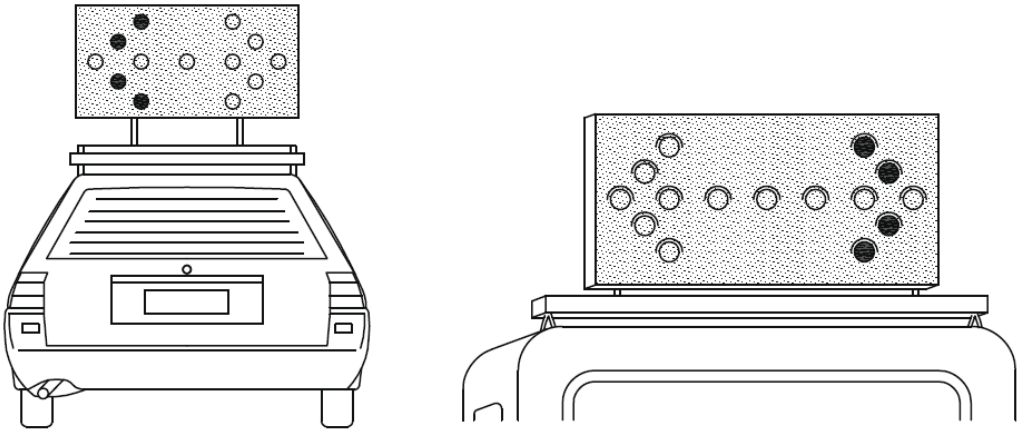


Figure 6: Illuminated Flashing Arrow Sign

6.15 SECURING SIGNS

AS 1742.3 indicates that signs and devices shall be positioned and erected so that they are properly displayed and securely mounted. The mountings should also be stable in windy conditions and from the effects of moving traffic.

Where windy conditions are expected either due to weather or heavy vehicles; signs should have additional sign support and be located with adequate lateral clearance from the travelled way. It is recommended in these conditions that signs either be mounted on permanent posts or, where this is not practicable, a cleat or similar should be affixed to the outside of the edge of the sign approximately a quarter up from its base. Sufficiently weighted sand bags should then be attached to this with rope / string with some tension applied to the cleat.

6.16 COVERING REGULATORY ROAD MARKING

In addition to the requirement to remove or cover regulatory devices that the TMP forces road users to contravene; it is recommended that regulatory road marking that portray a speed limit or traffic movement different to that shown in the TMP be covered.

Covering the road marking can be done with sticker products available from most sign makers. The colour of the sticker selected shall be similar to colour of the road surface. Long-term work sites should use the grinding and reinstatement method OR undertake routine inspection and maintenance on the stickers.

Where not possible to cover arrow pavement marking, lane status signs shall be provided that depict the permitted movements under the TGS.

7. BEST PRACTICE

Main Roads encourages the use of the following Traffic Management devices that increase the levels of safety, compliance and/or road user satisfaction at worksites.

7.1 ELECTRONIC SPEED LIMIT SIGNS

The Road Traffic Code 2000 allows for the use of electronic speed limit signs.

The use of these on road works sites is encouraged, particularly in situations where: there are frequent changes in speed limits required as a part of the works OR it is hazardous to manually change speed limits OR the works are of a long term nature.

When using electronic speed limit signs; accurate time stamped records on exactly when the speed limits have been changed must be kept. The usual sign inspection regime must be adhered to and back up devices made available to enable prompt replacement of faulty electronic signs.

7.2 TEMPORARY SPEED HUMPS

Temporary Speed Humps may be used to increase compliance with 40km/h speed zones at work sites. They are only to be installed when there are actual works taking place that require the 40km/h speed limit (as per AS1742.3 and this Code) and all other road environment options (to encourage speed limit compliance) have been exhausted.

The Guidelines for Temporary Speed Humps at Work Sites are available on the MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'.

7.3 VIDEO EVIDENCE

Clause 2.6.1 of AS1742.3 - 2009 and Section 5.5 of this Code give requirements for record keeping when conducting works on or near roads. Due to the availability of smart phones and video cameras, when conducting workplace inspections and/or altering the traffic guidance scheme, video evidence should be considered (to support written documented records).

7.5 INNOVATIVE TRAFFIC CONTROL DEVICES

When new innovative traffic control products emerge in the market there is a need for Main Roads WA to review and approve these devices before they are used to ensure they will be safe and effective. A list of recently approved devices and associated guidelines for use can be found on the Main Roads website, go to www.mainroads.wa.gov.au > 'Our Roads > 'Temporary Traffic Management' > 'Recently Approved Temporary Traffic Management Products'

7.6 SPEED FEEDBACK SIGNS

These devices detect vehicle speeds (using laser speed-detection equipment, for example) and either the speed or a message (e.g. SLOW DOWN) is displayed on an electronic sign. The primary purpose is to make drivers aware of their speed and encourage them to reduce their speed through the worksite. Research indicates that these are very effective in reducing drivers speed for short term purposes.

Speeds significantly above the posted speed limit should not be displayed on the sign, i.e. just a message, such as SLOW DOWN, should be shown.

8. ACCREDITATION REQUIREMENTS

8.1 GENERAL

Persons undertaking any of the tasks listed in Table 6 shall hold relevant MRWA accreditation, as indicated:

Task	Required MRWA Accreditation
Preparation of procedures for routine daily traffic management activities in accordance with and up to the planning level specified in Clause 2.2.1 (a) of AS1742.3 – 2009. On-site management of the installation and maintenance of traffic signs and control devices at worksites (and events) on or near roads including ensuring the correct TGSs are implemented for the required stage of the works. Adjustment of signs and devices within tolerances.	*Basic Worksite Traffic Management*
The operation of a truck mounted attenuator (TMA) when carrying out traffic management activities.	*Operate Truck Mounted Attenuator*
Review TMPs prepared by a person holding an AWTM accreditation. Monitoring the effectiveness of, and on-site adjustments to the Traffic Management Plan in accordance with its scope and objectives. This includes adjusting, adding and/or removing signs and devices where the intent/objectives of the TMP and operation of the road network are not adversely impacted. Changes to the TMP/TGS shall not involve adding lane or road closures, speed limit changes, or adding any additional regulatory signs that have not been approved (note: WTMs may add repeater signs).	*Worksite Traffic Management*
Prepare, review, monitor and adjust Traffic Management Plans and Traffic Guidance Scheme.	*Advanced Worksite Traffic Management*
On site manual traffic control using a Stop-Slow bat. Operate portable traffic signals systems. Operate portable boom barrier.	*Traffic Controller*
Review and endorsement of Traffic Management Plans involving ‘complex traffic arrangements’. Suitability and compliance audits of Traffic Management Plans involving ‘complex traffic arrangements’, as may be specified for works undertaken for or on behalf of MRWA. Undertaking ‘risk management’, and preparation or endorsement of, any Traffic Management Plan proposing to implement a lesser treatment than required by this Code for all works undertaken for or on behalf of MRWA.	*Roadworks Traffic Manager*

Table 6 – Tasks Requiring MRWA Accreditation

Any party intending to conduct works that may impact on traffic within any road reserve shall, as a condition of approval by MRWA, Local Government or any other authority responsible for the road, ensure that the persons performing the tasks contained in Table 6 hold a relevant and current certificate of accreditation.

A MRWA certificate is issued for each category of accreditation to individuals who successfully meet the pre-requisites applicable for each level of accreditation. Accreditation certificates are only permitted to be issued by MRWA approved training providers. Contact details for MRWA approved training providers are listed on the MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Training and Accreditation'.

8.2 BASIC WORKSITE TRAFFIC MANAGEMENT ACCREDITATION

A MRWA accreditation certificate in Basic Worksite Traffic Management will be issued to those meeting the following pre-requisites:

- an Australian Qualifications Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIWHS302D – Implement traffic management plan, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIICOM201D – Communicate in the workplace, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIWHS201D – Work safely and follow WHS policies and procedures, or equivalent (or the replacement unit of competency if and when applicable);
- evidence of been issued with a valid WorkSafe WA Construction Safety Awareness Training card.

Where the Statement of Attainment is obtained outside of Western Australia, applicants may be requested to undertake further training and assessment in the performance criteria specific to the laws, regulations and Codes of Practice that apply in Western Australia.

Provisional MRWA accreditation as an 'Endorsed Trainee in Basic Worksite Traffic Management' can be issued for a maximum period of three (3) months following successful completion of the written assessments to enable persons to gain hands-on experience prior to completing the practical assessment component of the training and obtaining full accreditation. Such provisional accreditation is valid only when the endorsed trainee is under the direct supervision of a person holding current accreditation in Basic Worksite Traffic Management.

Where traffic devices are used, all work sites shall have at least one person with Basic Worksite Traffic Management accreditation on-site at all times when road workers are present.

Road workers with at least 12 months experience working on roads are permitted to implement signs under direct supervision of someone that holds a BWTM accreditation. This is only permitted on local roads with a permanent speed limit of 50 km/h or less and less than 15,000 vehicles per day.

8.3 OPERATE TRUCK MOUNTED ATTENUATOR

A MRWA accreditation certificate in Operate Truck Mounted Attenuator will be issued to those meeting the following pre-requisites:

- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIICOM201D – Communicate in the workplace, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIRTM301D – Operate a truck or trailer mounted attenuator, or equivalent (or the replacement unit of competency if and when applicable);
- hold a current and valid heavy vehicle licence of a suitable class to operate the TMA (Medium Rigid licence as a minimum)
- documentary evidence of at least 80 hours experience operating heavy vehicles in the last 6 months;
- hold a valid Work Safe WA Construction Safety Awareness Training card;
- hold a current MRWA Basic Worksite Traffic Management Accreditation (see 8.2);
- documentary evidence of at least 50 hours practical experience in traffic management in the last 6 months.

8.4 WORKSITE TRAFFIC MANAGEMENT ACCREDITATION

A MRWA accreditation certificate in Worksite Traffic Management will be issued to those meeting the following pre-requisites:

- an Australian Qualifications Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIRIS402D – Carry out the risk management process, or equivalent (or the replacement unit of competency if and when applicable), and;
- a current certificate of accreditation in Basic Worksite Traffic Management*, and;
- evidence of been issued with a valid WorkSafe WA Construction Safety Awareness Training card, and;
- attendance of the 4 day course in Advanced Worksite Traffic Management – including national units RIICWD503D - Prepare workzone traffic management plan and RIIRIS402D - Carry out the risk management process.

  This includes successful completion of the in class written assessments which involves participants amending 3 TGSs that require updating. Participants to address site specific issues in the risk assessment and changes to be noted in the daily diary, and;
- documentary evidence of at least 1 year's practical experience in traffic management;

  or
- documentary evidence of at least 2 years practical experience in road construction or maintenance.

Expiry of pre-requisite Basic Worksite Traffic Management accreditation can be deferred to enable re-accreditation to coincide with the expiry of Worksite Traffic Management accreditation.

*Exemption from holding a current BWTM accreditation may be offered for employees working in Main Roads, Local Governments or other approving bodies with at least 3 years' experience in traffic management, road safety, road construction/maintenance or road design that will be endorsing TMP's. Additionally they must have previously held BWTM accreditation.

8.5 ADVANCED WORKSITE TRAFFIC MANAGEMENT ACCREDITATION

A MRWA accreditation certificate in Advanced Worksite Traffic Management will be issued to those meeting the following pre-requisites:

- Documentary evidence of at least 1 years' experience in traffic management, road asset management, road safety, road design, road construction or road maintenance;
- an Australian Qualifications Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIICWD503D – Prepare work zone traffic management plan, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualifications Framework compliant Statement of Attainment in the Risk Management Unit of Competency RIIRIS402D – Carry out the risk management process, or equivalent (or the replacement unit of competency if and when applicable);
- evidence of holding or having held a Main Roads Western Australia accreditation in Basic Worksite Traffic Management or an Australian Qualification Frameworks compliant Statement of Attainment in 'Implement Traffic Management Plan'.
- evidence of been issued with a valid WorkSafe WA Construction Safety Awareness Training card.

8.6 TRAFFIC CONTROLLER ACCREDITATION

A MRWA Traffic Controller accreditation certificate will be issued to those meeting the following pre-requisites;

- an Australian Qualifications Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIWHS205D – Control traffic with a stop-slow bat, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIICOM201D – Communicate in the workplace, or equivalent (or the replacement unit of competency if and when applicable);
- an Australian Qualification Framework compliant Statement of Attainment in the Resources and Infrastructure Industry Training Package Unit of Competency RIIWHS201D – Work safely and follow WHS policies and procedures, or equivalent (or the replacement unit of competency if and when applicable);
- current or previous evidence of holding a valid driver's licence;
- evidence of been issued with a valid WorkSafe WA Construction Safety Awareness Training card.

Basic Worksite Traffic Management accreditation is also required where Traffic Controllers are responsible for installing and maintaining associated signing and devices, e.g. temporary speed limit signs, 'Prepare to Stop' signs, etc.

Where the above Statement of Attainment is obtained outside of Western Australia, applicants may be requested to undertake further training and assessment in the performance criteria specific to the laws, regulations and Codes of Practice that apply in Western Australia.

Provisional MRWA accreditation as an 'Endorsed Trainee Traffic Controller' can be issued for a maximum period of three (3) months following successful completion of the written assessments to enable persons to gain hands-on experience prior to completing the practical assessment component of the training and obtaining full accreditation. Such provisional accreditation is valid only when the endorsed trainee is under the direct supervision of a person holding current Traffic Controller accreditation.

Accredited Traffic Controllers at roadwork sites in Western Australia shall operate in compliance with the Traffic Controllers Handbook which is available on MRWA's website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'.

8.7 ROADWORKS TRAFFIC MANAGER ACCREDITATION

Applications for Roadworks Traffic Manager accreditation are subject to assessment by the RTM Accreditation Panel comprising selected Government, professional and industry representatives. For further detail and application process go to the MRWA website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Roadworks Traffic Managers'.

Applicants are assessed on the basis of the following minimum criteria:

- hold a current Main Roads' Advanced Worksite Traffic Management Accreditation;
- Have 5-years practical experience as an AWTM (or equivalent) responsible for the review, approval or design of Traffic Management Plans.
- Have completed the WA Road Safety Audit Course, within the previous 5 years, OR be a current practicing WA accredited Road Safety Auditor
- Have been an Audit Team Member or Audit Team Trainee on at least five Road Safety Audits or Temporary Traffic Management Audits within the previous two years under the guidance of an accredited Senior Road Safety Auditor or accredited Roadworks Traffic Manager
- Have been an Audit Team Member or Audit Team Trainee on at least one detailed design stage audit within the previous two years, under guidance of an accredited Senior Road Safety Auditor
- evidence of attending the Main Roads (or equivalent) Temporary Workzone Barrier design course, within the previous three years;
- Carried out at least one compliance or one suitability audit of a Traffic Management Plan involving 'complex traffic arrangements' under the guidance of an independent[13] Roadworks Traffic Manager.
- signing of Roadworks Traffic Managers Code of Conduct;
- have in place Professional Indemnity / Public Liability insurance certificate of currency*

[13] Independent is defined as not having the potential for financial gains.

*It is the responsibility of RTMs, as well as anyone engaging them, to ensure they have the appropriate level of insurance.

Applicants that the Panel assesses to have met these prerequisites will be required to undertake an 'in office' assessment to verify their traffic management knowledge.

8.8 PROOF OF CERTIFICATION

Proof of certification is issued by training providers in the form of a 'Photo ID' card. Persons performing on-site traffic management tasks shall always carry this proof of certification with them.

A database of persons holding current accreditation is maintained by training providers on Main Roads website at www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Training and Accreditation'.

8.9 ISSUE OF CERTIFICATION AND RE-ACCREDITATION

The issue of accreditation can only be undertaken by training providers that have the relevant training Unit of Competency in their scope of registration by the WA Training Accreditation Council or Australian Skills Quality Authority, and are separately approved by MRWA to issue such accreditation. For those seeking accreditation based on Statements of Attainment issued outside of Western Australia, applicants must be able to demonstrate knowledge of relevant laws, regulations and codes of practice specific to Western Australia.

All MRWA accreditations are valid for three years, following which re-accreditation is required. Re-accreditation is subject to persons being 'refreshed' on any changes to relevant laws, regulations, standards and codes of practice that may have occurred since the issue of the previous accreditation. Applicants must have achieved statements of attainment in the current units of competency prior to being re-accredited.

9. AUSTROADS SAFETY AT ROAD WORKSITES

9.1 Austroads Guide to Temporary Traffic Management

The Austroads Guide to Temporary to Temporary Management (AGTTM) is now freely available on the Austroads website (https://www.onlinepublications.austroads.com.au).

Practitioners are encouraged to familiarise themselves with AGTTM and incorporate components as soon as practical. The AGTTM will be fully adopted in WA by 1st February 2021 (in conjunction with AS 1742.3-2019). Following this date a cut down version of the Code of Practice will remain as a supplement to the AGTTM.

Note: this Code in conjunction with AS1742.3-2009 can continue to be used until AGTTM is adopted.

9.2 Road Categories and Training

A road categorisation system has been adopted in the AGTTM based on the New Zealand road levels. While all works on roads are considered high risk, the categorisation into three categories allows design practices and training to be tailored to the different risk levels at each category.

There are three core TTM defined roles with three road categories:

Role	Category 1	Category 2	Category 3
Traffic Controller	✓	✓	N/A*
Traffic Management Implementer	✓	✓	✓
Traffic Management Designer	✓	✓	✓

*Traffic Controllers not permitted on Category 3 roads.

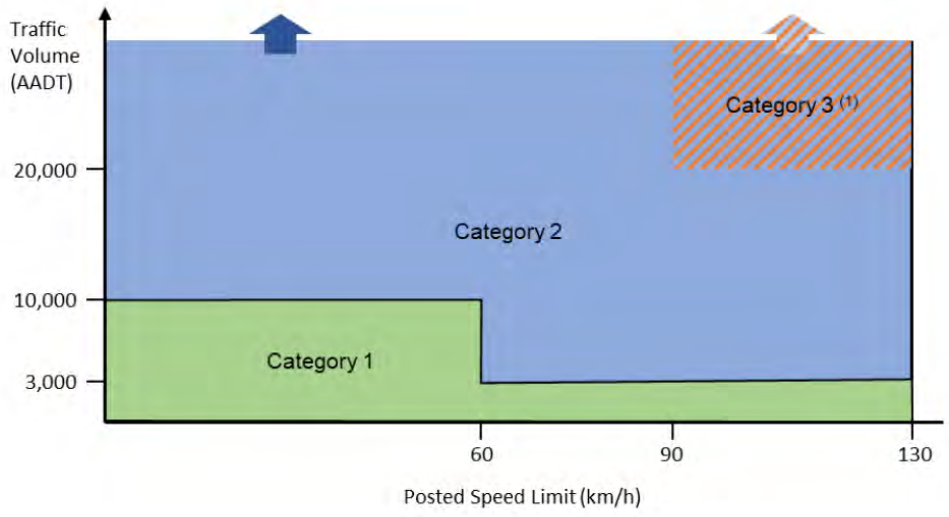


Figure 7: Road categories for TTM applications

Note: Category 3 applies only when the road is an expressway type road or is predominantly characterised by grade separated intersections.

See AGTTM Part 8 for more details.

Austroads will be developing the entire training package, this is due for completion by the 3rd quarter of 2020. Following project completion there will be an 18 month transition period before the framework is adopted in WA.

10. FURTHER INFORMATION

Further information relating to this Code may be obtained from:

Gareth Peers
Main Roads Western Australia
PO Box 6202
EAST PERTH WA 6892

Phone: 138 138
Email: roadsafety@mainroads.wa.gov.au

11. REFERENCES

- AS 1742 – Manual of uniform traffic control devices
  - Part 1 – General introduction and index of signs 2014
  - Part 2 – Traffic control for general use 2009
  - Part 3 – Traffic control for works on roads 2009
  - Part 4 – Speed controls 2008
- AS 1743:2018 – Road signs – Specifications
- AS/NZS 1906 – Retroreflective materials and devices for road traffic control purposes
  - Part 1 – Retroreflective sheeting 2017
  - Part 2 – Retroreflective devices (non-pavement application) 2007
  - Part 3 – Raised pavement markers (retroreflective and non-retroreflective) 2017
  - Part 4 – High visibility materials for safety garments 2010
- AS/NZS 3845.1:2015 – Road safety barrier systems and devices – Road safety barrier systems
- AS/NZS 3845.2:2017 Road safety systems and devices – Road safety devices
- AS/NZS ISO 31000:2009 – Risk Management – Principles and Guidelines
- AS/NZS 4602.1:2011 – High visibility safety garments – Garments for high risk applications
- Austroads Glossary of Terms
- Austroads Guide to Road Design
- Austroads Guide to Traffic Management
- Austroads Guide to Temporary Traffic Management
- Disability Services Act 1993
- Guidelines for the Use of Truck Mounted Attenuators in WA
- Local Government Act 1995
- Main Roads Act 1930
- Occupational Safety & Health Act 1984
- Occupational Safety & Health Regulations 1996
- Road Traffic Act 1974
- Road Traffic Code 2000
- Temporary Traffic Management: Traffic Signals Approval Policy
- Traffic Controllers' Handbook
- Traffic Management at Roadworks on State Roads Policy and Application Guidelines
- Traffic Management for Events Code of Practice
- Utility Providers Code of Practice for Western Australia

APPENDIX 1 – Definitions

NOTE: Some of the definitions below are from AS 1742.3 – 2009, AS 1348 – 2002 and AS/NZS ISO 31000:2009

Access roads:	As per Metropolitan Functional Road Hierarchy definitions below(1)
AS:	Australian Standard
AS/NZS:	Australian / New Zealand Standard
Average Daily Traffic (ADT):	The total traffic volume on all traffic lanes on the affected carriageway during a stated period, divided by the number of days in that period (normally over a seven day week, i.e. including weekend traffic)
Authorised Body:	Being the same definition as that in Regulation 3 of the Road Traffic Code 2000 – means a government department, government instrumentality, statutory authority, local government or a body authorised by the Commissioner of Main Roads for the purposes of Regulation 297(2) of the Road Traffic Code 2000
Built up area:	Being the same definition as that in Regulation 3 of the Road Traffic Code 2000 – means the territory contiguous to and including any road – (a) on which there is provision for street lighting at intervals of not over 100 metres for a distance of at least 500 metres or, if the road is shorter than 500 metres, for the whole road; or (b) which is built up with structures devoted to business, industry or dwelling houses at intervals of less than 100 metres for a distance of one half kilometre or more
Carriageway:	Section of the road devoted particularly to the use of vehicles, that is between the guideposts, kerbs or barriers where these are provided, inclusive of shoulders and auxiliary lanes
Children's Crossings:	Means a facility controlled by a crossing attendant warden who is employed by the WA Police or engaged by the school's authorised parents association or a non-government school's administrative body.
Clear zone:	The horizontal width of space available for the safe use of an errant vehicle which consists of the verge area and is measured from the nearside edge of the left-hand traffic lane. In the case of a divided road, it is also measured from the offside edge of the right-hand traffic lane to the edge of the pavement for opposing traffic. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope and a run-out area, but all parts can be traversed.

Contra-flow:	Traffic flow in a direction opposite to the normal flow
Crash Attenuator:	Devices that prevent an errant vehicle from impacting hazardous objects by gradually decelerating the vehicle to a safe stop or by directing the vehicle away from the hazard. They are often used as the end treatment on the leading end of a road safety barrier system.
Crossing Attendant:	Means a person appointed as or trained as a crossing attendant warden under regulation 23 of the Western Australian Road Traffic (Administration) Act 2008 – Part 3, to perform duties relating to the controlling of vehicles and pedestrians at children's crossings and pedestrian crossings.
Delineation:	Treatments that enhance the selection of the appropriate path and speed or position, to allow a manoeuvre to be carried out safely and efficiently, in accordance with Clause 3.9 and Clause 3.10 of AS 1742.3 – 2009
Delineator:	As detailed in Clause 3.9.2 of AS 1742.3 – 2009
Direct Supervision:	Within visual and verbal communication of a qualified person
District distributor:	As per Metropolitan Functional Road Hierarchy definitions below(1)
Divided Road	A highway or road with separated carriageways for traffic travelling in opposite directions.
Duty of care:	The legal duty on the part of all employers, employees and others including contractors and consultants who have an influence on the potential hazards in a work site, which requires them to take reasonable care to protect the health and safety of others at the work site including road users who may be at a foreseeable risk of harm
Emergency:	A situation where a life threatening risk exists and the consequences of not taking action are judged to be worse than if action is taken.
Excavation:	For the purpose of this Code an 'excavation' is deemed to have been formed when material is removed by digging as a result of or in the course of 'work'.
Instrument of Authorisation:	A legal instrument through which the Commissioner of Main Roads, under Regulation 297 of the Road Traffic Code 2000, formally delegates to an Authorised Body the authority to erect, establish or display and alter or take down any road sign or traffic control signal for the purpose and duration of any roadworks subject to conditions set out in the instrument. In order to take effect, the instrument must be executed by the Commissioner and the body the subject of the instrument.
IPWEA:	Acronym for Institute of Public Works Engineering Australia

Level of Service:	(a) An index of the operational performance of traffic on a given traffic lane, carriageway or road when accommodating various traffic volumes under different combinations of operating conditions
Long-term:	More than one shift
Metropolitan Area / Region	Main Roads regional boundaries can be found using the Road Information Mapping (RIM) system, go to www.mainroads.wa.gov.au > 'Our Roads' > 'Facts and Figures' > 'Road Information Mapping'
Offset Speed Zone:	Temporary Speed zoning which results in speed limits which are different for each direction of travel at a particular location.
Operating speed:	85%th percentile speed, exclusive of stops, at which individual drivers travel on a given section of road under the prevailing traffic conditions
Pavement:	That portion of a carriageway placed above the sub-grade for the support of, and to form a running surface for, vehicular traffic
Primary distributor:	As per Metropolitan Functional Road Hierarchy definitions below[1]
Protective treatment:	For the purpose of this Code, Road Safety Barriers, Work Zone Barriers or other delineation installed in series at a pre-determined spacing, to protect or demarcate a work site or excavation from traffic
Rail Infrastructure Manager	An organisation responsible for managing the safe operation of a railway. This is often separate to the rail owner.
Residential Road / Street	Normally a single carriageway, two-way road in a residential district of an urban area carrying little through traffic and few large vehicles even during peak hours. Such roads have a speed limit not exceeding 60 km/h.
Residual risk:	Risk remaining after risk treatment (process to modify risk). Residual risk can contain unidentified risk. Residual risk can also be known as 'retained risk'.
Risk management:	Coordinated activity to direct and control an organisation with regards to risk
Road:	For the purpose of this Code has the same meaning as that defined in Main Roads Act: means any thoroughfare, highway or road that the public is entitled to use and any part thereof, and all bridges (including any bridge over or under which a road passes), viaducts,

	tunnels, culverts, grids, approaches and other things appurtenant thereto or used in connection with the road;
Road reserve:	For the purpose of this Code includes the land set aside, gazetted under an enactment or commonly used by the public as a road and all verges, traffic islands, median strips and other provisions associated therein for the conveyance or travel persons but does not include private tenements or freehold land.
School Zone:	Means a carriageway or length of carriageway (a) defined at its beginning by means of a 'School Zone' sign and at its end by means of an 'End School Zone 'sign; or (b) that forms part of a network of 2 or more carriageways defined by means of 'school zone' signs erected near the boundary of each carriageway that provide access to the network and 'End School Zone' signs erected near the boundary of each carriageway that provided exit from the area.
School Zone Period:	Means the days (if any), and the period (if any) during those days, that the speed limit indicates by a 'School Zone' sign has effect.
Shall:	Indicates that a statement is mandatory
Short-term:	One shift or lesser
Should:	Indicates a recommendation.
Speed zone:	A length of road subject to legally enforceable speed limits
Traffic control device:	Any sign, signal, pavement marking or other installation placed or erected by a public authority or official body, having the necessary jurisdiction, for the purpose of regulating, warning or guiding traffic
Traffic Control Diagram (TCD):	See Traffic Guidance Scheme
Traffic Guidance Scheme (TGS):	Documentation depicting the safe work methods and, where applicable, the arrangement of temporary signs and devices to warn, instruct and guide traffic around, through or past a work site or temporary hazard.
Traffic Management Plan (TMP):	A document containing Traffic Guidance Schemes and documentation of project details in regard to traffic management at a work site. The documentation of project details includes, inter alia, responsible personnel, proposed timing of the works, approvals that have been gained, traffic volume/type details, documentation of risk management and special provisions for specific road user types.

Truck Mounted Attenuator (TMA):	A combination of Host Vehicle and Crash Attenuator unit either mounted to the Host Vehicle or towed by the Host Vehicle to protect road workers.
Very low volume:	< 200 vpd
vpd:	Acronym for vehicles per day.
Work area:	The specific area where the work is being done.
Work/s:	Where it appears in the Code it refers to construction and maintenance work in work sites wholly or partly within the road reserve boundaries and shall apply in accordance with the scope as defined in Clause 1.1 of AS 1742.3 – 2009[(2)]
Work site:	An area which includes the work area(s) and any additional length of road required for advance signing, tapers, side-tracks or other areas needed for associated purposes.
Work zone barrier:	A physical barrier separating the work area and the travelled path, designed to resist penetration by an out-of-control vehicle and as far as reasonably practicable, to redirect out of control vehicles back into the travelled path.

NOTES:

[(1)]Metropolitan Functional Road Hierarchy Definitions

Primary Distributors:	These provide for major regional and inter-regional traffic movement and carry large volumes of generally fast moving traffic. Some are strategic freight routes and all are National or State roads. They are managed by MRWA.
District Distributor A:	These carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
District Distributor B:	Perform a similar function to type A District Distributors but with reduced capacity due to flow restrictions caused by access to and roadside parking alongside adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid which would ideally space them around 1.5km apart. They are managed by Local Government.
Local Distributors:	Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local Government.
Access Roads:	Provides access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local Government.

The decision about which functional type should be designated to each road can only be made by the Authority responsible for managing that road.

[2]Clause 1.1 of AS1742.3 – 2009

1.1 Scope

This Standard specifies the traffic control devices to be used to warn, instruct and guide road users in the safe negotiation of work sites on roads including unsealed roads together with footpaths, shared paths, and bicycle paths adjacent to the roadway. It is applicable to traffic guidance schemes for road and bridge construction and maintenance sites, works associated with other public utilities and services, or any other works which cause interference or obstruction to the normal use of a road by any road user. It also provides guidance for the planning, design, installation and operation of such traffic guidance schemes together with requirements for maintaining a safe workplace for workers on site.

APPENDIX 2 – Traffic Risk Classification

In order to clearly understand the risks associated with the works and then outline the manner in which identified risks will be managed, the TMP designer needs to undertake an assessment of all significant foreseeable risks associated with the works and determine the treatment measures that, so far as practicable, minimise the risk.

The identification and assessment process is to be undertaken in accordance with AS/NZS ISO 31000 and the likelihood and consequences rated before the application of risk treatments (primary risk) and after (residual risk) the determined controls utilising Table A2-1, Table A2-2, Table A2-3 and Table A2-4 below.

The TMP designer is to, so far as practicable, control or reduce identified risks in accordance with the hierarchy of control. Treatment measures are to be in accordance with the below Table A2-5 Management Approach for Residual Risk Rating.

A Residual Risk Rating of Very High is not permissible.

TABLE A2-1 – QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Consequence	Description
Insignificant	Midblock hourly traffic flow per lane is equal to or less than the allowable lane capacity detailed in AS1742.3. No impact to the performance of the network. Affected intersection leg operates at a Level of Service (LoS) of A or B. No property damage.
Minor	Midblock hourly traffic flow per lane is greater than the allowable road capacity and less than 110% of the allowable road capacity as detailed in AS1742.3. Minor impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of C. Minor property damage.
Moderate	Midblock hourly traffic flow per lane is equal to and greater than 110% and less than 135% of allowable road capacity as detailed in AS1742.3. Moderate impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of D. Moderate property damage.
Major	Midblock hourly traffic flow per lane is equal to and greater than 135% and less then170% of allowable road capacity as detailed in AS1742.3. Major impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of E. Major property damage.
Catastrophic	Midblock hourly traffic flow per lane is equal to and greater than 170% of allowable road capacity as detailed in AS1742.3. Unacceptable impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of F. Total property damage.

TABLE A2-2 OSH QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Level	Consequence	Description
1	Insignificant	No treatment required
2	Minor	First aid treatment required.
3	Moderate	Medical treatment required or Lost Time Injury
4	Major	Single fatality or major injuries or severe permanent disablement
5	Catastrophic	Multiple fatalities.

TABLE A2-3 – QUALITATIVE MEASURES OF LIKELIHOOD

Likelihood	Description
Rare	The event or hazard: may occur only in exceptional circumstances, will probably occur with a frequency of less than 0.02 times per year (i.e. less than once in 50 years).
Unlikely	The event or hazard: could occur at some time, will probably occur with a frequency of 0.02 to 0.1 times per year (i.e. once in 10 to 50 years).
Possible	The event or hazard: might occur at some time, will probably occur with a frequency of 0.1 to 1 times per year (i.e. once in 1 to 10 years).
Likely	The event or hazard: will probably occur in most circumstances, will probably occur with a frequency of between 1 and 10 times per year.
Almost certain	The event or hazard: is expected to occur in most circumstances, will probably occur with a frequency in excess of 10 times per year.

IMPORTANT NOTE: The likelihood of an event or hazard occurring shall first be assessed over the duration of the activity (i.e. “period of exposure”). For risk assessment purposes the assessed likelihood shall then be proportioned for a “period of exposure” of one year.

Example: An activity has a duration of 6 weeks (i.e. “period of exposure” = 6 weeks). The event or hazard being considered is assessed as likely to occur once every 20 times the activity occurs (i.e. likelihood or frequency = 1 event/20 times activity occurs = 0.05 times per activity). Assessed annual likelihood or frequency = 0.05 times per activity x 52 weeks/6 weeks = 0.4 times per year. Assessed likelihood = Possible.

TABLE A2-4 – QUALITATIVE RISK ANALYSIS MATRIX – RISK RATING

	Consequence				
Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (A)	**Low 5**	**High 10**	**High 15**	**Very High 20**	**Very High 25**
Likely (B)	**Low 4**	**Medium 8**	**High 12**	**Very High 16**	**Very High 20**
Possible (C)	**Low 3**	**Low 6**	**Medium 9**	**High 12**	**High 15**
Unlikely (D)	**Low 2**	**Low 4**	**Low 6**	**Medium 8**	**High 10**
Rare (E)	**Low 1**	**Low 2**	**Low 3**	**Low 4**	**Medium 7**

TABLE A2-5 – MANAGEMENT APPROACH FOR RESIDUAL RISK RATING

Residual Risk Rating	**Required Treatment**
Very High	Unacceptable risk. **HOLD POINT**. Work cannot proceed until risk has been reduced.
High	High priority, Roadworks Traffic Manager (RTM) must review the risk assessment and approve the treatment and endorse the TGS prior to its implementation.
Medium	Medium Risk, standard traffic control and work practices subject to review by accredited AWTM personnel prior to implementation.
Low	Managed in accordance with the approved management procedures and traffic control practices.

APPENDIX 3 – Typical Instrument of Authorisation for Local Government

(See page xi)

WESTERN AUSTRALIA
ROAD TRAFFIC CODE 2000
REGULATION 297(2)
INSTRUMENT OF AUTHORISATION

Pursuant to Regulation 297(2) of the Road Traffic Code 2000 the Commissioner of Main Roads ('the Commissioner') hereby authorises *(Insert name of Local Government)* ('Authorised Body') by itself, its employees, consultants, agents and contractors (together 'Representatives') to, from the date indicated below, erect, establish, display, alter or take down such traffic signs and traffic control devices of whatsoever type or class (except for permanent traffic control signals) as may be required for the purpose and duration of any works, survey or inspection, associated with the construction, maintenance or repair on a road (other than a main road or highway), any adjoining land or any portion thereof within its jurisdiction, SUBJECT ALWAYS to the following terms and conditions:

(a) the Authorised Body shall at all times observe, perform and comply with the provisions of the 'Traffic Management for Works on Roads Code of Practice' (as amended or replaced from time to time in consultation with the Traffic Management for Roadworks Advisory Group) issued by Main Roads Western Australia ('the Code') referring to the version which is current at the time of the relevant works, a copy of which can be obtained from Main Roads Western Australia from www.mainroads.wa.gov.au or by contacting Main Roads by phone;

(b) the Authorised Body shall develop and implement procedures that will satisfy the Commissioner that traffic management implemented by the Authorised Body, its employees, agents and contractors will in all respects conform to and comply with the requirements of the Code; and

(c) the Authorised Body shall ensure that its Representatives comply with the terms and conditions identified above at paragraphs (a) and (b) as if they were named in those paragraphs in place of the Authorised Body.

By executing and returning the acknowledgment at the foot of this authorisation, the Authorised Body agrees to observe, perform and comply with the above terms and conditions.

This Instrument of Authorisation replaces any prior Instrument of Authorisation under Regulation 297(2) of the Road Traffic Code 2000 between the Commissioner and the Authorised Body. The Commissioner's delegation dated 17 July 1975 to a number of Local Governments outside the Perth metropolitan area, is not affected by this Instrument of Authorisation except that this Instrument of Authorisation prevails wherever roadworks are concerned. That 1975 delegation was made under Regulation 301 of the Road Traffic Code 1975 and related to non-regulatory signage.

Dated:

THE COMMON SEAL OF THE)
COMMISSIONER OF MAIN ROADS)
WAS AFFIXED BY)
)
)
COMMISSIONER OF MAIN ROADS)
FOR THE TIME BEING IN THE PRESENCE OF:)

_____
Signature of Witness

_____
Name of Witness

ACKNOWLEDGMENT BY AUTHORISED BODY

(Insert name of Local Government) agrees to observe, perform and be bound by the above conditions.

THE COMMON SEAL OF THE)

(Insert name of Local Government))
WAS AFFIXED PURSUANT TO A RESOLUTION)
OF THE COUNCIL IN THE PRESENCE OF)

_____
Chief Executive Officer

_____
Witness

APPENDIX 4 – Sample 'Notification of Roadworks' Form

A sample Notification of Roadworks form is provided on page x. ***NOTE:*** *The distribution list in this form is based on Perth metropolitan area and it needs to be appropriately modified for use elsewhere.*

An electronic version of the sample Notification of Roadworks form is available on MRWA website www.mainroads.wa.gov.au; go to 'Our Roads' > 'Temporary Traffic Management' > 'Forms and Publications'.

Contact details of MRWA Regional Offices for sending the Notification of Roadworks forms and TMPs are given in Table A4-1 below.

Region	Email	Phone
Kimberley (Derby and Kununurra)	Kimreg@mainroads.wa.gov.au	(08) 9158 4333 (Derby) (08) 9167 4777 (Kununurra)
Pilbara (South Hedland)	NoR Form: Pilreg@mainroads.wa.gov.au TMP submissions: Pilbaranetworkmanagement@mainroads.wa.gov.au	(08) 9172 8877
Mid West - Gascoyne (Geraldton and Carnarvon)	MWGreg@mainroads.wa.gov.au	(08) 9941 0777 (Carnarvon) (08) 9956 1200 (Geraldton)
Goldfields – Esperance (Kalgoorlie)	GEreg@mainroads.wa.gov.au	(08) 9080 1400
Wheatbelt (Northam and Narrogin)	Wheatbelt@mainroads.wa.gov.au	(08) 9622 4777 (Northam) (08) 9881 0566 Narrogin
Great Southern (Albany)	GSreg@mainroads.wa.gov.au	(08) 9892 0555
South West (Bunbury)	SWreg@mainroads.wa.gov.au	(08) 9724 5656

Table A4-1 – MRWA Regional contact details for sending Notification of Roadworks forms and TMPs

NOTIFICATION OF ROADWORKS

Notifications are to be distributed at least one (1) week in advance of works
Where the traffic management is to interfere with traffic signal operation, prior approval is required 3wks in advance via enquiries@mainroads.wa.gov.au.

TMP reference		Communication plan sent to MRWA	Yes ☐	No ☐	N/A ☐
			If No provide reason. If Yes provide email contact		
Anticipated start date:		Anticipated finish date:			
Daily work hours:		Is weekend work applicable?:	Yes ☐	No ☐	
Location of works (Road/Street, Suburb):					
Description of works:					
Description of traffic management arrangements:					
Posted Speed Limit:		Worksite speed limit:		After hours speed limit:	

What is the anticipated effect on traffic flows?:				Will there be restricted width for oversize escorted vehicles?:		Yes ☐	No ☐
Are lanes closed at signals?:	Yes ☐	No ☐	N/A ☐	Are signal loops or hardware affected?:	Yes ☐	No ☐	No ☐
Will signal phases need time changes?	Yes ☐	No ☐	N/A ☐	Will signals need to revert automatically?:	Yes ☐	No ☐	N/A ☐
Date of signal 'black out':				Times of signal 'black out':			
Will Police attendance be required?:	Yes ☐	No ☐		Dates for Police attendance :			
Are bridges located in area of works, (inc detours)?:	Yes ☐	No ☐		Will changes to traffic flows/composition occur on bridges?:		Yes ☐	No ☐
Are the works located within a School Zone?:	Yes ☐	No ☐		Will children's crossings be altered during works?:		Yes ☐	No ☐

Will there be a width restriction for oversize vehicles exceeding 2.5m in width?	Yes ☐	No ☐	Will there be a height restriction for oversize vehicles exceeding 4.3m in height?	Yes ☐	No ☐
If yes, what width limit is to be imposed on oversize vehicles travelling through the site?			If yes, what is the minimum height of the structure causing the restriction?		
Can the width restrictions be removed if operators provide prior notice?	Yes ☐	No ☐	If the width restrictions are fixed in place, are operators able to have a wider oversize combination if a 1.2m ground clearance can be achieved?	Yes ☐	No ☐
If yes, how much notice will be required? (i.e. 24/48 hours' notice).			If yes, how much notice will be required? (i.e. 24/48 hours' notice).		
Please provide the name and phone number of the best contact for further details in relation to these works.	Name: Contact number (mobile):				
Please provide the name and phone number of the contact for prior notification of movements.	Name: Contact number (mobile):				
Will the work result in a road closure that will impact on Restricted Access Vehicles?	Yes ☐	No ☐	If yes, have discussions been held with Main Roads Heavy Vehicle Services (HVS) in regards to a suitably approved RAV network detour. If no, please contact HVS Route Assessments on 138 486 for assistance. Note: an assessment request for a proposed detour may take up to a week to be processed.	Yes ☐	No ☐

Road Authority:					
Postal Address:					
Telephone:		Email:		Facsimile:	
Contact:					
Telephone:		Email:		Mobile:	

Construction Contractor:					
Postal Address:					
Telephone:		Email:		Facsimile:	
Contact:					
Telephone:		Email:		Mobile:	
After hours contact:		Telephone:		Mobile:	

Traffic Management Contractor:					
Postal Address:					
Telephone:		Email:		Facsimile:	
Contact:					
Telephone:		Email:		Mobile:	
After hours contact:		Telephone:		Mobile:	

Distribution List	Email/Website
WA Police State Traffic Coordination	State.Traffic.Intelligence.Planning.&.Co-ordination.Unit.SMAIL@police.wa.gov.au
WA Police Student Pedestrian Policy Unit	childrenscrossingunitsmail@police.wa.gov.au
MRWA Customer Information Centre	enquiries@mainroads.wa.gov.au
MRWA Road Network Operations Centre	RNOC.Control.Room.Information.Desk@mainroads.wa.gov.au
MRWA Heavy Vehicle Services	hvs@mainroads.wa.gov.au
MRWA Engineer Bridge Loading	DLSEHeavyLoadsGroup@mainroads.wa.gov.au
St John Ambulance	BSS@stjohnwa.com.au
Fire & Emergency Services	For relevant contact details see website: www.dfes.wa.gov.au/contactus/pages/dfesoffices.aspx
Public Transport Authority	For relevant contact details see website: www.pta.wa.gov.au/AboutUs/ContactUs
Arc Infrastructure	thirdparty.notifications@arcinfra.com
MRWA Digital Communications	communications@mainroads.wa.gov.au
Local Government	For contact details see local government website

Note: the above distribution list is an example and should be modified as required. See section 5.4

APPENDIX 5

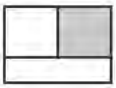
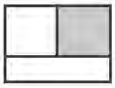
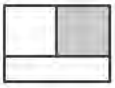
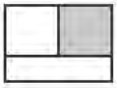
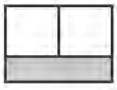
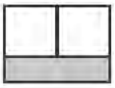
Multi-Messages Sign Inventory

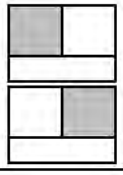
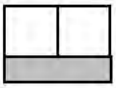
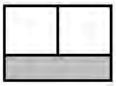
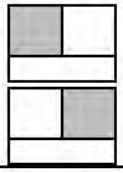
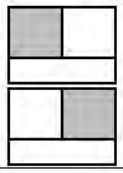
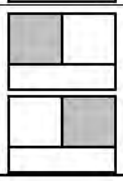
And

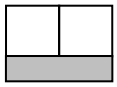
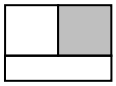
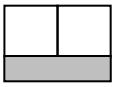
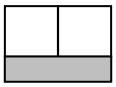
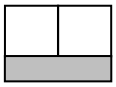
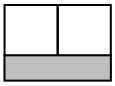
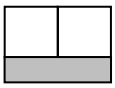
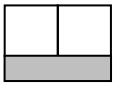
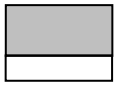
Application Schedule

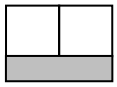
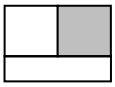
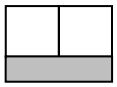
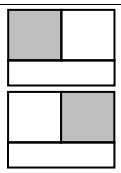
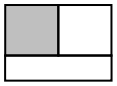
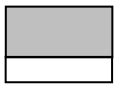
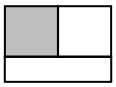
APPENDIX 5 - Multi-Message Sign Inventory and Application Schedule

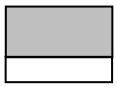
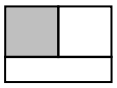
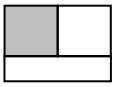
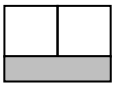
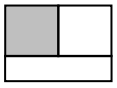
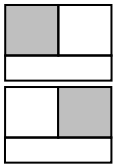
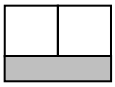
THIS APPENDIX IS TO BE READ IN CONJUNCTION WITH THE MAIN ROADS WA TRAFFIC MANAGEMENT FOR WORKS ON ROADS CODE OF PRACTICE

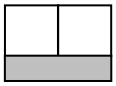
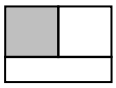
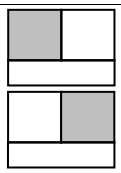
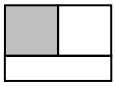
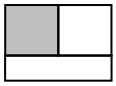
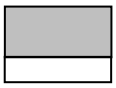
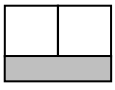
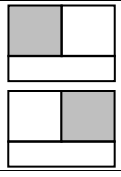
Group	ADVANCE WARNING SERIES SIGNS Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
				1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
ADV		MMS-ADV-1	1200 x 300	 'X' km AHEAD • Shall not be used in conjunction with a regulatory speed sign.
ADV		MMS-ADV-2	600 x 600	 'X' km AHEAD • Shall not be used in conjunction with a regulatory speed sign. • Sign may be classified as symbolic.
ADV		MMS-ADV-3	600 x 600	 40 km/h AHEAD SYMBOLIC
ADV		MMS-ADV-3	600 x 600	 60 km/h AHEAD SYMBOLIC
ADV		MMS-ADV-3	600 x 600	 80 km/h AHEAD SYMBOLIC
ADV		MMS-ADV-4	1200 x 300	 AT INTERSECTION • Shall not be used in conjunction with a regulatory sign.
ADV		MMS-ADV-5	1200 x 300	 AT SIGNALS • Shall not be used in conjunction with a regulatory sign.
ADV		MMS-ADV-6	1200 x 600	 BLASTING AREA SWITCH OFF RADIO TRANSMISSION • Only to be used where the posted speed is less than or equal to 80kpH.

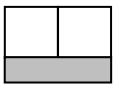
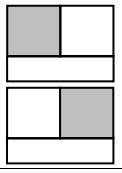
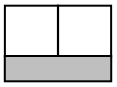
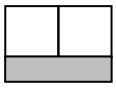
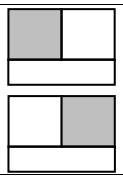
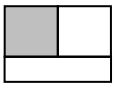
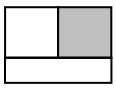
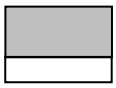
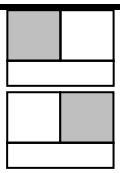
ADV	BRIDGE WORK AHEAD	MMS-ADV-7	600 x 600	BRIDGEWORK AHEAD 
ADV	BRIDGEWORK AHEAD	MMS-ADV-8	1200 x 600	BRIDGEWORK AHEAD 
ADV	DETOUR AHEAD	MMS-ADV-9A	600 x 600	DETOUR AHEAD 
ADV	DETOUR AHEAD	MMS-ADV-9B	1200 x 600	DETOUR AHEAD 
ADV	DO NOT OVERTAKE	MMS-ADV-10	1200 x 300	DO NOT OVERTAKE 
ADV	DRIVE SLOWLY	MMS-ADV-11	1200 x 300	DRIVE SLOWLY 
ADV	GRADER AHEAD	MMS-ADV-12	600 x 600	GRADER AHEAD 
ADV	HEAVY VEHICLES	MMS-ADV-13	600 x 600	HEAVY VEHICLES 
ADV	HIGH VEHICLES	MMS-ADV-14	600 x 600	HIGH VEHICLES 
ADV	LINE MARKING	MMS-ADV-15	600 x 600	LINE MARKING 

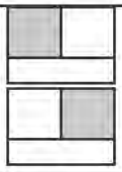
ADV	LINE MARKING	MMS-ADV-16	1200 x 300		LINE MARKING
ADV	LOOK BOTH WAYS TWO-WAY TRAFFIC	MMS-ADV-17	1200 x 600		LOOK BOTH WAYS TWO WAY TRAFFIC
ADV	NEXT km	MMS-ADV-18	600 x 600		NEXT 'X' km • Shall not be used in conjunction with a regulatory speed sign. • Sign may be classified as symbolic.
ADV	NEXT km	MMS-ADV-19	1200 x 300		NEXT 'X' km (WHITE) • Shall not be used in conjunction with a regulatory speed sign.
ADV	NOW	MMS-ADV-20	1200 x 300		NOW • Shall only be used in conjunction with the sign MMS-ADV-30.
ADV		MMS-ADV-21	1200 x 300		OBSTRUCTION MARKER • Shall not be used in conjunction with an Advanced Warning message panel.
ADV	ON SIDE ROAD	MMS-ADV-22	1200 x 300		ON SIDE ROAD
ADV	OVER m	MMS-ADV-23	1200 x 300		OVER 'X' m
ADV	OVER GVM	MMS-ADV-24	1200 x 300		OVER 'X' GVM
ADV	POWER LINE WORKS IN PROGRESS	MMS-ADV-25	1200 x 600		POWER LINE WORKS IN PROGRESS

ADV	PREPARE TO STOP	MMS-ADV-26	1200 x 300		PREPARE TO STOP
ADV	PREPARE TO STOP	MMS-ADV-27	600 x 600		PREPARE TO STOP
ADV	REDUCE SPEED	MMS-ADV-28	1200 x 300		REDUCE SPEED
ADV	REDUCE SPEED	MMS-ADV-29	600 x 600		REDUCE SPEED
ADV	REDUCE SPEED	MMS-ADV-30	1200 x 600		REDUCE SPEED • Shall only be placed in advance of the primary regulatory speed sign.
ADV	ROAD CLOSED	MMS-ADV-31	600 x 600		ROAD CLOSED
ADV	ROAD CLOSED	MMS-ADV-32	1200 x 600		ROAD CLOSED
ADV	ROAD CLOSED AHEAD	MMS-ADV-33	1200 x 600		ROAD CLOSED AHEAD
ADV	ROAD PLANT AHEAD	MMS-ADV-34	600 x 600		ROAD PLANT AHEAD
ADV	ROAD PLANT AHEAD	MMS-ADV-35	1200 x 600		ROAD PLANT AHEAD

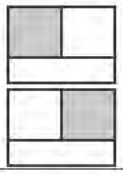
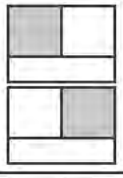
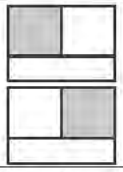
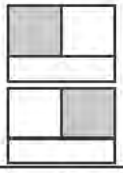
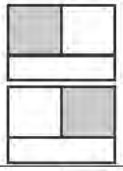
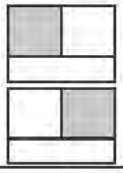
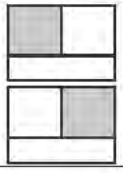
ADV		MMS-ADV-36	1200 x 600		ROAD PLANT ON SIDE ROAD
ADV		MMS-ADV-37	600 x 600		ROAD SIDE HAZARD • Shall only be used in conjunction with a speed restriction sign • Shall only be used as part of an after-care traffic control scheme
ADV		MMS-ADV-38	600 x 600		ROAD WORK AHEAD
ADV		MMS-ADV-39	1200 x 600		ROADWORKS AHEAD
ADV		MMS-ADV-40	1200 x 300		ROADWORKS
ADV		MMS-ADV-41	1200 x 600		ROADWORK ON SIDE ROAD
ADV		MMS-ADV-42	600 x 600		SIDE ROAD CLOSED
ADV		MMS-ADV-43	1200 x 600		SIDE ROAD CLOSED
ADV		MMS-ADV-44	600 x 600		TEMPORARY HAZARD MARKER
ADV		MMS-ADV-45	1200 x 300		TEMPORARY HAZARD MARKER

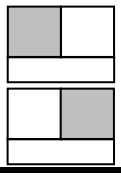
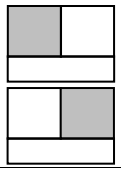
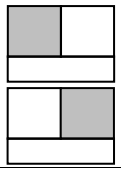
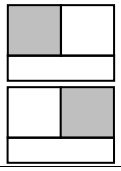
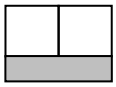
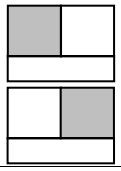
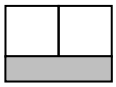
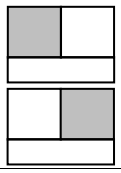
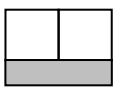
ADV		MMS-ADV-46	1200 x 300		TEMPORARY HAZARD MARKER • Only to be used where the top two (2) panels contain a yellow background. Otherwise the temporary hazard marker 'MMS-ADV-45' shall be used.
ADV		MMS-ADV-47	600 x 600		TRAFFIC CONTROLLER SYMBOLIC
ADV		MMS-ADV-48	600 x 600		TRAFFIC SIGNALS
ADV		MMS-ADV-49	600 x 600		TRAFFIC SIGNALS NOT IN USE
ADV		MMS-ADV-50	600 x 600		TRAFFIC SIGNALS NOT WORKING
ADV		MMS-ADV-51	600 x 600		TRUCK SYMBOLIC
ADV		MMS-ADV-52A	600 x 600		WORKER SYMBOLIC
ADV		MMS-ADV-52B	1200 x 600		WORKER SYMBOLIC
ADV		MMS-ADV-53	1200 x 300		UHF CHANNEL XX • The use of channels 31-38 UHF is prohibited; channels 5 & 35 are for emergency use only.
ADV		MMS-ADV-54	600 x 600		UHF CHANNEL XX • The use of channels 31-38 UHF is prohibited; channels 5 & 35 are for emergency use only.

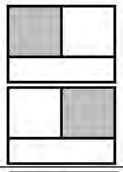
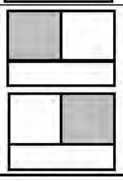
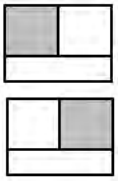
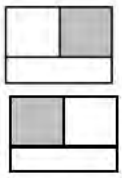
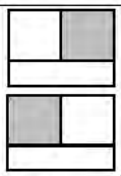
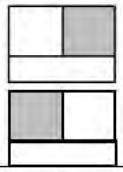
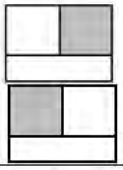
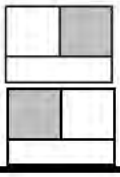
ADV		MMS-ADV-56	1200 x 300		DETOUR AHEAD
ADV		MMS-ADV-57	600 x 600		VERGE WORKS
ADV		MMS-ADV-58	1200 x 600		VERGE WORKS
ADV		MMS-ADV-59	1200 x 300		BRIDGE WORKS
ADV		MMS-ADV-60	1200 x 300		ON RAMP • To be used to give advanced warning of works on the off-ramp.
ADV		MMS-ADV-79	600 x 600		BOOM BARRIER
ADV		MMS-ADV-80	600 x 600		RUMBLE STRIPS • Shall only be used in conjunction with the sign MMS-ADV-81.
ADV		MMS-ADV-81	600 x 600		RUMBLE STRIPS • Shall only be used in conjunction with the sign MMS-ADV-80.
ADV		MMS-ADV-82	1200 x 600		STOP HERE WHEN DIRECTED
ADV		MMS-ADV-83	600 x 600		MONITORING CAMERA

Group	Sign	MRWA Sign Number	Panel Size (mm)	
ADV		MMS-ADV-84	600 x 600	 WORKS UNDER BRIDGE

Group	POSITION SERIES SIGNS			SIGN APPLICATION AND DESCRIPTION
	Sign	**MRWA Sign Number**	**Panel Size (mm)**	1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.

POS		MMS-POS-1(L)	600 x 600	 LANE STATUS
POS		MMS-POS-1(R)	600 x 600	 LANE STATUS
POS		MMS-POS-2(R)	600 x 600	 LANE STATUS
POS		MMS-POS-2(L)	600 x 600	 LANE STATUS
POS		MMS-POS-3(R)	600 x 600	 LANE STATUS
POS		MMS-POS-3(L)	600 x 600	 LANE STATUS
POS		MMS-POS-4	600 x 600	 LANE STATUS

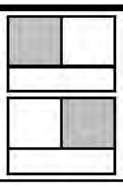
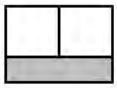
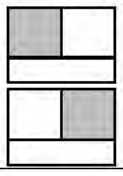
POS		MMS-POS-5	600 x 600		LANE STATUS
POS		MMS-POS-6(L)	600 x 600		LANE STATUS
POS		MMS-POS-6(R)	600 x 600		LANE STATUS
POS		MMS-POS-7(L)	600 x 600		LANE STATUS
POS		MMS-POS-7(R)	600 x 600		LANE STATUS
POS		MMS-POS-8	1200 x 300		LANE STATUS
POS		MMS-POS-9(L)	600 x 600		MERGE LEFT
POS		MMS-POS-10(L)	1200 x 300		MERGE LEFT
POS		MMS-POS-9(R)	600 x 600		MERGE RIGHT
POS		MMS-POS-10(R)	1200 x 300		MERGE RIGHT

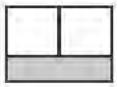
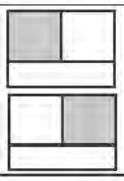
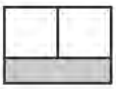
POS		MMS-POS-11	600 x 600	 LANE STATUS
POS		MMS-POS-12	600 x 600	 LANE STATUS
POS		MMS-POS-13 (L)	600 x 600	 LANE STATUS
POS		MMS-POS-13(R)	600 x 600	 LANE STATUS
POS		MMS-POS-14(L)	600 x 600	 LANE STATUS
POS		MMS-POS-14(R)	600 x 600	 LANE STATUS
POS		MMS-POS-15(L)	600 x 600	 LANE STATUS
POS		MMS-POS-15(R)	600 x 600	 LANE STATUS

TRAFFIC DIVERSION SERIES SIGNS

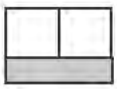
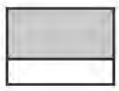
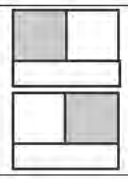
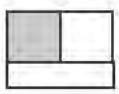
SIGN APPLICATION AND DESCRIPTION

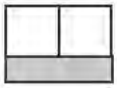
1. Sign panels shall only be located in the frame location as shown.
2. Left side multi-message sign shown only.
3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed.
4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management.
5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.

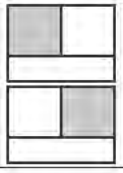
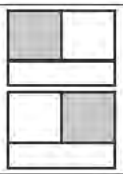
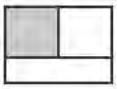
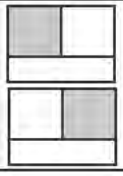
Group	Sign	MRWA Sign Number	Panel Size (mm)	
DIV		MMS-DIV-1	600 x 600	 DETOUR
DIV		MMS-DIV-2(L)	1200 x 600	 DETOUR FOR HEAVY VEHICLES LEFT
DIV		MMS-DIV-2(R)	1200 x 600	 DETOUR FOR HEAVY VEHICLES RIGHT
DIV		MMS-DIV-3(L)	1200 x 600	 DETOUR FOR HIGH VEHICLES LEFT
DIV		MMS-DIV-3(R)	1200 x 600	 DETOUR FOR HIGH VEHICLES RIGHT
DIV		MMS-DIV-4(L)	1200 x 300	 DETOUR LEFT ARROW
DIV		MMS-DIV-4(R)	1200 x 300	 DETOUR RIGHT ARROW
DIV		MMS-DIV-5	600 x 600	 DETOUR MARKER

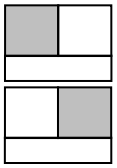
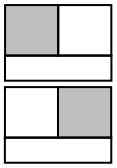
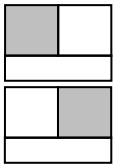
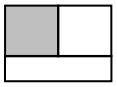
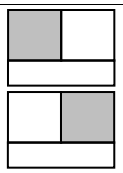
DIV	LOCAL TRAFFIC ONLY	MMS-DIV-6	1200 x 300		LOCAL TRAFFIC ONLY • Shall not be used in conjunction with a regulatory sign.
DIV	LOCAL TRAFFIC ONLY	MMS-DIV-7	600 x 600		LOCAL TRAFFIC ONLY • Shall not be used in conjunction with a regulatory sign.
DIV	DETOUR	MMS-DIV-8	1200 x 300		DETOUR LEFT
DIV	DETOUR	MMS-DIV-9	1200 x 300		DETOUR AHEAD

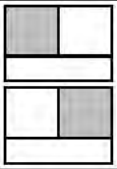
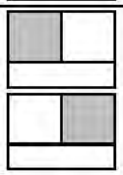
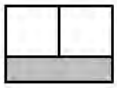
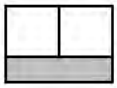
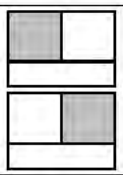
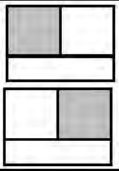
Group	TERMINATION SERIES SIGNS Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
				1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.

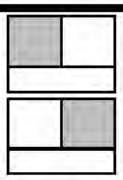
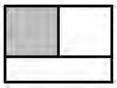
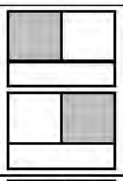
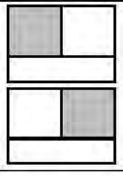
TER	DRIVE SAFELY	MMS-TER-1	1200 x 300		DRIVE SAFELY
TER	END BLASTING AREA	MMS-TER-2	1200 x 600		END BLASTING AREA
TER	END DETOUR	MMS-TER-3	600 x 600		END DETOUR
TER	END ROAD WORK	MMS-TER-4	600 x 600		END ROADWORK

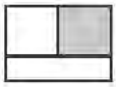
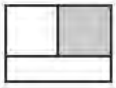
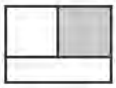
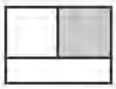
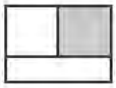
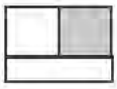
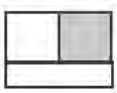
Group	Sign	MRWA Sign Number	Panel Size (mm)	
TER	END ROADWORK	MMS-TER-5	1200 x 600	 END ROADWORK
TER	THANK YOU	MMS-TER-6	1200 x 300	 THANK YOU

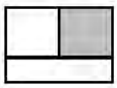
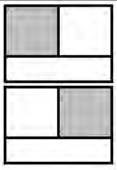
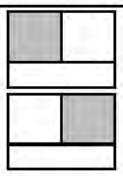
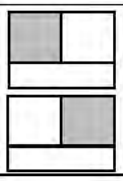
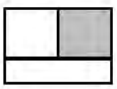
Group	Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
	ROAD CONDITION SERIES SIGNS			1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
RC		MMS-RC-1	600 x 600	 LOOSE STONES
RC	LOOSE SURFACE	MMS-RC-2	600 x 600	 LOOSE SURFACE
RC	NEW WORK NO LINES MARKED	MMS-RC-3	1200 x 600	 NEW WORK NO LINES MARKED
RC	NO LINES	MMS-RC-4	600 x 600	 NO LINES
RC	ROUGH SURFACE	MMS-RC-5	600 x 600	 ROUGH SURFACE
RC		MMS-RC-6	600 x 600	 SLIPPERY

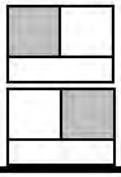
R C		MMS-RC-8	600 x 600		SOFT EDGES
R C		MMS-RC-9	600 x 600		TRAFFIC HAZARD • For emergency use only, see Clause 3.16.5 of AS 1742.3.
R C		MMS-RC-10	600 x 600		WATER OVER ROAD
R C		MMS-RC-11	1200 x 600		WATER OVER ROAD
R C		MMS-RC-12	600 x 600		WET BITUMEN
R C		MMS-RC-13	600 x 600		ROUGH SURFACE (CYCLIST)

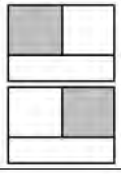
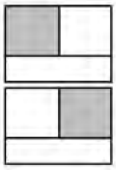
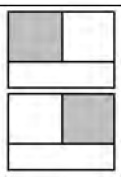
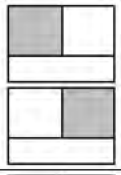
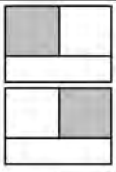
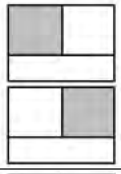
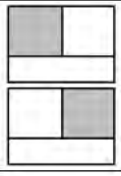
Group	PEDESTRIAN SERIES SIGNS Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
				1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
PED		MMS-PED-1	600 x 600	 FOOTPATH CLOSED
PED		MMS-PED-2	600 x 600	 FOOTPATH TRIP HAZARD
PED		MMS-PED-3(L)	1200 x 300	 PEDESTRIANS LEFT ARROW
PED		MMS-PED-3(R)	1200 x 300	 PEDESTRIANS RIGHT ARROW
PED		MMS-PED-4	600 x 600	 PEDESTRIANS WATCH YOUR STEP
PED		MMS-PED-5	600 x 600	 SLIPPERY (FOOTPATH)
PED		MMS-PED-6	600 x 600	 USE OTHER FOOTPATH
PED		MMS-PED-7	600 x 600	 CYCLISTS DISMOUNT • See section 6.1.7 for conditions of use
PED		MMS-PED-8	600 x 600	 PATH CLOSED

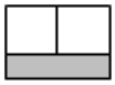
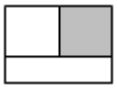
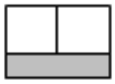
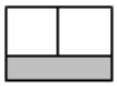
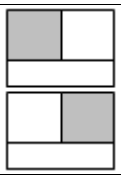
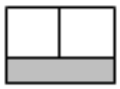
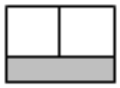
Group	EVENT SERIES SIGNS Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
				1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
EVE		MMS-EVE-1	600 x 600	 CYCLIST
EVE		MMS-EVE-2	600 x 600	 END EVENT
EVE		MMS-EVE-3	600 x 600	 EVENT AHEAD
EVE		MMS-EVE-4	1200 x 300	 EVENT IN PROGRESS
EVE		MMS-EVE-5	1200 x 600	 EVENT ON SIDE ROAD
EVE		MMS-EVE-6	600 x 600	 PEDESTRIANS
EVE		MMS-EVE-7	600 x 600	 RUNNER
EVE		MMS-EVE-9	1200 x 600	 END EVENT

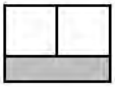
Group	REGULATORY SERIES SIGNS Sign	MRWA Sign Number	Panel Size (mm)	SIGN APPLICATION AND DESCRIPTION
				1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
REG		MMS-REG-1(40)	600 x 600	 40 km/h SPEED SIGN
REG		MMS-REG-1(50)	600 x 600	 50 km/h SPEED SIGN • Shall only be used to terminate a temporary speed zone.
REG		MMS-REG-1(60)	600 x 600	 60 km/h SPEED SIGN
REG		MMS-REG-1(70)	600 x 600	 70 km/h SPEED SIGN • Shall only be used to terminate a temporary speed zone.
REG		MMS-REG-1(80)	600 x 600	 80 km/h SPEED SIGN
REG		MMS-REG-1(90)	600 x 600	 90 km/h SPEED SIGN • Shall only be used to terminate a temporary speed zone.
REG		MMS-REG-1(100)	600 x 600	 100 km/h SPEED SIGN • Shall only be used to terminate a temporary speed zone.
REG		MMS-REG-1(110)	600 x 600	 110 km/h SPEED SIGN • Shall only be used to terminate a temporary speed zone.

REG		MMS-REG-2(40)	600 x 600		END 40 km/h SYMBOLIC • Shall only be used to terminate a temporary speed zone on a road that had not been speed zoned.
REG		MMS-REG-2(60)	600 x 600		END 60 km/h SYMBOLIC • Shall only be used to terminate a temporary speed zone on a road that had not been speed zoned.
REG		MMS-REG-2(80)	600 x 600		END 80 km/h SYMBOLIC • Shall only be used to terminate a temporary speed zone on a road that had not been speed zoned.
REG		MMS-REG-3	600 x 600		NO ENTRY SYMBOLIC
REG		MMS-REG-4(L)	600 x 600		NO LEFT TURN SYMBOLIC • Shall be used at intersections where vehicles are prohibited from making a left turn (not to be used as advanced warning).
REG		MMS-REG-4(R)	600 x 600		NO RIGHT TURN SYMBOLIC • Shall be used at intersections where vehicles are prohibited from making a right turn (not to be used as advanced warning).
REG		MMS-REG-5	600 x 600		NO OVERTAKING OR PASSING
REG		MMS-REG-6(L)	600 x 600		LEFT ONLY
REG		MMS-REG-6(R)	600 x 600		RIGHT ONLY

Group				
REG		MMS-REG-7	600 x 600	 SHARED PATH

Group	INCIDENT, FIRE AND EMERGENCY SERIES SIGNS			SIGN APPLICATION AND DESCRIPTION
	Sign	**MRWA Sign Number**	**Panel Size (mm)**	6. Sign panels shall only be located in the frame location as shown. 7. Left side multi-message sign shown only. 8. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 9. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 10. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
		MMS-ADV-61	600 x 600	 BUSHFIRE SYMBOLIC
		MMS-ADV-62	600 x 600	 WATER OVER ROAD SYMBOLIC
		MMS-ADV-63	600 x 600	 CRASH SYMBOLIC
		MMS-ADV-64	600 x 600	 HAZARDOUS MATERIAL SYMBOLIC
		MMS-ADV-65	600 x 600	 BUSH FIRE
		MMS-ADV-66	600 x 600	 ROAD FLOODED
		MMS-ADV-67	600 x 600	 ROAD CRASH

		MMS-ADV-68	600 x 600		HAZARDOUS MATERIAL
		MMS-ADV-69	1200 x 300		EMERGENCY AHEAD
		MMS-ADV-70	600 x 600		POLICE CONTROL
		MMS-ADV-71	1200 x 300		POLICE CONTROL AHEAD
		MMS-ADV-73	600 x 600		BURNING OFF
		MMS-ADV-74	1200 x 300		BURNING OFF
		MMS-ADV-75	600 x 600		HEADLIGHTS ON
		MMS-ADV-76	1200 x 300		BUSH FIRE
		MMS-ADV-77	600 x 600		SMOKE HAZARD
		MMS-ADV-78	1200 x 300		SMOKE HAZARD

Group	MISCELLANEOUS SIGNS			SIGN APPLICATION AND DESCRIPTION
	Sign	**MRWA Sign Number**	**Panel Size (mm)**	1. Sign panels shall only be located in the frame location as shown. 2. Left side multi-message sign shown only. 3. Multi-message signs located on both sides of the roadway shall form a mirrored image of the signs being displayed. 4. For sign specification go to www.mainroads.wa.gov.au >Building Roads >Standards and Technical >Road and Traffic Engineering >Traffic Management. 5. For multi-message signs frame refer to Main Roads WA standard drawing 201031-0155.
		N/A	1200 x 300	 BLANK - BLACK • May be used in lieu of 'THANK YOU', 'DRIVE SLOWLY' and/or 'DRIVE SAFELY' to reduce redundant messages.

Multi-Message Sign Combination Examples (not all combinations shown)

END OF DOCUMENT

UTILITY PROVIDERS

CODE OF PRACTICE

FOR WESTERN AUSTRALIA

DIAL BEFORE YOU DIG
www.1100.com.au
The Essential First Step.

UTILITY PROVIDERS CODE OF PRACTICE

Correspondence should be addressed to:
Don McAdie
Chairman/Co-ordinator
Utility Providers Services Committee
Water Corporation

Mailing address:

PO Box 100
Leederville WA 6902

Visiting address:

John Tonkin Water Centre
629 Newcastle Street
Leederville WA 6007

E-mail:

don.mcadie@watercorporation.com.au

Copies of the Utility Providers Code of Practice including subsequent amendments can be obtained from:

Hard copies:

Dial Before You Dig WA Limited
State Manager
77 North Lake Road
Myaree WA 6154
wa@1100.com.au

The UPSC Code of Practice for Western Australia can be located via the website:
www.1100.com.au

Should you have difficulty locating this content please email:
wa@1100.com.au or contact 08 9330 3166

Keeping Code of Practice up to date

The Code of Practice is a living document reviewed and updated periodically by the Utility Providers Services Committee to meet the evolving needs of industry. Between editions amendments may be issued. Readers of the Code of Practice are to ensure they are reading the latest version and any amendments that are issued since the latest published version. To assist in this endeavour the Committee would appreciate feedback on any aspects of this manual including inaccuracies, ambiguities and suggestions for improvements.

Disclaimer

Every reasonable effort has been made to ensure this document is accurate at the time of printing and the Committee disclaim any and all liability to any person in respect of anything done or omitted to be done in reliance upon the whole or any part of this document.

UTILITY PROVIDERS CODE OF PRACTICE FOR WESTERN AUSTRALIA

DIAL BEFORE YOU DIG®
www.1100.com.au
The Essential First Step.

Produced by the Utility Providers Services Committee.

Applicable from 01 March 2018

Supersedes all previous Information Manuals

and Codes of Practice.

Amendments:

Updated contact details and miscellaneous typographic corrections.
Amendments from 4P's to 5P's of Safe Work

Utility Providers Services Charter

Who we are

The Utility Providers Services Committee has been in place in Western Australia since June 22, 1923. Since that time it has been a model of cooperation between Utilities and other bodies interested in sharing Public Land to provide utility services to the Community.

What we do

The UPSC meet regularly to discuss servicing issues and to maintain the UPSC Code of Practice for Western Australia. The Code of Practice documents current industry best practice for Utility interactions and provides essential information and guidance in managing and undertaking works associated with the provision of utility services in Western Australia.

Our commitment

The organisation leaders fully support the Utility Providers Services Committee and the Code of Practice and commit their Organisation to complying wherever practicable with the Code of Practice. They further commit to supporting the Committee by providing authorised representatives, and agree to raise any issues with the Code of Practice through the Committee so that they can be resolved in the best interests of the Community.

UPSC Member Organisations:

WATER CORPORATION
Australian Gas Infrastructure Group
UDIA Urban Development Institute of Australia
City of Perth
mainroads WESTERN AUSTRALIA
WALGA
nbn
CCF CIVIL CONTRACTORS FEDERATION
It's ON
ATCO
Telstra
DIAL BEFORE YOU DIG www.1100.com.au The Essential First Step.

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1 INTRODUCTION

The Utility Providers Code of Practice is published by the Utility Providers Services Committee to document industry best practice and provide essential information and guidance in managing and undertaking street works associated with the provision of underground utility services in public road reserves. The Code of Practice is an authorative reference for utility services providers, local governments, developers and their contractors throughout WA.

This document includes:

- Allocation of space for underground utility services
- Pre-construction planning including locating existing services
- Environmental and heritage compliance requirements
- Installation and reinstatement requirements.
- Recording of as constructed information.
- Emergency contact details of all utility service providers.

2 HISTORY

The Public Utilities Services Committee (PUSC) was founded on June 22, 1923 when a meeting of representatives of the Perth City Council, various Government Departments and public utility providers met in the Council Chambers, Town Hall, Hay Street, Perth.

Following a period between mid-1994 and the end of 1996 in which the PUSC did not meet, the PUSC was reconstituted at a meeting on February 11, 1997, with Main Roads WA providing the new role of Chairperson and Co-ordinator of the Committee.

The Committee was chaired and co-ordinated by the Department for Planning and Infrastructure between 2003 and 2006. This role was transferred back to Main Roads WA between 2006 and 2009.

During 2009, the Committee appointed a representative from Western Power as Chairman/Co-ordinator for a fixed period.

On 4th March 2016, the Committee appointed a representative from the Water Corporation as Chairman.

Due to the commercialisation and privatisation of Utility owners, the PUSC was changed to the Utility Providers Services Committee (UPSC).

3 TERMS OF REFERENCE AND ACCOUNTABILITY

The UPSC operates as an independent entity and focuses on establishing standards for operational issues including the co-ordination of utility service works, site work safety, environment, allocation of alignments and corridors for utility services within road reserves and services lot entry arrangements.

The Utility Providers Code of Practice is referenced in *Liveable Neighbourhoods* produced by the Western Australian Planning Commission, Commission for Occupational Health and Safety Code of Practice – Excavation and Electricity (Supply Standards and System Safety) Regulations 2001 – Schedule 2.

Telecommunication Carriers are defined in and subject to Commonwealth legislation under the *Telecommunications Act (1997)* (Cmth) and the *Telecommunications Code of Practice (1997)* (Cmth), including subsequent amendments.

Licensed Telecommunications Carriers are exempt from some State or Territory laws. Where these laws are not consistent with the Telecommunications Act, the Commonwealth legislation will apply.

In addition there may be a requirement for telecommunication service providers to obtain development approvals and building licences from Local Governments for works other than those defined as 'low impact' facilities in the *Telecommunications (Low-impact Facilities) Determination 1997* and subsequent amendments.

Based on this framework, the aims of the UPSC are:

(a) To secure the co-operation of all authorities concerned to co-ordinate the use of space within road reserves and assist in the approval of utility services located within rail reserves;

(b) To develop and issue Codes of Practice agreed in principle by the authorities concerned;

(c) To determine methods of control and to co-ordinate the use of agreed Codes of Practice;

(d) To facilitate co-ordinated works-programs to achieve maximum efficiency and to minimise costs to communities through the mutual co-operation of the authorities concerned;

(e) To develop and implement guidelines for activities within environmentally sensitive areas, to minimise impact on streetscapes and to maintain acceptable safety standards;

(f) To enable authorities concerned to share information on technological 'best practices'.

Although the above compliance obligations have been established for the UPSC, investigation is being done to determine the most appropriate framework, be that legislative or otherwise, to provide Main Roads WA and Local Government with clear jurisdiction to manage services within road reserves in a consistent and fair manner.

Roads in WA are managed by the relevant Local Government, Main Roads WA or the Department of Parks and Wildlife (within National Parks). However, land within dedicated public roads is Crown land subject to the *Land Administration Act 1997 (LAA).* The Department of Planning, Lands and Heritage (DPLH) administers the LAA and has a key role in relation to policy, legal and land management issues impacting on roads. The DoL also manages the use of the DBNGP Corridor under the *Dampier to Bunbury Pipeline Act 1997 (*DBP Act)

Notes:

(a) In this Code of Practice 'road authority' refers to Main Roads WA and Local Governments.

(b) Refer also to Main Roads WA documents 'Utility Services in Road Reserves - Policy Statement; Application Guidelines; Approval Guidelines; Technical Guidelines; and Administration Guidelines' regarding location of utility services in road reserves, including structures, managed by Main Roads WA. In particular note Policy and Guidelines applicable to declared Control of Access road reserves and rural/regional road reserves outside urban/town site areas.

(c) Maps of State Roads and Local Roads managed by Main Roads WA and Local Governments, including those declared Control of Access, are located on Main Roads WA Website: 'Using Roads' > 'Touring WA & Maps' > 'Road Information Mapping System'

4 ORGANISATIONS REPRESENTED ON THE UTILITY PROVIDERS SERVICES COMMITTEE (UPSC)

- Western Power (Chairman/Co-ordinator)
- Dial Before You Dig (WA) (DBYD)
- Main Roads WA
- Water Corporation
- Western Power
- ATCO Gas Australia (Gas Distribution)
- Dampier Bunbury Natural Gas Pipeline (AGIG)
- APA Group
- Telstra
- NBN Co
- Horizon Power
- Civil Contractors Federation (WA)
- Urban Development Institute of Australia (UDIA)
- Western Australian Local Government Association (WALGA)
- City of Perth
- Public Transport Authority

Stakeholder organisations not represented on the UPSC

- Australian Pipeline Trust
- WA Police Service
- WorkSafe WA
- Energy Safety WA
- City of Fremantle
- Department of Planning, Lands and Heritage
- WA Planning Commission
- Department of Environment Regulation
- Department of Planning
- Roadside Conservation Committee
- Institute of Public Works Engineering,
- Australia (WA Division)

5 STANDARD UTILITY SPACE ALLOCATION IN ROAD RESERVES AND LOT ENTRY ARRANGEMENTS

5.1 Road reserve

5.1.1 Application

This Code of Practice applies to both urban (town site and built up areas) and rural/regional road reserves (outside town sites and built up areas), Applications of this Code of Practice apply to standard service alignments, green field developments, utilities located in narrow road reserves (nominally 14-16 metres) and paved laneways, but not to services within private property, although developers may consider applying these guidelines in some applications, such as survey strata developments.

Utilities may require easements over their services located outside of road reserves.

In rural/regional road reserves utility providers are to refer to either Main Roads WA or the Local Government for advice, as urban type standard allocations may not apply. In the case of main roads, it is policy to locate utility services outside the road reserve unless there are exceptional circumstances that preclude this position. Special easements may be required for these cases. It is also recommended that utility services are located outside of Local Government road reserves where this minimises the impact on native vegetation.

In the case of road reserves with declared Control of Access, location of utility services is generally not permitted. Refer to Clause 3, **Notes** (b) regarding Main Roads WA Policy and Guidelines for 'Utility Services in Road Reserves'.

Co-location of similar utility services is most desirable and encouraged.

5.1.2 Service allocation principles

In developed road reserves the previously agreed alignments already occupied may continue to apply, but for green field developments, narrow road reserves and paved laneways present Code of Practice alignments will be adhered to for all new utility services including non-active utility services for future use. Alteration to standard positions may be made following negotiation between engineers or qualified officers of the road authority concerned and the utility provider and between affected utility providers. Refer to Special Notes, Clause 11.1 and 11.2. When alteration from allocated alignments is made, a written agreement is required for future reference.

5.1.3 Services allocation diagrams

Diagrams showing the standard location of utility services in the road reserve together with associated notes are detailed in Appendix B.

5.1.4 Impact of environmental considerations

Although standard allocation of space in road reserves is provided as a desirable practice, environmental considerations described in Clause 10 may impact on these standard allocations.

The provision of reduced verge width adjacent to parks/public open space may require services to be located within the parks/public open space with the approval of the Local Government. A special easement may be required.

5.1.5 Road reserve management

Unless otherwise directed, road authorities are responsible for the management of the total road reserve and associated structures e.g. bridges and tunnels.

5.1.6 Signage in road reserves

Signage installations shall not impact on existing services and be positioned to minimise impact on existing and future utility services.

Signage is all types of signs that require footings or any form of ground penetration to erect.

Sign positions shall be agreed with the road authority. The following is recommended:

Permission to be obtained from the appropriate road authority and affected (adjacent or above proposed footing) utility owner.

Installers undertake a Dial Before You Dig enquiry to ascertain location of existing recorded services.

Plan, prepare, pothole, protect and proceed in accordance with section 6.3.

Signage with deep support footings that adjacent to services shall have frangible or breakaway posts to prevent footing movement damaging adjacent services.

5.2 Lot entry services arrangement

Services interface arrangements between the utilities in road reserves and lot owner connections are detailed in Appendix A for both front of lot and rear laneway access arrangements. Laneway access is not preferred and must be agreed between developers, local government authorities and utility providers considering difficulties of servicing from the front of lots such as high retaining walls, facing public open space and no vehicle access.

6 STANDARD PROCEDURES PRIOR TO COMMENCING SERVICES INSTALLATION

Prior to commencing any work involving excavation, horizontal directional drilling boring or ground works in the road reserve or on private land, appropriate planning shall be undertaken including obtaining approvals from appropriate authorities, liaising with utilities and obtaining as detailed in the Code of Practice.

Note that Dial Before You Dig information generally does not cover private installations except utility services that extend into these lands.

6.1 Project planning – Utility providers and road authorities

6.1.1 Services to be installed in their standard alignment

(a) Obtain information on the location of all other utility providers' plant throughout the length of the proposed route.

Refer to Dial Before You Dig (6.2).

(b) Check for potential environmental and heritage impacts and obtain approvals from Regulatory Agencies (e.g. Heritage Council of WA, Department of Environment Regulation Department of Aboriginal Affairs, Local Government, etc.).

(c) Where applicable walk the route of proposed works with the road authority representative to identify native vegetation, possible locations of conflict and alternative routes.

(d) Any parties doing work in the road reserve must submit a notification of works to the relevant road authority. In some cases approval to do works may be required, please consult with the relevant road authority. Notifications shall be at least ten working days before commencing work. The Application must include a completed Environmental Checklist (as detailed in Appendix E or equivalent) applicable to the proposed works. This is a mandatory requirement.

Note:

A clearing permit is likely to be required from the Department of Water and Environment Regulation where any clearing of native vegetation (herbs, shrubs, trees [dead or alive]) occurs and can take several months to complete the process.

In the case of Main Roads WA, utility providers are required to submit an application form, which includes an Environmental Checklist advising Main Roads WA of the proposed works and reference to any current Agreement or Memorandum of Understanding between Main Roads WA and the Utility Provider. These documents can be accessed from the Main Roads WA Website: www.mainroads.wa.gov.au

In the case of Telstra, for activities that are defined as 'low-impact facilities' in accordance with the *Telecommunications (Low-impact Facilities) Determination 1997,* the use of the application form and other approval processes (e.g. Environmental Checklist) set out in Clause 6.1.1 (d) are not applicable. Unless otherwise agreed (within an MOU or other formal Agreement), Telstra will provide 10 business days notification to road authorities, in accordance with the Telecommunications Code of Practice 1997, using a standard Telstra Land Access and Activity Notice The road authority may object to the proposed activity in accordance with the *Telecommunications Act 1997* and Telecommunications Code of Practice 1997 (e.g. incomplete information and environmental assessment).

(e) Obtain an agreement with the road authority on the Reinstatement Requirement applicable in the road reserve and applies to trenched pavements and cleared vegetation in the road verge area. Main Roads WA or Local Government (endorsed Institute of Public Works Engineering, Australia document) specifications are available. Refer to Clause 9.

(f) Prior to commencing the works, traffic management and safety permits from the road authority. will be obtained as required. The road authority must respond in a timely manner. This does not apply to emergency works, however the road authority must be informed as soon as practicable.

Refer to Appendix C, Traffic Control and Safety.

(g) It is the responsibility of road authorities and utility providers and their contractors or subcontractors to be fully conversant with all relevant Codes, Regulations, Policies and Acts that apply to their work. Consultation with relevant road authorities and utility providers may be necessary to obtain this information (e.g. notification of proposed works, environmental assessment, traffic management plans, reinstatements, etc).

(h) Telecommunications within Road Reserves - Austroads Guidelines and subsequent amendments: Austroads has produced two documents for use by road authorities when Telecommunication Carriers plan to install 'Low-impact Facilities' (particularly cables/conduits) in road reserves:

- Operational Guidelines (2007) – also equivalent document produced by the Communication Alliance for use by Carriers; and
- Administrative Guidelines (2007).

Regarding facilities that are not 'Low-impact Facilities', planning approvals are required in addition to established policies in Main Roads WA, Local Government and the Western Australian Planning Commission.

Main Roads WA owns and manages many major roads, such as highways and main roads in WA. Local roads are managed by the relevant Local Government. Land in dedicated public roads is, however, Crown land owned by the State of WA. The Department of Planning, Lands and Heritage (DLP) administers Crown land on behalf of the State. The Telecommunications Code of Practice provides for comment from both the land owner (DLP), in relation to local public roads and occupier (Local Government, as road manager) to proposed installations of 'Low-impact Facilities'.

(DLP) have a Memorandum of Understanding (MOU) with Telstra, which avoids the need for specific Land Access Notifications of most 'Low- impact Facilities' to be installed in roads. However, this applies to Telstra only. All other Carriers will need to notify and seek comment from (DLP) for installations in road reserves, except those owned by Main Roads WA.

Note: Main Roads WA has a MOU (currently being updated with Telstra to assist in the management of Telstra facilities in Main Roads WA road reserves and applies to activities for which Telstra is required to give notices under the *Telecommunications Act 1997* (Cmlth) and the *Telecommunications Code of Practice 1997 and subsequent amendments.*

6.1.2 Services to be installed outside standard alignments

(a) The conditions for services within the standard alignments shall apply in addition to the following clauses.

(b) Obtain information on the location of other utility providers' plant and proposed street alignments throughout the length of the proposed route in consultation with all authorities concerned. Consult with affected land owners if applicable, the appropriate land use planning authority for long term planning if necessary and ensure all land matters are in order before proceeding.

Refer to Dial Before You Dig Clause (6.2). A NOTICE OF INTENT or PRELIMINARY TO WORKS (in accordance with Land and Planning Acts) may not be adequate in all cases.

(c) There may be instances where plant is located in existing and/or future reserves or easements that may impact on adjoining property as identified in Special Note Clause 10.8.

(d) Formally notify all utility providers and appropriate road authorities at least ten working days in advance of proposed work including provision of a route plan showing street alignments. Approvals must be obtained or Notifications undertaken in accordance with Clause 6.1.1(d) prior to proceeding with the works. This is a mandatory requirement**.**

(e) Obtain an agreement with the road authority on the Reinstatement Requirement applicable in the road reserve. Refer to Clause 6.1.1 (e).

(f) Refer to 6.1.1 (f) and Appendix C regarding Traffic Control and Safety.

(g) Refer Special Notes Clause 11.2 for additional requirements.

6.1.3 Services maintenance work in road reserve

(a) Notify any utility provider or road authority that may be affected (e.g. excavation in a busy street or footpath) to expedite reinstatement. Refer to Dial Before You Dig (Clause 6.2).

(b) Utility providers must obtain an agreement with the road authority on the Reinstatement Requirement applicable in the road reserve. Refer to Clause 6.1.1 (e). This is a mandatory requirement.

(c) Refer to Clause 6.1.1 (f) and Appendix C regarding Traffic Control and Safety.

6.1.4 Special precautions

In areas where special conditions apply, such as excavation of busy streets and pedestrian ways, appropriate preparations, notifications and agreements are to be made by the utility provider undertaking the work to minimise inconvenience to the public and to comply with legal requirements.

6.1.5 Road construction notification

The road constructing authority proposing new road works is to notify and consult all utility providers in advance including a plan showing extent of earthworks and finished levels of the proposed construction. This consultation process should allow for delays in obtaining appropriate information and approvals. As a mandatory requirement service relocation issues, including cost, shall be resolved before proceeding with any works.

In the case of rural/regional areas, where services may not be on allocated alignments, it is essential to resolve relocation issues prior to proceeding with any works.

Where a road authority is proposing to do work that will affect utility services they must consult with the effected utilities in a timely manner. The service provider shall respond in a timely manner.

6.1.6 Connection of a utility service to a street main

The utility providers concerned shall be responsible for determining the exact location of existing plant in the road reserve before starting work e.g. ‘pot-holing’ by hand. The utility provider shall provide as much guidance and control as possible, particularly when contractors and sub-contractors are involved. Refer to Standard Procedures Prior to Commencing Work in Clauses 6.2 and 6.3 with emphasis on PLAN, PREPARE, POTHOLE, PROTECT then PROCEED.

6.1.7 Subsurface works not for service connections

For sub-surface works in the road reserve other than for service connection.

(a) Obtain information on the location of all utility provider plant in the area affected. Refer to Dial Before You Dig (Clause 6.2).

(b) The design of the work shall take into account the existing plant in the road reserve, shall conform to this Code of Practice and the road authority advised of proposed works.

6.1.8 Rural/Regional areas.

Traditionally most utility services in rural areas have been located within the road reserve. They may be located outside road reserves, particularly those managed by Main Roads WA. However, road reserves often contain important native vegetation and thus every effort should be made to avoid the placement of new utility services in the road reserve. Should it be necessary to install utility services in the road reserves, methods such as horizontal directional drilling or thrust boring should be considered to minimise the disturbance to vegetation. In these situations and undertaking vegetation maintenance within the utility service corridor, consultation with both the road authority and other utility service providers (as applicable) is mandatory.

For information on utility services in regional locations, contact Dial Before You Dig and the relevant regional office of the utility provider. Note that Dial Before You Dig covers all of the State but not all asset owners are members and are not associated with the Dial Before You Dig service. Refer Clause 6.2.

6.1.9 Attachment of non-visible utility services to road authority bridges and structures

Generally these are Main Roads WA managed.

Non-visible utility services include conduits, pipes, etc., but exclude microwave dishes, mobile phone antennae, etc.

The Utility Provider shall consult with Main Roads WA or the relevant road authority and obtain a Utility Service Management Agreement prior to the installation and attachment of a utility service facility to existing or new traffic bridges, traffic structures, tunnels and other road service structures. Refer to Section 3.4.3 of Main Roads WA 'Utility Services Application and Approval Guidelines' located on Main Roads WA Website (refer to Page 2).

6.1.10 Redundant or abandoned utility services

When utility services have become redundant, decommissioned from service or abandoned, the utility provider must remove the service from the road reserve or make the service safe regarding interference to adjacent infrastructure and environment and keep records of these abandoned services to enable information to be provided via Dial Before You Dig as required.

In the case of utility services attached to bridges or other structures managed by road authorities, detail of managing redundant services, including the removal of the service from the structure, is included in a Service Management Agreement (refer to Main Roads WA Application and Approval Guidelines, Section 3.4.3).

6.1.11 Organisations other than utility providers and road authorities.

For those organisations other than utility providers and road authorities planning to work in road reserves, obtain approval in writing from the road authority before commencing work. This is a mandatory requirement.

6.2 DIAL BEFORE YOU DIG

DIAL BEFORE YOU DIG®
www.1100.com.au
The Essential First Step.

Digging Without Disasters

Dial Before You Dig provides a single Australia wide point of contact between excavators and major utilities that own buried pipes and cables, as well as the owners of other buried services. This service makes it easier and safer for people undertaking excavation activities by enabling them to determine what services exist in the area of proposed work

Note: The individual utility provider members may charge for provision of maps and information. This service does not include railway infrastructure in rail reserves for which information should be sought from Public Transport Authority (Rail).

To use the Dial Before You Dig service simply lodge your enquiry at least two working days in advance of your intention to excavate. Enquiries may also be lodged by

Website: www.1100.com.au; Phone: 1100;

The website is web enabled for mobile devices.

The requested information shall clearly identify the precise location where the excavation is proposed.

If you have not received your requested information from Dial Before You Dig members after two working days from the date of your request, contact the member directly as listed on your Dial Before You Dig Request Confirmation.

Note:

(a) No work is to commence until all relevant information has been received. Refer also to WorkSafe WA *Occupational Safety and Health Regulations 1996* section 3.21. It is a requirement of section 3.21 that all underground assets are located (potholed) in a job site prior to excavation. Utility maps MUST be on site.

(b) If you have received information from Dial Before You Dig and require further data and/or other information, it can be obtained by telephoning the contacts listed on the Confirmation response.

(c) Be aware that not all owners of underground assets are members of Dial Before You Dig. Provision of Dial Before You Dig information depends on membership type and the information provided is indicative only.

Those underground asset owners who choose not to register with Dial Before You Dig make it difficult for the excavator/contractor to be aware of the underground assets and to take precautionary measures to avoid damaging those assets.

(d) For further information on Dial Before You Dig, visit the Website: **www.1100.com.au** or Telephone: 1100 during office hours.

(e) Contact the relevant road authority. Note that Main Roads WA is not a member of Dial Before You Dig.

(f) For activities and works in the Dampier Bunbury Natural Gas Pipeline (DBNGP) Corridor contact Department of Lands. Also refer to Appendix D.

Why you should:

Dial Before You Dig

Refer to the following pictures of events that caused major damage and injury which could have been avoided if the worker had used:

Dial Before You Dig

6.3 Duty of care and prevention of damage to services

To assist a person(s) or Agency proposing to undertake excavation work in meeting their duty of care and to prevent or minimise damage to services, the following actions shall be implemented as a minimum requirement:

- Plan
- Prepare
- Pothole
- Protect – and only then
- Proceed

PLAN

Obtain all applicable plant drawings available.

In addition contact the relevant road authority as Dial Before You Dig does not represent all asset owners.

Contact utility providers for their recommended safe digging practices to protect their plant and comply with any specific requirements.

For services intended to enter or cross rail reserves in the Metropolitan Area, which are usually fenced with gates, contact Public Transport Authority (Rail) for advice on accessing the rail reserve even for preliminary reconnaissance. Where a road authority proposes to do work that will affect utility services they must consult with the effected parties.

PREPARE

Prepare for your works by reviewing the utility plans and contacting the utility if you need assistance. Look for onsite asset and infrastructure clues such as pit lids, marker posts and meters. These onsite clues will assist you to identify the potential location of assets on site from the utility plans and also identify any other assets and infrastructure that may not be marked on utility plans or where the utility may not be a Dial Before You Dig member.

It is then recommended, unless advised otherwise by a utility, to engage a DBYD Certified Locator who can:

- Interpret plans
- Identify and locate assets
- Where possible identify and locate any unrecorded assets existing on site (e.g. domestic gas or /power lead-ins are generally not recorded on Dial Before You Dig utility plans)
- Provide results / maps / information on located services to AS5488 specifications
- Provide locating assistance during potholing

POTHOLE

Potholing is the practice of digging a test hole to expose underground utilities to ascertain the horizontal and vertical location of the facility.

(a) Potholing is to be carried out prior to drilling or excavating to establish the exact location of all underground assets. (Always visually sight the service or utility)

(b) Prior to any potholing being carried out, you must implement the Prepare step by reading the Dial Before You Dig plans and utilising electronic methods and ground penetrating radar to fully understand what utilities are in the vicinity and also the required safe Minimum Approach Distance (MAD). Contact the respective utility for MAD values and safety requirements. It is necessary to pothole to determine the accuracy of any non-invasive methods.

For instance you are not permitted to excavate within:

- 15 meters of a high pressure gas main without prior consultation and approval from the relevant gas asset owner.
- 3 meters of water mains greater than 300mm (unless they are Asbestos Cement – AC, or Reinforced Concrete - RC, if they are either of these materials then an Asset Damage Risk Assessment (ADRA) is required). Any size sewer pressure main requires an ADRA if within 3m of it.
- Electrical reticulation approach distances provided with requested Dial Before You Dig package and information available from utility website.

Note:

Potholing on the Dampier Bunbury Natural Gas Pipeline Corridor is only permitted by WA State Government written approval and carried out under AGIG supervision.

(c) Potholing can be carried out with a hand shovel or by vacuum extraction. Water jetting while vacuuming has the potential to damage buried assets. Care should be taken if water jetting and water pressures limited to 1500 psi (100 bar) to avoid damage.

(d) Potholing should never be carried out with a mechanical excavator.

(e) If you are unable to locate the service by potholing, contact the utility provider and your supervisor and do NOT precede with any drilling or excavation works.

(f) It is mandatory that potholing be carried out for identified assets however safe digging practices should be implemented as not all asset owners are registered with Dial Before You Dig:

- at every location where an existing utility crosses the proposed excavation or drilling including the installation of poles and stay wires
- at spacings determined by risk assessment for all existing utilities running parallel to the proposed excavation or drilling to fully determine the alignment and depth of the existing services
- to locate existing utilities within 2 meters of the start and finish locations of any excavation or drilling and at every excavation required for drilling entry and exit points
- safe Minimum Approach Distance (MAD) and exclusion zones noted by each utility within the Dial Before You Dig plans and notes

(g) Always **visually** sight the service or utility.

(h) When working in areas that have a hard surface such as concrete, bitumen or any other non-moveable surface you may mark out the location of existing utilities with non-permanent spray paint. As a guide you could utilise different colours such as:

Gas	Yellow
Power	Orange / Red
Water	Blue
Telstra Communications	White
Drainage	Green

(i) It is also recommended that visual markers be placed above the pothole position. White PVC pipe or a white stake directly over the existing service to record the depth, alignment and direction is widely used for this purpose. If you are unable to install the marker directly over the existing utility and you need to offset the marker, then you shall install 2 pegs as offsets and record the offset on the pegs. We also suggest that you use a thick black marking pen and record the depths of existing services in mm. Please note that the depth and position markings recorded on PVC pipe or stakes is for information only and must be confirmed by potholing.

(j) If you are unable to locate the service, contact the utility provider and your supervisor and do **NOT proceed with any drilling or excavation**.

Notes:

(a) No digging shall be done over high pressure gas transmission mains or within the easement set aside for high pressure gas transmission mains (or laterals) without written permission from the owner or manager of the pipeline, or in the case of activities and works in the DBNGP Corridor written approval is required from, Department of Planning, Lands and Heritage (DPLH) on behalf of the DBNGP Land Access Minister. The table below lists the major Pipelines and Managers.

Pipeline	Manager
DBNGP Corridor	Department of Planning, Lands and Heritage
Dampier Bunbury Natural Gas Pipeline	AGIG - Land Management
Karratha to Port Hedland	APA Group
Pilbara to Goldfields	APA Group
Cape Lambert Pipeline	APA Group
Parmelia Pipeline (Dongara to Pinjarra)	APA Group
Mid-West Pipeline (Geraldton to Murchison)	APA Group
Port Hedland to Telfer Pipeline	APA Group
Kambalda to Esperance Pipeline	WorleyParsons Asset Mgt P/L
Eastern Goldfield Pipeline	APA Group
Fortescue River Pipeline	DDG Development Group
Wheatstone Ashburton Pipeline	DDG Development Group

Table: Pipeline Owners

(b) Warning: These pipelines should be treated with extreme caution. If fractured gas will escape with an explosive force and will probably catch fire and destroy everything in the vicinity.

(c) For railway crossings, buried signals and communications services need to be located or exposed by Brookfield or PTA (Rail) staff

PROTECT

Protect all applicable plant in either a bore or trench that has been exposed (barricades, para webbing, flags, etc.).

Located assets should be clearly marked or flagged and if necessary, have protective barriers, supports erected or other methods in accordance with the asset owner's requirements (barricades, para webbing, flags, etc.).

Any utility or industry regulated No Go Zones or Exclusion Zones must be adhered to and enforced on site.

Ensure Supervision or monitoring of the operator of the trenching or boring machine when near plant.

Advise ALL personnel working on site of existing hazards.

PROCEED

When ALL checks have been completed - then **proceed with care**. Ensure you have verified that all the information in the preceding steps is still current. If the use by date of Dial Before You Dig plans have expired, you will need to obtain current plans and if necessary, re-validate any changes that may have occurred;

For **emergencies** refer to the contact numbers listed inside back cover.

6.4 'As Constructed' detail of works

Any agency or contractor constructing works shall ensure that adequate 'as constructed' detail of the works is recorded. The 'as constructed' information shall be submitted to the appropriate agency in a form acceptable to them for inclusion in their records. This is a mandatory requirement and shall include equipment and plant in and where agreed outside the designated alignments. Also refer Clause 11.2 'Plant proposed outside allocated alignment'.

When an agency or contractor receives 'as constructed' information from a Dial Before You Dig member that proves to be inaccurate, they shall provide the accurate information to the appropriate agency for updating of their records or through the Dial Before You Dig Asset Location Feedback portal on the website www.1100.com.au.

7 PROJECT CONSTRUCTION

7.1 Duty of Care

Constructing authorities and others operating in the public road reserve or rail reserve have a duty of care to protect the existing service assets of utility providers, the infrastructure of road authorities, the infrastructure of Public Transport Authority (PTA) and the adjacent environment in addition to the duty of care to protect the safety of employees and public in the vicinity of the work area (refer to Clause 6.1.1 (f) and Appendix C).

It is essential to determine the location of existing assets by obtaining plans and proving the exact location prior to commencement of excavation. Location plans of utility services are obtained in the first instance upon lodgement of a request to Dial Before You Dig (refer to Section 6.2).

Note that buried earth grids may exist around utility equipment, for example Water Corporation pipeline valves are not indicated on Dial Before You Dig drawings that may extend into adjacent alignments. If required to be disturbed by construction works liaise with the appropriate utility to ensure safe work procedure and reinstatement requirements are undertaken.

Failure to exercise this duty of care may result in a utility provider or road authority taking action to halt works and to recover the full cost of damages.

Where it is not practical to comply with safety clearance and services allocation requirements of this Code, approval shall be obtained from the utility provider

Any damage to underground services, however minor, shall be reported to the utility provider.

Refer to standard procedures prior of commencing work outlined in Sections 6.2 and 6.3 with emphasis on PLAN, PREPARE, POTHOLE, PROTECT then PROCEED.

7.2 Emergency procedures and contacts

In an event of damage to a utility provider's, Main Roads WA, Local Government or PTA (Rail) asset, the person/Agency responsible for causing the damage shall immediately advise all asset owners affected. Refer 'Emergency Procedures and Contacts' page for asset owner's emergency contact details.

7.3 Closure of roads or major interference to traffic.

When project construction requires closure of roads or major interference to vehicular or pedestrian traffic, detailed discussion/liaison is to be initiated and maintained with the WA Police Service and approval obtained from the road authority not less than 30 working days prior to the proposed road closure or interference to traffic. Consideration shall be given to the effect of temporary closure of high load routes. Also notify Department of Fire and Emergency Services, St John Ambulance Association, Transperth (Department of Transport) and the Taxi Council of WA.

All traffic management and safety must comply with Australian Standards, *Road Traffic Act 1974, Road Traffic Code 2000, Occupational Health and Safety Act 1984* and *Traffic Management for Works on Roads Code of Practice 2009* referenced in Appendix C.

7.4 Use of long term contractors and sub-contractors

The use of Contractors or Sub-Contractors on a long-term basis by both the road authority and utility providers is a common method of service delivery on behalf of the Principal Agency. It is emphasised that it is the Principal Agency's responsibility to ensure that contractors and sub-contractors acting on their behalf are fully conversant with the requirements of this Code of Practice and obligation to consult relevant parties prior to proceeding with the works**.**

8 MINIMUM STANDARD OF COVER FOR UNDERGROUND UTILITY SERVICES AND CLEARANCE OF OVERHEAD POWER LINES AND TELECOMMUNICATION CABLES

8.1 Minimum cover for underground utility services

Although utility providers have a commitment to comply with allocated alignments and depths, no assurance can be given that the depths of cover stated will exist for all existing facilities. Before any excavation is planned or commenced contact Dial Before Your Dig for the appropriate procedure and information (refer to Clause 6).

The minimum depths of cover required for new services buried in Rail Reserves are defined in AS4799-2000.

All hardware located across the road reservation which is controlled by Main Roads WA, shall be installed by trench-less technology (directional drilling) and placed perpendicular to and at grade to a minimum depth of 1.5m cover (to overt) for the full width of the road crossing or unless otherwise advised**.**

It is emphasised that utility providers and associated contractors have a Duty of Care whilst undertaking service works. Refer to Clause 6.3 and 7.1.

Note:

(a) Refer to Appendix A for pipe colours**.** . These pipe colours relate only to PVC and polyethylene pipe. Other materials could be used, particularly in older established areas unless otherwise stated. Some services can be buried directly in the ground and not in conduits.

(b) All buried service assets should be treated as 'Live' unless otherwise confirmed.

(c) The term 'under road surface means under the road pavement surface', that is, the area of the road reserve upon which motor vehicles travel.

8.1.1 Gas

Gas (Yellow Pipe or Yellow Striped Pipe)

(a) Distribution Mains (ATCO Gas Australia)

Street mains

- 750 mm in road reserve (verge or under road surface)

Consumer services

- 600 mm in road reserve (verge or under road surface)

(b) High Pressure Distribution Pipelines (ATCO Gas Australia)

Street mains

- 1 200 mm in road reserve (verge or under road surface)

Consumer services

- 1 200 mm in road reserve (verge or under road surface)

(c) For specific details applicable to ATCO Gas or APA contact these utility providers or relevant pipeline managers direct.

8.1.2 Electricity

Electricity (Orange pipe or Orange Striped Black Poly Pipe or Orange Electrical Tape for directly buried black cable).

Some underground cables installed by directional drilling **may not** have tape above and are **black**.

CAUTION

It is possible that power cables may be located in multiple layers.

Most mains and services (Western Power and Horizon Power)

- 750 mm minimum cover in verge and under road surface. Installation depths to be in accordance with Western Power and Horizon Power standards or as otherwise agreed between Western Power/Horizon Power and the road authority.
- Non Western Power and Horizon Power Street Light and low voltage private cables shall be buried at a minimum depth of 600mm. Refer to Appendix B, Figure B3 Note 19 of service allocations applied to green field developments.

WARNING

Western Power supplies Un Metered Services (UMS) to Local Governments for street lights, illuminated signs, parks, etc. These services are typically service pillars or cable pits and are required to be shown on Western Power Plans. Cabling beyond these services are Local Government assets, the recording of which is their responsibility.

8.1.3 Telecommunications

Telecommunications (White telecommunications pipe)

Street mains

- 450 mm for excavation installations
- 600 mm for trench less installations

Consumer services

- 450 mm for excavation installations
- 600 mm for trench less installations

Note: There may be multi-Carriers with separate plant located within the allocated telecommunications alignment.

8.1.4 Water

Water (Blue Pipe, Blue Striped or Black Pipe)

Distribution mains

- 750 mm in road reserve (verge or under road surface)

Reticulation mains

- 600 mm in road reserve (verge or under road surface)

Consumer services

- 450 mm in road reserve (verge or under road surface).

8.1.5 Sewerage

Sewerage (Cream Pipe or Grey Pipe or Cream/Grey Striped Pipe)

Sewer mains

- 900 mm in road reserve (verge or under road surface)

Consumer services

- 900 mm in road reserve (verge or under road surface).

8.1.6 Main Drainage

Main Drainage (Water Corporation)

Stormwater mains

- 750 mm in verge
- 900 mm under road surface.

8.1.7 Street Drainage

Street Drainage (Main Roads WA or Local Government)

Street Mains

- 600 mm in road reserve (verge or under road surface)

Consumer services

- 600 mm in road reserve (verge or under road surface).

8.1.8 Main Roads WA (MRWA) Traffic Signals, Roadway Lighting and Intelligent Transport Systems (ITS) Cables

Traffic Signals, Roadway Lighting and Intelligent Transport Systems (ITS) Cables

(a) Traffic Signals MRWA Specification 712

Street mains (Orange Pipe)

- 600 - 800 mm in verge and under road surface.

Detectors (Orange Pipe or White Pipe)

- 35 mm in carriageway asphalt
- 300 mm in verge encased in PVC conduit.

(b) Roadway Lighting MRWA Specification 701 (Orange Pipe)

- 600 mm in verge and under road surface.

(c) ITS Cable Conduits MRWA Specification 704 (Orange Pipe for power source) and (White Pipe for communications)

- 600 mm in verge.

8.2 Clearance from overhead power lines and telecommunications cables

Clearance of overhead power lines and telecommunications cables above the ground in road reserves is to be in accordance with Western Power, Horizon Power, Telecommunications Carrier, and Worksafe WA requirements. For clearances above road surfaces, the organisation responsible for the overhead power lines or telecommunications cables is to obtain from the applicable road authority the maximum combined vehicle and load height for the road, and together with the overhead power line or telecommunication cable route data determine the clearance requirement.

9 STANDARD RESTORATION AND REINSTATEMENT OF INFRASTRUCTURE

9.1 General

Reinstatements are to be carried out as soon as practicable following work by a utility provider in a road reserve or rail reserve as agreed with the Road Authority or Public Transport authority.

The specification for reinstatement work and backfill of trenches including sign off of works undertaken and maintenance period is obtained from the road or rail **a**uthority Refer to Clause 6.1.1(e).

The Restoration and Reinstatement Specification produced by the Institute of Public Works Engineering, Australia (WA Division), for use by Local Governments is printed as a companion document with this Code of Practice on the Dial Before You Dig website.

The utility provider or contractor is responsible for the Duty of Care in ensuring the safety of the public as well as employees during all works and reinstatement, until the site is accepted as satisfactory by the Road Authority or PTA (Rail).

9.2 Cost of reinstatement

The utility provider or contractor is responsible for the cost of the reinstatement, inspections and any subsequent related work required during the maintenance period of the road, footpath, verge and other applicable infrastructure or damaged plant and property in accordance with any agreement between the utility provider and the road authority.

10 ENVIRONMENT AND HERITAGE

10.1 Native vegetation

Native vegetation has been extensively cleared from much of the south west of WA. As a result, special attention and specific actions are required when works may impact on remaining native vegetation, particularly in verge areas of road reserves.

(a) Declared Rare Flora

The Department of Water and Environment Regulation (DWER) should be contacted during the planning phases of the proposed works to ensure that no rare flora or threatened ecological communities will be affected by the works.

Fines for illegally taking rare flora are significant.

Further information is available from the Department of Water and Environmental Regulation.

(b) Clearing native vegetation

If any clearing of native vegetation is anticipated, the Department of Water and Environmental Regulation must be contacted to determine if a clearing permit is required. It is recommended that this is done during early stages of planning the proposed works. Exemptions do not apply in environmentally sensitive areas.

Large projects with extensive environmental impacts may require referral to the Environmental Protection Authority.

Clearing should be avoided wherever possible by installing utility services in already cleared land or use of horizontal directional drilling or thrust boring and other trenchless technology.

If clearing is necessary, rehabilitation must use local species. The Department of Water and Environmental Regulation can provide advice regarding appropriate and successful rehabilitation of cleared areas.

Note: Fines for illegally clearing native vegetation are significant.

Refer to the Department of Water and Environmental Regulation website: www.dwer.wa.gov.au or contact them for more information regarding clearing regulations.

(c) Dieback and weeds

Dieback, caused by Phytophthora cinnamomi (Pc), results in irreversible damage to natural environments and some tree crops.

To prevent the spread of dieback caused by Pc all machinery, equipment and vehicles must be cleaned on entry and exit from site. Dieback-free fill should be used and site activities should be planned for dryer months.

Further information is available from the Roadside Conservation Committee (email rcc@dpaw.wa.gov.au) and Department of Water and Environmental Regulation.

Weeds displace native vegetation and once established are difficult to control. Good hygiene practices of clean on entry and clean on exit from the site and the use of weed-free fill will minimise the spread of weeds.

It is recommended that utility service providers and local governments use the Environmental Checklist (or equivalent) provided in Appendix D.

10.2 Environmental considerations in Main Roads WA road reserves

Utility providers and their Contractors/Sub-Contractors are required to be aware of Main Roads WA environmental requirements when undertaking works in the road reserve. Refer to Clause 6.1.1 (d).

10.3 Environmental considerations in railway reserves

Rail land can also include important native vegetation. The Public Transport Authority maintains a Land and Transport Information System database (LATIS) that includes the location of any rare flora in railway reserve that has been advised by the Department of Environmental Regulation. This shall be checked as part of the approval process for any works in railway reserves.

Refer also to Brookfield Rail for environmental information within their rail reserves.

10.4 Impact upon heritage nominated and listed places

References should be made to both the Heritage Council of WA (Heritage Register) and relevant Local Government (Municipal Heritage Inventory) to assess potential impacts upon heritage listed sites. This also includes the impact of machinery causing vibration when working in close proximity to heritage-listed sites.

Penalties for damage to places listed under the *Heritage of Western Australia Act 1990* are significant.

In pedestrian and heritage areas, particularly within the CBD, utility providers are to ensure that pit covers do not detract from the area and are level with the footpath surface.

10.5 Aboriginal heritage sites

Aboriginal sites are protected under the *Aboriginal Heritage Act 1972 (WA)*. A check must be made with the Department of Planning, Lands and Heritage for any registered sites and the potential for the existence of any unregistered sites must also be investigated.

10.6 Existing and planned streetscape amenity (Street trees)

Whilst it is acknowledged there will or may be conflict with existing streetscape amenity, particularly street trees when installing or upgrading infrastructure in established areas, preservation of mature flora where possible is encouraged. Liaison and consultation with the relevant Local Government (policy and specification), other utility providers and the community is required. This may require Utility Providers to be responsible for tree replacement and possible compensation for the loss of mature trees.

Refer to the WA Planning Commission publication *Liveable Neighbourhoods*, particularly for green field developments.

10.7 Impacts of pollutants

Utility providers and their Contractors/Sub-Contractors are responsible for the use, control and impact of potentially polluting substances and any associated spills. Use of any classified material should be in accordance with the relevant manufacturer's specification and Dangerous Goods Act and Regulations. Consideration should also be given to impact on and protection of the underlying water table.

Responsibility for the impact of pollutants applies to any site remediation work required as a result of discharge from any existing infrastructure, i.e. leaking oil pipes or sewer pressure mains. Liaison with other utility providers will be necessary in most instances.

10.8 Impact on adjoining lands and impact of noise

Consideration must be given to the impact on adjoining lands when working in the road reserve. This extends from discharging and dumping on adjoining land that may result in impact on drainage, watercourses, wetlands and water protection areas.

Noise impacts may require restricted hours of work permitted under the *Environmental Protection (Noise) Regulations 1997* and requirements of the Local Government. Refer also to WA Planning Commission Noise Policies which may also apply.

Utility providers and their contractors are actively encouraged to pursue sustainable work practices through material reuse and recycling wherever practicable.

11 SPECIAL NOTES

11.1 Provision of As Constructed records

Utility providers agree to co-operate in providing details of buried services plant that may be affected by the operations of others proposing to do work in the vicinity of the plant. It is the responsibility of the organisation that proposes to do work in the vicinity of other plant to seek this information (refer to Clause 6.2 Dial Before You Dig).

11.2 Plant proposed outside allocated alignment

Utility providers agree to construct their new plant within the allocated corridor and under the conditions stipulated and will consult the other utility providers concerned when this is impractical. When plant is not located on allocated alignments, it is mandatory for records to be kept by the Utility Provider which provide details of plant alignment and includes the agreement of the other utility providers that may be affected by the adjusted alignment. Refer to Road Reserve Allocations, Appendix B.

'As constructed' drawings and details shall be kept by the Utility Provider for all new plant that occupies a non-standard alignment.

Junction pits, access chambers, poles, valve boxes, etc. should be constructed within the allocated corridor if practical. These corridors shown in diagrams in Appendix B have been allocated with respect to distances from the property line on the cross-section of the road reserve.

Should encroachment beyond allocated corridors be required, the agreement of the affected utility providers must be obtained prior to installation of the plant.

It is not practical to specify the location of trees, poles and underground structures such as junction pits, boxes, etc., within the allocated corridor on a longitudinal basis. The utility providers concerned are expected to locate their plant in positions that avoid existing entrances to properties and other obstacles and to provide for future developments. Consultation regarding such issues with Main Roads WA, Local Government or Planning Authority is considered essential for the benefit and interest of all parties.

11.3 Road and footpath crossings

Underground crossings of roads and footpaths should be made at right angles and the position of consumer's meter (if any) should be indicative of the service route (does not apply to electrical meters).

11.4 Minimising road and rail formation damage

All attempts shall be made to minimise damage to the road surface or railway formation**.** Alternatives to open trenching such as horizontal directional drilling or thrust boring and other trenchless technology should be considered in preference to open trenching. Consultation regarding the proposed method should occur with the Road Authority or Public Transport Authority and the method agreed by both parties prior to commencement of work. When trenching is necessary, service providers should liaise and try to co-locate cables/conduits and share trench space to minimise disruption to traffic and reinstatements.

11.5 Fire hydrant boxes

Fire hydrants must be clear to operate at all times. Particular care must be taken in carrying out work on the road reserve to prevent interference with the access to or operation of fire hydrants. Refer to local water authority for location of plant and reporting damage to plant.

11.6 Safety precautions – Utility services structures in road reserves

All appropriate structures (except utility power supply structures) within the road reserve and subjected to traffic are to be designed for a loading in accordance with the appropriate Austroads Standards. Approval to erect such structures is to be obtained from the applicable road authority.

11.7 Private installations

Proponents who wish to install private installations in road or rail reserves shall seek approvals from the relevant government authority, road authority or PTA (Rail) and relevant utility providers if there is likely interference with existing services. Approvals shall be obtained for alignment and depth/cover of service, installation conditions (protection of existing services, traffic management, public safety, etc) and maintenance requirements. A record of the private installation shall be recorded and retained by the responsible organisation and be available through Dial Before You Dig requests, that will require Dial Before You Dig membership. For further information contact Dial Before You Dig.

11.8 Rail Reserves

If any works are proposed to be undertaken within or adjacent to rail reserves contact the relevant rail authority to obtain permission and compliance requirements.

SERVICES DEPTHS

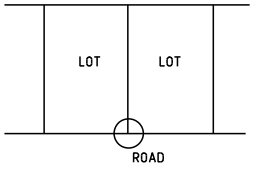
SERVICES	SERVICE CONNECTION		CONSUMER GUIDELINE	
	COVER DEPTH	TYPICAL MATERIALS AND DIAMETER	COVER DEPTH	TYPICAL MATERIALS AND DIAMETER
GAS	600mm	YELLOW PIPE OR YELLOW STRIPED PIPE	PE/PVC 450mm COPPER 300mm	20mm YELLOW PE OR PVC OR COPPER
ELECTRICITY	750mm MIN.	ORANGE PIPE OR ORANGE STRIPED PE PIPE OR ORANGE TAPE OVER BARE CABLE.	600mm Min.	CONSUMERS MAIN IN ORANGE CONDUIT
TELECOMMUNICATIONS	NOTE 3	WHITE TELECOMMUNICATIONS PIPE	NOTE 4	WHITE TELECOMMUNICATIONS PIPE
DRINKING WATER	600mm	20mm COPPER, DN25 OR DN32 BLUE STRIPED PE	450 TO 500mm	20mm COPPER OR DN25 BLUE STRIPED PE
NON DRINKING WATER	600mm	DN25 OR DN32 FULL COLOUR LILAC PE	500 TO 550mm	20mm COPPER OR DN25 FULL COLOUR LILAC PE.
SEWERAGE	900mm	150/225 mm PVC	VARIABLE	100mm PVC

NOTES: 1. UNDERLINED WATER DEPTHS ARE PREFERRED DEPTHS.
2. SERVICES SEPARATION SHALL COMPLY WITH AS/NZS 3000 REQUIREMENTS.
3. ROAD VERGE: 450mm MIN. COVER. ROADS: 450mm MIN. COVER OR AS DIRECTED BY THE TELECOM. AUTHORITY.
4. 450mm MIN. COVER IN ROAD VERGE RISING TO 350mm MIN. COVER IN CONSUMER'S PROPERTY.

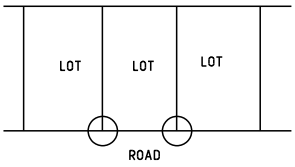
WATER SERVICE LOCATIONS - PREFERED ARRANGEMENTS TABLE

THE FOLLOWING WATER SERVICE LOCATION ARRANGEMENTS ARE TO BE CONSIDERED BY THE DESIGN ENGINEER FOR ALL FLAT GREENFIELD AND REDEVELOPMENT SITES.

	PROPERTIES WITH ROAD FRONTAGES UP TO 6.5m IN WIDTH.	PROPERTIES WITH ROAD FRONTAGES UP TO 12m IN WIDTH.	PROPERTIES WITH ROAD FRONTAGES GREATER THAN 12m IN WIDTH.
PREFERED	SPLIT ALL SERVICES BETWEEN FRONT OR REAR OF PROPERTY (REAR LANEWAY ARRANGEMENT)	SEPERATE SERVICES TO FRONT LEFT (FL) AND FRONT RIGHT (FR)	SEPERATE SERVICES TO FRONT LEFT (FL) AND FRONT RIGHT (FR)
	IF MAJORITY OF SERVICES ALL ON ONE ROAD FRONTAGE LOCATE WATER SERVICE WITH EXTENDED CLEARANCE TO POWER DOME	LOCATE WATER SERVICES ALONGSIDE DRIVEWAY FURTHER INTO PROPERTY	FOR CORNER BLOCKS POSITION WATER SERVICES ON OTHER ROAD FRONTAGE AWAY FROM POWER SERVICE.
		LOCATE WATER SERVICES ON OPPOSITE SIDE OF DRIVEWAY (TOWARDS MIDDLE OF PROPERTY) WHERE THERE ARE DUAL DRIVEWAYS.	LOCATE WATER SERVICES ON SIDE OF DRIVEWAY TOWARDS MIDDLE OF PROPERTY.
			IF SERVICES ALL ON ONE ROAD FRONTAGE LOCATE WATER SERVICE WITH EXTENDED CLEARANCE TO POWER DOME.
NON-PREFERED	CONSOLIDATED SERVICES ARRANGEMENT	CONSOLIDATED SERVICES ARRANGEMENT	CONSOLIDATED SERVICES ARRANGEMENT



CONSOLIDATED SERVICES



SEPARATED SERVICES

LIST OF DRAWINGS

FIG. A1 TYPICAL LOT ENTRY ARRANGEMENTS - INFORMATION DRAWING
FIG. A2 TYPICAL LOT ENTRY ARRANGEMENTS - SINGLE AND DUAL SEWER CONNECTION
FIG. A3 TYPICAL LOT ENTRY ARRANGEMENTS - DUAL SEWER, NO WATER AND NO GAS
FIG. A4 TYPICAL LOT ENTRY ARRANGEMENTS - DUAL SERVICES ENTRY NO SEWER, POWER/COMMS AND WATER/GAS SEPERATED WITH OPTIONS.
FIG. A5 TYPICAL LOT ENTRY ARRANGEMENTS - DUAL SERVICES ENTRY NO SEWER
FIG. A6 TYPICAL LOT ENTRY ARRANGEMENTS - DUAL SERVICES ENTRY POWER/COMMS SEPARATE.
FIG. A7 TYPICAL LOT ENTRY ARRANGEMENTS - LOW RETAINING WALLS SINGLE DN20 SERVICE - EXAMPLE DRAWING
FIG. A8 TYPICAL LANEWAY LOT ENTRY ARRANGEMENTS - SHEET 1 OF 2
FIG. A9 TYPICAL LANEWAY LOT ENTRY ARRANGEMENTS - SHEET 2 OF 2

SEVICES LEGEND

- COMMUNICATIONS
- ELECTRICITY
- GAS (ALL PRESSURES)
- NON DRINKING WATER
- SEWERAGE
- DRINKING WATER
- STORM WATER
- SEWER CONNECTION: CIRCULAR CONCRETE COVER OR UNDERGROUND CONCRETE ENCASEMENT.
- SEWER CONNECTION: UNDERGROUND CONCRETE ENCASEMENT
- WATER METERS
- POWER DOME AND SERVICES EXCLUSION ZONE (1000mmØ)

NOTES:-

1. THE FOLLOWING DRAWINGS INDICATE SERVICE ENTRY ARRANGEMENTS WITHIN LOTS AND COMMS PITS IN ROAD RESERVES.
2. REFER UTILITY STANDARDS FOR DETAILED SERVICES REQUIREMENTS.
3. PIPE COLOURS: REFER 'SERVICE AND PIPE COLOURS' IN APPENDIX B.

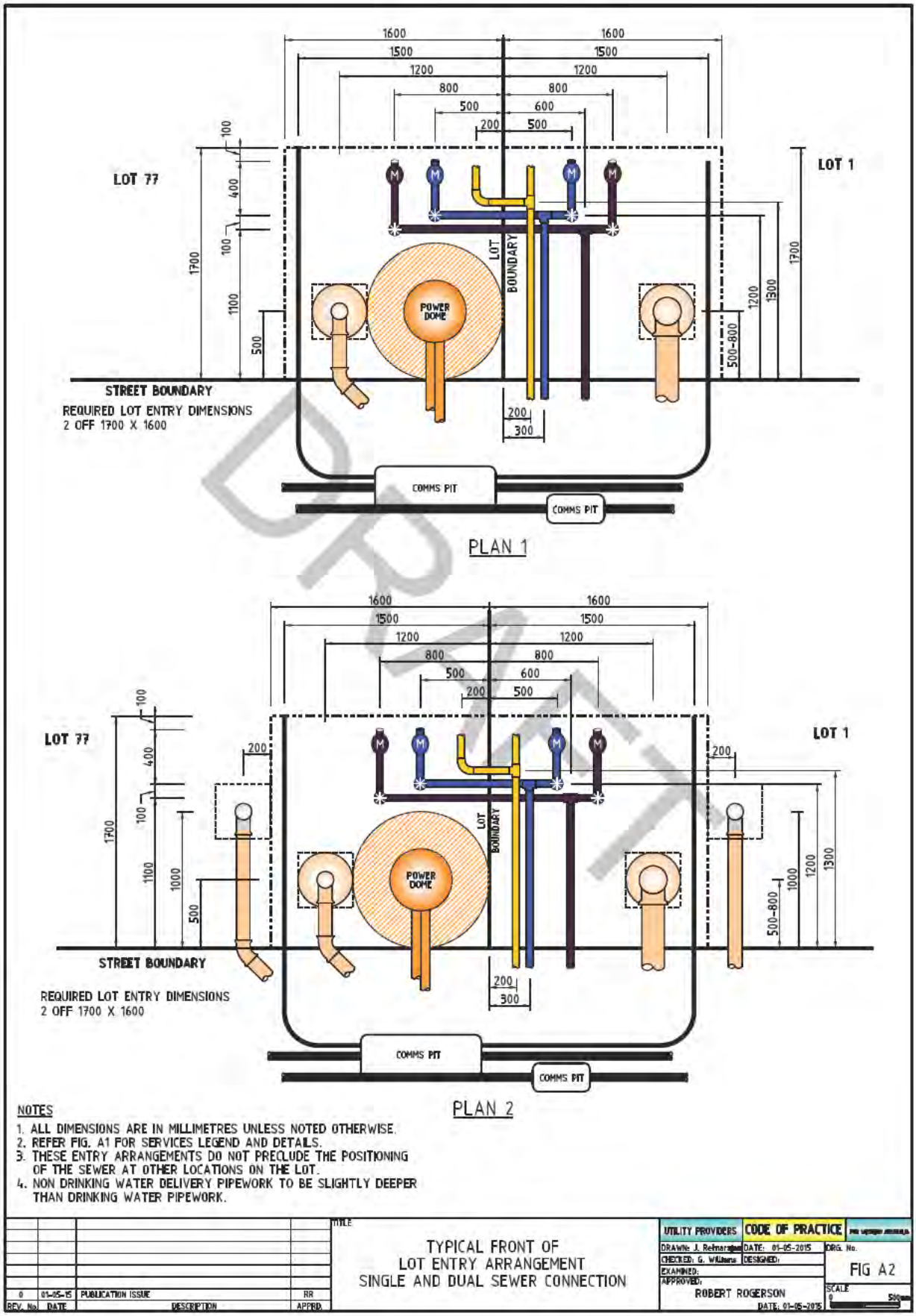
REV. No	DATE	DESCRIPTION	APPRD.
0	01.05.2015	PUBLICATION ISSUE	RR

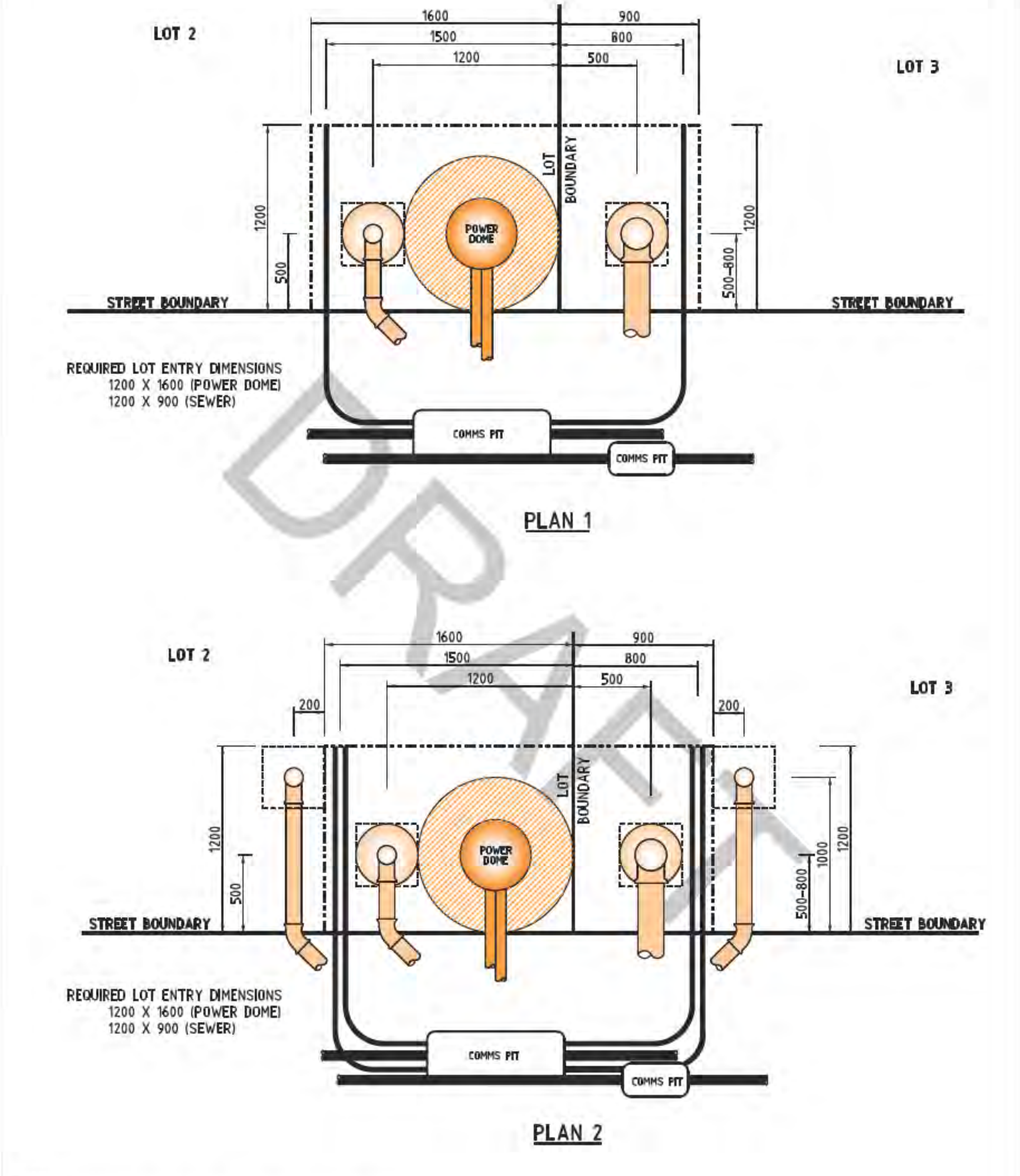
TITLE: TYPICAL LOT ENTRY ARRANGEMENTS INFORMATION DRAWING

UTILITY PROVIDERS CODE OF PRACTICE FOR WESTERN AUSTRALIA

DRAWN: J. Retnarajan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015

DRG. No. FIG A1
SCALE



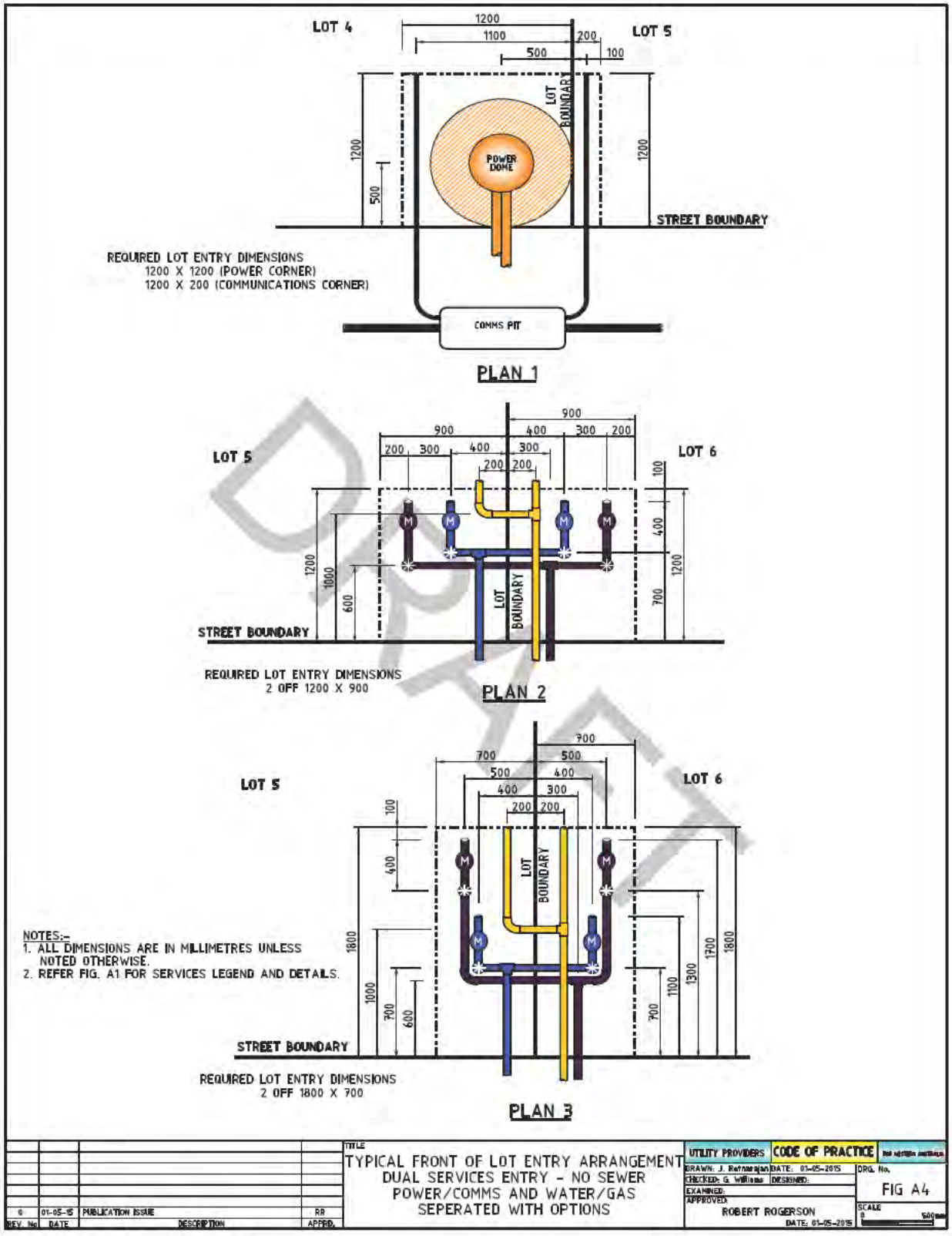


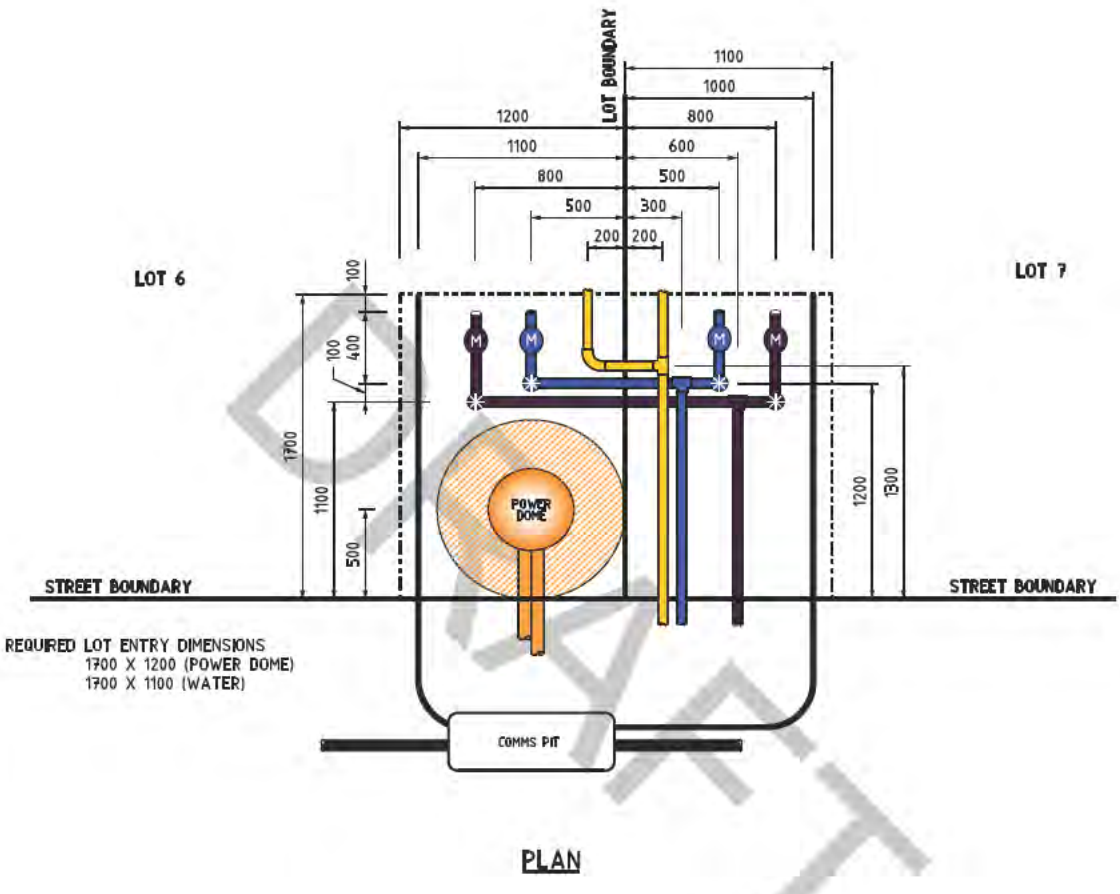
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER FIG. A1 FOR SERVICES LEGEND AND DETAILS.
3. THESE ENTRY ARRANGEMENTS DO NOT PRECLUDE THE POSITIONING OF THE SEWER AT OTHER LOCATIONS ON THE LOT.

REV. No	DATE	DESCRIPTION	APPRD.
0	01-05-15	PUBLICATION ISSUE	RR

TITLE: TYPICAL FRONT OF LOT ENTRY ARRANGEMENT DUAL SEWER – NO WATER NO GAS

UTILITY PROVIDERS CODE OF PRACTICE
DRAWN: J. Refmarajan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015
DRG. No. FIG A3
SCALE 0 500mm





REQUIRED LOT ENTRY DIMENSIONS
1700 X 1200 (POWER DOME)
1700 X 1100 (WATER)

PLAN

NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER FIG. A1 FOR SERVICES LEGEND AND DETAILS.

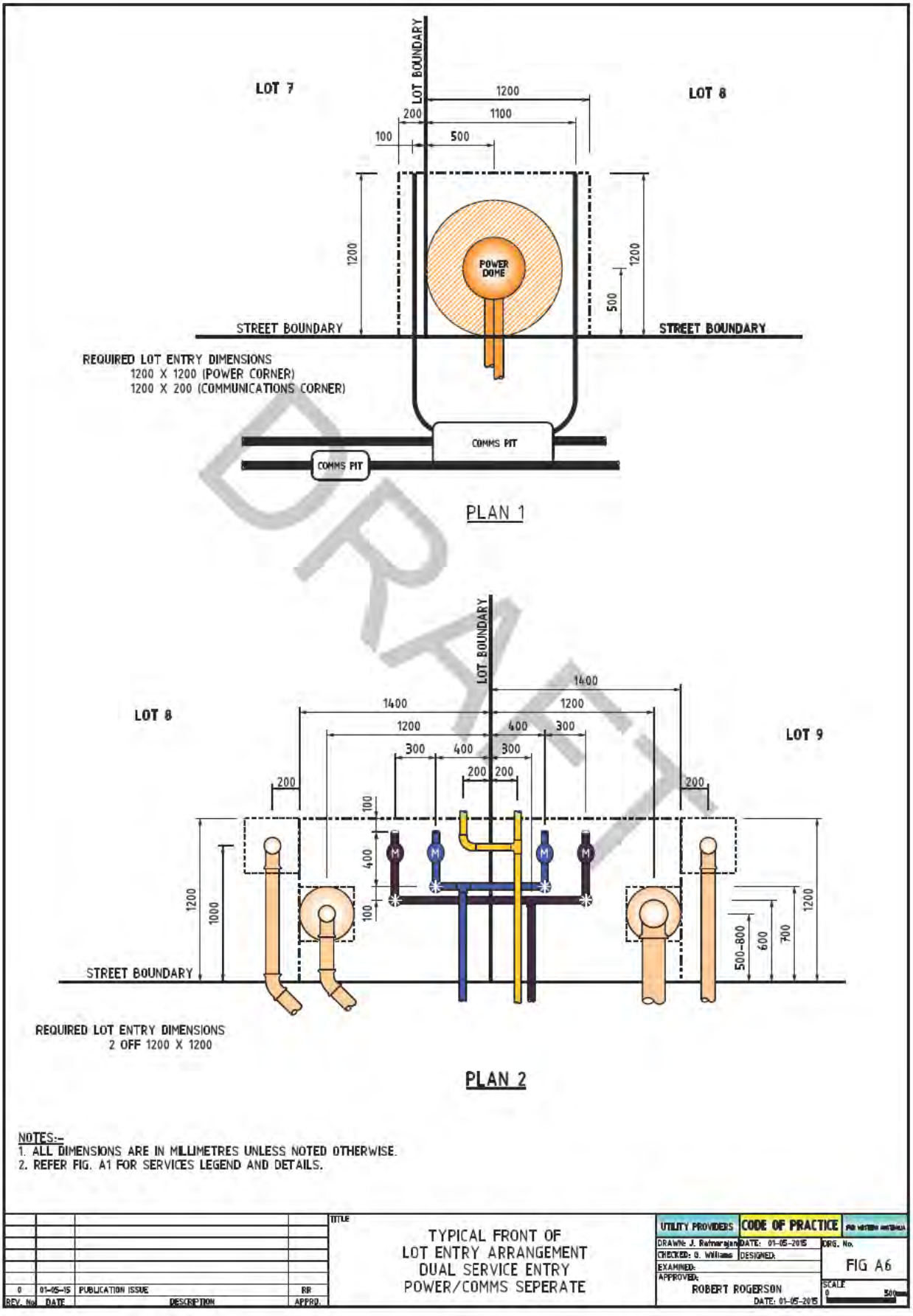
REV. No	DATE	DESCRIPTION	APPRD.
0	01-05-15	PUBLICATION ISSUE	RR

TITLE: TYPICAL FRONT OF LOT ENTRY ARRANGEMENT DUAL SERVICES ENTRY - NO SEWER

UTILITY PROVIDERS CODE OF PRACTICE

DRAWN: J. Retnarajan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015

DRG. No. FIG A5
SCALE 0 500mm



NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER FIG. A1 FOR SERVICES LEGEND AND DETAILS.

REV. No	DATE	DESCRIPTION	APPRD.
0	01-05-15	PUBLICATION ISSUE	RR

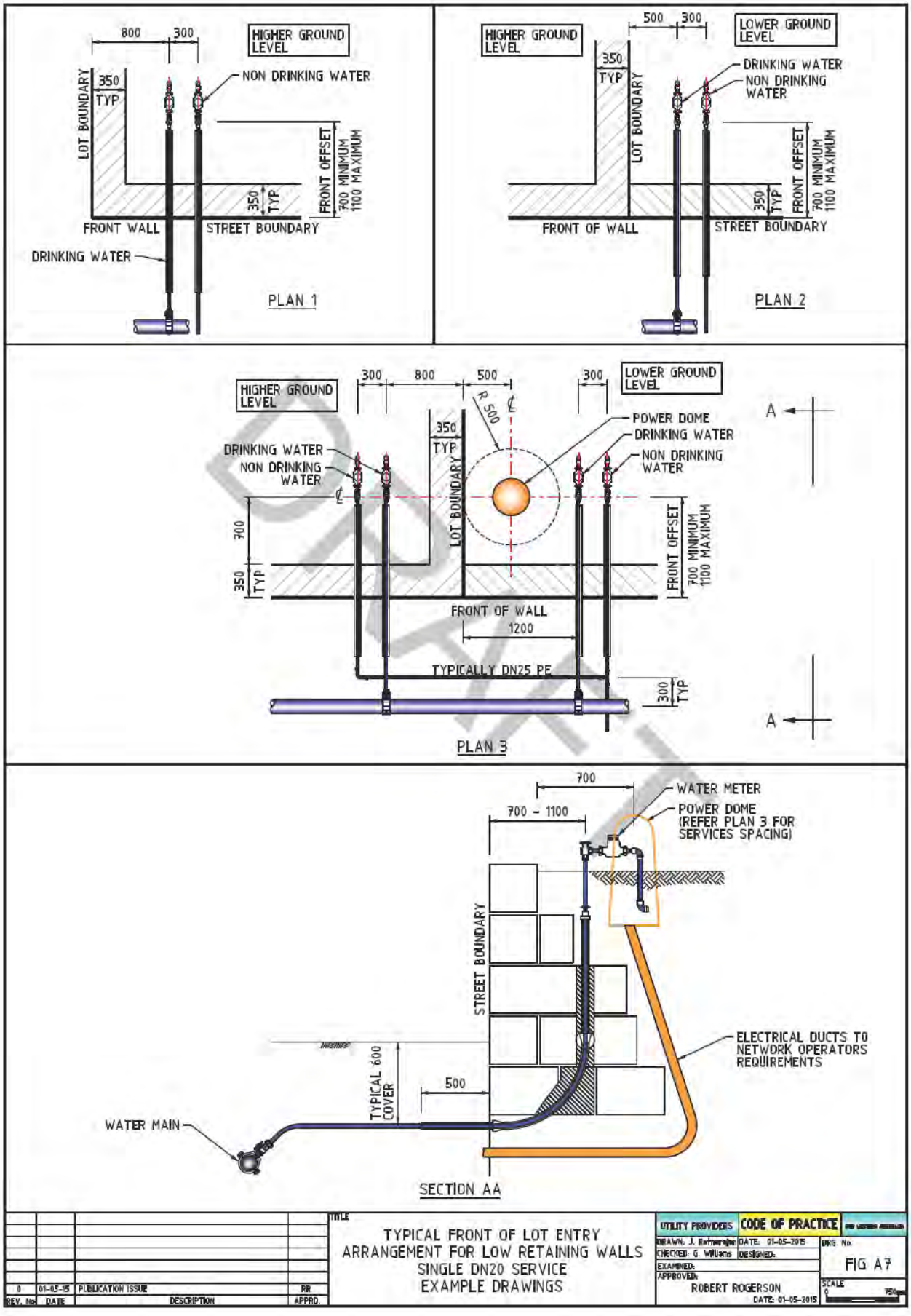
TITLE: TYPICAL FRONT OF LOT ENTRY ARRANGEMENT DUAL SERVICE ENTRY POWER/COMMS SEPERATE

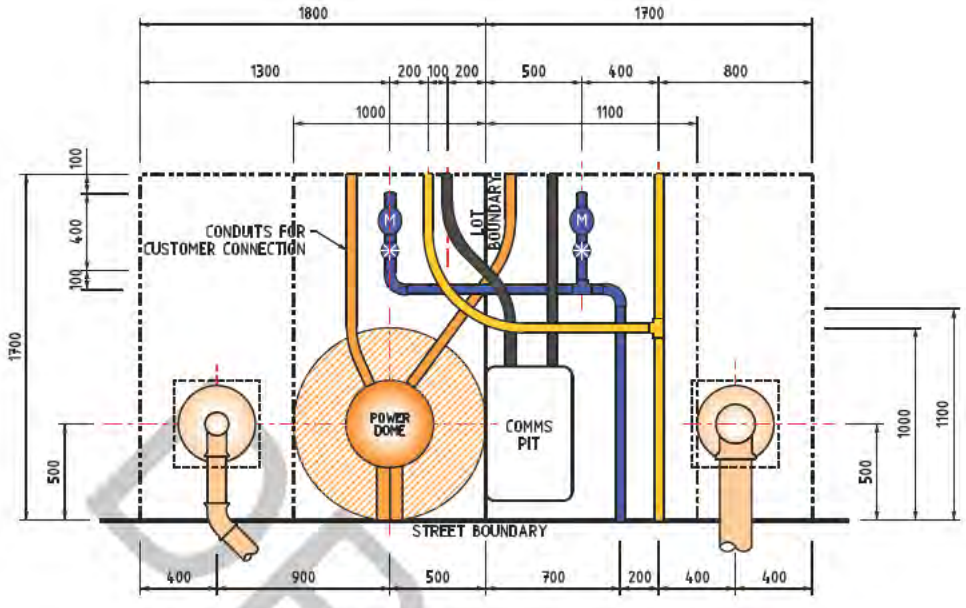
UTILITY PROVIDERS CODE OF PRACTICE

DRAWN: J. Ratnarajan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015

DRG. No. FIG A6

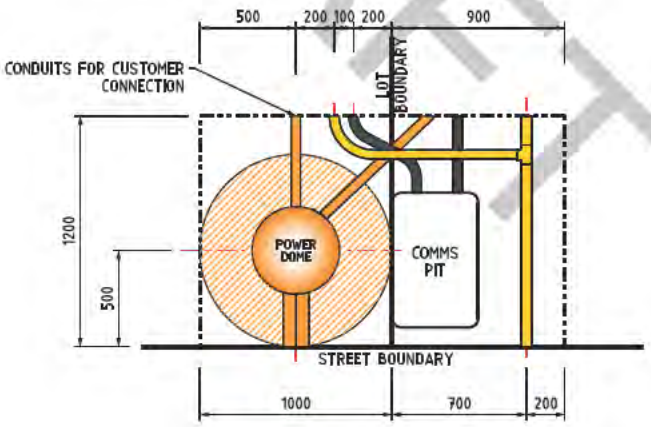
SCALE: 0 500mm





PLAN 1

RIGHT HAND WATER ENTRY
SEWER AND NO SEWER OPTIONS



PLAN 2

NO SEWER, NO WATER

NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER FIG. A1 FOR SERVICES LEGEND AND DETAILS.

REV. No	DATE	DESCRIPTION	APPRD.
0	01-05-15	PUBLICATION ISSUE	RR

TITLE

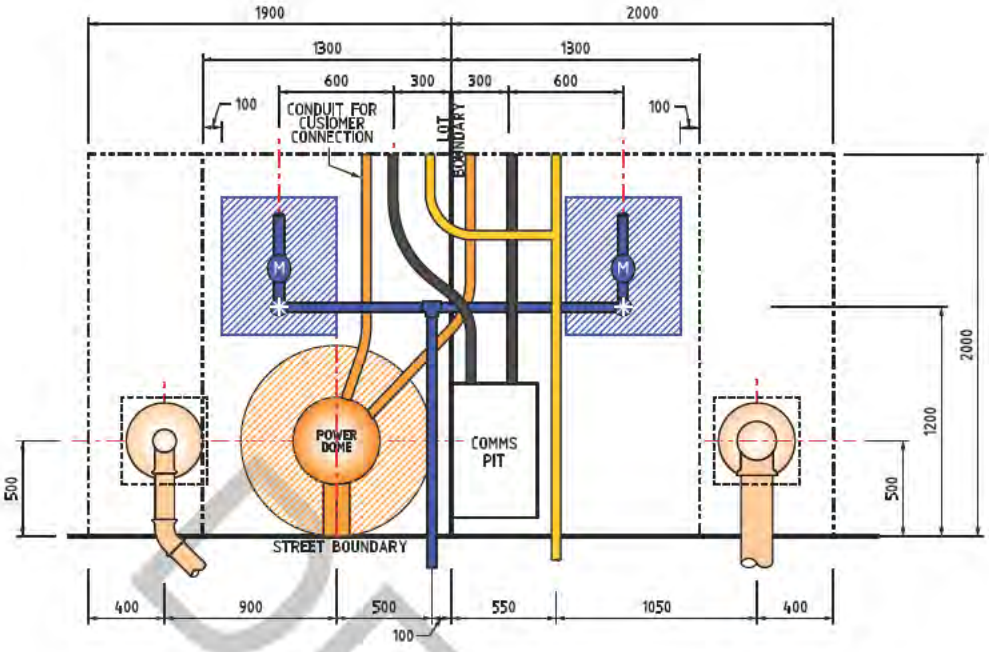
TYPICAL LANEWAY
LOT ENTRY ARRANGEMENTS
SHEET 1 OF 2

UTILITY PROVIDERS CODE OF PRACTICE

DRAWN: J. Ratnarajan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015

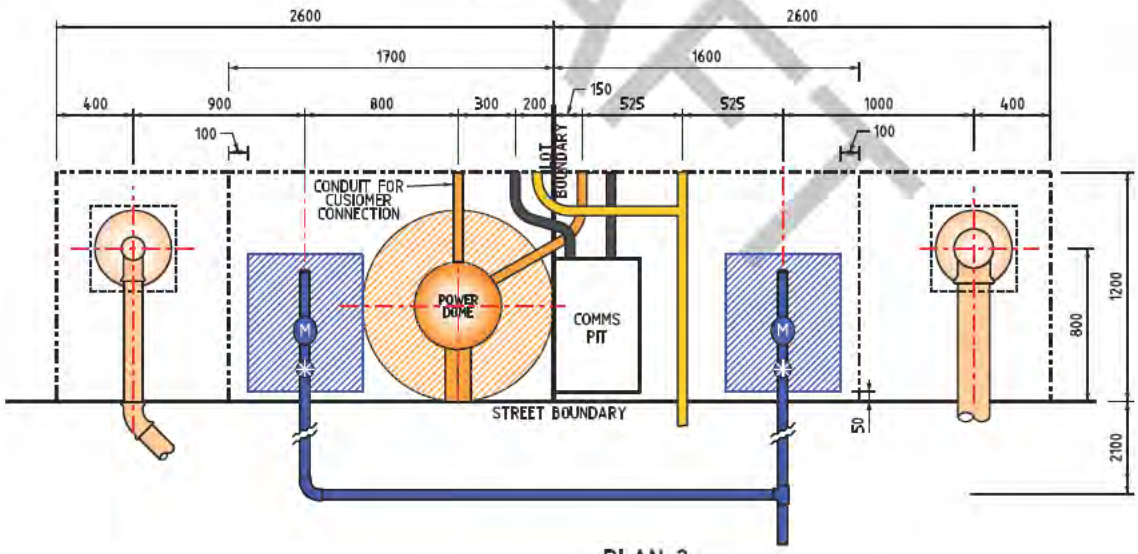
DRG. No. FIG A8

SCALE 0 500mm



PLAN 1

CENTRE WATER ENTRY, WATER METERS IN PITS
SEWER AND NO SEWER OPTIONS



PLAN 2

DUAL WATER ENTRIES, WATER METERS IN PITS
SEWER AND NO SEWER OPTIONS

NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER FIG. A1 FOR SERVICES LEGEND AND DETAILS.

REV. No	DATE	DESCRIPTION	APPRD.
0	01-05-15	PUBLICATION ISSUE	RR

TITLE: TYPICAL LANEWAY LOT ENTRY ARRANGEMENTS SHEET 2 OF 2

UTILITY PROVIDERS CODE OF PRACTICE

DRAWN: J. Rehaaglan DATE: 01-05-2015
CHECKED: G. Williams DESIGNED:
EXAMINED:
APPROVED: ROBERT ROGERSON DATE: 01-05-2015

DRG. No. FIG A9

SCALE 0 500mm

APPENDIX A

LOT ENTRY ARRANGEMENTS

Drawings showing typical utility services front of lot and laneway lot entry arrangements

APPENDIX B

ROAD RESERVE ALLOCATIONS FOR UTILITY PROVIDERS

Figures showing utility services allocation in:

Standard Alignment (pre 2001)

Green Field Development (After 2001)

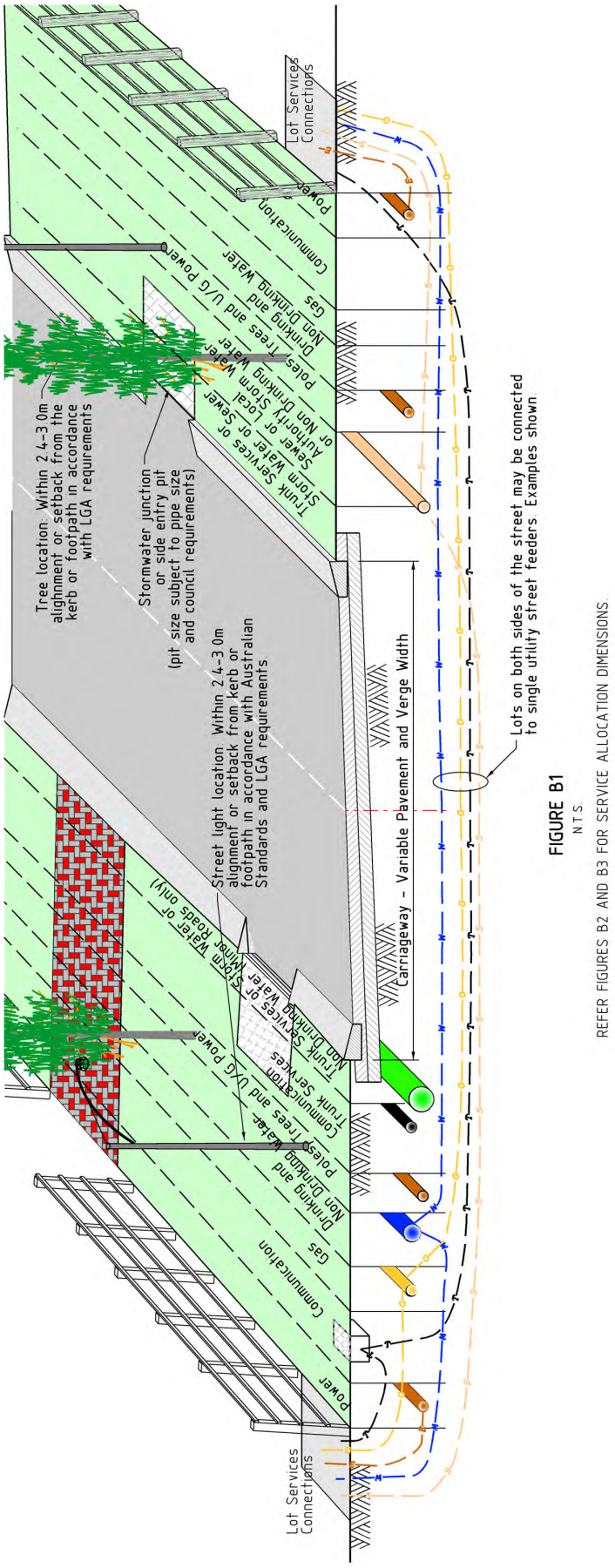
Narrow Road Reserves

Paved Laneways

Figures showing recommended utility services set out practices

ILLUSTRATION OF TYPICAL ROADWAY UTILITY SERVICES ARRANGEMENTS

FIGURE B1

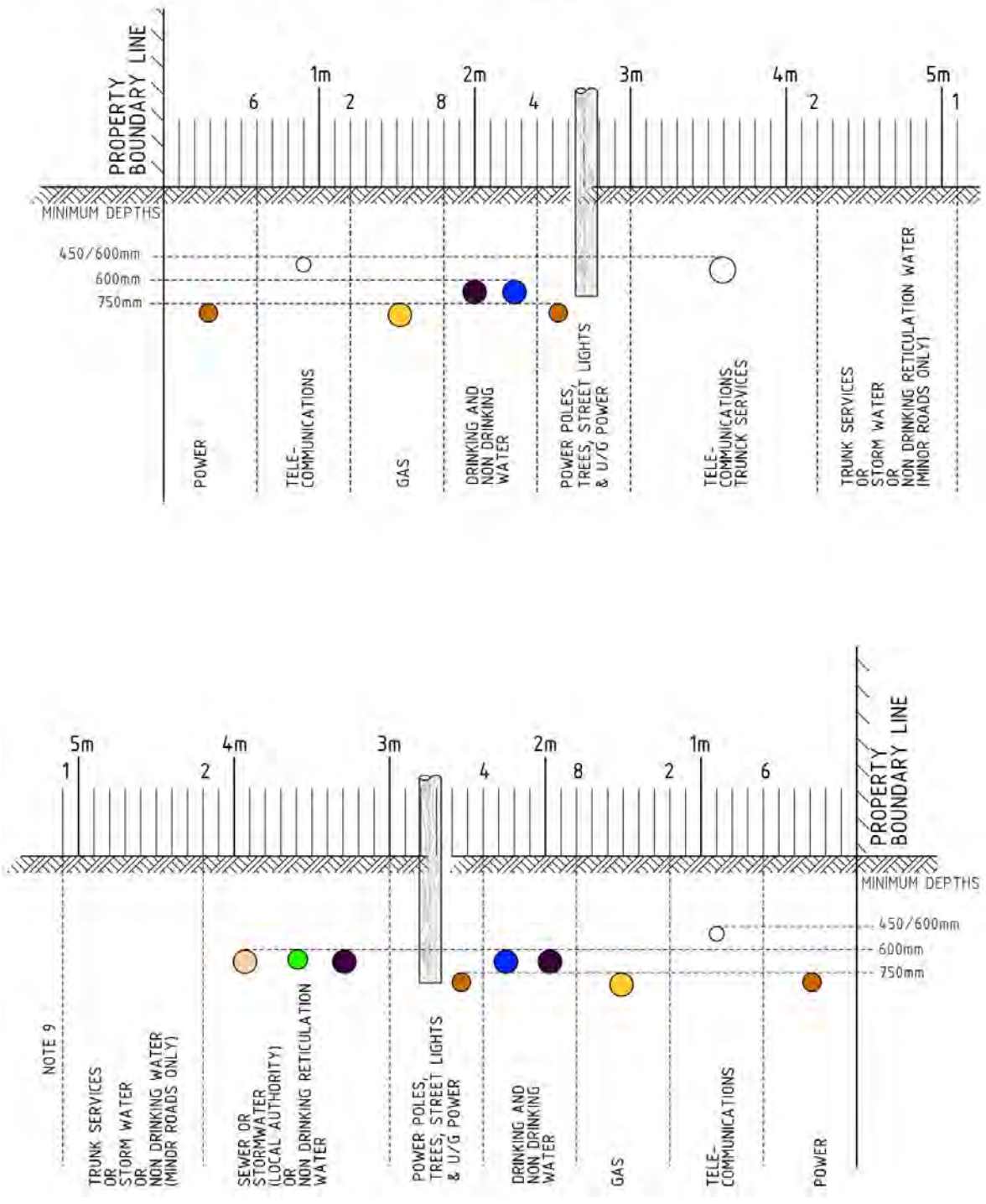


ROAD RESERVE ALLOCATION FOR UTILITY SERVICE PROVIDERS WHEN USING STANDARD ALIGNMENTS

(Applicable PRIOR to June 2001 and not applicable to new 'Green Field' Developments

FIGURE B2

ROAD RESERVE ALLOCATION FOR UTILITY SERVICES *PRIOR* TO JUNE 2001



Notes:

1 All measurements relate to distance from the boundary line on each side of the road reserve unless otherwise specified.

2 Junction pits and access chambers may extend into the 2.4 - 3.0 metre corridor.

3 Trunk services allocations may be interchanged with approval from all affected utility providers.

4 Traffic light installation cables for synchronising systems to be located in verge by arrangement.

5 Under established footpaths some variations may be necessary to Western Power and Telecommunications cable alignments following negotiation and approval from other affected utility providers.

6 In general, no underground utility service shall exceed a nominal 300mm diameter in the 0 - 3.0 metre alignment. Larger utility services may be located within this alignment following negotiation and approval from other utility providers.

7 Local Government reticulation, rising irrigation or non-drinking water mains location options indicated as non potable water pipes in Figure B2. Agreement must be obtained from relevant water utility prior to works commencing.

8 The planting of street trees should be of a type and variety to have a minimal interference to utility services. (Refer to the applicable Local Government for policy and specification).

9 Utility services may, in special circumstances, be located beneath the carriageway where verge space is insufficient. Approval must be sought from all utility providers and road authority.

10 In established localities where overhead power cables have been located underground, power cables may exist in the 2.4 - 3.0 metre corridor. Beware that in many instances power cable 'tape' has not been installed.

11 Verge widths may vary. Refer to current version of the Liveable Neighbourhoods produced by the WA Planning Commission for acceptable verge widths, particularly if trees are to be planted in the verge. Also consult appropriate Local Government.

12 Access points may extend partly into adjacent allocations, particularly in Common Trenching.

13 Refer Special Notes 11.2.

14 In established areas (Bright Telecommunications) pit and pipe installation is on the 2.7 metre alignment.

15 Where overhead power is being undergrounded or where there are problems with the 0 to 0.6 metre alignment, power may be installed on the 2.4 – 3.0 metre alignment, subject to approval by Western Power or Horizon Power.

16 For stormwater pipes, minimum cover may be reduced to 600 mm.

17 Cover, bedding and backfill requirements to be in accordance with appropriate utility provider's requirements (e.g. water reticulation in accordance with Water Corporation's Drawing BD62-1-1) and road authority's reinstatement specification requirements.

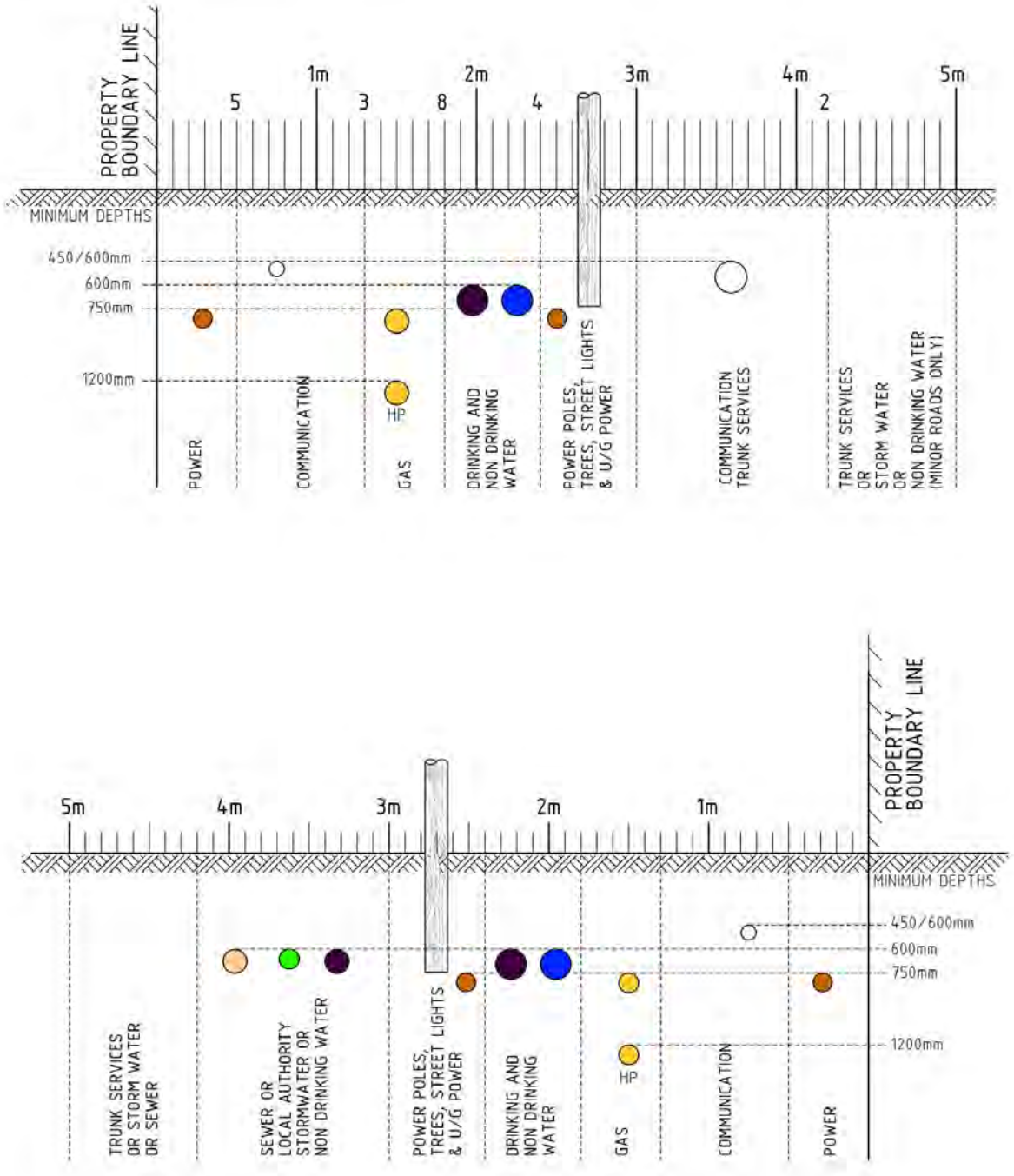
18 Service allocation in the 3.0 – 4.2 alignment shall be by agreement with nominated utility providers.

ROAD RESERVE ALLOCATION FOR UTILITY SERVICE PROVIDERS IN NEW 'GREEN FIELD' DEVELOPMENTS

(Applicable AFTER May 2001) and supersedes **ALL** allocations shown in previous codes

FIGURE B3

ROAD RESERVE ALLOCATION FOR UTILITY SERVICES *AFTER* MAY 2001



Notes:

1 All measurements relate to distance from the Property Line on each side of the road reserve unless otherwise specified.

2 Although the diagrams show a single utility service within each corridor, these may be multiple services of similar utilities.

3 Junction pits and access chambers may extend into the 2.4 - 3.0 metre corridor by agreement with the electricity network provider.

4 Alignments in the 4.2 - 5.0 metre corridor may be used by arrangement between utility providers.

5 Traffic light installation cables for synchronising systems to be located in the verge by arrangement with utility providers. Similarly under established footpaths some variations may be necessary to electrical and telecommunication cable alignments following negotiation and approval from other affected utility providers.

6 In new developments Power and Communications distribution cables are to be laid in locations shown. Under established footpaths some variations may be necessary following negotiation and approval from other affected utility providers and the road authority.

7 In general, no underground utility service shall exceed a nominal 300mm diameter within the 0 - 3.0 metre corridor. Larger utility services may be located within this corridor following negotiation and approval of other utility providers.

8 Local Government reticulation, rising irrigation or non-drinking water mains location options indicated as non potable water pipes in Figure B3. Agreement must be obtained from relevant water utility prior to works commencing.

9 The planting of street trees should be of a type and variety to cause minimal interference to utility services. (Refer to the applicable Local Government for policy and specification).

10 Utility services may be located beneath the carriageway where verge space is insufficient. Consultation must be made and agreements obtained with all relevant utility providers and road authorities.

11 Verge widths may vary. Refer to the current version of the Liveable Neighbourhoods produced by the Western Australian Planning Commission for acceptable verge widths, particularly if trees are to be planted in the verge. Also consult appropriate Local Government.

12 Electricity cables and conduits to pass under gas and water.

13 Gas to pass under water at reticulation crossings.

14 Gas services (lead ins) connecting to the property shall pass under communications and over underground power cables and water mains.

15 A minimum clearance of 300mm is required between gas and other utility services. If 300mm clearance cannot be achieved, approval of the gas provider shall be obtained.

16 A minimum clearance of 150mm is required between sewer main and other utility services and between water main and other utility services. (Note clearance of reticulation services may vary from this value). Refer also to Table B1, Clearance Zones Guide regarding minimum clearances between utility services when undertaking works within the road reserve.

17 Cover, bedding and backfill are to be in accordance with utility provider's requirements (e.g. water reticulation in accordance with Water Corporation's Drawing BD62-1-1) and road authority's reinstatement specification requirements.

18 All reticulation to be laid within +/-100mm wherever practicable of the indicated centre line and secured against movement with initial backfill. Some utility practices may vary from this requirement particularly for multiple utility services.

19 Low voltage cables used by non-network provider for street lighting shall be installed in the 2.4 - 3.0 metre service allocation. Cabling outside of the alignment including streetlight and unmetered supply consumers mains cabling shall be run at right angles to the services corridors including road crossings. Streetlight cabling in median strips shall be installed directly between poles but installation under road ways shall be avoided. Refer also to Section 8.1.2 of this Code.

20 Different alignment corridors may apply to green field developments in Narrow Road Reserves with widths of 14.0 - 16.0 metres. **Refer to Figure B4**.

21 Where there are problems with the 0 - 0.5 metre alignment, power may be installed on the 2.4 – 3.0 metre alignment subject to approval by Western Power or Horizon Power.

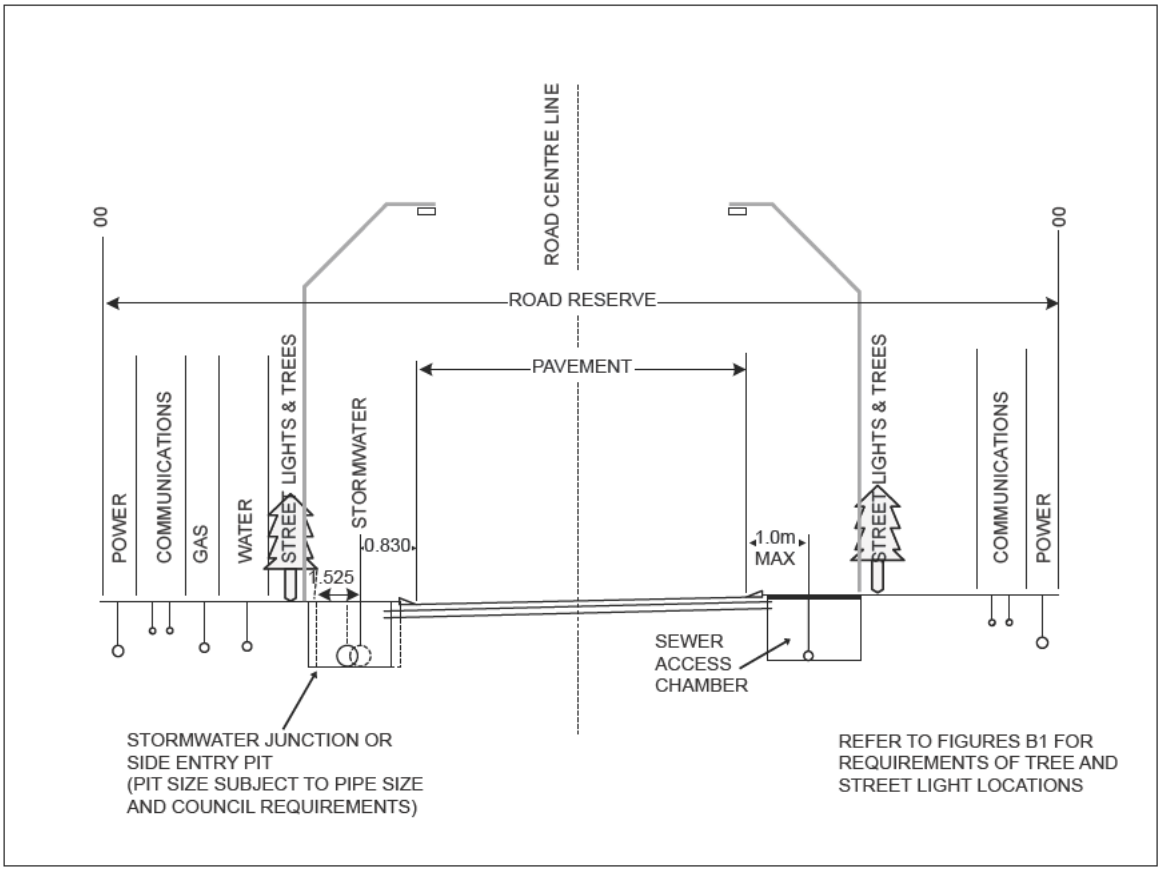
22 Services allocation in the 3.0 – 4.2 metre alignment shall be by agreement with nominated utility providers**.**

ROAD RESERVE ALLOCATION FOR UTILITY SERVICE PROVIDERS IN NARROW ROAD RESERVES (NOMINALLY 14.0 – 16.0 METRES)

These allocated alignments apply to all new developments after October 2002 and supersedes all allocations shown in previous Codes of Practice, including Standard and Common Trenching. All affected utility service providers must agree to proposed variations to these allocations.

All previous utility services allocation notes apply except where varied below.

Figure B4 Narrow road typical services installation arrangement.



Notes:

1 The designers of narrow road reserves are obliged to consider the relationship of all utility services, surfaces and furniture with each other. The corridors shown in this diagram can only be varied with approval from all affected utility service providers.

2 All measurements generally relate to the distance from the property line on each side of the road reserve unless otherwise specified.

3 Access chambers may extend into the trees and lights corridor.

4 In general, no underground utility service shall exceed a nominal 300 mm diameter within the 0 - 3.0 metre corridor. Larger utility services may be located within this corridor only after negotiation with all utility providers.

5 Local Government reticulation or irrigation pressure mains are to be located beyond the 3.0 metre alignment by arrangement.

6 For narrow reserves with a wide road surface, the verge space available may be insufficient for trees while maintaining minimum clearances from other utility services. (Refer to current version of the Western Australian Planning Commission Liveable Neighbourhoods and applicable Local Government for Policy and Specification).

7 Provision of an alignment for water distribution mains and other 'trunk' services can be negotiated on the verge adjacent to the sewer in 16 metre reserves.

8 Verge widths may vary. Refer to the current version of Liveable Neighbourhoods produced by the Western Australian Planning Commission for acceptable verge widths, particularly if trees are to be planted in the verge. Also consult appropriate Local Government.

9 Cover, bedding and backfill requirements to be in accordance with appropriate utility provider's requirements (e.g. water reticulation in accordance with Water Corporation's Drawing BD62-1-1) and road authority's reinstatement specification requirements.

10 For sewers in curved streets:

Access chambers and maintenance shafts should be positioned in the sewer corridor. Alternatively they may need to be positioned in the surface. The minimum distance from the sewer to the property boundary shall be 1.0 metres. Access chambers and maintenance shafts should be clear of the kerb. The minimum cover to the sewer shall be 0.9 metre. A similar approach shall apply to stormwater pipe work.

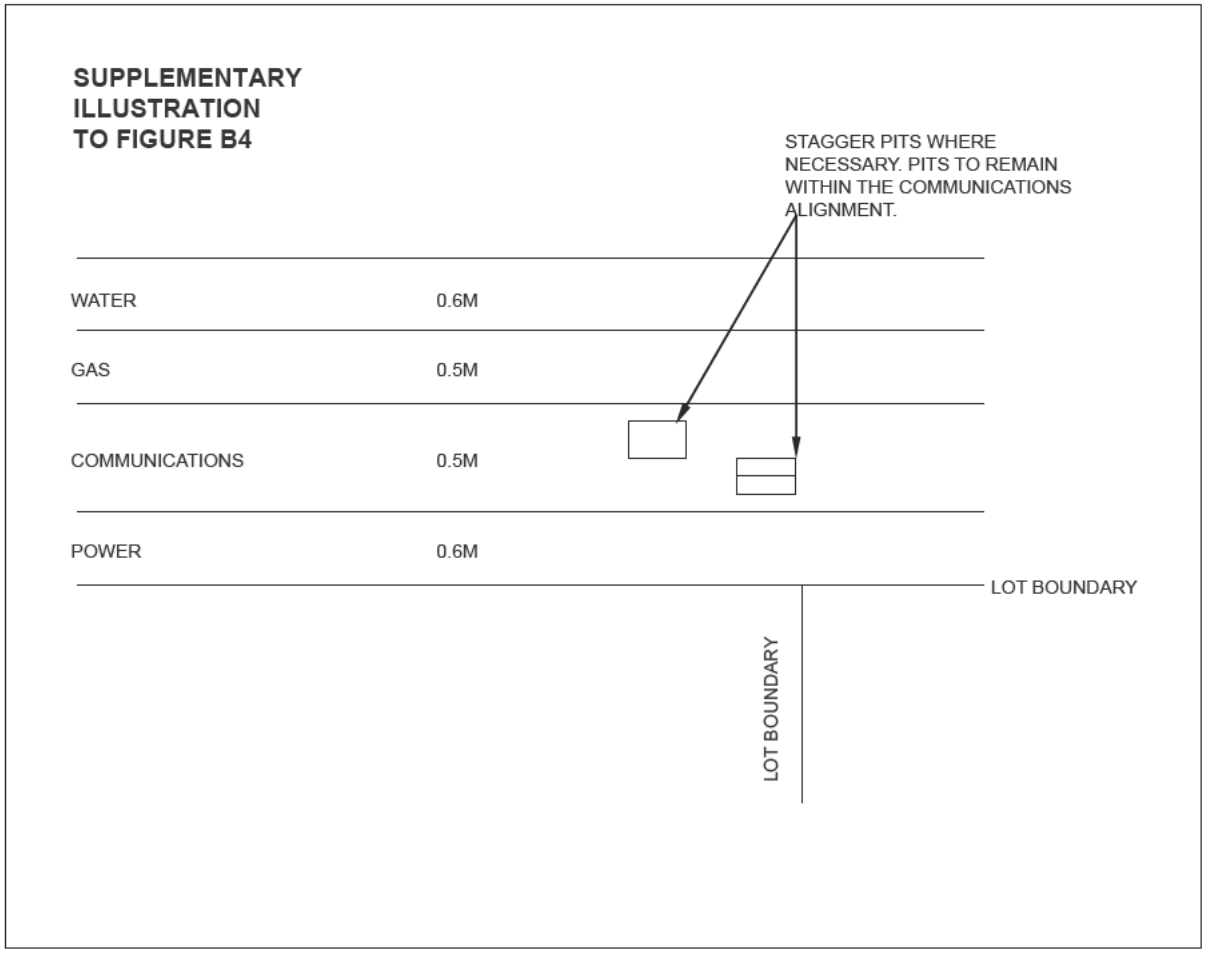
11 All pits shall be totally contained within the utility service corridor except where approved by the utility service provider whose alignment is encroached upon. This may require staggering of pits as shown in the following Supplementary Diagram to Figure B4.

12 Underground power cables may be installed on the 2.4 – 3.0 metre alignment, where there are installation and maintenance issues adjacent to retaining walls in the 0-0.5 metre corridor provided it is acceptable to other Utility Service Providers and doesn't interfere with street trees.

13 Service allocation in the 3.0 – 4.2 alignment shall be by agreement with nominated utility providers.

'GREEN FIELD' DEVELOPMENTS IN NARROW ROAD RESERVES

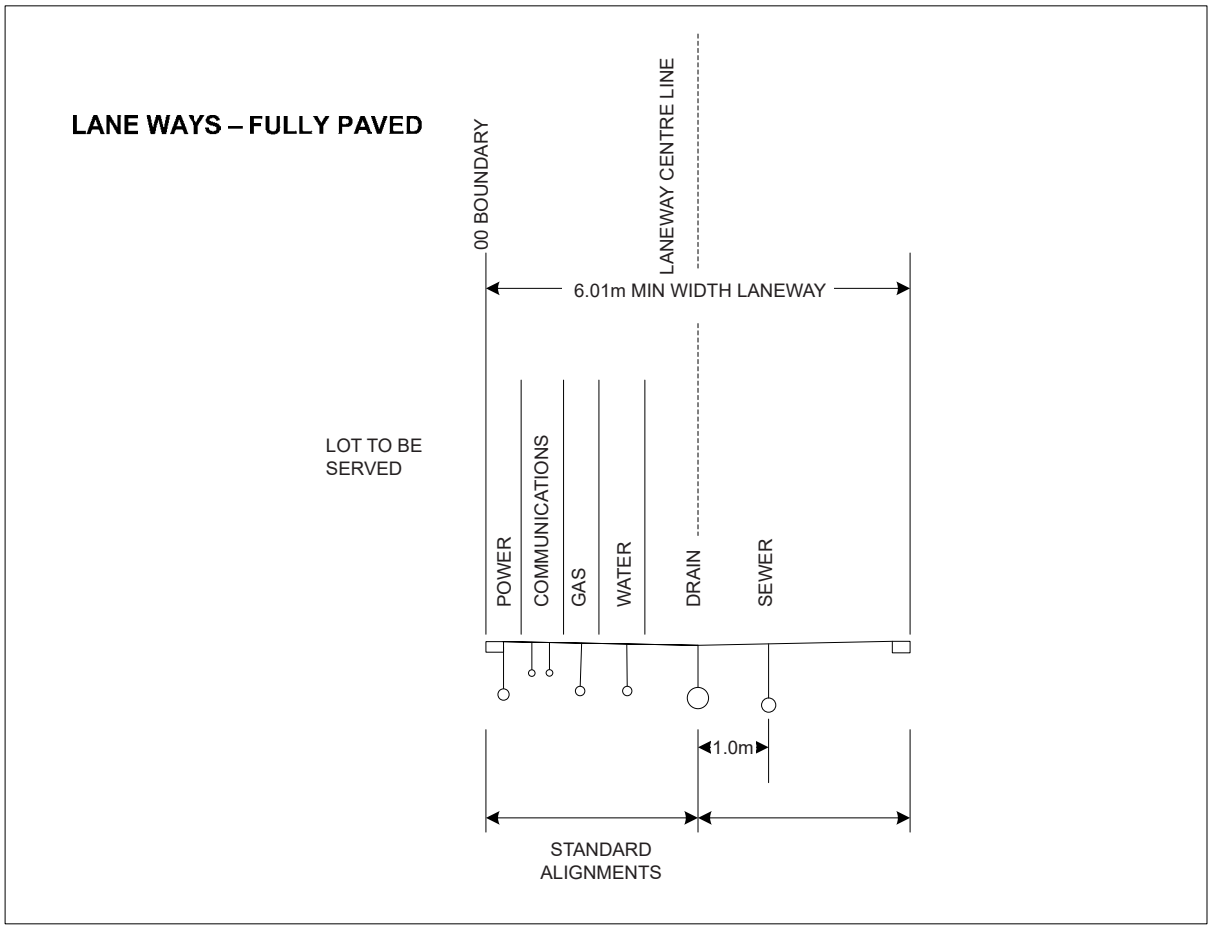
(NOMINALLY 14.0 – 16.0 METRES) SUPPLEMENTARY DIAGRAM TO FIGURE B4



ROAD RESERVE ALLOCATION FOR UTILITY SERVICES IN LANEWAYS

(AS DEFINED IN THE PLANNING AND DEVELOPMENT ACT)

Figure B5



Notes:

1 Cover to utility services to be the same as for roadways.

2 Where a laneway lot fronts a primary street the location of utility services shall be in the primary street, except where building setbacks and/or topography constrains the provision of utility services in the primary street, i.e. natural or altered land environment, including retaining walls.

3 Where a laneway lot fronts Public Open Space, consideration should be given to relocating some of the utility services to the Public Open Space; e.g. sewer.

4 Utility Services are to be placed on the side of the laneway servicing the greatest number of lots, unless there are topographical constraints.

5 Street lights to be positioned to suit Local Government requirements and to minimise the effect on the other utility services.

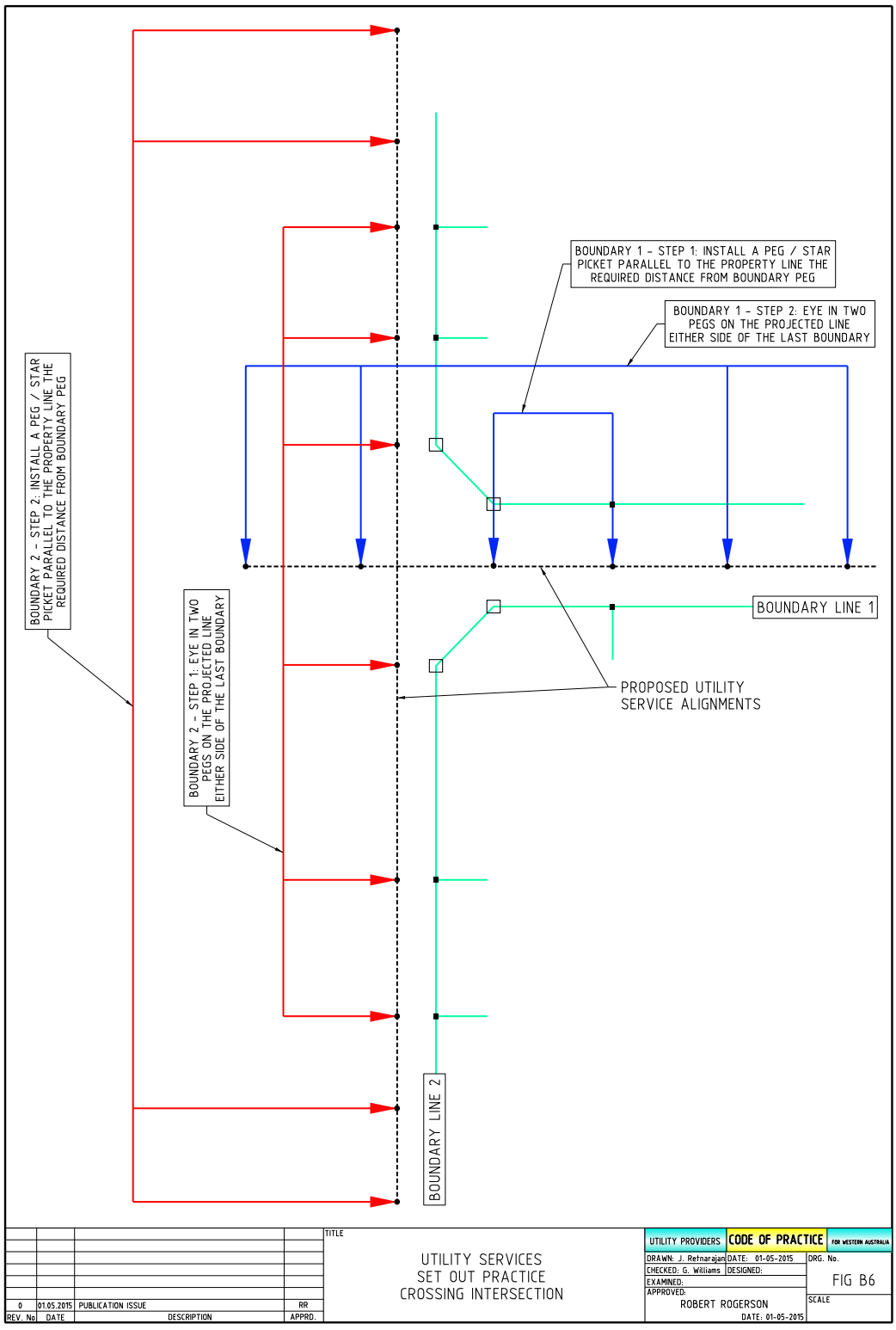
6 For all laneway widths, utility services are to remain in their relative positions.

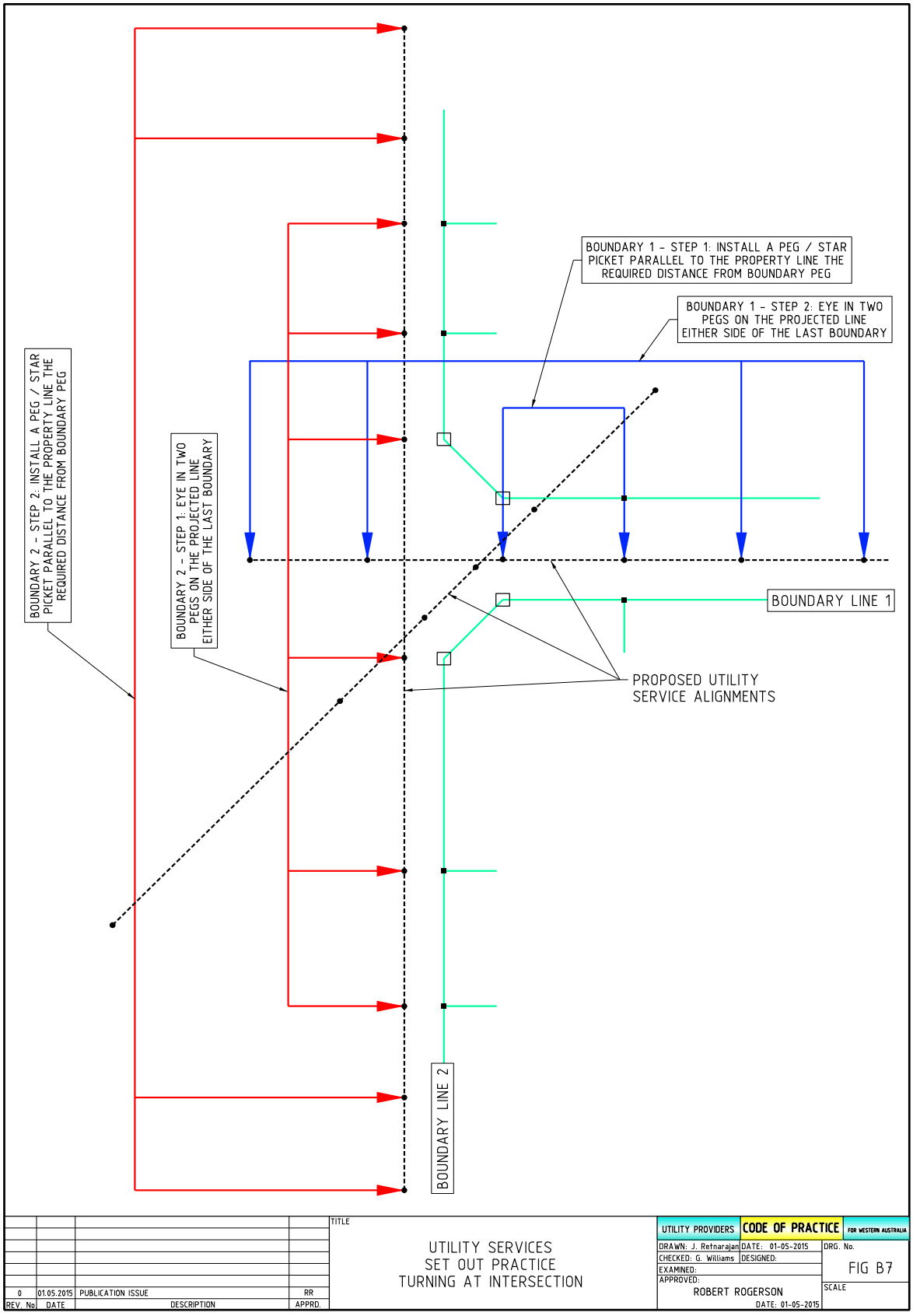
7 Proposed variations to these allocations must be agreed by all affected utility service providers.

UTILITY SERVICES SET OUT PRACTICE:

CROSSING INTERSECTIONS, TURNING AT INTERSECTION AND CHANGE OF STREET ALIGNMENT

The following drawings indicate suggested utility services set out practice drawings to ensure accurate alignment at roadway intersections and truncations.





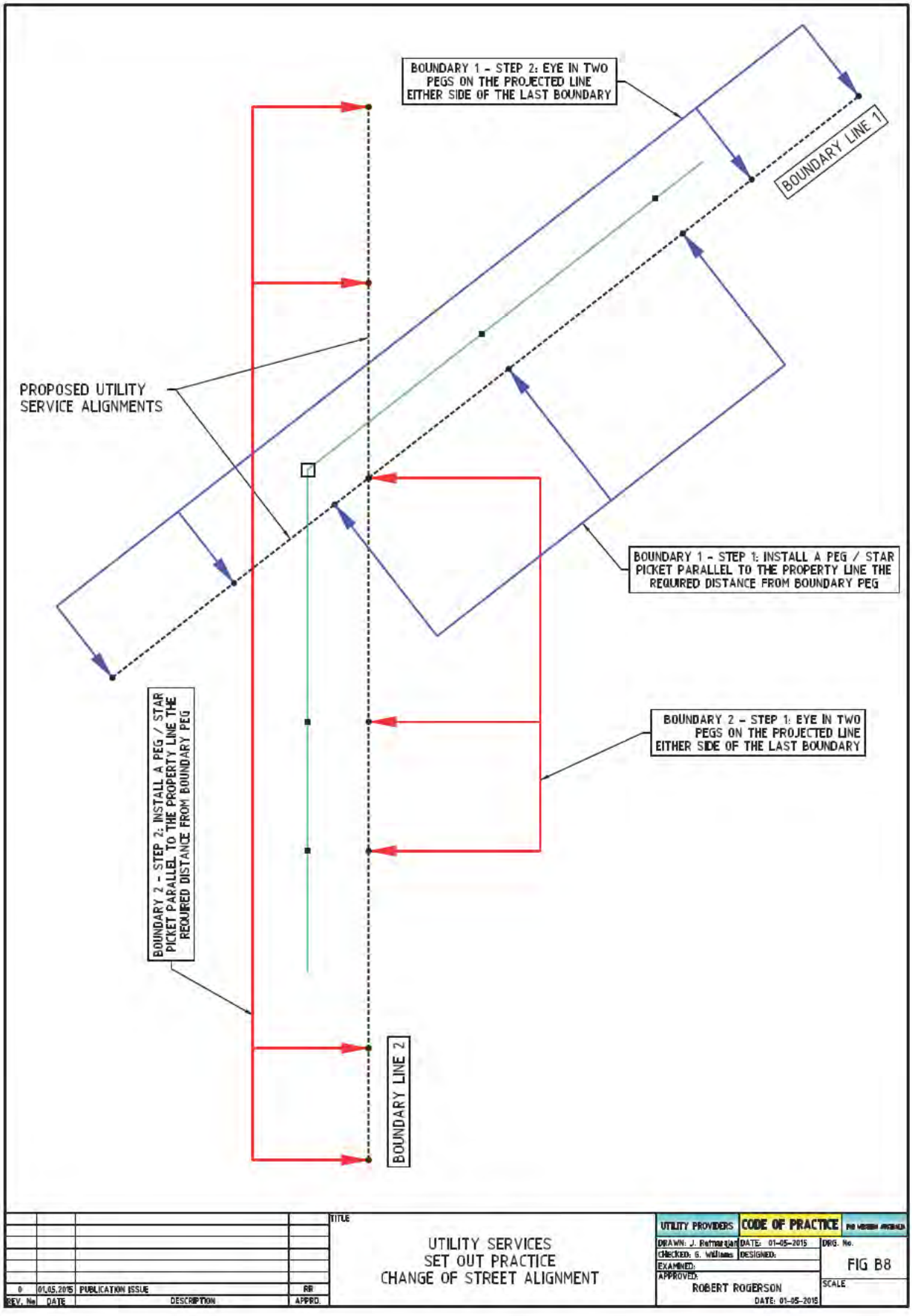
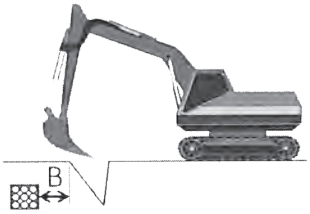


TABLE B1

CLEARANCE ZONES GUIDE - CLEARANCE LIMITS TO UNDERGROUND UTILITY SERVICES WHEN UNDERTAKING WORKS IN ROAD RESERVES

This Clearance Zone Table provides the minimum approach distance that powered excavating machines may operate before the Controls are applied. Use of this Table provides protection of the utility service and ensures the safety of the excavator and operator. Adoption of this Table will improve site safety and demonstrate Duty of Care by both the utility service provider and excavator operator.

Types of Underground Utility Services	Clearances	Clearance Zone for Powered Excavation	Controls	Typical Depths
Note: The owners of utility services registered with the Dial Before You Dig service are covered by this Guide and require an enquiry through this free service and the compliance with any directive issued with information regarding the utility service.	The minimum approach distance for individuals carrying out work near underground utility services.	Distance B is the minimum approach distance for powered excavating machines  B = the distance from the underground utility service to the break of the surface created by an excavating machine digging away from the underground utility service. The machine will be on the other side of the cut away from the underground utility service. For directional boring across the line of a utility service, a minimum clearance of 300 mm from the utility service will be maintained. For directional boring parallel to the utility service and at the level of the utility service, a clearance of 500mm shall be maintained from the edge of the nearest utility service. Prior to commencing any directional drilling you must know the exact location of all utilities within the vicinity. Refer to potholing Clause 6.	If the risk assessment identifies a potential risk of making contact with both underground and overhead utility services, two safety observers would be required. One observer to ensure that the machinery maintains a safe distance from underground utility services, the other observer to ensure a safe distance from the overhead utility services e.g. power lines. In the case of gas or electricity utility services, an appropriate fire extinguishing system must be accessible to meet the identified fire risk. If the width and /or depth of the excavation will expose the utility service, the utility service provider must be contacted prior to commencing work.	Below natural ground level or top of road pavement.

Low and Medium Pressure Gas Services.	N/A	**300mm**	Pot hole to confirm location of utility service. The position of the utility service may not appear on the plans.	**300 - 600 mm.**
Low and Medium pressure gas mains.	N/A	**300mm**	Pot hole to confirm location of utility service. The Code of Practice for shafts, tunnels and trenches, and the Guideline to dangers of poorly ventilated workplaces. Only one individual at a time should be excavating if hand excavation is being undertaken in a confined space. Another should act as an observer and be able to operate any breathing, escape or fire equipment if required. The elimination of an ignition source in the event of an escape. Excavation below underground utility services should not be undertaken within a distance of 300mm below the utility service located at the lowest level.	**600 - 750mm**
High Pressure gas services, mains and pipelines.	Refer to utility service provider requirements.	Refer to utility service provider requirements.	If excavation is required within 15 metres of a high pressure gas pipeline prior approval must be obtained from the relevant gas owner. However, for any excavation in the vicinity of the DBNGP refer Appendix D for approval requirements. Must contact the utility service provider for specific conditions. ATCO Gas conditions: http://www.atcogas.com.au/Safety/Working-around-gas-infrastructure Note: All transmission pipelines involving gas (also oil and petrochemical) have separate requirements and the utility service provider should be contacted.	**900 - 1200mm**

Dampier Bunbury Natural Gas Pipeline (DBNGP).	**Refer to Department of Lands approval conditions.**	**Refer to Department of Lands approval conditions.**	**Refer to Department of Planning, Lands and Heritage approval conditions.**	**Refer to Department of Planning, Lands and Heritage approval conditions.**
Low Voltage Electricity cables – voltages less than or equal to 1000V (1kV)	Refer to utility service provider requirements.	Refer to utility service provider requirements.	Must contact the utility service provider for specific conditions prior to excavating. Western Power conditions: http://www.westernpower.com.au/safety-working-near-electricity.html	**500mm minimum.**
High Voltage Electricity cables – voltages from 1000V (1kV) up to 33000 (33kV)	Refer to utility service provider requirement.	Refer to utility service provider requirement.	Must contact the utility service provider for specific conditions prior to excavating. Western Power conditions: http://www.westernpower.com.au/safety-working-near-electricity.html	**500mm minimum.**
Underground sub-transmission cables 33000V (33kV) up to 132000V (132kV)	Refer to utility service provider requirement.	Refer to utility service provider requirement.	Must contact utility service provider for specific conditions. Western Power conditions: http://www.westernpower.com.au/safety-working-near-electricity.html	**750mm minimum.**
Telecommunications cables.	Contact utility service provider for specific requirement.	Contact utility service provider for specific conditions prior to excavating.	Must contact utility service provider for specific conditions prior to excavating.	Typically **450 – 600mm**, other assets to **1200mm**
Water pipelines.	N/A	**300mm** (if pipeline is **200mm** or greater in diameter).	Pot hole to confirm location of utility service.	**450mm minimum**
Sewer pipelines.	N/A	**300mm** (if pipeline is **200mm** or greater in diameter).	Pot hole to confirm location of utility service.	**600mm to 10 (ten) metres**

APPENDIX C

TRAFFIC CONTROL AND SAFETY

C1 TRAFFIC MANAGEMENT FOR ROADWORKS

The Utility Providers Code of Practice for Western Australia has adopted the following documents (unless otherwise agreed between the utility service provider and Main Roads WA) to be used for all traffic control and safety purposes:

Main Roads Western Australia, Traffic Management for Works on Roads Code of Practice (July 2014) - defined as 'Code of Practice' in the following text.

The Code of Practice is issued by Main Roads WA to establish and maintain a standardised system procedures and practices, for traffic management at all road works undertaken within the road reserve by direct labour (e.g. utility service provider) and contract. The Code of Practice is supported by the Australian Standard AS 1742.3 – 2009. It is also supported by the *Main Roads Act 1930, Occupational Safety and Health Act 1984, Road Traffic Act 1974, Road Traffic Code 2000* and *Disability Services Act 1993.*

The Code of Practice has been authorised by the Commissioner of Main Roads for use by Local Government and Main Roads (including authorised contractors) personnel. It is expected that State instrumentalities and other organisations such as utility service providers and their contractors will adopt the Code of Practice for all works on roads that are under the control of Main Roads WA or Local Government to ensure a safer road network environment for both the road works and road users.

The enforcement of safe worksite practices to ensure the safety of employees and public is undertaken by **Worksafe WA.**

It is essential that **only accredited personnel** who have completed modules of the Code of Practice training course can erect temporary traffic management signs.

Amendments to the Code of Practice may be made from time to time. Users of this document shall ensure that they are using the current document, which is available from the Main Roads WA Website: www.mainroads.wa.gov.au ('Using Roads' > 'Traffic Management' > 'Roadworks' > 'Traffic Management for Works on Roads - Code of Practice').

Note:

The Code of Practice is to be used in conjunction with Australian Standards AS 1742.3 - 2009

TITLES OF STANDARDS

AS 1742.3 (2009)

C2 ERECTION OF TEMPORARY REGULATORY TRAFFIC SIGNS AND DUTY OF CARE WHEN UNDERTAKING WORKS IN ROAD RESERVES

Part 20 Regulation 297 of the *WA Road Traffic Code 2000* provides that where work or a survey is being carried out upon a road by an authorised body, that authorised body may erect, establish, display alter or take down any particular road sign or traffic control signal approved by the Commissioner of Main Roads so as to only apply to one lane, or one dissection of the

carriageway to which the work or survey relates. Motorists must not exceed speed limits displayed on a speed restriction sign operating over any portion of road that lies between this sign and a de-restriction sign. It is implicit that such signs will be of a temporary nature for the purpose of warning motorists and for the prevention of injury and loss of life to the persons carrying out the works or survey in question and possibly also to a lesser extent to the motorist and their vehicle.

A **duty of care** would arise on the part of anybody, whether government or private, who is carrying out operations on a road which is otherwise open to traffic, to take all reasonable measures to prevent accident or injury to persons carrying out those operations and also to members of the public lawfully using the road. Part of this **duty of care** would consist of the erection of warning signs, which would be of a temporary nature, to alert motorists to the impending danger for as long as the operations are being carried out within the road reserve. **This duty of care is the responsibility of those carrying out the works or surveys** within the public road reserve and not upon the Commissioner of Main Roads or the relevant Local Government. These temporary signs would have to be removed from the road or vicinity of the road as soon as the works or survey has been completed.

The traffic management including reduced speed limits in place for the safety of the public and utility workers and contractors must suit the site conditions acknowledging whether workers are on site. For instance prior to the workers leaving site the speed limits must be adjusted to suit the changed situation.

APPENDIX D

UTILITY SERVICES LOCATED IN THE DAMPIER TO BUNBURY NATURAL GAS PIPELINE (DBNGP) CORRIDOR

D1 PROCESS AND INFORMATION

D1.1 INTRODUCTION

The DBNGP is Australia's longest high pressure gas pipeline and one of Western Australia's most critical pieces of energy infrastructure. The DBNGP covers more than 1,530km starting from the Burrup Peninsula in the State's North West and finishing near Bunbury in the State's South West. The DBNGP also includes numerous lateral pipelines at various locations along its length.

Built by the State Energy Commission of Western Australia (SECWA), the Dampier to Kwinana section of the DBNGP was commissioned in 1984 with the extension south to Bunbury commissioned in 1985. In 1995, under the Government's energy reform program, SECWA was split into gas (AlintaGas) and electricity (Western Power). As a result, the pipeline assets were vested in AlintaGas.

In 1996, Cabinet approved the sale of the DBNGP and subsequently the *Dampier to Bunbury Pipeline* Act 1997 (the Act) provided for the sale of the DBNGP (Pipeline) to Epic Energy in March 1998. Under the Act, the land within the DBNGP Corridor was vested in the DBNGP Land Access Minister (the Minister) and managed on behalf of the Minister by the Western Australian State Government.

In October 2004 the Pipeline was sold to the Dampier Bunbury Pipeline (DBP) group, The DPB group is now part of the Australian Gas Infrastructure Group (AGIG) who are the current owner and manager of the Pipeline.

The DBNGP corridor is currently managed by Department of Planning, Lands and Heritage (DPLH) on behalf of the Minister.

Management of the DBNGP corridor is an integral part of ensuring transportation of natural gas supplies from the North West Shelf to the South West of Western Australia. The gas is used for heavy and light industry, power generation and homes.

The Minister acting with the advice of the Minister for Energy has control over the DBNGP corridor to assist with the gas needs of the State.

D1.2 THE DAMPIER TO BUNBURY PIPELINE ACT 1997 (THE ACT)

In considering this information potential applicants should be mindful of the central requirements of the Act.

Utility providers, land owners, pipeline operators and other third parties cannot use land in the DBNGP Corridor in a way that is inconsistent with anything that is on, or is being done on the land in accordance with rights granted to access right holders under section 34 of the Act.

Utility providers, land owners, pipeline operators and other third parties must seek written approval from the Department of Planning, Lands and Heritage, who administers the DBNGP

Corridor on behalf of the Minister, to carry out any work within the DBNGP Corridor. Such approval can be sought only by written application to the Department of Planning, Lands and Heritage.

Penalties are provided under section 41 of the Act and Regulation 4A of the *Dampier to Bunbury Pipeline (Corridor) Regulations 1998* for unauthorised use of the DBNGP Corridor. A successful criminal prosecution under these provisions can result in a fine of up to $10,000.

D2 INFORMATION FOR APPLICATIONS TO UNDERTAKE ACTIVITIES AND WORKS IN THE DBNGP CORRIDOR

D2.1 INTRODUCTION

The following information provides details for all proponents and organisations seeking to undertake activities and works in the DBNGP Corridor.

Detailed information regarding the DBNGP Corridor, appropriate land use, activities and works, and the section 41 application process can be found in the Department of Planning, Lands and Heritage Land Use Guidelines. Copies can be downloaded from the Department of Planning, Lands and Heritage Website: www.dplh.wa.gov.au or contact the Infrastructure Corridors Branch (contact details below).

D2.2 LOCATION OF PIPELINE(S)

Where a pipeline is constructed in the DBNGP Corridor, the area is marked by warning signs. Warning signs do not indicate the exact location of a pipeline and should only be used as an indication that a high pressure gas pipeline exists in the DBNGP Corridor.

The greatest risk to high pressure gas pipelines and to people in the vicinity is damage by persons unfamiliar with the requirements for the safe work around high pressure gas pipelines.

D2.3 APPLICATION PROCESS

Before undertaking any works within the DBNGP Corridor, contact **Dial Before You Dig** - Dial 1100.

Prior to commencement of intended works within the DBNGP Corridor, all parties must submit a written application for approval from the DBNGP Land Access Minister through the Department of Planning, Lands and Heritage. This is a requirement under section 41 of the Act.

All applicants are advised to submit an application at the earliest possible stage to allow sufficient time for assessment from a technical, social, environmental and safety-hazard perspective.

Submissions should include the following information:

- Land description and map identifying location of the proposed works.
- Type of works to be carried out.
- Intended future use of the land.
- Type and weight of machinery that will be used.
- Timeframe of the works.
- Any plans or diagrams of the works.

Approval will only be granted to the party responsible for the works.

The approval process should take approximately 3 weeks and includes referral to all relevant section 34 access right holders (gas pipeline owners and/or operators) for comment and technical and safety conditions regarding works in the vicinity of high pressure gas pipelines.

Indemnification will be sought from the proponent for all proposed works within the DBNGP Corridor and shall be completed by the proponent and returned to Department of Planning, Lands and Heritage prior to commencement of processing the section 41 application.

The section 41 application form can be downloaded from the Department of Planning, Lands and Heritage website:

(refer to Section 2.1)

or contact the Infrastructure Corridors Branch (contact details below).

When completed, the application form and relevant information to support the application should be forwarded by either email, facsimile or post to:

The Manager Infrastructure Corridors
Department of Planning, Lands and Heritage
PO Box 1143
WEST PERTH WA 6872
Ph.: +61 8 6552 4400
Fax: +61 8 6552 4420

If you have any questions that are not covered on the website or in the Land Use Guidelines, please contact the Infrastructure Corridors team at Department of Planning, Lands and Heritage.

The section 41 application process is **free of charge.**

D2.4 PERMISSION TO ACCESS LAND

Please note that any such conditional approval granted under section 41 of the Act does not of itself provide any further approval required from any underlying land owner or other interest holder to access the land concerned.

For example, a third party holding conditional approval under section 41 of the Act should not access the land without appropriate permission from the land owner.

D2.5 TELECOMMUNICATION CARRIERS

Telecommunication Carriers are defined in and subject to Commonwealth legislation under the *Telecommunications Act 1997* (Cmth) and the *Telecommunications Code of Practice 1997* (Cmth), including subsequent amendments.

Licensed Telecommunications Carriers are exempt from some State or Territory laws. Where these laws are not consistent with the Telecommunications Act, the Commonwealth legislation will apply.

To ensure compliance with all safety and technical requirements for working in the vicinity of high pressure gas pipelines it is essential to contact Department of Planning, Lands and Heritage and provide a Land Activity and Access Notice, pursuant to Schedule 3 Part 1 Division 5 Section 17 of the *Telecommunications Act 1997* (Cmth), of intended works to enable referral to relevant section 34 access right holders before undertaking any activities or works in the DBNGP corridor. The approval process should take approximately 3 weeks.

APPENDIX E

ENVIRONMENT CHECKLIST

The following Environmental Checklist is a **minimum** requirement to be completed by Utility Service Providers for proposed works in road reserves managed by Main Roads WA and Local Governments. Approvals to undertake works may be required from the Department of Water and Environment Regulation, Department of Planning, Lands and Heritage, etc. Refer to Section 8.1 regarding clearing of native vegetation and possible requirement for a clearing permit which could take several months to complete.

Item No.	Item	Yes / No / Not Applicable.
1	**Protection of rare flora, fauna or other significant vegetation** 1(a) Identified significant vegetation or habitat. 1(b) Alternatives routes and methods considered. 1(c) Obtained approval to disturb this vegetation/habitat.	
2	**Clearing of native vegetation** 2(a) Routes and methods that do not require clearing considered. 2(b) Obtained all necessary approvals to clear. 2(c) Revegetation/rehabilitation plans prepared.	
3	**Phytophthora cinnamomi Dieback** 3(a) Work in area with rainfall greater than 600mm per year. 3(b) Hygiene practices will be in place. 3(c) Work to take place during dry periods.	
4	**Water protection and Conservation Areas** 4(a) Identified wetlands, sensitive water courses, drinking water areas, Swan River Trust management areas, Bush Forever areas, etc. 4(b) Alternatives routes and methods considered. 4(c) Obtained approval to work near sensitive water or conservation areas. 4(d) Obtained approval to undertake dewatering.	
5	**Aboriginal heritage** 5(a) Identified existing and potential for Aboriginal heritage sites. 5(b) Alternatives routes and methods considered. 5(c) Obtained approval to disturb sites.	
6	**Cultural heritage** 6(a) Identified existing heritage sites. 6(b) Alternatives routes and methods considered. 6(c) Obtained approval to disturb sites.	
7	**Adjoining residential and other sensitive properties** 7(a) Identified need to control dust, vibration and noise. 7(b) Obtained approval to do work outside normal hours.	
9	**Acid Sulphate Soils (ASS)** 9(a) Identified requirement for ASS management. 9(b) Obtained approval for ASS management plan	

EMERGENCY PROCEDURES AND CONTACTS

In the event of damage to Utility Provider's asset, Main Roads WA asset, Local Government asset or PTA (Rail) asset, the person/Agency responsible for causing the damage shall immediately advise all asset owners affected.

Refer to emergency numbers as follows to be used in Emergency (Hazardous Situations) only:

Fire (Fire, Rescue, Hazardous Material), Police and Ambulance (life threatening) **Dial 000**.

NON LIFE THREATENING

Fire and Emergency Services ..... (08) 9323 9300
Police 131 444
St John Ambulance ..... (08) 9334 1234

GAS PROVIDERS

ATCO Gas..... 13 13 52
APA:
Goldfields Gas Pipeline 1800 151 016
Pilbara Pipeline System..... 1800 625 665
Parmelia Pipeline..... 1800 019 966
Epic Energy 1800 625 665
Land Fill Gas and Power (office) ..... (08) 9475 0144
(Managing Director) 0412 314 002
Dampier Bunbury Natural Gas Pipeline (DBNGP) 1800 019 919
Esperance Gas ..... (08) 9072 1422 or 0429 886 016

POWER PROVIDERS

Western Power 13 13 51
Horizon Power 13 23 51

WATER PROVIDERS

AQWEST
Bunbury Water Corporation ..... (08) 9791 3272
Busselton Water ..... (08) 9781 0500
Water Corporation 13 13 75

SAFETY AUTHORITIES

Worksafe WA ..... (08) 9327 8777
(24hr Accident Reporting) 1800 305 791
Energy Safety WA ..... (08) 9422 5200
(24hr Accident Reporting) 1800 678 198

TELECOM PROVIDERS

AAPT Telecommunications 13 88 86
AMCOM PtyLtd 1800 262 663
Broadcast Engineering Services..... (08) 9248 5200

TELECOM PROVIDERS *(continued)*

Optus 1800 505 777
Telstra 13 22 03
Uecomm Operations Pty Ltd 1800 707 447
Nextgen Group 1800 336 886
Vodaphone ..... (08) 9322 6444

LAND AUTHORITY

Department of Planning, Lands and Heritage ..... (08) 6552 4400
Dampier to Bunbury Natural Gas Pipeline
Corridor only: Infrastructure Corridors (DoL) 0477 723 360

ROAD AUTHORITIES

Local Governments – ..... (Refer to Appendix A for contact number details)
Main Roads WA 138 138

Rail Authorities

Public Transport Authority MetroRail
(24hr Emergency) ..... (08) 9220 9999
Brookfield Rail
Level Crossing Faults 1800 150 107
Midland Train Control 1300 987 246
Avon Train Control 1300 087 246

MISCELLANEOUS

BHP Supply Authority ..... 1800 677 639 or (08) 9175 3303
BP Refinery ..... (08) 9419 9500
Coogee Chemicals 1800 800 655
Co-operative Bulk Handling ..... (08) 9237 9600
Curtin University ..... (08) 9266 9266
or (24hr Security) ..... (08) 9266 4444
Defence, Property Management ..... (08) 9311 2685 or (08) 9311 2680
Fax: ..... (08) 9311 2670
(24 hour emergency) 1300 658 975
Department of Industry and Technology
C/- Zernike Australia Pty Ltd 0408 877 215
Ensite Claude 0414 225 826
Fremantle Ports ..... (08) 9430 3442 or (08) 9335 1300
Pilbara Iron Utilities
(Tom Price) ..... (08) 9143 3271
(Paraburdoo) ..... (08) 9143 4668
(Dampier) ..... (08) 9143 5650
Adshel ..... (08) 9387 7444 or 0438 253 557
People Telecom ..... (08) 9318 6555
(24 hour emergency) 1300 736 877
University of WA ..... (08) 6488 2025

NOTES

NOTES

Appendix I – Previous Geotechnical Report

Australian Government

Department of Infrastructure, Regional Development and Cities

Department of Infrastructure, Regional Development and Cities

Christmas Island Stormwater Remediation Works

Preliminary Geotechnical Report

30 May 2018

Document No: 11980-6135637

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1. Introduction

1.1 Project background

During the 2016 Christmas Island experienced a year with over 5 metre of rain occurring, which was substantially above the average annual rainfall for the island of approximately 2.2 metres annual (BoM Station 200790). During a 6 day period from 11th to the 15th of October 2016 at total of 526.4mm was recorded. During another 5 day period from 27th November to 1st of December in 2017 a total of 501.8mm was recorded. These rainfall event led to the stormwater drainage system of the island being overwhelmed, particularly around the Drumsite area. The overwhelmed drainage system discharged a very large quantity of water down the escarpment between the Drumsite and Kampong residential area along with increased flows on the George Fam Incline, a heritage listed concrete ramp and railway incline, this resulted in significant erosion and a landslip in the areas behind and to the south of the Kampong and Port Mangers facility.

To prevent such an overflow event re-occurring the Department of Infrastructure, Regional Development and Cities (DIRDC), who are responsible for governance and maintenance on Christmas Island, engaged GHD to complete a drainage study and to design improvements to the Drumsite stormwater drainage network. As part of the drainage study and design work, a need for new and/or expanded detention basins and stormwater bunds were identified. To inform the design of the new infrastructure, a geotechnical investigation was undertaken.

1.2 Purpose of this report

The purpose of this report is:

- To document the geotechnical site investigation undertaken;
- Present the data acquired during the site investigation; and
- Present an interpretation of the site investigation data, with geotechnical recommendations and/or comments relevant to the design of the proposed infrastructure.

1.3 Scope of work

The proposed scope of work was set out in GHD's letter to David Nutt of DIRDC dated 16 October 2017. This letter described the recommended "Further field investigations" as comprising:

- Field testing (with backhoe test pitting) of pipe routes.
- Field testing (with backhoe test pitting) of basin sites including:
    - Incline Basin,
    - Basin 1 and 2 within Northern Drumsite,
    - Southern Drumsite basin, and
    - Infiltration testing for basins.
- Laboratory testing of samples suitability for construction and or impact on construction method.
- Reporting on results (this report).

1.4 Limitations

This report has been prepared by GHD for Department of Infrastructure, Regional Development and Cities (DIRDC) and may only be used and relied on by DIRDC for the purpose agreed between GHD and the DIRDC as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other DIRDC arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by DIRDC and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Reference information

2.1 Geological conditions

Christmas Island forms the exposed summit of an isolated volcanic seamount that rises some 4.5 km from the seafloor near the edge of the Java Trench, which marks the margin of the Australian Continental Plate. The core of the island consists mainly of basaltic volcanics of Late Cretaceous age overlain by a sequence of limestones, interbedded volcanics and phosphate rich deposits that range from Eocene to Recent in age. The coastline is mostly comprised of steep cliffs, which rise to a central plateau via a series of gently to steeply sloping escarpments with intervening flat areas commonly referred to as the "terraces". The proposed infrastructure is located on the 4th and 5th terrace levels, at an elevation of about 141 m AHD (Poon Saan site) and 98 m AHD (Silver City site).

The carbonate rock types comprise Eocene to Recent limestones ranging in thickness from tens of metres above the central plateau to in excess of 250 m along the edge of the island. The limestones range in composition from massive skeletal fossil coral to shallow marine calcarenites and calcirudites. The limestones have been variably affected by post-depositional processes, including the formation of solution features and recrystallization that can produce a limestone close to chalk in properties and appearance.

2.2 Proposed design

The proposed design is shown in plan view on Figures 1 to 4. In brief description, the proposed design for infrastructure comprises the following:

- Early works, which involve the construction of a bund along the southern boundary of Nursery Court, between the Ranger Station and Christmas Island Phosphates (CIP) conveyor.
- Construction of a stormwater detention basin south of the Christmas Island school, and the existing stormwater storage basin. This basin is envisaged as being constructed from permeable rockfill, allowing stored water to flow through.
- Construction of two shallow stormwater detention basins near the existing CIP workshop, between Lam Lok Loh and Murray Road, on land currently used as a car park and including associated outlet works.
- Construction of earth structures, channels and drains adjacent to and above the George Fam Incline. These infrastructure are intended to receive the stormwater from the basins near the CIP workshop and convey it to a large, high compensating basin on steeply sloping ground between Silver City and the George Fam Incline.

3. Site description

3.1 Central Drumsite

The site of the proposed central Drumsite works (where significant priority early works for the project are planned) is along Nursery Court, parallel to the existing CIP conveyor and Nursery Road. The proposed design arrangement is shown on Figure 2.

The proposed bund location is currently situated on undeveloped grassy land south of the CIP conveyor. The other (northern) side of Nursery Court contains the Christmas Island nursery, which is a moderately developed area with carpark, administration buildings and planter boxes.

Local topography slopes downhill to the north-west. The eastern end of the proposed early works bund, shown on Figure 2, is downhill from the Christmas Island Ranger Station and abuts near to a drain that flows under Nursery Court, which is elevated on a small bridge to cross the drain. The western end of the proposed early works bund is adjacent to an existing drainage pit and culvert system, intended to convey stormwater across Nursery Row. These drainage pit and culverts are proposed to be significantly upgraded or replaced after the early works programme.

3.2 Southern Drumsite

The proposed south Drumsite basin, to the south of the Christmas Island School and shown in Figure 1, site currently comprises densely vegetated regrowth forest, sitting immediately west to an existing stormwater sump, tennis courts and lawns. To the east north east of the proposed basin site, and 5-10 m higher in elevation, are the school playing fields.

The topography of the basin site slopes down to the west and south-west with a relatively constant grade. The playing fields, school and tennis courts appear to be built on fill pads of re-worked local soils.

3.3 Northern Drumsite

The two proposed northern Drumsite basins are situated to the west of the existing CIP workshop and are to be located on relatively flat ground, Figure 3. The ground surface at these locations is principally chalk gravel (pavement), with the land used as laydown space for sea containers, miscellaneous mine equipment and as a carpark by workshop staff. The south-western end of the site is elevated approximately 0.5 m compared to the pavement area, and is grassy instead of paved with chalk gravel.

The two shallow basins are bounded to the south by Lam Lok Loh and to the north by an embankment adjacent to Murray Road. This embankment supports a concrete footpath and contains Water Corporation distribution pipes.

3.4 Incline basin

The proposed incline basin is located in a regrowth vegetated forest between Poon Saan and the George Fam Incline, shown in Figure 4. The ground is heavily vegetated, significantly more densely vegetated than the South Drumsite location, and incised by drainage gullies. The land generally falls northward (towards the Settlement areas) with natural slopes very steep, reaching approximately 1(V):2(H) in parts. A significant minor catchment drains westward, however eventually drains to the George Fam Incline adjacent Seaview Drive.

The proposed incline basin is oriented roughly east-west, with a north-south oriented saddle dam on the western side. Between the two embankments a limestone ridge or a group of limestone pinnacles were observed during the site visit.

Included in the incline basin area is an earth/concrete ramp on the George Fam Incline and a channel structure that is design to direct and conveys water from near to the CIP area downhill of the conveyor silos to the incline basin for detention.

4. Site investigation

4.1 General

The geotechnical investigation of the proposed drainage infrastructure comprised visual observations, hand auger boreholes, excavation of test pits and a laboratory testing programme.

The site investigation fieldwork was undertaken from 9 January to 13 January 2018 under the direction of a Senior Geotechnical Engineer from GHD and in accordance with Australian Standard AS 1726. Five test pits and twelve hand auger boreholes were undertaken across the various infrastructure locations, named TP01 to TP05 and HA01 to HA12 respectively. All test locations are shown in plan view on Figure 1 to Figure 4.

Each test location's coordinates and the termination depths are summarised in Table 1 below. The test locations were recorded using a hand held GPS assumed to be accurate to ± 5 m.

Table 1 Summary of site test locations

Test Location	Easting	Northing	Termination Depth (m)	Reason for Termination
TP01	573797.7846	8846919.151	1.7	Refusal
TP02	573812.600	8846937.364	1.25	Refusal
TP03	573868.112	8846962.862	0.85	Refusal
TP04	573092.541	8846235.640	1.9	Refusal
TP05	573077.044	8846239.912	1	Refusal
HA01	573119.474	8846204.438	0.32	Refusal
HA02	573101.609	8846210.189	3	End of Reach
HA03	573094.663	8846203.938	1.1	Refusal
HA04	573066.981	8846225.743	1.1	Refusal
HA05	573985.090	8847239.048	0.11	Refusal
HA06	573984.457	8847198.874	0.23	Refusal
HA07	573793.588	8846918.607	0.23	Refusal
HA08	573985.659	8847334.509	1	Target Depth
HA09	573970.257	8847383.75	0.7	Refusal
HA10	573972.327	8847413.41	2	Target Depth
HA11	573227.308	8846646.19	0.7	Refusal
HA12	573317.523	8846692.39	0.18	Refusal

4.2 Hand auger drilling

Due to the difficult or constrained access to most of the proposed infrastructure locations, hand auger boreholes were used as the primary field investigation tool. A 75 mm diameter hand auger with 2 m of extension rods (allowing a maximum 3 m deep hole) was used by GHD to perform the hand auger drilling for the project.

Twelve hand augers were completed, named HA01 to HA12 in order of their completion. All test locations are shown in plan view on Figure 1 to Figure 4.

Ten hand augers were terminated by refusal on rock or similar hard horizon. One hand auger (HA08) was terminated at its target depth of 1 m, while one other (HA02) was terminated at 3 m depth due to the limit of reach.

4.3 Infiltration tests

Infiltration tests were undertaken in two hand auger boreholes – HA04 and HA10. Infiltration tests involve the push-in insertion of a solid PVC pipe into the material forming the base of the hand auger borehole, filling the pipe with water and then measuring the head in the pipe over time.

The infiltration test in HA10 was terminated at 11 minutes after a tree branch fell on the pipe, knocking it askew and invalidating the test. The test was not reattempted due to heavy rain and the likelihood of additional water entering the test down annulus between the pipe and borehole void.

4.4 Test pits

Four test pits, named TP01 to TP04 in order of their completion, were undertaken during the test pitting phase of the site investigation. All test locations are shown in plan view on Figure 1 to Figure 4.

All test pits were terminated due to refusal of the 3 tonne Yanmar Vio27 excavator used for the investigation. Refusal was caused by contact with limestone rock or pinnacles.

Test pits were logged by a Senior Geotechnical Engineer from GHD and then photographed. Test pit logs are provided as Appendix B, with test pit photographs presented in Appendix C. Representative samples were obtained from a majority of test pits for subsequent laboratory testing. On completion of sampling and logging, all test pits were backfilled and lightly tamped with the back of the excavator bucket.

4.5 Laboratory testing

A program of laboratory testing was performed on selected samples of soil collected during the field program. The laboratory testing suite was determined based on the conditions encountered during the investigation.

The laboratory testing was carried out at GHD's laboratory in Artarmon, NSW due to import and quarantine restrictions. GHD's Artarmon laboratory is National Association of Testing Authorities (NATA) accredited for the tests undertaken. Laboratory test certificates are presented in Appendix D.

All laboratory tests were conducted in accordance with the relevant Australian Standard. The testing programme included the following:

- Fourteen (14) Particle Size Distribution (PSD) tests.
- Fourteen (14) Plasticity Index tests.

- Two (2) Standard Maximum Dry Density – Optimum Moisture Content (compaction) tests.

Laboratory results are summarised below in Table 2.

Table 2 Laboratory testing summary

Sample Location	Sample Depth	% Fines	% Sand	% Gravel	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	SMDD (t/m^3)	OMC (%)
HA01	0.0 - 0.32	55.2	31.8	13	22	60	10.0		
HA02	0.0 - 1.0	38.5	53.5	8	22	63	9.5		
HA02	1.0 - 2.0	42	43	15	22	59	7.5		
HA02	2.0 - 3.0	49	34	17	21	60	7.5		
HA03	0.0 - 1.0	65.8	21.2	13	19	59	8.0		
HA04	0.0 - 1.0	89.2	7.8	3	34	74	17.0		
HA06	0.0 - 0.23	34.2	30.8	35	4	27	4.0		
HA08	0.0 - 0.4	64.6	31.4	4	7	39	5.0		
HA08	0.4 - 0.5	37.7	61.3	1					
HA09	0.0 - 0.7	62.4	36.6	1	6	41	5.5		
HA10	0.0 - 1.0	67	33	0	5	39	4.0		
HA10	1.0 - 2.0	68.1	31.9	0	7	39	5.0		
TP01	1.2 - 1.7	38.8	34.2	27	17	44	8.5	1.675	23.6
TP04	0.0 - 1.5	95.1	3.9	1	26	64	12.0	1.317	40.1

5. Subsurface conditions

5.1 Central Drumsite

Subsurface conditions at the central Drumsite area were assessed primarily on the basis of two hand auger boreholes (HA11 and HA12) undertaken on the northern (nursery) side of Nursery Court. This is the opposite site of the road to the proposed works. The hand auger boreholes were moved due to the presence of power lines, a water pipe and the CIP conveyor which restricted safe access to the southern side of Nursery Court. Subsurface conditions are not expected to be appreciably different on either side of Nursery Court.

HA11 was situated at approximately the midpoint of the central Drumsite works, refusing at 0.7 m depth on limestone. From a hand auger borehole it is not possible to distinguish a limestone boulder or pinnacle from a more widely distributed layer of rock. Above the limestone, red-brown high plasticity silt was identified.

HA12 was drilled further north-west than the central Drumsite works area, near the intersection with a short bridge over a drainage culvert, and refused on limestone gravel and wood fragments at 0.18 m depth. From the ground surface to refusal depth HA12 encountered clayey sand fill material, with limestone gravel, roots and organic matter.

Laboratory testing was not undertaken on soils recovered from the central Drumsite area.

5.2 South Drumsite

The southern Drumsite area subsurface was investigated primarily on the basis of four hand auger boreholes, HA01 to HA04, and two test pits (TP04 and TP05). HA01 was situated at the eastern boundary, near to the proposed tie-in point with the playing fields. HA04 was situated at the western boundary, near to the proposed outlet works. HA02 and HA03 investigated the interior of the proposed basin. TP04 and TP05 were situated on the northern margins of the proposed southern Drumsite basin, where access could be achieved without clearing of vegetation.

Three of the four hand augers refused on limestone, at depths between 0.32 m (HA01) and 1.1 m (HA03 and HA04). HA02 was terminated at 3 m depth at the limit of reach. TP04 refused on limestone at 1.9 m while TP05 encountered refusal at 1 m depth, also on limestone.

All geotechnical investigation points within the southern Drumsite project area encountered similar conditions – a red-brown coloured high plasticity silt or sandy silt with trace amounts of limestone gravel. Limestone is present throughout the project subsurface, appearing to be randomly distributed in plan extent and depth. Approximately centrally in the basin footprint, a large stockpile of limestone boulders was identified, which have likely been placed after excavation elsewhere – possibly the nearby existing school stormwater detention basin.

5.3 Northern Drumsite

The northern Drumsite area was investigated by three test pits (TP01 to TP03) and one hand auger (HA05). HA01 and TP01 were situated at the western end of the northern Drumsite area, with TP02 approximately central and TP03 at the eastern end. All investigations undertaken in the northern Drumsite basin area refused at shallow depth on limestone.

All investigations in the northern Drumsite basin area encountered fill from surface, to a maximum depth of 1.2 m. Two types of fill were encountered near to the ground surface.

At the western end, the fill which appeared to have been placed for landscaping purposes, comprised reworked red-brown high plasticity sandy silt in TP01, TP02 and HA01. This

landscaping fill contained construction and demolition rubble (bricks, derelict pipe, scrap metal etc.). Underlying the silty fill (in TP01 and TP02) was natural material, also comprising red-brown high plasticity silt or sandy silt. Cobbles and boulders of limestone to 400 mm diameter were identified in TP02.

In TP03, within the hardstand and on land used by CIP as a carpark and laydown, the fill comprised creamy white chalk gravel. The gravel became appreciably sandier and less well-graded with depth in TP03, before refusal at 0.85 m depth on limestone.

5.4 Incline basin

5.4.1 Bund

Two hand auger boreholes, HA05 and HA06, were undertaken at the proposed earthfill bund adjacent the George Fam Incline, and appurtenant pits and bunds. Both these boreholes refused at shallow depth on limestone gravel. Prior to refusal, the soil materials encountered in the hand augers were similar – high plasticity sandy silt with limestone gravel. This material could have been reworked (or transported) as part of the George Fam Incline construction and may therefore be classified as fill.

5.4.2 Channel

One hand auger borehole, HA08, was undertaken where proposed channel works are located. HA08 reached target depth of 1 m. This borehole encountered pale brown, firm, low plasticity sandy silt to the base of excavation. A thin layer, markedly sandier than material above and below it, was encountered between 0.4 m and 0.5 m depth.

5.4.3 Basin

Two boreholes, HA09 and HA10 which reached depths of 0.7 m and 2 m respectively were situated in the incline basin area. HA09 refused on limestone rock or a cobble of limestone. HA10 was terminated at 2 m depth (target depth) owing to the practical difficulties of using over 2 m of extension rods in dense tropical forest.

Both boreholes encountered similar subsurface materials – a firm, low plasticity, pale brown sandy silt with a trace of limestone gravel.

Access to the basin site was very difficult, with steep and slippery natural slopes of about 20-25° and dense vegetation. No tracks were present in the area, which complicated access further and made safe access to a majority of the basin with hand-operated equipment impossible. The two hand auger boreholes undertaken were located within the only areas that could be safely accessed.

6. Engineering discussion

6.1 Proposed development

To mitigate significant risk, such as landslides and flooding, in the existing stormwater drainage system around Drumsite additional stormwater detention systems and associated outlet works are proposed for Christmas Island. Design drawings show that work is broken into an “Early Works” package to be undertaken in the 2017-18 financial year, and the balance of the works which will be delivered at a later time. Staging of the works is critical to safe construction and operation, with both the design report and technical specification providing guidance on the recommended staging.

6.2 Geological site model

The geological site model proposed for the project areas is that the site subsurface principally comprises calcarenite limestone, typically in the form of boulders and pinnacles of rock surrounded in a phosphate rich matrix of silt and sandy silt. The soil is considered to be predominantly a weathering product of the original basalt (volcanic) core of the island.

The consistent position of a rock head was not able to be determined with precision based on the available geotechnical data. Most of the hand auger borehole refusals could reasonably be inferred to be caused by pinnacles of limestone, or a boulder of limestone within residual silty soil.

6.3 Geohazards

Christmas Island is known to have two pervasive geohazards. These are:

1. Landslide risk.

Christmas Island experiences occasional landslides and geotechnical instability. In some cases this is the result of natural geological process. In many other cases these natural geological process are accelerated and/or exacerbated by modification of the land.

A landslide risk management programme is operated by Shire of Christmas Island and DIRDC separate to this drainage improvement project. The drainage improvements proposed as part of this project seek to improve the landslide risk profile of Christmas Island, however care may be necessary when cutting into natural slopes and/or devegetating that small landslips do not occur.

2. Limestone voids.

All calcareous rocks such as limestone are prone to forming dissolution voids, where the rock mass has been dissolved by flowing water over time. Voids are known to exist within the Christmas Island limestone, although none of significance are known to be within the project area.

The presence of limestone voids near to any of the proposed project infrastructure could lead to sudden collapse beneath earthmoving plant or cranes during construction, the sudden large movement of civil infrastructure under design load, or the progressive subsidence of infrastructure over time as material is transported by percolation of surface water into deeper voids.

6.4 Subsurface permeability

The single valid falling head infiltration test completed, in HA04, was analysed using models proposed by Hvorslev (1951). The analysis determined a field permeability of 1.9 x 10^{-6} m/s, or 0.16 m/day. This value is considered reasonably likely to be representative of the in-situ sandy silt and silt materials encountered during the site investigation.

If the in-situ sandy silt or silt is excavated, reworked and compacted then a lower permeability could be expected.

6.5 Geotechnical properties for design

Geotechnical properties relevant to the ground materials encountered that are recommended for design of engineered structures are set out below in Table 3.

Table 3 Recommended geotechnical properties for design

Geotechnical unit	Strength (degrees)	Dry density (t/m^3)	Permeability (m/s)
Silt (in-situ)	Φ' = 25°	1.2	$2x10^{-6}$
Silt (compacted)	Φ' = 27°	1.35	$2x10^{-6}$
Sandy silt (in-situ)	Φ' = 28°	1.6	$2x10^{-6}$
Sandy silt (compacted)	Φ' = 28°	1.65	$1x10^{-6}$
Limestone silty gravel (fill)	Φ' = 32°	1.7	$1x10^{-5}$
Limestone rock	UCS = 2 MPa	1.8	Variable

6.6 Excavations

6.6.1 Materials

Materials likely to be excavated during construction of the Drumsite stormwater improvement works are expected to primarily comprise silt and silty sand, sometimes as reworked local material (fill) and sometimes as natural material. Excavation of the silty material is expected to be achievable using plant appropriate to the size of the excavation.

A significant minor component of excavation materials may be limestone rock material. The geotechnical investigation has been unable to determine where limestone materials that were encountered represent a continuous layer of rocky material, or where the limestone materials are isolated in plan or elevation (e.g. a boulder, or pinnacle of material). Higher capacity earthmoving plant than required for the size of the excavation are likely to be required if a limestone rock layer is encountered, with rock breakers or rock saws possibly necessary for localised excavation. Limestone boulders may require using a rock-pick or similar attachment on excavation plant.

6.6.2 Temporary cut slope angles

All excavation work undertaken for the Drumsite stormwater upgrade project should be compliant with the Australian Code of Practice for Excavations. Spoil from excavations should be placed away from the crest of the excavation a minimum distance equal to the vertical height of the excavation.

Temporary excavation up to 3 m depth in silt or sandy silt (whether fill or natural materials) is likely to be stable at batter slopes of 1(V):1(H). This batter slope angle should be reviewed onsite during excavation and is dependent on the following conditions being met:

- The excavation is above the water table.
- External runoff is diverted away from the excavation and is not permitted to flow down the batters.

Temporary excavations up to 3 m depth in limestone are likely to be stable at batter slopes of 1(V):0.5(H), depending upon the presence of voids or planes of weakness that may become apparent during excavation, and subject to the same requirements as excavation in silt or sandy silt listed above.

Excavations deeper than 3 m in any material may require a different configuration of batters, or engineered trench support such as shoring or trench shields.

If personnel are required to enter temporary excavations then WorkSafe Australia regulations may require additional controls to those stated above, or may require a different configuration of batter slopes.

6.7 Key geotechnical risks

The key geotechnical risks identified at this stage of the project are as follows:

1. Limestone voids. If voids are present at or near to foundation level they have the potential to cause excessively high deformation and/or translation of engineered infrastructure.
2. Landslides. Excavation work on existing sloping ground may trigger, or exacerbate existing, landslide surfaces.
3. Available geotechnical information. The Incline basin embankment was not able to be safely accessed for investigation. This lack of information for a higher hazard structure is a significant geotechnical risk.

7. Recommendations

7.1 Site preparation and earthworks

7.1.1 Site preparation

Site earthworks and construction work should be preceded by appropriate preparation of the ground surface in the area proposed for development. Preparation should include the following as applicable:

- Identification, diversion, and/or protection of any buried services within work areas;
- Stripping of the surface layer of soil that may contain quantities of organic material (e.g. plant roots and seeds) or other deleterious material;
- Protection of adjacent structures prior to excavation, as required; and
- Excavation and removal of any refuse, rubbish and/or localised softened or loose zones of soil identified by visual examination of the stripped ground surface.

7.1.2 Earthworks

Engineered earth fill, where required, should be moisture conditioned to within 2% of its Optimum Moisture Content (OMC) in a stockpile or other bulk source, then placed in loose layers of no greater than 300 mm thickness. Each layer should be compacted with suitable equipment to achieve the greater of 95% of standard maximum dry density (SMDD) or a density index of 75% (if granular). It is recommended that confirmation of compliance with compaction and moisture content requirements be made by field testing using methods such as the Nuclear Density Meter or Sand Replacement Test.

7.2 Excavations

7.2.1 Stability

Excavation for the proposed works is likely to require excavation of limestone rock material or limestone boulders. This may require the use of a rock-breaker and/or higher capacity plant than the excavation depth would normally require.

Temporary excavations should be battered, or supported through the use of an engineered system such as shoring. Batter slopes recommended vary depending on the excavation material, amongst other factors. Recommended batter slopes are provided in Section 6.6.2, along with a discussion on factors that could potentially influence batter slopes.

7.2.2 Reuse of excavated materials

Pipe trench backfill materials should comply with typical industry requirements, as described in AS2566. In general, three zones of material type are required:

- Pipe embedment: comprising the material placed on the base of a trench, or compacted in-situ materials, intended to form a smooth layer for bedding,
- Pipe haunch support and overlay material: comprising material placed on the sides and immediately above a pipe, intended to provide lateral restraint against hoop stress and thermal expansion.
- Trench fill: comprising the bulk refilling of excavations from the top of the pipe overlay to ground level (non-trafficable areas) or to subgrade level (trafficable areas).

Based on the results of the site investigation and the laboratory testing, the majority of materials intersected along the pipeline are generally unsuitable for reuse as pipe embedment, pipe haunch support or pipe overlay material. The principle reason for unsuitability is excessive fines content (i.e. >12% fines).

Suitable site-won materials for pipe bedding, haunch support and overlay is not expected to be identified. Imported material for these purposes will therefore be required for this purpose.

Excavated natural materials are considered suitable for use as trench fill. Site-won natural material is also considered to be generally suitable for use as bulk fill and for use as engineered fill in water-retaining structures such as basins.

It should be noted that the use of clean sand backfill around a pipeline can create an undesirable conduit for water accumulation and / or flow. The designer should consider the construction of a low permeability capping layer to mitigate water infiltration into the sand backfill around the pipeline. The designer should also consider the construction of low permeability conduit barriers at regular intervals over long sections of pipeline and where the pipe grades steeply, to mitigate flow of water within the pipe bedding material. Where pipes penetrate through embankments, concrete encasement should be considered to reduce the risk of internal erosion.

7.2.3 Backfill of excavations

Temporary excavations should be backfilled as soon as reasonably practical, e.g. work should be staged such that progressive backfill of pipe trenches can occur.

Backfill material should be placed in thin layers appropriate to the material and compaction plant available, and then compacted to minimum of 92% SMDD (non-trafficable areas) or 95% SMDD (in trafficable areas).

Where roads and/or pavements have been excavated as part of the works, backfill material should be placed to subgrade level only. Above the subgrade, pavement materials should be placed and compacted to match the adjoining road pavement. Replacement of the seal and bituminous surfacing should follow, to match pre-construction conditions.

7.3 Additional geotechnical investigation

As discussed in Section 5.4.3, safe access for geotechnical investigation to the Incline Basin was not possible. The available geotechnical data for the proposed structure is therefore very limited in this respect and poses one of the key geotechnical risks to the project.

Additional geotechnical investigation for the Incline Basin is therefore recommended, in order to evaluate abutment and foundation conditions. For safe access, it will be necessary to either cut a track through the regrowth tropical forest (probably required for construction purposes anyway) or undertake the investigation after clearing and stripping of the basin and embankment footprint.

Figures

Figure 1 Site Plan (1 of 4)

573000 573050 573100 573150 573200 573250

8846370 8846300 8846230 8846160 8846090

Legend

- Hand Auger Location
- Test Pit Location
- Proposed Drainage
- Proposed Earthworks
- Major Contour (5m)
- Minor Contour (1m)
- Cadastre

EXISTING SCHOOL BASIN

PROPOSED SOUTHERN BASIN

TP04 TP05

HA01 HA02 HA03 HA04

Murray Rd

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 48

N

Australian Government
Department of Infrastructure, Regional Development and Cities

GHD

The Department of Infrastructure, Regional Development and Cities
Christmas Island Stormwater Remediation Works

Site Plans - Southern Drumsite

Project No. 61-35637
Revision No. 0
Date 30/05/2018

FIGURE 1

G:\61\35637\GIS\Maps\Working\Site Plans Rev 0\61135637_SitePlans_Rev0.mxd
Print date: 30 May 2018 - 14:28

Data source: GHD: Proposed Drainage Pipes, Proposed Earthworks - 20180529; DIRD: Contour, Imagery, Cadastre, Road - 2017. Created by: artermulo

Figure 2 Site Plan (2 of 4)

573150 573200 573250 573300 573350 573400

8846790 8846720 8846650 8846580 8846510

Legend

- Hand Auger Location
- Proposed Drainage
- Proposed Earthworks
- Major Contour (5m)
- Minor Contour (1m)
- Cadastre

TERRITORY DAY PARK

EXISTING OUTLET

TERRITORY PARK BUNDING AND PIPE UPGRADE

CENTRAL DRUMSITE DRAINAGE UPGRADE

HA11

HA12

Nursery Ct

Murray Rd

Tutor Cl

Sin Sang Rd

Mine Office Access Rd

Jalan Ketam Merah

Lam Lok Loh

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 48

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Christmas Island Stormwater Remediation Works

Site Plans - Central Drumsite

Project No. 61-35637
Revision No. 0
Date 30/05/2018

FIGURE 2

G:\61\35637\GIS\Maps\Working\Site Plans Rev 0\61\35637_SitePlans_Rev0.mxd
Print date: 30 May 2018 - 14:25

Data source: GHD: Proposed Drainage Pipes, Proposed Earthworks - 20180529; DIRD: Contour, Imagery, Cadastre, Road - 2017. Created by: artermulo

Figure 3 Site Plan (3 of 4)

573700 573750 573800 573850 573900 573950

8847070 8847000 8846930 8846860 8846790

Legend

- Hand Auger Location
- Test Pit Location
- Proposed Drainage
- Proposed Earthworks
- Major Contour (5m)
- Minor Contour (1m)
- Cadastre

CIP WORKSHOP

PROPOSED NORTH DRUMSITE BASIN 2

PROPOSED NORTH DRUMSITE BASIN 1

NORTHERN DRUMSITE

DRUMSITE VILLAGE

Murray Rd

Lam Lok Loh

Tong Yan Loh

Sung Miaw Low

Jalan Ketam Merah

HA07 TP01 TP02 TP03

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 48

N

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The Department of Infrastructure, Regional Development and Cities
Christmas Island Stormwater Remediation Works

Site Plans - Northern Drumsite

Project No. 61-35637
Revision No. 0
Date 30/05/2018

FIGURE 3

G:\61\35637\GIS\Maps\Working\Site Plans Rev 0\61135637_SitePlans_Rev0.mxd
Print date: 30 May 2018 - 14:21

Data source: GHD: Proposed Drainage Pipes, Proposed Earthworks - 20180529; DIRD: Contour, Imagery, Cadastre, Road - 2017. Created by: artermulo

Figure 4 Site Plan (4 of 4)

573850 573900 573950 574000 574050 574100

8847490 8847420 8847350 8847280 8847210 8847140

Legend

- Hand Auger Location
- Proposed Drainage
- Proposed Earthworks
- Major Contour (5m)
- Minor Contour (1m)
- Cadastre

HA10

HA09

HA08

HA05

HA06

PROPOSED INCLINE BASIN

PROPOSED INCLINE DIVERSION

CIP DIVERSION

Murray Rd

Paper Size ISO A3

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 48

N

Australian Government
Department of Infrastructure, Regional Development and Cities

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The Department of Infrastructure, Regional Development and Cities
Christmas Island Stormwater Remediation Works

Site Plans - George Fam Incline

Project No. 61-35637
Revision No. 0
Date 30/05/2018

FIGURE 4

G:\61\35637\GIS\Maps\Working\Site Plans Rev 0\61135637_SitePlans_Rev0.mxd
Print date: 30 May 2018 - 14:18

Data source: GHD: Proposed Drainage Pipes, Proposed Earthworks - 20180529; DIRD: Contour, Imagery, Cadastre, Road - 2017. Created by: artermulo

Appendices

Appendix A – Hand auger borehole logs

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA01**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 119, N 8846 204
Ground Surface Elevation:
Total Depth: 0.3m
Commenced: 10-Jan-18 **Completed:** 10-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	10-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments
					CI	CLAY (CI) Reddish brown, medium plasticity, with fine to coarse grained sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with rootlets	M (W>Wp)	F-St	0.00		
		0.32							0.32		
	Groundwater not encountered					Termination Depth = 0.32m (Refusal)					
1											
2											
3											

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HAND AUGER LOG

Location No.: **HA02**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 102, N 8846 210
Ground Surface Elevation:
Total Depth: 3.0m
Commenced: 10-Jan-18 **Completed:** 11-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	11-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
1	Groundwater not encountered				CI	CLAY (CI) Reddish brown, medium plasticity, with fine to coarse grained sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with rootlets No gravel between 0.4 m and 0.9 m	M (W>Wp)	F-St St	0.00 1.00 1.00			1
2									2.00 2.00			2
3		3.00				Termination Depth = 3m (End of Reach)			3.00			3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

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HAND AUGER LOG

Location No.: **HA03**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 095, N 8846 204
Ground Surface Elevation:
Total Depth: 1.1m
Commenced: 11-Jan-18 **Completed:** 11-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	11-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
1	Groundwater not encountered	1.10			CI	CLAY (CI) Reddish brown, medium plasticity, with fine to coarse grained sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with rootlets From 0.2 m, gravel content becomes trace fine grained angular limestone gravel From 0.4 m, no rootlets From 0.7 m, gravel content becomes with fine grained angular limestone gravel	M (W>Wp)	F-St	0.00 1.00 1.00 1.10			1
2						Termination Depth = 1.1m (Refusal)						2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

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HAND AUGER LOG

Location No.: **HA04**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 067, N 8846 226
Ground Surface Elevation:
Total Depth: 1.1m
Commenced: 11-Jan-18 **Completed:** 11-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	11-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments
1	Groundwater not encountered	1.10			CI	CLAY (CI) Reddish brown, medium plasticity, with fine to coarse grained sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with roots and rootlets From 0.3 m, no roots or rootlets At 0.8 m, a 5 mm diameter root encountered	M (W>Wp)	F-St St	0.00 1.00 1.00 1.10		
2						Termination Depth = 1.1m (Refusal)					
3											

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

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HAND AUGER LOG

Location No.: **HA05**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 985, N 8847 239
Ground Surface Elevation:
Total Depth: 0.1m
Commenced: 11-Jan-18 **Completed:** 11-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	11-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					CI	FILL (CI)	M (W>Wp)	St	0.00			
		0.11				Pale brown, medium plasticity gravelly clay, gravel comprises fine to coarse grained angular limestone fragments, with fine to coarse grained sand (comprising limestone fragments), with roots and minor organics			0.11			
	Groundwater not encountered					Termination Depth = 0.11m (Refusal)						
1												1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

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HAND AUGER LOG

Location No.: **HA06**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 984, N 8847 199
Ground Surface Elevation:
Total Depth: 0.2m
Commenced: 11-Jan-18 **Completed:** 11-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	11-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					CI	SANDY CLAY (CI) Pale greyish brown, medium plasticity, fine to coarse grained angular sand (comprising fragments of limestone), with fine to coarse grained angular limestone gravel, with rootlets, trace organics	M (W>Wp)	St	0.00			
		0.23				Gravel content increases, grades coarser with depth (medium and coarse grained at 0.2 m) Termination Depth = 0.23m (Refusal)			0.23			
1	Groundwater not encountered											1
2												2
3												3

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HAND AUGER LOG

Location No.: **HA07**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 794, N 8846 919
Ground Surface Elevation:
Total Depth: 0.2m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					CI	FILL (CI) Pale greyish brown, medium plasticity sandy clay, fine to coarse grained angular sand (comprising fragments of limestone), with fine to coarse grained angular limestone gravel, with rootlets, trace organics	M (W>Wp)	St	0.00			
		0.23				Termination Depth = 0.23m (Refusal)			0.23			
1	Groundwater not encountered											1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA08**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 986, N 8847 335
Ground Surface Elevation:
Total Depth: 1.0m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
		0.00			CL	SANDY CLAY (CL) Pale brown-white, low plasticity, fine grained sand, with rootlets and roots to 0.2 m,	M (W>Wp)	F	0.00			
	Groundwater not encountered	0.40			SC	CLAYEY SAND (SC)	M	MD	0.40 0.40			
		0.50			CL	Brown, fine to coarse grained, rounded sand particles, low plasticity fines	M (W>Wp)	F	0.50 0.50			
						SANDY CLAY (CL) Pale brown, low plasticity, fine grained rounded sand From 0.9 m: trace fine grained angular limestone gravel	W (W>Wp)					
1		1.00				Termination Depth = 1m (Target Depth)			1.00			1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA09**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 970, N 8847 384
Ground Surface Elevation:
Total Depth: 0.7m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					CL	SANDY CLAY (CL) or SANDY SILT (ML)? Pale brown-white, low plasticity, fine grained rounded sand	M (W>Wp)	F	0.00 0.70			
	Groundwater not encountered	0.70				Termination Depth = 0.7m (Refusal)						
1												1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA10**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 972, N 8847 413
Ground Surface Elevation:
Total Depth: 2.0m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
1	Groundwater not encountered				CL	SANDY CLAY (CL) or SANDY SILT (ML)? Pale brown-white, low plasticity, fine grained rounded sand	M (W>Wp)	F	0.00 1.00 1.00			1
2		2.00				Termination Depth = 2m (Target Depth)			2.00			2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA11**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 227, N 8846 646
Ground Surface Elevation:
Total Depth: 0.7m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
		0.10			CL	TOPSOIL (CL)	M (W>Wp)	F	0.00			
					CL	Dark brown, low plasticity clay, with roots and rootlets, with organics	M (W>Wp)	F				
						CLAY (CI) Reddish brown, medium plasticity, with fine to coarse grained sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with rootlets Grades less limestone gravel with depth						
		0.70							0.70			
	Groundwater not encountered					Termination Depth = 0.7m (Refusal)						
1												1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

HAND AUGER LOG

Location No.: **HA12**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: **E** 573 318, **N** 8846 692
Ground Surface Elevation:
Total Depth: 0.2m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Equipment Operator: AW

Equipment: 75 mm hand auger, 2 m extension rods

Hole Diameter (mm): 75

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	SMcKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/ Test Records & Comments	Depth Scale (m)
					SC	FILL (SC)	M	MD	0.00			
		0.18				Brown mottled dark brown clayey sand, fine to coarse angular sand (comprising limestone fragments), low plasticity fines, with fine and medium grained angular limestone gravel, with roots and organics			0.18			
	Groundwater not encountered					Termination Depth = 0.18m (Refusal)						
1												1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

Appendix B – Test pit logs

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

TEST EXCAVATION LOG

Test Pit No.: **TP01**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: E 573 798, N 8846 919
Ground Surface Elevation:
Total Depth: 1.7m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Contractor: Acker Pty Ltd **Operator:** Wayne

Equipment: Yanmar Vio27
Bucket Size (m): 0.3

Excavation Width (m): Not Recorded
Excavation Length (m): Not Recorded
Orientation/ Bearing: Not Recorded

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	S McKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
1	Groundwater not encountered	1.2			CI	FILL (CI) Pale greyish-brown, medium plasticity sandy clay, fine to coarse grained angular sand (comprising fragments of limestone), with fine to coarse grained angular limestone gravel, with rootlets, with limestone cobbles to 150 mm, with scrap metal and rubbish, trace organics	M (W>Wp)	St			
		1.7			CI	SANDY CLAY (CI) Brown, medium plasticity, fine to coarse grained angular sand (comprising fragments of limestone), with fine to coarse grained angular limestone gravel	M (W>Wp)	St			
2						Termination Depth = 1.70m (Refusal)					
3											

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

TEST EXCAVATION LOG

Test Pit No.: **TP02**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: **E** 573 813, **N** 8846 937
Ground Surface Elevation: **Total Depth:** 1.3m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Contractor: Acker Pty Ltd **Operator:** Wayne

Equipment: Yanmar Vio27
Bucket Size (m): 0.3
Excavation Width (m): Not Recorded
Excavation Length (m): Not Recorded
Orientation/ Bearing: Not Recorded

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	S McKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
1	Groundwater not encountered	0.5			SP	FILL (SP) Pale yellow-white, fine to coarse grained angular gravelly sand (comprising limestone fragments), with limestone cobbles to 250 mm	M	D				1
		1.3			CI	CLAY (CI) Brown, medium plasticity, with fine to coarse grained angular sand (comprising limestone fragments), with fine to coarse grained angular limestone gravel, with limestone cobbles and boulders to 400 mm	M (W>Wp)	St				
						Termination Depth = 1.25m (Refusal)						
2												2
3												3

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

TEST EXCAVATION LOG

Test Pit No.: **TP03**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: **E** 573 868, **N** 8846 963
Ground Surface Elevation: **Total Depth:** 0.9m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Contractor: Acker Pty Ltd **Operator:** Wayne

Equipment: Yanmar Vio27
Bucket Size (m): 0.3
Excavation Width (m): Not Recorded
Excavation Length (m): Not Recorded
Orientation/ Bearing: Not Recorded

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	S McKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments	Depth Scale (m)
	Groundwater not encountered				GW	FILL (GW) Creamy-white, fine to coarse grained angular sandy gravel (comprising limestone fragments), fine to coarse grained sand, with limestone cobbles to 150 mm	M	D				
		0.5			GP	FILL (GP) White, medium and coarse grained angular sandy gravel (comprising limestone fragments), brown fine to coarse grained sand	M	D				
		0.9				Termination Depth = 0.85m (Refusal)						
1												1
2												2
3												3

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

TEST EXCAVATION LOG

Test Pit No.: **TP04**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: **E** 573 093, **N** 8846 236
Ground Surface Elevation: **Total Depth:** 1.9m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Contractor: Acker Pty Ltd **Operator:** Wayne

Equipment: Yanmar Vio27
Bucket Size (m): 0.3

Excavation Width (m): Not Recorded
Excavation Length (m): Not Recorded
Orientation/ Bearing: Not Recorded

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	S McKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
1	Groundwater not encountered				Cl	CLAY (Cl) Brown, medium plasticity, with fine to coarse grained angular sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with roots and rootlets No rootlets, less roots below 0.4 m	M (W>Wp)	St			
		1.9				Termination Depth = 1.90m (Refusal)					
2											
3											

GHD | MANAGEMENT ENGINEERING ENVIRONMENT | GHD Pty Ltd 239 Adelaide Tce Perth WA 6004

TEST EXCAVATION LOG

Test Pit No.: **TP05**

Sheet 1 of 1

Client: Dept of Infrastructure, Regional Devel't and Cities
Project: Drumsite Stormwater Remediation
Job No.: 6135637

Coordinates: **E** 573 077, **N** 8846 240
Ground Surface Elevation: **Total Depth:** 1.0m
Commenced: 12-Jan-18 **Completed:** 12-Jan-18
Contractor: Acker Pty Ltd **Operator:** Wayne

Equipment: Yanmar Vio27
Bucket Size (m): 0.3

Excavation Width (m): Not Recorded
Excavation Length (m): Not Recorded
Orientation/ Bearing: Not Recorded

Logged:	AWalker	12-Jan-18
Processed:	AWalker	30-May-18
Checked:	S McKean	30-May-18

Depth Scale (m)	Water	Depth (m)	Geological Unit	Graphic Log	Classification	Strata Description (type; colour; fines plasticity or particle characteristics; minor components; structure and/or origin)	Moisture Condition	Consistency/ Relative Density	Sample Type & Depth	Sample No.	Sample/Test Records & Comments
1	Groundwater not encountered	1.0			Cl	CLAY (Cl) Brown, medium plasticity, with fine to coarse grained angular sand (comprising limestone fragments), with fine and medium grained angular limestone gravel, with roots and rootlets No rootlets, less roots below 0.4 m	M (W>Wp)	St			
						Termination Depth = 1.00m (Refusal)					
2											
3											

GENERAL LOG 6136136567 - GEOTECHNICAL LOGS.GPJ GHDPER.GDT 30/5/18

Appendix C – Test pit photographs

Above: TP 01

Above: TP 02

GHD GEOTECHNICS

GHD Pty Ltd
239 Adelaide Terrace Perth WA 6004
PO Box Y3106 Perth WA 6832
T 61 8 6222 8222 F61 8 6222 8555
E permail@ghd.com.auwww.ghd.com.au

Drawn: A Walker	Date: 21/05/18	Job Number: 61/36567	A4	Title: TEST PIT PHOTOGRAPHS
Checked: S McKean	Date: 24/05/18			
Revision: 0	Date: 25/05/18	Cad Reference: N/A		

This drawing should be read in conjunction with report number 61\35637-REP-GT-0001

Client: Dept of Infrastructure, Regional Devel't and Cities

Project: Christmas Island Stormwater Upgrade

Figure No:

Above: TP 03

Above: TP04

GHD GEOTECHNICS

GHD Pty Ltd
239 Adelaide Terrace Perth WA 6004
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Drawn: A Walker	Date: 21/05/18	Job Number: 61/36567	A4	Title: TEST PIT PHOTOGRAPHS
Checked: S McKean	Date: 24/05/18			
Revision: 0	Date: 25/05/18	Cad Reference: N/A		

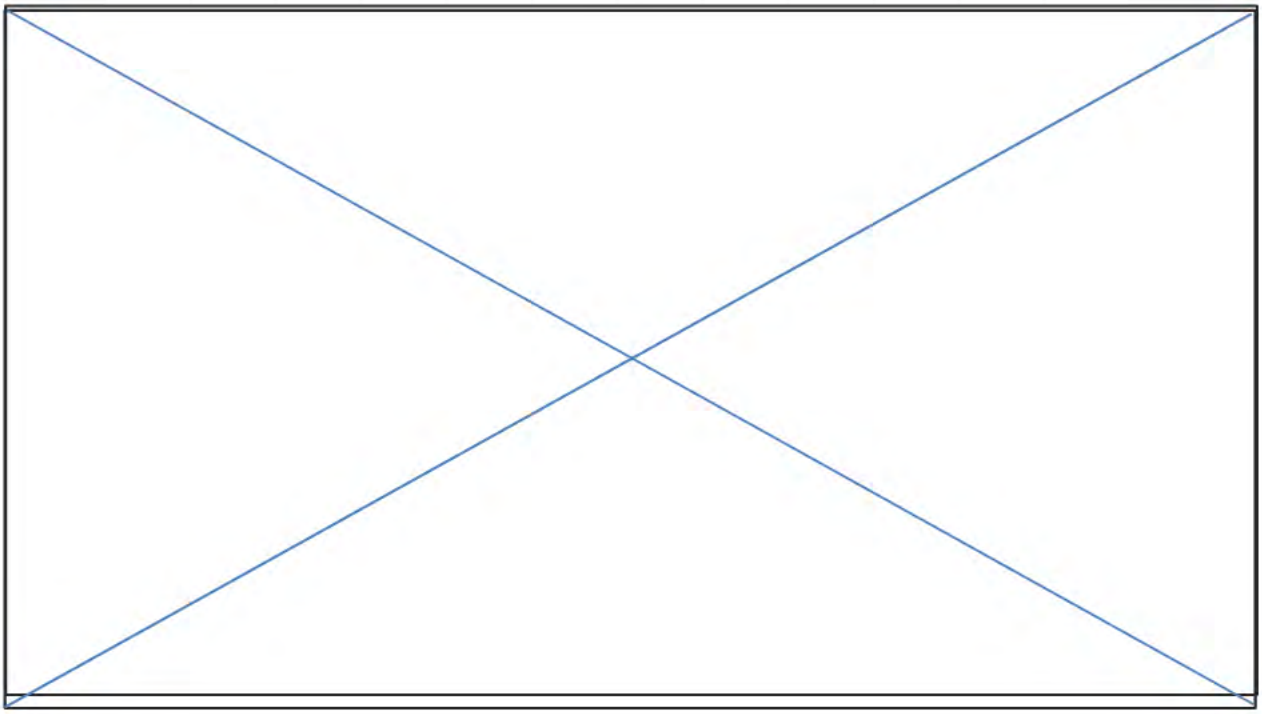
This drawing should be read in conjunction with report number 61\35637-REP-GT-0001

Client: Dept of Infrastructure, Regional Devel't and Cities

Project: Christmas Island Stormwater Upgrade

Figure No:

Above: TP 05



GHD GEOTECHNICS
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Drawn: A Walker	Date: 21/05/18	Job Number: 61/36567	A4	Title: TEST PIT PHOTOGRAPHS
Checked: S McKean	Date: 24/05/18			
Revision: 0	Date: 25/05/18	Cad Reference: N/A		

This drawing should be read in conjunction with report number 61\35637-REP-GT-0001

Client: Dept of Infrastructure, Regional Devel't and Cities

Project: Christmas Island Stormwater Upgrade

Figure No:

Appendix D – Laboratory test certificates

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1800345
Issue No: 1
This report replaces all previous issues of report no 'SYD1800345'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-01
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA01
Depth (m)	0.0 - 0.32
Soil Description	Sandy SILT: trace gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.0	
Mould Length (mm)		125.1	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	60	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	38	
Plasticity Index (%)	AS 1289.3.3.1	22	
Date Tested		28/02/2018	

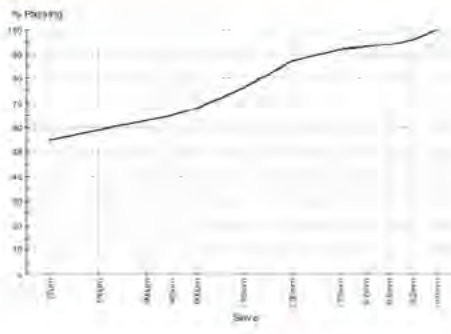
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	96	
9.5mm	94	
6.7mm	93	
4.75mm	92	
2.36mm	87	
1.18mm	76	
600µm	68	
425µm	65	
300µm	63	
150µm	59	
75µm	55	

Chart



Comments

N/A

Sydney Laboratory
Unit 5/43 Herbert St
Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1800346
Issue No: 1
This report replaces all previous issues of report no 'SYD1800346'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-02
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA02
Depth (m)	0.0 - 1.0
Soil Description	Sandy SILT: trace gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.5	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	63	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	41	
Plasticity Index (%)	AS 1289.3.3.1	22	
Date Tested		28/02/2018	

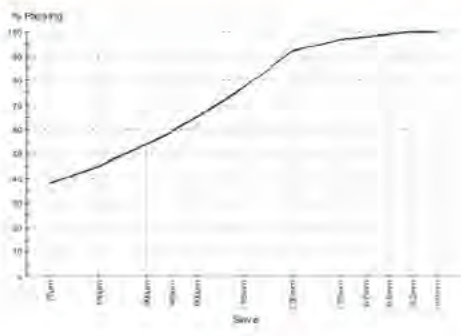
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	100	
9.5mm	99	
6.7mm	98	
4.75mm	97	
2.36mm	92	
1.18mm	77	
600µm	65	
425µm	59	
300µm	54	
150µm	45	
75µm	38	

Chart



Comments

N/A

Sydney Laboratory
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Artarmon NSW 2064
email: artarmon@ghd.com.au
web: www.ghd.com.au/ghdgeotechnics
Tel: (02) 9462 4860
Fax:(02) 9462 4710

Aggregate/Soil Test Report

Report No: SYD1800347
Issue No: 1
This report replaces all previous issues of report no 'SYD1800347'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-03
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA02
Depth (m)	1.0 - 2.0
Soil Description	Sandy SILT: with gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	59	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	37	
Plasticity Index (%)	AS 1289.3.3.1	22	
Date Tested		28/02/2018	

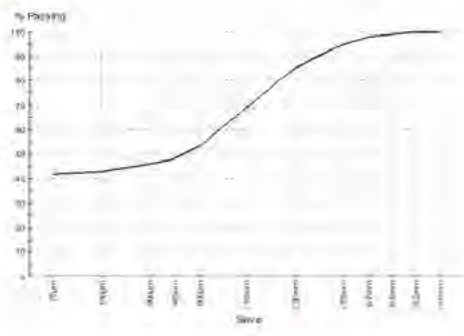
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	100	
9.5mm	99	
6.7mm	98	
4.75mm	95	
2.36mm	85	
1.18mm	69	
600µm	53	
425µm	48	
300µm	46	
150µm	43	
75µm	42	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800348
Issue No: 1
This report replaces all previous issues of report no 'SYD1800348'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-04
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA02
Depth (m)	2.0 - 3.0
Soil Description	Sandy SILT: with gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	60	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	39	
Plasticity Index (%)	AS 1289.3.3.1	21	
Date Tested		28/02/2018	

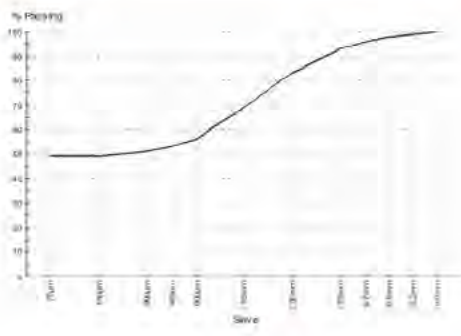
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	99	
9.5mm	98	
6.7mm	96	
4.75mm	93	
2.36mm	83	
1.18mm	69	
600µm	56	
425µm	53	
300µm	51	
150µm	49	
75µm	49	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800349
Issue No: 1
This report replaces all previous issues of report no 'SYD1800349'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-05
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA03
Depth (m)	0.0 - 1.0
Soil Description	SILT: trace sand & gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	59	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	40	
Plasticity Index (%)	AS 1289.3.3.1	19	
Date Tested		28/02/2018	

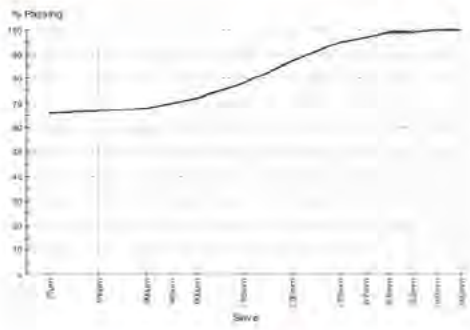
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	100	
13.2mm	99	
9.5mm	99	
6.7mm	97	
4.75mm	95	
2.36mm	87	
1.18mm	78	
600µm	72	
425µm	70	
300µm	68	
150µm	67	
75µm	66	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800350
Issue No: 1
This report replaces all previous issues of report no 'SYD1800350'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-06
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA04
Depth (m)	0.0 - 1.0
Soil Description	SILT: trace sand

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	17.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	74	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	40	
Plasticity Index (%)	AS 1289.3.3.1	34	
Date Tested		6/03/2018	

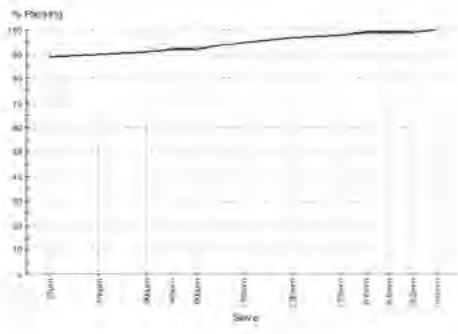
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	99	
9.5mm	99	
6.7mm	99	
4.75mm	98	
2.36mm	97	
1.18mm	95	
600µm	92	
425µm	92	
300µm	91	
150µm	90	
75µm	89	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800351
Issue No: 1
This report replaces all previous issues of report no 'SYD1800351'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-07
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA06
Depth (m)	0.0 - 0.23
Soil Description	Silty sandy GRAVEL (see comments)

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.2	27	
Method		One Point	
Plastic Limit (%)	AS 1289.3.2.1	23	
Plasticity Index (%)	AS 1289.3.3.1	4	
Date Tested		6/03/2018	

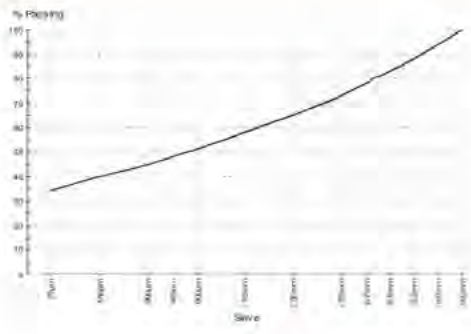
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	94	
13.2mm	88	
9.5mm	83	
6.7mm	78	
4.75mm	73	
2.36mm	65	
1.18mm	58	
600µm	51	
425µm	48	
300µm	45	
150µm	40	
75µm	34	

Chart



Comments

Small sample - Insufficient sample mass to comply with minimum mass requirements AS1289 1.1

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Aggregate/Soil Test Report

Report No: SYD1800353
Issue No: 1
This report replaces all previous issues of report no 'SYD1800353'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-09
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA08
Depth (m)	0.0 - 0.4
Soil Description	Sandy SILT

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	39	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	32	
Plasticity Index (%)	AS 1289.3.3.1	7	
Date Tested		6/03/2018	

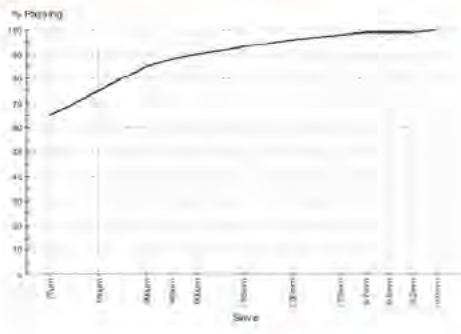
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	99	
9.5mm	99	
6.7mm	99	
4.75mm	98	
2.36mm	96	
1.18mm	93	
600µm	90	
425µm	88	
300µm	85	
150µm	75	
75µm	65	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800354
Issue No: 1
This report replaces all previous issues of report no 'SYD1800354'.

Client:
Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

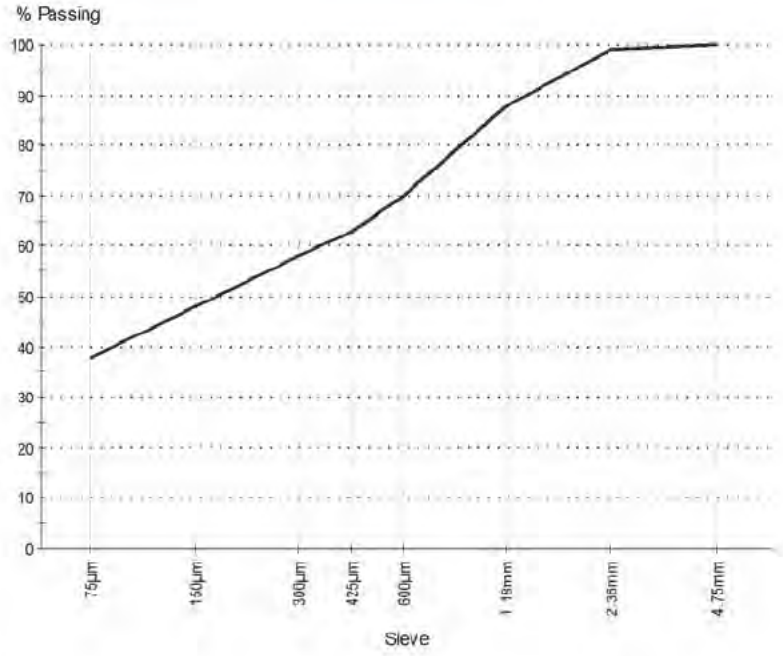
Sample Details

GHD Sample No	SYD18-0058-10
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA08
Depth (m)	0.4 - 0.5
Soil Description	Sandy SILT (visual assessment of plasticity)

Other Test Results

Description	Method	Result	Limits

Particle Size Distribution



Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
4.75mm	100	
2.36mm	99	
1.18mm	88	
600µm	70	
425µm	63	
300µm	58	
150µm	48	
75µm	38	

Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800355
Issue No: 1
This report replaces all previous issues of report no 'SYD1800355'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-11
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA09
Depth (m)	0.0 - 0.7
Soil Description	Sandy SILT

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.5	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	41	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	35	
Plasticity Index (%)	AS 1289.3.3.1	6	
Date Tested		6/03/2018	

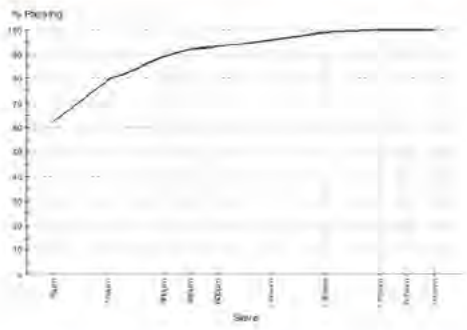
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	99	
1.18mm	96	
600µm	93	
425µm	92	
300µm	89	
150µm	79	
75µm	62	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800356
Issue No: 1
This report replaces all previous issues of report no 'SYD1800356'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-12
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA10
Depth (m)	0.0 - 1.0
Soil Description	Sandy SILT

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	39	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	34	
Plasticity Index (%)	AS 1289.3.3.1	5	
Date Tested		7/03/2018	

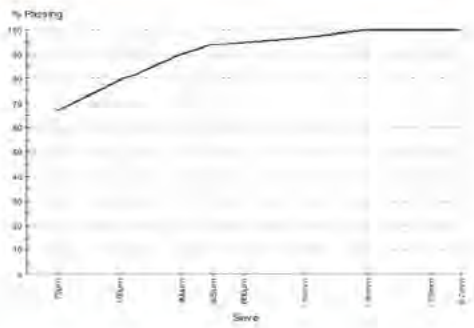
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
6.7mm	100	
4.75mm	100	
2.36mm	100	
1.18mm	97	
600µm	95	
425µm	94	
300µm	90	
150µm	79	
75µm	67	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800357
Issue No: 1
This report replaces all previous issues of report no 'SYD1800357'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-13
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	HA10
Depth (m)	1.0 - 2.0
Soil Description	Sandy SILT

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	39	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	32	
Plasticity Index (%)	AS 1289.3.3.1	7	
Date Tested		7/03/2018	

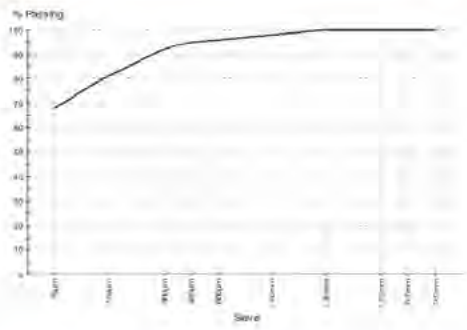
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 20/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	100	
1.18mm	98	
600µm	96	
425µm	95	
300µm	92	
150µm	81	
75µm	68	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800359
Issue No: 1
This report replaces all previous issues of report no 'SYD1800359'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-15
Client Sample ID	TP01@ 1.2-1.7m
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	TP01
Depth (m)	1.2 - 1.7
Soil Description	Sandy SILT with gravel

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.5	
Mould Length (mm)		125	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	44	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	27	
Plasticity Index (%)	AS 1289.3.3.1	17	
Date Tested		7/03/2018	
Standard Maximum Dry Density (t/m³)	AS 1289.5.1.1	1.68	
Standard Optimum Moisture Content (%)		23.5	
Retained Sieve 19.0mm (%)		8	
Compactive Effort		Standard	
Date Tested		2/03/2018	

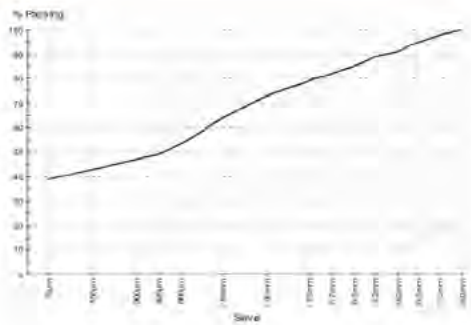
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven
Date Tested: 23/03/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
53.0mm	100	
37.5mm	98	
26.5mm	95	
19.0mm	91	
13.2mm	89	
9.5mm	85	
6.7mm	82	
4.75mm	79	
2.36mm	73	
1.18mm	64	
600µm	53	
425µm	49	
300µm	47	
150µm	43	
75µm	39	

Chart



Comments

N/A

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Aggregate/Soil Test Report

Report No: SYD1800360
Issue No: 1
This report replaces all previous issues of report no 'SYD1800360'.

Client: Dep't of Infrastructure & Regional Development
Christmas Island Stormwater
Christmas Island

Project: 6135637/01

Accredited for compliance with ISO / IEC 17025 - Testing

NATA Accredited Laboratory Number: 679

Approved Signatory: D.P Brooke (Sydney Laboratory Manager)

Date of Issue: 8/03/2018

Sample Details

GHD Sample No	SYD18-0058-16
Date Sampled	10/01/2018
Sampled By	Sampled by GHD
BH / TP No.	TP04
Depth (m)	0.0 - 1.5
Soil Description	SILT

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	12.0	
Mould Length (mm)		125.2	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	64	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	38	
Plasticity Index (%)	AS 1289.3.3.1	26	
Date Tested		7/03/2018	
Standard Maximum Dry Density (t/m³)	AS 1289.5.1.1	1.32	
Standard Optimum Moisture Content (%)		40.0	
Retained Sieve 19.0mm (%)		1	
Compactive Effort		Standard	

Particle Size Distribution

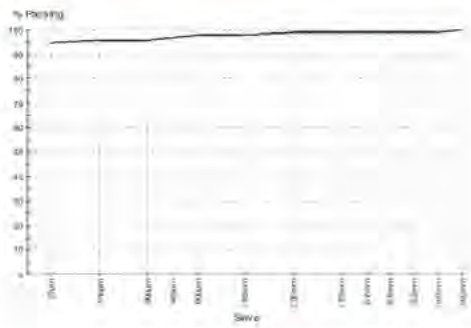
Method: AS 1289.3.6.1

Date Tested: 23/02/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
26.5mm	100	
19.0mm	99	
13.2mm	99	
9.5mm	99	
6.7mm	99	
4.75mm	99	
2.36mm	99	
1.18mm	98	
600µm	98	
425µm	97	
300µm	96	
150µm	96	
75µm	95	

Chart



Comments

N/A

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6135637-72894/https://projects.ghd.com/oc/WesternAustralia/christmasislandstorm/Delivery/Documents/61-35637-REP-GT-0001.docx

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		Name	Signature	Name	Signature	Date
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A	S Cleary M Craft B Kirby A Walker C Maekivi R Paul P Hulcup I Pexton	J Mackay S Cleary T Tucak S McKean E Bishop	Timothy Tucak Digitally signed by Timothy Tucak Date: 2020.11.20 12:21:06 +08'00'	P Seman	P. A. Seman	20/11/20

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