Appendix – Forms A-I

Transport and Main Roads Specifications

MRTS16 Landscape and Revegetation Works

July 2017

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# Form A – Soil Management Plan - Construction

The Contractor shall prepare a Soil Management Plan – Construction using this form.

|  |  |  |  |
| --- | --- | --- | --- |
| Project Name |  | | |
| Contract No. |  | Date |  |
| Site Description |  | | |
| Prepared by |  | | |

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| --- | --- | --- |
| 1 Topsoil volumes assessment |  | m³ |
| Total scheduled volume of topsoil. |  | m³ |
| Estimated total volume of potentially¹ suitable site topsoil, as per Clause 8.2 Topsoil Stripping Dimensions, of MRTS04 General Earthworks. |  | m³ |
| If shortfall in site topsoil, estimated volume of topsoil to be imported. |  | m³ |
| If surplus of site topsoil, estimated volume of topsoil to be disposed. |  | |
| If shortfall in suitable site topsoil¹, the Contractor may provide a proposal to adjust the areas and / or depths to be stripped; or where this is not practicable, propose to import topsoil – | | |
| If surplus in site topsoil, the Contractor shall treat material in accordance with Clause 8.4.2 Surplus Material of MRTS04 General Earthworks, or provide a proposal to avoid surplus volumes by reducing areas to be stripped and / or depths of stripping – | | |

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| 2 Integrated soil management activities  The Contractor shall describe how topsoil and subsoil operations will be integrated with the requirements and associated operations of each of the following documents: |
| Road Construction Program - including stripping depths and locations, topsoil stockpile locations, amelioration, road embankment construction, ground work operations, and placement of soil – |
| Environmental Management Plan (Construction) – in particular acid sulphate soils, contaminated soils, red imported fire ants, water quality and erosion and sediment control operations – |
| Other documents – |

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| 3 Amelioration program and operations  The Contractor shall refer to the Soil Assessment Report(s) and provide a soil amelioration program and describe the amelioration operations for each of the following materials: |
| Stripped topsoil stockpiles – |
| Subsoil (broadacre area subsoils in areas to be vegetated) – |
| Subsoil (cut and fill batters to be vegetated): |

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| 4 Appendix A – Soil Management Plan – Construction Site Plans  The Contractor shall include in Appendix A site plan/s (drawing/s) showing:  Topsoil  areas specified not to be stripped of topsoil / not to be disturbed  stockpile locations and stockpile identification numbers  stockpiles to be disposed of on / off site  if disposing of topsoil on site, location and footprint of disposal site  amelioration agents and application rates per stockpile as per Soil Assessment Report  Subsoil  batters not specified to be treated with a vegetation treatment  cut and fill batter identification number  location of each subsoil sampling location  amelioration agents and application rates for subsoil areas as per Soil Assessment Report |

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| 5 Appendix B – Soil Assessment Report(s)  The Contractor shall include a Form B – Soil Assessment Report and the associated test form per sample as follows: | |
| Form / Set of Tests | Material to be Tested / Managed |
| Form C – Topsoil Testing | * stockpiled site topsoil * imported topsoil |
| Form D – Manufactured Site Topsoil Compliance Testing | * compliance testing of stockpiled site topsoil after amelioration |
| Form E – Subsoil Testing | * subsoil |
| Form F – Drainage Basin Soil Testing | * soil used in basins |
| Where organic soil conditioner is to be used as a soil ameliorant and / or where an organics blanket is specified, the Contractor shall include: | |
| Form G – Organic Soil Conditioner Testing | * organic soil conditioner and organics blankets |
| Where non-potable water is proposed, the Contractor shall include: | |
| Form H – Non-potable Water Management Plan | * dam * bore * creek / river * lake water |
| Form I – Non-potable Water Testing and Assessment Report |

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| 6 Soil Test Results Summary  The Contractor shall summarise the soil test results for each topsoil and subsoil sample using the following tables (for accurate interpretation show the relevant ‘a - d' sub-parameter with the test result and non-complying results in red text): |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TOPSOIL Test Results Summary | | | | | | | | | | |
| Parameter | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** |
| Bulk density |  |  |  |  |  |  |  |  |  |  |
| Organic matter |  |  |  |  |  |  |  |  |  |  |
| Wettability |  |  |  |  |  |  |  |  |  |  |
| pH a) General b) Acid soils c) Alkaline soils d) Strongly  alkaline |  |  |  |  |  |  |  |  |  |  |
| Electrical conduct |  |  |  |  |  |  |  |  |  |  |
| Ext. phosphorus a) Very sensitive b) Mod. Sensitive c) Non-sensitive |  |  |  |  |  |  |  |  |  |  |
| Permeability |  |  |  |  |  |  |  |  |  |  |
| Texture |  |  |  |  |  |  |  |  |  |  |
| Particle size a) Site soil b) Imported  topsoil |  |  |  |  |  |  |  |  |  |  |
| Plant propagules (imported topsoil) |  |  |  |  |  |  |  |  |  |  |
| Water repellence |  |  |  |  |  |  |  |  |  |  |
| Soil texture range: a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Exch. Calcium |  |  |  |  |  |  |  |  |  |  |
| Exch. Magnesium |  |  |  |  |  |  |  |  |  |  |
| Ca:Mg |  |  |  |  |  |  |  |  |  |  |
| ESP |  |  |  |  |  |  |  |  |  |  |
| Exch. Potassium |  |  |  |  |  |  |  |  |  |  |
| Exch. Aluminium |  |  |  |  |  |  |  |  |  |  |
| ECEC |  |  |  |  |  |  |  |  |  |  |
| Sol. Chloride |  |  |  |  |  |  |  |  |  |  |
| Ext. sulfur |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SUBSOIL Test Results Summary | | | | | | | | | | |
| Parameter | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** | **Sample ID** |
| Wettability |  |  |  |  |  |  |  |  |  |  |
| pH a) General b) Acid soils c) Alkaline soils d) Strongly  alkaline |  |  |  |  |  |  |  |  |  |  |
| Electrical conduct. |  |  |  |  |  |  |  |  |  |  |
| Texture |  |  |  |  |  |  |  |  |  |  |
| Water repellence |  |  |  |  |  |  |  |  |  |  |
| Emerson class no. |  |  |  |  |  |  |  |  |  |  |
| Soil texture range: a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Exch. Calcium a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Exch. Magnesium a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Ca:Mg a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| ESP a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Exch. Potassium a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Exch. Aluminium a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| ECEC a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Sol. Chloride a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Ext. sulfur a) / b) / c) |  |  |  |  |  |  |  |  |  |  |
| Slaking class no. |  |  |  |  |  |  |  |  |  |  |
| Clouding class no. |  |  |  |  |  |  |  |  |  |  |

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| 7 Appendix C – Additional Information  The Contractor may include an Appendix C and provide additional information to support the Soil Management Plan – Construction – for example, delivery dockets for imported materials. |

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| NOTE – ¹ Suitable topsoil refers to stockpiled site topsoil, identified by a qualified Soil Scientist as being a soil that can be used with or without amelioration; and any required amelioration is considered to be practicable. |

# Form B – Soil Assessment Report

The Soil Scientist is to complete this form and attach the relevant soil testing forms (C, D, E or F) for each soil sample.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NOTE –  A Soil Assessment Report is not required for certified complying, imported topsoil. | | | | | | | | | |
| Site Sample Identification | | | | | | | | | Sample Date: |
| Project Name: | | | | | | | | Sample Location: | |
| Job / Contract No: | | | | | | | | Site / Stockpile / Batter No: | |
| Form attached: | | C | D | E | | F | | | |
| Testing Laboratory Sample Identification | | | | | | | | | |
| Laboratory: | | | | | Sample No: | | | | Date Tested: |
| Soil scientist name (person who prepared report | | | | | | | |  | |
| Compliance: |  | | | | | | | | |
| Complies: | Non-compliant – ameliorate | | | | | | Non-compliant – impracticable to ameliorate | | |

|  |  |  |
| --- | --- | --- |
| 1 Interpretation of test parameter result  The Soil Scientist is to indicate (x) the non-compliant soil parameters and provide an interpretation for each parameter relevant to the soil test parameter requirement. | | |
| Soil Test Parameter | Non-compliant | Interpretation |
| Bulk density (BD) |  |  |
| Organic matter (OM) |  |  |
| Wettability |  |  |
| pH (H2O, 1:5) |  |  |
| Electrical conductivity (H2O, 1:5) |  |  |
| Extractable phosphorus content (Extr. P) |  |  |
| Permeability |  |  |
| Texture |  |  |
| Particle size |  |  |
| Plant propagule (imported topsoil) |  |  |
| Water repellence class number |  |  |
| Dispersion – Emerson class number (subsoil) |  |  |
| Exchangeable calcium (Ca) |  |  |
| Exchangeable magnesium (Mg) |  |  |
| Calcium magnesium ratio (Ca:Mg) |  |  |
| Exchangeable sodium percentage (ESP) |  |  |
| Exchangeable potassium (K) |  |  |
| Exchangeable aluminium (Al) percentage |  |  |
| Effective cation exchange capacity (ECEC) |  |  |
| Soluble chloride (Cl –) |  |  |
| Extractable sulfur (S) |  |  |
| Slaking class number (subsoil) |  |  |
| Clouding (dispersion) class number (subsoil) |  |  |

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| 2 Assessment of test results of site TOPSOIL  The Soil Scientist is to provide an assessment per sample relevant to: |
| Suitability and practicability of the topsoil to comply with Form C – in particular describe how the parameters as a whole affect the suitability of the soil – |
| Erodibility and / or dispersion risk of topsoil: |
| Best use of the topsoil relevant to vegetation treatment and installation location (batters, basins, drains and so on): |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 Amelioration treatment of TOPSOIL – initial and compliance testing  The Soil Scientist is to provide an amelioration treatment in the schedule below, addressing the non-compliant topsoil parameters in Form C and Form D, as per sample and in particular – | | | | |
| * organic matter content (OM) * acidity and / or alkalinity (pH) * water repellence (hydrophobicity) class number * calcium magnesium ratio (Ca:Mg) | * concentration of calcium (Ca) * concentration of magnesium (Mg) * exchangeable sodium percentage (ESP) * fertiliser type(s) and application is rate(s) | | | |
| TOPSOIL Amelioration Schedule | | | | |
| Ameliorant | Rate ¹, ² | | Workings | |
| Agricultural lime |  | kg/m³ | – | |
| (Agricultural) dolomite |  | kg/m³ | – | |
| Agricultural gypsum |  | kg/m³ | – | |
| Organic soil conditioner |  | kg/m³ |  | % by volume |
|  |  | kg/m³ | – | |
| Vegetation treatment type (e.g. turfed areas)    Fertiliser type and analysis (N:P:K:S) |  | kg/ha |  | |
| Vegetation treatment type (e.g. seeded areas)    Fertiliser type and analysis (N:P:K:S) |  | kg/ha |  | |
| Vegetation treatment type (e.g. planted areas)    Fertiliser type and analysis (N:P:K:S) |  | kg/ha |  | |

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| 4 Assessment of test result of SUBSOIL  The Soil Scientist is to provide an assessment per subsoil sample relevant to: |
| Suitability and practicability of the subsoil to comply with Form E – |
| Erodibility and / or dispersion risk of subsoil – |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 5 Amelioration treatment of SUBSOIL  NOTE – Compliance testing of ameliorated subsoil is not required.  The Soil Scientist is to provide amelioration treatment addressing the non-compliant subsoil parameters and in particular – | | | | | | | |
| * wettability * acidity and / or alkalinity (pH) * calcium magnesium ratio (Ca:Mg) * concentration of calcium (Ca) | | | * concentration of magnesium (Mg) * exchangeable sodium percentage (ESP) * aluminium toxicity (Al) * slaking and / or clouding class number | | | | |
| SUBSOIL Amelioration Schedule | | | | | | | |
| Ameliorant | Rate ¹, ² | | | | Workings | | |
| Agricultural lime |  | kg/m² | |  | kg/m³ x 0.2 m = |  | kg/m² |
| (Agricultural) dolomite |  | kg/m² | |  | kg/m³ x 0.2 m = |  | kg/m² |
| Agricultural gypsum |  | kg/m² | |  | kg/m³ x 0.2 m = |  | kg/m² |
|  |  | kg/m² | |  | kg/m³ x 0.2 m = |  | kg/m² |

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| 6 Justification for exceeding ameliorants maximum amelioration rates  The Soil Scientist shall provide justification for recommending an application rate for a single or combination of agents that exceeds the maximum rate specified below: |

|  |  |  |
| --- | --- | --- |
| NOTE –  ¹Amelioration rate units and calculation standards  Chemical ameliorant application rate of topsoil – shall be stated as dry weight (kg) of ameliorant to volume (m³) of stockpiled soil – (kg/m³).  Chemical ameliorant application rate of subsoil – shall be stated as dry weight (kg) of ameliorant to area (m²) of subsoil – (kg/m²). The volume of subsoil to be treated is the top 200 mm depth. The rate for amelioration of subsoil is not based on the depth of incorporation (depth of ground preparation operations). For example, a batter that is to be ameliorated with 5 kg / m³ of lime and roughened to the standard depth of 50 mm will receive 1 kg/m² of lime (and not 0.25 kg/m²). | | |
| Organic soil conditioner amelioration rate shall be stated as volume (m³) of ameliorant to volume (m³) of stockpiled topsoil – (m³/m³). | | |
| ²Ameliorants maximum application rates  The following ameliorant application rates are not to be exceeded unless justification has been provided and deemed suitable: | | |
| Ameliorant | Topsoil – Max. Rate | Subsoil – Max. Rate |
| Agricultural lime – CaCO3  (Agricultural) dolomite – CaMg(CO3)2  Agricultural gypsum – CaSO4.2H2O  Organic soil conditioner – by volume of topsoil | 10 kg/m³  10 kg/m³  10 kg/m³  0.2 m³/m³ | 15 kg/m³ (3 kg/m²)  15 kg/m³ (3 kg/m²)  15 kg/m³ (3 kg/m²)  – |

# Form C – Topsoil Testing

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Site Sample Identification | | | | | Sample Date: |
| Project Name: | | | | Sample Location: | |
| Job / Contract No: | | | | Site / Stockpile No: | |
| **NOTE** – sample shall be taken from topsoil layer and be a composite, representative sample per topsoil type | | | | | |
| Testing Laboratory Sample Identification | | | | | |
| Laboratory: | | Sample No: | | | Date Tested: |
| Complies | Non-compliant – ameliorate | | Non-compliant – impracticable to ameliorate | | |
| Imported Topsoil Only | | | | | |
| Date of Manufacture: | | | | Name of the Manufacturer: | |
| Manufacture Batch Number: | | | | Complies | Non-compliant |

|  |  |  |  |
| --- | --- | --- | --- |
| Soil Test Parameter | Test Method | Soil Test Parameter Requirement | Soil Test Result |
| Refer AS 4419 – Soils for landscaping and garden use – NOTE MODIFIED REQUIREMENTS | | | |
| Bulk density (BD) | Clause 5.2 | > 0.7 kg/L |  |
| Organic matter (OM) (relevant to the organic carbon concentration) | Clause 5.3 | 3 to 10% |  |
| Wettability | Clause 5.4 | > 5 mm/min. – < 150 mm/min. |  |
| pH (H2O, 1:5):   1. General range 2. Naturally occurring acid soils 3. Naturally occurring alkaline soils 4. Naturally occurring strongly alkaline soils | Clause 5.5 | > 5.5 and < 7.5  > 5.5 and < 6.5  > 7.0 and < 8.5  ≥ 8.5 and < 9.5 |  |
| Electrical conductivity (EC H2O, 1:5) | Clause 5.6 | < 1.2 dS/m |  |
| Extractable phosphorus content (Extr. P)  a) Very P sensitive plants  b) Moderately P sensitive plants  c) Non-sensitive P plants | Clause 5.8 | < 5 mg/kg  < 20 mg/kg  < 100 mg/kg |  |
| Permeability | Clause 5.12 | 2 to 35 cm/hr |  |
| Texture | Clause 5.13 | Texture Classification |  |
| Particle size:  a) Site soil  b) Imported topsoil | – | 100% by weight to pass a 40 mm sieve  100% by weight to pass a 20 mm sieve |  |
| Imported topsoil only – plant propagule content | Clause 5.15 | Free from any living parts of plants generally considered to be weeds |  |
| Refer TMR Materials Testing Manual – Test Method Q160: Water repellency of soil | | | |
| Water repellence (hydrophobicity) class number | Table 1 | Class 0 or 1 |  |
| Refer Soil Chemical Methods: Australasia – Rayment & Lyons, CSIRO 2011 | | | |
| NOTE – Select soil texture range: a)  b)  c) | | | |
| Exchangeable calcium (Ca)  a) Sands and loamy sands  b) Sandy loams to silty clay loams  c) Sandy clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | ≥ 2 meq/100 g  ≥ 5 meq/100 g  ≥ 5 meq/100 g |  |
| Exchangeable magnesium (Mg)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.6 meq/100 g  > 1.0 meq/100 g  > 1.0 meq/100 g |  |
| Calcium magnesium ratio (Ca:Mg)  Exchangeable form for  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | 2 to10 |  |
| Exchangeable sodium percentage (ESP)  (Na base saturation % = % Na of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | < 6  < 15  < 15 |  |
| Exchangeable potassium (K)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.2 meq/100 g  > 0.4 meq/100 g  > 0.4 meq/100 g |  |
| Exchangeable aluminium (Al) percentage  (Al base saturation % = % Al of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH < 6.0  Method 15G1 | < 25  < 40  < 40 |  |
| Effective cation exchange capacity (ECEC)  (ECEC = sum of exchangeable cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 15J1 | > 5 meq/100 g  > 10 meq/100 g  > 10 meq/100 g |  |
| When EC > 1.2 dS/m – Soluble chloride (Cl -)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 5A | < 900 mg/kg |  |
| When EC > 1.2 dS/m – Extractable sulfur (S)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 10B | < 100 mg/kg |  |

# Form D – Manufactured Site Topsoil Compliance Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site Sample Identification | | | | Sample Date: |
| Project Name: | | | Sample Location: | |
| Job / Contract No: | | | Site / Stockpile No: | |
| **NOTE** – sample shall be a composite, representative sample taken from soil 500 mm below the stockpile surface | | | | |
| Testing Laboratory Sample Identification | | | | |
| Laboratory: | Sample No: | | | Date Tested: |
| Complies | | Non-compliant – ameliorate | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Soil Test Parameter | Test Method | Soil Test Parameter Requirement | Soil Test Result |
| Refer AS 4419 – Soils for landscaping and garden use – NOTE MODIFIED REQUIREMENTS | | | |
| Organic matter (OM) (relevant to the organic carbon concentration) | Clause 5.3 | 3 to 10% |  |
| pH (H2O, 1:5):   1. General pH range soils 2. Naturally occurring acid soils 3. Naturally occurring alkaline soils 4. Naturally occurring strongly alkaline soils | Clause 5.5 | > 5.5 and < 7.5  > 5.5 and < 6.5  > 7.0 and < 8.5  ≥ 8.5 and < 9.5 |  |
| Electrical conductivity (EC H2O, 1:5) | Clause 5.6 | < 2.4 dS/m when agricultural lime, gypsum or dolomite added:  otherwise < 1.2 dS/m |  |
| Texture | Clause 5.13 | Texture Classification |  |
| Refer TMR Materials Testing Manual – Test Method Q160: Water repellency of soil | | | |
| Water repellence (hydrophobicity) class number | Table 1 | Class 0 or 1 |  |
| Refer AS 1289.3.8.1 – Methods of testing soils for engineering purposes | | | |
| Dispersion – Emerson class number | Method 3.8.1 | Class 3 to 8 |  |
| Refer Soil Chemical Methods : Australasia – Rayment & Lyons, CSIRO 2011 | | | |
| NOTE – Select soil texture range: a)  b)  c) | | | |
| Exchangeable calcium (Ca)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | ≥ 2 meq/100 g  ≥ 5 meq/100 g  ≥ 5 meq/100 g |  |
| Exchangeable magnesium (Mg)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.6 meq/100 g  > 1.0 meq/100 g  > 1.0 meq/100 g |  |
| Calcium magnesium ratio (Ca:Mg)  Exchangeable form for –  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | 2 to10 |  |
| Exchangeable sodium percentage (ESP)  (Na base saturation % = % Na of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | < 6  < 15  < 15 |  |
| Exchangeable potassium (K)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.2 meq/100 g  > 0.4 meq/100 g  > 0.4 meq/100 g |  |
| Exchangeable aluminium (Al) percentage  (Al base saturation % = % Al of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH < 6.0  Method 15G1 | < 25  < 40  < 40 |  |
| Effective cation exchange capacity (ECEC)  (ECEC = sum of exchangeable cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 15J1 | > 5 meq/100 g  > 10 meq/100 g  > 10 meq/100 g |  |

# Form E – Subsoil Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site Sample Identification | | | | Sample Date: |
| Project Name: | | | Sample Location: | |
| Job / Contract No: | | | Site / Stockpile / Batter No: | |
| **NOTE** – sampling of batters to be taken from surface to 200 mm depth | | | | |
| Testing Laboratory Sample Identification | | | | |
| Laboratory: | Sample No: | | | Date Tested: |
| Complies | | Non-compliant – ameliorate | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Soil Test Parameter | Test Method | Soil Test Parameter Requirement | Soil Test Result |
| Refer AS 4419 – Soils for landscaping and garden use – NOTE MODIFIED REQUIREMENTS | | | |
| Wettability | Clause 5.4 | > 5 mm/min – < 150 mm/min |  |
| pH (H2O, 1:5):   1. General range 2. Naturally occurring acid soils 3. Naturally occurring alkaline soils 4. Naturally occurring strongly to very strongly alkaline soils | Clause 5.5 | > 5.5 and < 7.5  > 5.5 and < 6.5  > 7.0 and < 8.5  ≥ 8.5 and < 9.5 |  |
| Electrical conductivity (EC H2O, 1:5) | Clause 5.6 | < 1.2 dS/m |  |
| Texture | Clause 5.13 | Texture Classification |  |
| Refer TMR Materials Testing Manual – Test Method Q160: Water repellency of soil | | | |
| Water repellence (hydrophobicity) class number | Table 1 | Class 0 or 1 |  |
| Refer AS 1289.3.8.1 – Methods of testing soils for engineering purposes | | | |
| Dispersion – Emerson class number | Method 3.8.1 | Class 3 to 8 |  |
| Refer Soil Chemical Methods : Australasia – Rayment & Lyons, CSIRO 2011 | | | |
| NOTE – Select soil texture range: a)  b)  c) | | | |
| Exchangeable calcium (Ca)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | ≥ 2 meq/100 g  ≥ 5 meq/100 g  ≥ 5 meq/100 g |  |
| Exchangeable magnesium (Mg)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.6 meq/100 g  > 1.0 meq/100 g  > 1.0 meq/100 g |  |
| Calcium magnesium ratio (Ca:Mg)  Exchangeable form for –  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | 2 to 10 |  |
| Exchangeable sodium percentage (ESP)  (Na base saturation % = % Na of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | < 6  < 15  < 15 |  |
| Exchangeable potassium (K)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | > 0.2 meq/100 g  > 0.4 meq/100 g  > 0.4 meq/100 g |  |
| Exchangeable aluminium (Al) percentage  (Al base saturation % = % Al of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH < 6.0  Method 15G1 | < 25  < 40  < 40 |  |
| Effective cation exchange capacity (ECEC)  (ECEC = sum of exchangeable cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 15J1 | > 5 meq/100 g  > 10 meq/100 g  > 10 meq/100 g |  |
| When EC > 1.2 dS/m – Soluble Chloride (Cl -)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 5A | < 900 mg/kg |  |
| When EC > 1.2 dS/m – Extractable Sulfur (S)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 10B | < 100 mg/kg |  |
| Refer TMR Materials Testing Manual – Test Method Q161 Field dispersion indicator test of soil – slaking | | | |
| Slaking class number | Table 1 | Class 0 – 2 |  |
| **Refer TMR Materials Testing Manual** – Test Method Q162 Field dispersion indicator test of soil – clouding | | | |
| Clouding (dispersion) class number | Table 1 | Class 0 – 1 |  |

# Form F – Drainage Basin Soil Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site Sample Identification | | | | Sample Date: |
| Project Name: | | | Sample Location: | |
| Job / Contract No: | | | Site / Stockpile / Batter No: | |
| **NOTE** – sampling of batters to be taken from surface to 300 mm depth | | | | |
| Testing Laboratory Sample Identification | | | | |
| Laboratory: | Sample No: | | | Date Tested: |
| Complies | | Non-compliant – ameliorate | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Soil Test Parameter | Test Method | Soil Test Parameter Requirement | Soil Test Result |
| Refer MRTS04 – General Earthworks | | | |
| Earth fill material Class A | Tables 14.2.2-A and 14.2.2-B | Requirements as per Tables 14.2.2-A and 14.2.2-B |  |
| Refer AS 1289.3.8.1 – Methods of testing soils for engineering purposes | | | |
| Dispersion – Emerson class number | Method 3.8.1 | Class 3 to 8 |  |
| Refer TMR Material Testing Manual -  Test method Q142A: Dry density – moisture relationship of soils and crushed rock - standard | | | |
| Construction moisture content | Q142A | ± 2% (OMC) |  |
| Refer AS 4419 – Soils for landscaping and garden use – NOTE MODIFIED REQUIREMENTS | | | |
| pH (H2O, 1:5):   1. General range 2. Naturally occurring acid soils 3. Naturally occurring alkaline soils 4. Naturally occurring strongly alkaline soils | Clause 5.5 | > 5.5 and < 7.5  > 5.5 and < 6.5  > 7.0 and < 8.5  ≥ 8.5 and < 9.5 |  |
| Electrical conductivity (EC H2O, 1:5) | Clause 5.6 – Method 3A1 | < 1.2 dS/m |  |
| Refer Soil Chemical Methods : Australasia – Rayment & Lyons, CSIRO 2011 | | | |
| NOTE – Select soil texture range: a)  b)  c) | | | |
| Exchangeable sodium percentage (ESP)  (Na base saturation % = % Na of total cations)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | When pH ≤ 7.3  Method 15B3  When pH > 7.3  Method 15C1 | < 6  < 15  < 15 |  |
| When EC > 1.2 dS/m – Soluble chloride (Cl -)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 5A | < 900 mg/kg |  |
| When EC > 1.2 dS/m – Extractable sulfur (S)  a) Sands and loamy sands  b) Sandy loams to clay loams  c) Sandy light clay to heavy clay | Method 10B | < 100 mg/kg |  |
| Refer TMR Materials Testing Manual – Test Method Q161 Field dispersion indicator test of soil – slaking | | | |
| Slaking class number | Table 1 | Class 0 – 2 |  |
| **Refer TMR Materials Testing Manual** – Test Method Q162 Field dispersion indicator test of soil – clouding | | | |
| Clouding (dispersion) class number | Table 1 | Class 0 – 1 |  |

# Form G – Organic Soil Conditioner Testing

Organic soil conditioner shall comply with:

1. AS 4454 Clause 3.1.1.1 (d) mature compost and Clause 3.1.1.2 (a) soil conditioner, and
2. Form G.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site Sample Identification | | | | Sample Date: |
| Project Name: | | Sample Location: | | |
| Job / Contract No: | | Site / Stockpile No. / Batch: | | |
| **NOTE** – sampling shall be in accordance with AS 4454 Clause 4.1 | | | | |
| Testing Laboratory Sample Identification | | | | |
| Laboratory: | Sample No: | | | Date Tested: |
| Date of Manufacture: | | Name of the Manufacturer: | | |
| Manufacture Batch No.: | Complies with AS 4454, and Form G | | Non-compliant with AS 4454 and Form G | |

|  |  |  |  |
| --- | --- | --- | --- |
| Organic Soil Conditioner Parameter | Test Method | Organic Soil Conditioner Test Parameter Requirements | Organic Soil Conditioner Test Results |
| Refer AS 4454 – Composts, soil conditioners and mulches – NOTE MODIFIED REQUIREMENTS | | | |
| Pathogen indicators:  a) E. coli  b) Salmonella spp.  c) Faecal coliforms | Appendix D –Clause D5.4 | < 100 MPN/g  absent  < 1000 MPN/g |  |
| Nitrogen Drawdown Index (NDI) | Appendix O | > 0.5 NDI |  |
| Refer AS 4276.7 – Water microbiology - Escherichia coli and thermotolerant coliforms - Membrane filtration method | | | |
| Thermotolerant coliforms | AS 4276.7 | < 100 MPN/g |  |
| Refer AS 3896 – Waters - Examination for Legionella spp. including Legionella pneumophia | | | |
| Legionnella spp | AS 3896 | absent |  |
| Refer AS 5013.24.2 – Microbiology of food and animal feeding stuffs –  Horizontal method for the detection and enumeration of Listeria monocytogenes - Enumeration method | | | |
| Listeria spp | AS 5013.24.2 | absent |  |
| AS 4964 – Method for the qualitative identification of asbestos in bulk samples | | | |
| Asbestos containing material (ACM) –   1. Bonded (tightly bound) asbestos 2. Loosely bound (friable) asbestos | AS 4964 | absent |  |
| AS 4419 – Soils for landscaping and garden use | | | |
| pH (H2O, 1:5) | Clause 5.5 | 6.5 – 8.5 |  |
| Electrical conductivity (EC H2O, 1:5) | Clause 5.6 | < 1.2 dS/m |  |
| Aqueous film forming foams (AFFF) containing PFC compounds | | | |
| Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) | Method SOC-PFC via LC/MS/MS | < 0.0039 mg/kg |  |

# Form H – Non-potable Water Management Plan

The Contractor shall refer to Form I – Non-potable Water Testing and Assessment Report and prepare a management plan using this form.

|  |
| --- |
| **1 Integrated non-potable water management activities**  The Contractor shall describe how watering of vegetation treatments, using water sourced from the sampled water source, will be integrated with the requirements and associated operations of each of the following documents: |
| Environmental Management Plan (Construction) – in particular water and soil quality operations – |
| Guide to Workplace use of Non-potable Water Including Recycled Waters (DIER 2007) – in particular the management and application of water – |
| The Soil Management Plan – Construction – in particular salt build-up in soils – |
| Other documents – |

|  |  |  |  |
| --- | --- | --- | --- |
| 2 Amelioration program and operations  The Contractor shall refer to the Non-potable Water Assessment Report(s) and provide the watering practices and watering program to manage the saline properties of the water – in particular to include – | | | |
| Salt tolerance of plant species – indicate if a vegetation treatment contains plant species that are salt sensitive, salt tolerant and / or very salt tolerant, as per Department of Agriculture, Fisheries and Forestry. | | | |
| Vegetation Treatment | Salt sensitive | Salt tolerant | Very salt tolerant |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Suitable salt tolerant species to be substituted for the salt sensitive species indicated above – | | | |
| Water source(s) description – | | | |
| Water amelioration – | | | |
| Watering program – | | | |
| Watering practices – | | | |
| Water monitoring program – | | | |
| Plant and soil monitoring program – | | | |

# Form I – Non-potable Water Testing and Assessment Report

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Non-potable Water Assessment Report | | | | | |
| Site Sample Identification | | | | | Sample Date: |
| Project Name: | | | | Sample Location: | |
| Job / Contract No: | | | | Site / Water Body: | |
| Form attached: | | | | | |
| Testing Laboratory Sample Identification | | | | | |
| Laboratory: | | Sample No: | | | Date Tested: |
| Compliance | | | | | |
| Complies: | Non-compliant – ameliorate | | Non-compliant – impracticable to ameliorate | | |

|  |  |  |
| --- | --- | --- |
| 1 Interpretation of test parameter result  The Scientist is to indicate (x) the non-compliant water parameters and provide an interpretation for each parameter relevant to the water test parameter requirement. | | |
| Water Test Parameter | Non-compliant | Interpretation |
| E. coli (median) MPN/100 mL |  |  |
| Enumeration of Coliform; and E. coli (Petri Film) |  |  |
| Total coliforms |  |  |
| Salmonella spp |  |  |
| pH |  |  |
| Electrical Conductivity (EC  a) Salt sensitive plants  b) Salt tolerant plants  c) Very salt tolerant plants |  |  |
| Bicarbonate (HCO₃¹⁻) |  |  |
| Carbonate (CO₃²⁻) |  |  |
| Chloride (Cl¹⁻) |  |  |
| Sulphate (SO₄²⁻) |  |  |
| Calcium (Ca²⁺) |  |  |
| Sodium (Na1+) |  |  |
| Magnesium (Mg²⁺) |  |  |
| SAR  a) Salt tolerant plants  b) Salt sensitive plants |  |  |
| 2 Assessment of test results of water  The Scientist is to provide an assessment per sample relevant to – | | |
| Suitability and practicability of the water to comply with Form I –  NOTE – Water with EC > 5 dS/m is unsuitable for use. Irrigation water as amelioration is not practicable. | | |
| A use of water relevant to the type and plant / seed species of vegetation treatment – | | |

|  |  |  |
| --- | --- | --- |
| 3 Amelioration and management of water  The Scientist is to provide an amelioration treatment and the watering program and best practice addressing the water parameters in Form I, per sample and in particular – | | |
| * E. coli * Total coliforms * Salmonella spp | * pH * EC | * SAR * Cl¹- |

|  |  |  |
| --- | --- | --- |
| Water Amelioration Schedule | | |
| Ameliorant | Rate | Comments |
|  |  |  |
|  |  |  |
| Watering program – | | |
| Watering practices – | | |

|  |
| --- |
| Amelioration program and operations  The Contractor shall refer to the Non-potable Water Testing and Assessment Report/s and provide the watering practices and watering program to manage the saline properties of the water *in particular:*   * Regular monitoring of water source/s by testing the parameters of concern, using Form I. * Regular monitoring of plants by observation and soil by field testing the pH and EC of the soil using Form C parameter requirements; and inspecting plant foliage for signs of wilting and / or leaf burn. * Watering program to:   + prioritise night or early morning waterings to lessen evaporation and concentration of salts   + avoid windy conditions to lessen leaf burn / death of seedlings. * Watering practices to:   + apply a volume of water that allows for some leaching to move salts away from plant roots   + apply water that allows for deep wetting of the soil and subsequent reduction in the frequency of water to lessen salt build up in upper soil layers   + maintain soil moisture to reduce damage to plants when applying salty water to dry soil. * Sourcing an alternate low EC water source for intermittent leaching and removal of salt. |

Non-potable Water Testing

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Site Sample Identification | | | | | Sample Date: |
| Project Name: | | | | Sample Location: | |
| Job / Contract No: | | | | Site / Water Source No.: | |
| NOTE – sampling of water to be in accordance with Clause 7.10.2. | | | | | |
| Testing Laboratory Sample Identification | | | | | |
| Laboratory: | | Sample No: | | | Date Tested: |
| Complies: | Non-compliant – ameliorate | | Non-compliant – impracticable to ameliorate | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Water Quality Parameter | Test Method | Water Test Parameter Requirement | Water Test Result |
| E. coli (median) MPN/100 mL | AOAC Official Method 991.4 | < 100 MPN |  |
| Enumeration of Coliform, and  E. coli (Petri Film) | AOAC Official Method 991.4 | < 100 MPN |  |
| Total coliforms | MPN Method | < 100 MPN |  |
| Salmonella spp | MPN Method | Absent |  |
| Refer Australian Laboratory Handbook of Soil and Water Chemical Methods – Rayment & Higginson, 1992 | | | |
| pH | Water C | 6 – 8.5 |  |
| Electrical Conductivity (EC)  a) Salt sensitive plants  b) Salt tolerant plants  c) Very salt tolerant plants | Water B | ≤ 1.6 dS/m  ≤ 3 dS/m  3 – 5 dS/m |  |
| Bicarbonate (HCO₃¹⁻) | D | < 120 mg/L |  |
| Carbonate (CO₃²⁻) | D | < 350 mg/L |  |
| Chloride (Cl¹⁻) | E | < 600 mg/L |  |
| Sulphate (SO₄²⁻) | J | < 600 mg/L |  |
| Calcium (Ca²⁺) | L | > 80 mg/L |  |
| Sodium (Na¹⁺) | L | < 300 mg/L |  |
| Magnesium (Mg²⁺) | L | > 35 mg/L |  |
| SAR  a) Salt tolerant plants  b) Salt sensitive plants | M3a | ≤ 9  9 - < 24 |  |