



**TECHNICAL STANDARD TS 35 42 53.05
RETAINING WALLS ON WATERWAY BANKS**

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PART 1 GENERAL**1.01 INTRODUCTION****A. PURPOSE**

- a) The proposed work under this Technical Standard consists of the construction of retaining walls on the Corporation's public foreshore land by others.
- b) This Technical Standard is not intended for use in Corporation Contract documents.
- c) This Technical Standard provides a guide to Proponents for construction of retaining walls to a standard acceptable to the Corporation. Every application will be assessed on its merit for the particular site.
- d) The Corporation's general preference is to avoid construction of new private infrastructure on public foreshore land. Potential Proponents should contact the Corporation to discuss proposals prior to commencement of any significant design work.

B. GENERAL

- a) Undertake the works in accordance with relevant Legislation, Australian Standards, Codes of Practice, Corporation requirements and this Technical Standard.
- b) There shall be no deviation from the requirements of this Technical Standard unless prior written approval has been obtained from the Corporation.

C. EXCLUSIONS

Nil.

1.02 REFERENCES

- A. The publications listed below form a part of this Technical Standard to the extent referenced.
- B. The publications are referred to in the text by basic designation only. Where no date is given for referenced standards, the latest edition available shall be used.

C. AUSTRALIAN STANDARDS

- (a) AS 4678 - Earth retaining structures.
- (b) AS 1289 - Methods of testing soil for engineering purposes.
- (c) AS 1726 - Geotechnical site investigations.
- (d) AS 2758.0 - Aggregates and rock for engineering purposes.
- (e) AS 4997 - Guidelines for the design of maritime structures.
- (f) AS 1170.0 - Structural design actions, general principles.

- (g) AS 1657 - Fixed platforms, walkways, stairways and ladders, design, construction and installation.
- (h) AS 2156.1 - Walking tracks, classification and signage.
- (i) AS 2416 - Water safety signage.

D. LEGISLATION

- a) Occupational Health and Safety Act 2004.
- b) Occupational Health and Safety Regulations 2007.
- c) EPA Publication No. 1896 "Working within or adjacent to waterways"

E. GOULBURN-MURRAY WATER TECHNICAL STANDARDS

- a) TS 35 42 37.10 Placement of Rock Beaching under Clear Span Bridges
- b) TS 35 42 37.15 - Supply of rock products for rock armouring, rock beaching and rock spalls.
- c) TS 35 80 05.5 Erosion Protection of Reservoirs at Full Supply Level

1.03 DEFINITIONS

- A. Goulburn-Murray Water is referred to as the Corporation in this Technical Standard.

PART 2 DESIGN

2.01 DESIGN STANDARDS

- A. Retaining walls that are proposed to be constructed on Corporation waterways shall be designed and constructed to the following performance standards:
 - a) Design Life
 - i. Design life is the period of time for which a structure or an element of the structure remains fit for use for its intended purpose with appropriate maintenance.
 - ii. The Designer, in consultation with the Proponent, shall determine an appropriate maintenance regime consistent with the adopted design and materials that will achieve the design life. Particular care should be taken when considering design life and maintenance regimes for inaccessible elements of the wall. Such elements should have a design life (with no maintenance) equal to the design life of the wall.

- iii. At the end of its design life, the wall should have adequate strength to resist ultimate loads and be serviceable, but may have reached a stage where further deterioration will result in inadequate structural capacity.
 - iv. Retaining walls shall be designed, constructed and maintained for a minimum design life of 60 years.
- b) Minimise Public Risk
- i. All areas must be accessible to the public and to the Corporation.
 - ii. The Proponent, Designer and Constructor shall consider the public and operational risk posed by the wall during its design, construction, use and maintenance and demonstrate that risks have been minimised.
 - iii. In cases of high public risk, a detailed engineering design of the wall is required.
- c) Standards and Legislation
- i. Retaining walls shall be designed and constructed to AS 4678 and other relevant current Australian Standards and Legislation as listed in Sec 1.02.

PART 3 PRODUCTS

3.01 RETAINING WALL CONSTRUCTION MATERIALS

- A. Retaining walls may be constructed in concrete, timber, rock, gabions or sheet piles and shall be aesthetically and professionally completed. Minimalist unobtrusive infrastructure is preferred with a small footprint and negligible impact on the environment.
- B. Some examples are illustrated below:



Photo 1 - Timber construction



Photo 2 - Concrete construction

PART 4 RISK ASSESSMENT AND CLASSIFICATION OF STRUCTURE

4.01 AS 4678 RISK ASSESSMENT

A. The Proponent shall assess the risk of the structure and classify the structure according to Table 4.01A:

Table 4.01A from Table 1.1 - AS 4678: STRUCTURE CLASSIFICATION

CLASSIFICATION	EXAMPLES OF STRUCTURES	TYPICAL HEIGHT
C	Where failure would result in significant damage or risk to life	> 1.5 m
B	Where failure would result in moderate damage and loss of services	> 1.5 m
A	Where failure would result in minimal damage and loss of access	< 1.5 m

Notes:

1. Classification B includes structures not covered by Classifications A or C.
2. Structures where failure would result in minimal damage and loss of access where the wall height (H) is greater than 1.5 m are deemed to be Classification B structures.

4.02 AS 4678 FLOW CHART

A. The flow chart in Figure 4.02 is based on Appendix A, AS 4678 in order to help Proponents to classify their structure.

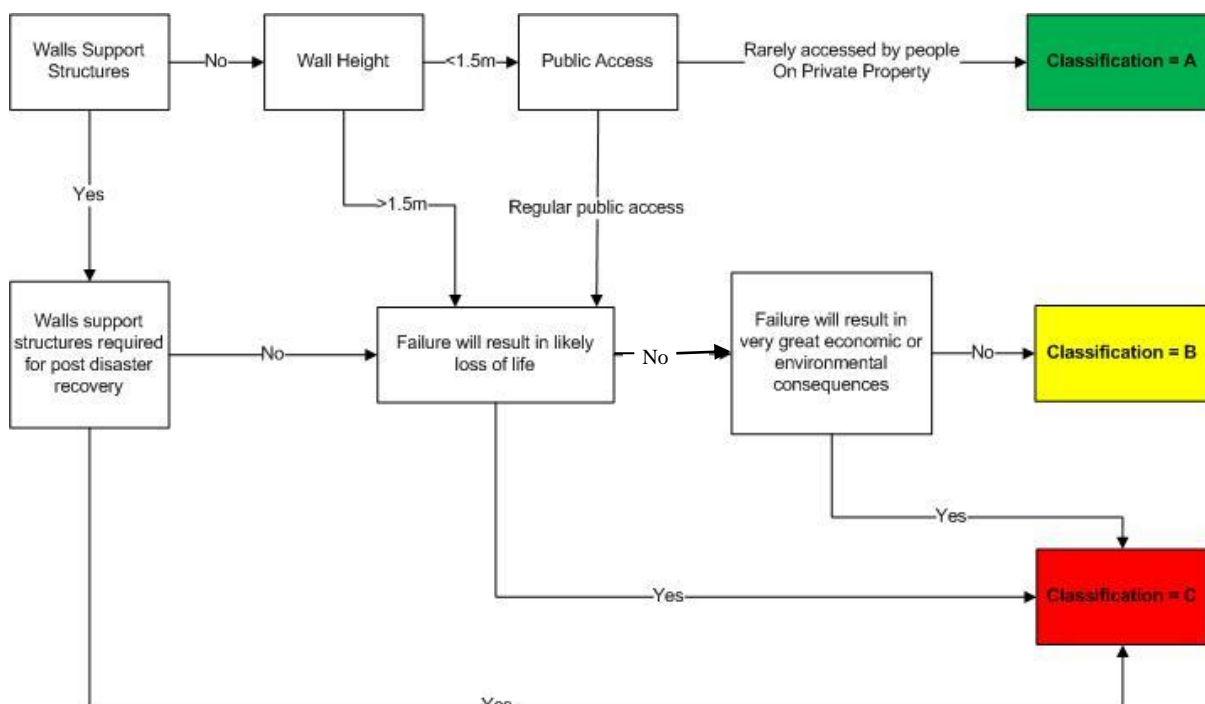


Figure 4.02A - Risk Assessment flow chart for classification of structures based on Appendix A of AS 4678

4.03 ASSESSMENT BY GOULBURN-MURRAY WATER AND INFORMATION TO BE PROVIDED**A. ASSESSMENT**

a) The Corporation will assess applications according to the structure classification identified in Part 4:

i. Classification A Structures

- ▶ The Proponent shall submit a design which will be assessed by a Corporation assessor and be in accordance with the Standard Drawings in Annexure 2.
- ▶ Non-standard arrangements will be considered to be Classification B structures.

ii. Classification B Structures

- ▶ The Proponent shall submit a design that has been certified by an Engineer registered as a Building Practitioner of Victoria. The design will be assessed by a Corporation assessor.

iii. Classification C Structures

- ▶ The Proponent shall submit a design that has been certified by an engineer registered as a Building Practitioner of Victoria. The design will be assessed by a Corporation assessor and by a third party Structural Engineer.

B. INFORMATION TO BE PROVIDED TO THE CORPORATION

a) In applying to construct a retaining wall on a Corporation foreshore, the Proponent shall include the following:

- i. Photo of site and site plan, including topographical and water depth contours (to mAHD), existing structures and features;
- ii. Design of wall, including the type and height of the proposed retaining wall;
- iii. Required geotechnical investigations and report, which are wall classification dependent;
- iv. Crown Allotment number or copy of title;
- v. Use and purpose of the wall;
- vi. Construction methodology;
- vii. Risk assessment in accordance with ISO 31000, which may be audited.

PART 5 DESIGN

5.01 PURPOSE

- A. The Designer shall consider the purpose of the retaining wall as part of the protection of the lake edge as well as its use for land and water access and activities.

5.02 LOCATION OF THE RETAINING WALL

- A. The Designer shall consider public and vehicular access to the wall, site conditions, constructability and the likely loading conditions on the wall.

5.03 LOADING ON THE RETAINING WALL

- A. The Designer shall consider the use and location of the wall to determine the worst likely loading cases. The Designer shall refer to AS 1170 and AS 4678 for loading design.

5.04 RISK

- A. The Designer shall mitigate the risk and consequence of failure of the retaining wall. The risk of failure shall determine the level of design required.
- B. The Designer shall consider the access of the public and Corporation staff to the retaining wall and include fall protection in accordance with AS 1657 if required.
- C. One safe form of personnel access to the water is also to be provided. Ladders or steps with hand rails may be considered.
- D. Appropriate signage shall be installed in accordance with AS 2156.1.

5.05 TOPOGRAPHY

- A. The Designer shall consider the surrounding topography as the slope above and below the wall may influence the likelihood of failure.
- B. The topography will determine the height of the wall.

5.06 GEOTECHNICAL INVESTIGATIONS

- A. Detailed site specific geotechnical investigations shall be carried out in accordance with Table 2.1 in AS 4678 for each structure classification, to determine the following design parameters:
 - a) Classification A Structures
 - i. Substrata type.
 - ii. Effect of drainage discharge onto surrounding site.
 - iii. Nature of retained material.

b) Classification B Structures

- i. All required investigations for Classification A structures.
- ii. Foundation and embankment strength parameters.
- iii. Existing ground water levels and seepage.
- iv. Effect of excavations and filling.
- v. Location of existing or proposed adjacent structures.

c) Classification C Structures

- i. All required investigations for Classification B structures.
- ii. Effect of modified water table on surrounding site.
- iii. Global stability.
- iv. Impact of structure 'zone of influence'.
- v. Ground movement.

5.07 GEOTECHNICAL TESTING

- A. Geotechnical testing shall be in accordance with Section 2.2 of AS 4678 and with the testing procedures of AS 1298.

5.08 SOIL PARAMETERS REQUIRED FOR DESIGN

- A. Geotechnical investigations shall be used to determine the internal friction angle (Φ) and cohesion factor (c).

5.09 FLOOD LEVELS, FREEBOARD AND FETCH

- A. Designer shall consider normal operating level, high water level, 1 in 100 year flood level and height of the wall to determine risk and likelihood of inundation.
- B. If inundation is likely, the wall shall be designed to withstand inundation and submergence and an appropriate drainage system shall be provided. The Designer shall consider the impact of piping or material loss from within the structure, the structure backfill or the foundations.
- C. The Designer shall consider draw down effects, differential and residual water levels and lag and the loss of backfill through the wall.
- D. The Designer shall consider the wave fetch and determine an appropriate amount of freeboard on the wall, which should be a minimum of 300 mm above the high water level. However, it is recognised that this may be limited by the topography at the location and the requirement to minimise fall hazards, particularly when the storage is drawn down from time to time.
- E. The Designer shall consider the impact of waves on the wall structure.

5.10 SCOUR PROTECTION

- A. The Designer shall consider and include provision for scour and erosion in front of the structure, which will include the analysis of the geomorphology of the area, the water current at the location and the proposed use of the wall.

5.11 REDUNDANCY

- A. Consideration should be given in the design of the wall and its elements to allow for redundancies to prevent failure of the structure in the event of the loss of a critical element.

5.12 ENVIRONMENTAL CONSIDERATIONS

- A. Design and construction of retaining wall shall consider environmental values at the location and mitigate against any damage to vegetation or aquatic habitat. Walls which unacceptably impact environmental values will not be approved.

5.13 MAINTENANCE

- A. The Designer shall design the retaining wall to require minimum maintenance over its entire life.
- B. The Designer must consider the following in the design of the retaining wall:
- a) Access to the various elements for maintenance / repair work;
 - b) The ability to remove or contain waste materials during repairs;
 - c) The ability to undertake repair work in situ to achieve the required standard;
 - d) The future availability of replacement members or elements;
 - e) The future availability of skilled tradespersons to undertake the maintenance / repairs over the design life.
- C. During the design life of the wall, maintenance will need to be undertaken to ensure that the design life is achieved. Such maintenance activities would include:
- a) Regular inspections;
 - b) Timely repairs;
 - c) Timely renewal of protection systems;
 - d) Timely replacement of worn-out components;
 - e) Keeping records of inspections carried out and maintenance performed.
- D. For continued licensing, the retaining wall must be well maintained and be in a satisfactory condition. It must be inspected and certified as being fit for use, every five years, by a Certified Engineer registered as a Building Practitioner of Victoria.

5.14 SAFETY

- A. The Designer shall design a retaining wall that is practical and safe to construct, use, maintain and dispose of over its entire life.

PART 6 EXECUTION

6.01 SATURATED AND INUNDATED GROUND CONDITIONS

- A. The retaining wall will likely be constructed within the waterway and be subject to saturated and inundated ground conditions, which will affect the method of construction. No cutting into the existing bank will be permitted.
- B. The construction methodology provided with the application shall provide details on how the retaining wall is to be constructed and how it will mitigate against any negative impacts on the waterway. It should also consider the prevailing water levels. The Constructor will also be required to consult with the Corporation in regard to the timing of the construction works.

6.02 COMPACTION

- A. The Constructor will demonstrate that fill is compacted to the required level of compaction.
- B. Soil compaction and density tests shall be conducted for all Type B and C retaining walls in accordance with AS 1289.5. The Proponent shall be responsible for making good any subsidence.

6.03 ROCK BEACHING

- A. Rock beaching shall be installed in accordance with the following Corporation Technical Standards:
 - a) TS 35 42 37.10 Placement of Rock Beaching under Clear Span Bridges
 - b) TS 35 42 37.15 - Supply of rock products for rock armouring, rock beaching and rock spalls.
 - c) TS 35 80 05.5 Erosion Protection of Reservoirs at Full Supply Level

PART 7 OHS CONSIDERATIONS

7.01 OCCUPATIONAL HEALTH AND SAFETY

- A. The Constructor shall comply with the following safety standards and legislation, as updated and amended from time to time:
 - a) ISO 31000 - Risk Management.
 - b) Occupation Health and Safety Act 2004 and OHS Regulations (2007).

PART 8 ENVIRONMENTAL CONSIDERATIONS**8.01 ENVIRONMENTAL IMPACT**

- A. The Constructor shall comply with the following environmental requirements, as updated and amended from time to time:
 - ▶ EPA Publication No. 1896 “Working within or adjacent to waterways”
- B. The Proponent shall assess the environmental risks associated with the proposed retaining wall in accordance with ISO 31000.

ANNEXURE 1 - DRAWINGS

GENERAL WORKS

- G1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH GWW TECHNICAL STANDARD TS 35 42 53.05. THESE RETAINING WALL DETAILS ARE GENERIC ONLY AND ARE APPLICABLE TO THE SOIL CONDITIONS IN NOTE W1. THESE DESIGN DRAWINGS SHOULD BE CERTIFIED BY A QUALIFIED ENGINEER TO ENSURE THE GROUND AND LOADING CONDITIONS ARE SUITABLE FOR EACH INDIVIDUAL SITE.
- G2 UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN MILLIMETRES.
- G3 THESE DRAWINGS SHALL NOT BE USED FOR FINAL SET OUT FOR THE PROJECT AND THE PROPONENT SHALL CHECK OR OBTAIN ALL DIMENSIONS RELEVANT TO SETTING OUT OF THE SITE WORKS, AND THE PROVISION OF ANY TEMPORARY BRACING, INCLUDING DESIGN, IN ACCORDANCE WITH THE SPECIFICATION.
- G4 SETTING OUT DIMENSIONS AND SIZES OF STRUCTURAL MEMBERS SHALL NOT BE OBTAINED BY SCALING THE STRUCTURAL DRAWINGS. ANY SETTING OUT DIMENSIONS INCLUDING LEVELS SHOWN IN THE STRUCTURAL DRAWINGS SHALL BE CHECKED BY THE PROPONENT BEFORE CONSTRUCTION COMMENCES.
- G5 THESE ENGINEERING DRAWINGS HAVE BEEN PREPARED FROM INFORMATION STATED ON THE DRAWINGS, AS THIS INFORMATION MAY BE SUBJECT TO CHANGE PRIOR TO OR DURING CONSTRUCTION THE PROPONENT IS TO INFORM GWW WHERE DISCREPANCIES OCCUR.
- G6 PRIOR TO THE COMMENCEMENT OF WORKS THE CONTRACTOR IS TO IDENTIFY ALL EXISTING SERVICES, ANY DAMAGE TO EXISTING SERVICES TO BE RECTIFIED AT THE PROPONENT'S EXPENSE.
- G7 DURING CONSTRUCTION, THE STRUCTURE SHALL BE MAINTAINED IN A SAFE AND STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE PROPONENT AS REQUIRED TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
- G8 THE STRUCTURAL COMPONENTS DETAILED ON THESE DRAWINGS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS AND LOCAL AUTHORITY ORDINANCES FOR THE FOLLOWING LOADINGS:
LIVE LOADS : SURCHARGE 5 kPa
- G9 ALL PENETRATIONS THROUGH SLABS AND BEAMS SHALL BE APPROVED BY GWW PRIOR TO COMMENCEMENT OF WORK.
- G10 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT AUSTRALIAN STANDARDS AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES.

REINFORCEMENT

- R1 REINFORCEMENT SHOWN ON THE DRAWINGS IS REPRESENTED DIAGRAMMATICALLY AND NOT NECESSARILY SHOWN IN TRUE PROJECTION.
- R2 BAR LAP LENGTHS SHALL BE SUFFICIENT TO DEVELOP THE FULL STRENGTH OF THE REINFORCEMENT. BAR LAPS IN MILLIMETRES ARE TO BE AS SHOWN BELOW (APPLICABLE FOR 32MPa CONCRETE STRENGTH):

N12	600	N24	1550
N16	800	N32	1900
N20	1050	N36	2500 FOR COMPRESSION LAP
N24	1300		MECHANICAL SPLICE FOR TENSION LAP
- R3 BUNDLED BARS SHALL BE TIED TOGETHER AT 50 BAR DIAMETER CENTRES WITH 3 WRAPS OF TIE WIRE.
- R4 REINFORCEMENT SYMBOLS:-
 - R - DENOTES GRADE 250R HOT ROLLED FLAT BARS TO AS 1471
 - N - DENOTES GRADE 500N HIGH YIELD DEFORMED BARS TO AS 4671

RETAINING WALL

- W1. RETAINING WALLS HAVE BEEN DESIGNED TO RETAIN A FREE DRAINING, WELL COMPACTED BACKFILL WITH A SLOPE NOT EXCEEDING 10° FROM HORIZONTAL (REFER DIAGRAMS). FOR DESIGN PURPOSES THE FOLLOWING SOIL PROPERTIES HAVE BEEN USED:-

 BACKFILL DENSITY = 1400 kg/m³
 BACKFILL FRICTION ANGLE = 25°
 BACKFILL COHESION C = 0 kPa

 WHICH CORRESPOND TO STIFF SANDY CLAYS, MEDIUM DENSE CLAYEY SANDS AND SANDY SILT MATERIALS. PARTIAL LOAD AND MATERIAL UNCERTAINTY FACTORS HAVE BEEN APPLIED IN ACCORDANCE WITH AS1674.
 W2. TREAT EARTH FACE WITH BITUMINOUS PAINT AND PROVIDE 1 LAYER OF 0.2mm WATERPROOF MEMBRANE.
 W3. PROVIDE Ø90mm AGG DRAIN AT BASE OF WALL AND CONNECT TO LEGAL POINT OF DISCHARGE. SURROUND AGG DRAIN WITH FILTER SOCK (GEO-TEXTILE 0.25MM PARTICLE SIZE RETAINING) AND AT LEAST 300mm OF GRAVEL OR CRUSHED STONE.
 W4. PROVIDE 300mm FREE DRAINING GRANULAR BACKFILL FOR FULL HEIGHT TO BACK FACE OF WALL.
 W5. BACKFILL WITH MATERIAL FROM SITE COMPACTED IN LAYERS NO MORE THAN 50mm DEEP. BACKFILL SHOULD NOT BE PLACED BEHIND THE WALL UNTIL AT LEAST TEN DAYS AFTER POURING FOOTINGS. PREFERABLE BACKFILL IS COARSE GRAINED SOIL WITHOUT AN ADMIXTURE OF FINE SOIL PARTICLES SUCH AS VERY PERMEABLE CLEAN SAND OR GRAVELS.
 W6. SEAL BACKFILL WITH A COMPACTED LAYER OF MATERIAL WITH LOW PERMEABILITY AND PROVIDE AN OPEN DRAIN AT SURFACE IF PAVING OR SIMILAR IS NOT TO BE CONSTRUCTED.
 W7. GLOBAL SLIP FAILURE IS NOT CONSIDERED AN ISSUE WHEN THE SOIL STRENGTH INCREASES WITH DEPTH. CONSULT AN ENGINEER IF THIS IS NOT THE CASE i.e. A SOFT LAYER OF CLAY IS BELOW THE WALL AND FOUNDATIONS.

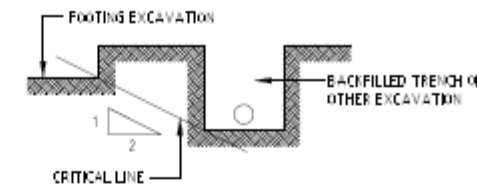
FOUNDATIONS

- F1 THE PROJECT GEOTECHNICAL ENGINEER (PGE) SHALL BE PRESENT FOR ALL EXCAVATIONS FOR BUILDING FOUNDATIONS. SOIL TESTS MUST BE CARRIED OUT AND THE FOUNDATION MATERIAL SHALL BE APPROVED BY THE PGE BEFORE PLACING BLINDING AND/OR REINFORCEMENTS.
- F2 ALL FOOTING EXCAVATIONS SHALL BE MAINTAINED FREE OF WATER BY PROVISION OF RELIEF DRAINS, OR DRAINAGE TO SUITABLE COLLECTION SUMPS FOR REMOVAL BY PUMPING OR MANUAL MEANS.
- F3 ALL FOOTING EXCAVATIONS SHALL BE INSPECTED & APPROVED BY PGE SO AS TO ENSURE DESIGN ASSUMPTIONS ARE MET.
- F4 FOUNDING MATERIAL ON SITE SHALL HAVE MINIMUM CHARACTERISTIC AS LISTED BELOW:

 MATERIALS: C/C/S/M/SC
 UNIT WEIGHT: 20kN/m³ FOR BACKFILL AND 18kN/m³ FOR NATURAL SOILS
 DRAINED: PHI=20 DEGREES MIN, AND C=0
 UNDRAINED: PHI=0 AND SU=100kPa MIN.
 IAH: 0.47
 F5 REMEDIATION OF ANY IDENTIFIED SOFT AND/OR ORGANIC MATERIAL, OR HARD LAYERS SHALL BE PERFORMED UNDER THE SUPERVISION OF THE ATTENDING PGE & APPROVED BY THE PGE.
 F6 ALL RETAINING WALLS AND TRENCHES SHALL BE TEMPORARILY PROPPED PRIOR TO BACKFILLING WITH PROPS BEING RETAINED UNTIL COMPLETION OF CURING OF SUPPORTING SLABS.
 F7 BACKFILL WITHIN A MINIMUM OF 400mm OF THE BACKFACE OF ANY RETAINING WALL SHALL BE AN APPROVED NON-PLASTIC, FREE DRAINING GRAVEL MATERIAL, FREE OF DELETERIOUS AND ORGANIC MATTER UNLESS NOTED OTHERWISE. OTHER ALL MATERIAL MAY BE MATERIAL AS EXCAVATED, COMPACTED TO 95% OF MAXIMUM DRY DENSITY (STANDARD COMPACTION TEST AS PER AS1289).
 F8 PGE TO INSPECT BATTERS AND ADJUST SLOPES AS NECESSARY DURING CONSTRUCTION TO ENSURE ADEQUATE STABILITY OF BATTERS.
 F9 FOUNDING MATERIAL FORMING BASE ARE TO BE CLEAN AND FREE OF ANY LOOSE MATERIAL SO AS TO ACHIEVE NOMINATED BEARING CAPACITY GIVEN ON THE DRAWINGS.

FOUNDATIONS CONT'D

F10 UNLESS APPROVED BY THE PGE EXCAVATIONS NEAR FOOTINGS SHALL NOT GO BELOW THE CRITICAL LINE AS SHOWN BELOW.



CONCRETE

- C1 ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600.
- C2 CONCRETE SHALL BE FROM AN APPROVED SOURCE AND SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING STANDARDS, UNLESS NOTED OTHERWISE:-

AS 3600	CONCRETE STRUCTURES
AS 4671	STEEL REINFORCING BARS FOR CONCRETE
AS 5972	PORTLAND CEMENT
AS 1379	READY-MIXED CONCRETE
AS 2754.1	CONCRETE AGGREGATES
- C3 CONCRETE SHALL BE SUPPLIED ON A PERFORMANCE BASIS AND HAVE THE FOLLOWING CHARACTERISTICS:-

ELEMENT	STRENGTH TO CLASS GP (MPa)	MAXIMUM AGGREGATE SIZE (mm)	SLUMP (mm)
SLEEPERS	N40	20	100
FORMED PIERS	N32	20	80
- C4 CONCRETE MIX DESIGN, INCLUDING PROPORTIONS OF ADDITIVES AND CEMENTITIOUS REPLACEMENT MATERIALS, SHALL BE APPROVED BY THE CERTIFYING ENGINEER PRIOR TO THE PLACEMENT OF ANY CONCRETE. CALCIUM CHLORIDE SHALL NOT BE USED IN ANY MIX. FLYASH SHALL NOT BE USED AS A CEMENT REPLACEMENT BUT MAY BE ADDED FOR WORKABILITY TO A MAXIMUM 25% OF CEMENT CONTENT.
- C5 THE FINISHED CONCRETE SHALL BE A DENSE HOMOGENEOUS MASS, COMPLETELY FILLING THE FORMWORK THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS.
- C6 ALL FORMED EXPOSED EDGES AND RE-ENTRANT CORNERS SHALL BE CHAMFERED OR FILLETED 5mm. FOR CHAMFERS, FILLETS ETC. REFER TO DETAILS. MAINTAIN MINIMUM COVER TO REINFORCEMENT AT THESE LOCATIONS.
- C7 NO PENETRATIONS, CHASES OR TEMPORARY FIXTURES ARE PERMITTED IN THE CONCRETE MEMBERS WITHOUT PRIOR APPROVAL OF THE CERTIFYING ENGINEER.
- C8 WHEN DRILLING INTO EXISTING STRUCTURES, USE HAMMER DRILLS ONLY. DO NOT USE DIAMOND CORE DRILLS, EXCEPT WHERE SPECIFICALLY NOTED. DO NOT CUT OR DAMAGE EXISTING REINFORCEMENT UNLESS NOTED.
- C9 CHEMICAL ANCHORS FOR FIXINGS TO CONCRETE SHALL BE MULTI-CHEMSET ANCHORS OR APPROVED SIMILAR.
- C11 ALL CONCRETE, INCLUDING SLABS ON GROUND & FOOTINGS, SHALL BE COMPACTED USING VIBRATION EQUIPMENT.
- C12 THE CONCRETE SHALL BE TESTED FOR COMPLIANCE WITH SPECIFIED STRENGTH & SLUMP IN ACCORDANCE WITH AS3600.
- C13 PROPONENT SUPPORT PROPPING SHALL BE LEFT IN PLACE TO AVOID OVERSTRESSING THE STRUCTURE DUE TO CONSTRUCTION LOADING. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT STRIPPING AND BACKPROPPING COMPLIES WITH THE REQUIREMENTS OF AS3610 - FORMWORK FOR CONCRETE.
- C14 NO CONCRETE TO BE POURED WHEN SITE TEMPERATURE EXCEEDS 35°C OR FALLS BELOW 5°C
- C15 NO WATER SHALL BE ADDED TO CONCRETE ON SITE WITHOUT PRIOR APPROVAL. ANY SAMPLE SHALL HAVE WATER ADDED ONLY TO THE AMOUNT ALLOWED ON THE SUPPLY TICKET AND SHALL BE TESTED AFTER THE ADDITION OF THE WATER.

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REV	DATE	REVISIONS										

BORED PIER

- BP1 BORED PIERS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH AS 2159.
- BP2 ALL CONCRETE SHALL HAVE A 28 DAY CHARACTERISTIC STRENGTH (F_{ck}) OF 32 MPa WITH A SLUMP OF 80mm.
- BP3 ALL CONCRETE WORK SHALL COMPLY WITH AS 3600, REFER NOTE C10.
- BP4 THE PROPONENT IS RESPONSIBLE FOR PROPERLY SETTING OUT THE PIER LOCATIONS.
- BP5 THE PIERS SHALL NOT DEVIATE FROM THE VERTICAL BY MORE THAN 1 IN 25.
- BP6 THE MAXIMUM DIMENSIONAL TOLERANCE IN ANY DIRECTION IS 20mm.
- BP7 WHERE PIERS HAVE BEEN SET OUT OR PLACED INCORRECTLY THE PROPONENT SHALL BE RESPONSIBLE FOR, AT HIS OWN COST, THE DESIGN AND CONSTRUCTION OF RECTIFICATION WORKS TO MAINTAIN THE DESIGN INTENT AND INTEGRITY OF THE FOUNDATION SYSTEM. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO:
 - DESIGN CHECKS BY ENGINEER
 - REVIEW OF RECTIFICATION PROPOSALS BY ENGINEER
 - DESIGN AND CONSTRUCTION OF ADDITIONAL BORED PIERS AND PILE CAP IF NECESSARY
 - INSPECTION AND CERTIFICATION OF RECTIFICATION WORKS THE ENGINEER'S SERVICES FOR THESE WORKS SHALL BE PAID BY THE PROPONENT.
- BP8 CONCRETE SHALL BE PLACED AS SOON AS POSSIBLE AFTER DRILLING AND AFTER APPROVAL HAS BEEN GIVEN BY THE CERTIFYING ENGINEER. IF NECESSARY, TEMPORARY LINING SHALL BE USED TO MAINTAIN THE SIDES OF THE PIER UNTIL CONCRETING.
- BP9 THE PIER HOLES SHALL BE KEPT FREE OF WATER AT ALL TIMES, BY BAILING OR PUMPING WHERE NECESSARY, PARTICULARLY PRIOR TO CONCRETING. CONCRETE SHALL NOT BE PLACED IN WATER. THE TOP OF THE HOLE SHALL BE PROPERLY COVERED TO PREVENT SURFACE WATER OR RAINFALL FROM ENTERING THE HOLE.
- BP10 PROPER SAFETY PRECAUTIONS SHALL BE TAKEN TO AVOID INJURY TO PEOPLE. THE UNATTENDED HOLE SHALL BE COVERED OR FENCED OFF AT ALL TIMES.
- BP11 WHERE THE FINAL CUT-OFF LEVEL IS ABOVE NATURAL GROUND LEVEL, THE PIERS MUST BE FORMED TO THE CORRECT LEVEL BY USING TEMPORARY LINERS.
- BP12 CONCRETE IN THE BASES AND SHAFTS SHALL BE PLACED CONTINUOUSLY UP TO THE UNDERSIDE OF PILE CAPS. CONCRETE SHALL NOT BE DROPPED BUT SHALL BE PLACED USING A CONCRETE PUMP OR A PROPERLY CONSTRUCTED CHUTE. CONCRETING SHALL BE TEMPORARILY STOPPED WHEN THE CONCRETE IS WITHIN ONE METRE BELOW THE TOP OF EACH LENGTH OF LINER IF PROVIDED AND THAT LENGTH OF LINER SHALL BE WITHDRAWN AND THE CONCRETE VIBRATED WITH IMMERSION TYPE VIBRATORS.
- BP13 CONCRETE SHALL BE COMPACTED BY IMMERSION VIBRATORS HAVING A FREQUENCY NOT LESS THAN 5000 VIBRATIONS PER MINUTE.

TIMBER


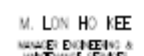
- T1 ALL TIMBER WORKMANSHIP SHALL BE IN ACCORDANCE TO AS1720.
- T2 ALL TIMBER SHALL BE SEASONED AUSTRALIAN HARDWOOD AND SHALL CONFORM TO REQUIREMENTS OF AS2082.
- T3 ALL TIMBER SHALL HAVE A MINIMUM STRESS GRADE OF F22.
- T4 ALL TIMBER SHALL BE OF THE FOLLOWING SPECIES:
 - IRONBARK, RED (EUCALYPTUS SIDEROXYLON)
 - IRONBARK, RED BROADLEAVED (EUCALYPTUS FIBROSA)
 - IRONBARK, GREY (EUCALYPTUS PANICULATA)
 - GUM, GREY (EUCALYPTUS PROFUNDUS)
- T5 ALL TIMBER TO BE USED SHALL BE CCA TREATED IN ACCORDANCE TO AS3604 TO CLASS H4.
- T6 ENDS OF ALL TIMBERS SHALL BE GIVEN A COAT OF PETROLEUM JELLY, OR SIMILAR APPROVED GREASE, WITHIN 48 HOURS OF BEING SAWN AT THE MILL.
- T7 ALL EXPOSED END GRAIN (INCLUDING DRILL HOLES) AND TIMBER TO TIMBER CONTACT SURFACES SHALL BE COATED WITH A HEAVY COAT OF PROTUM ON TIMBER PROTECTIVE EMULSION AFTER CUTTING/DRILLING.
- T8 ALL HOLES FOR JOINTS SHALL BE TRULY BORED AND ALL JOINTS CUT TO FIT ACCURATELY AND TIGHTLY. HOLES SHALL BE 10 PER CENT GREATER IN DIAMETER THAN THE BOLTS.
- T9 BOLT/ROD RECESSES (AFTER FINAL TIGHTENING OF BOLTS), SPLITS AND KNOTHOLES IN TIMBER SHALL BE FILLED WITH PACCO HYDROSEAL TYPE 367, KNIFE GRADE OR EQUIVALENT.
- T10 ALL BOLTS, NUTS AND WASHERS SHALL BE HOT DIPPED GALVANISED IN ACCORDANCE WITH AS 4460.
- T11 BOLTS SHALL BE GRADE 4.6S, WASHERS SHALL CONFORM TO AS 1720. BOLTS SHALL BE RETIGHTENED AT SIX MONTHS AFTER COMPLETION OF CONSTRUCTION.
- T12 ALL BOLTHEADS OR NUTS ON EXPOSED SURFACES SHALL BE RECESSED BELOW THE SURFACE.
- T13 TIMBER CONNECTIONS SHALL BE AS SHOWN ON THE DRAWINGS WHERE DETAILED, WHERE NOT DETAILED, THEY SHALL MATCH AS CLOSE AS PRACTICABLE THE EXISTING DETAILS THEY ARE REPLACING.

STEELWORK

- S1 ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 4100 AND AS 3554.
- S2 UNLESS SHOWN OTHERWISE ALL STEEL COMPONENTS SHALL BE IN ACCORDANCE WITH AS3601.1 GRADE 300.
- S3 ALL BOLTS TO BE STRENGTH GRADE 4.6 TO AS3111, TIGHTENED USING A STANDARD WRENCH TO A SNUG TIGHT CONDITION. ALL BOLTS SHALL BE OF SUCH LENGTH THAT AT LEAST ONE FULL THREAD IS EXPOSED BEYOND THE NUT AFTER THE NUT HAS BEEN TIGHTENED.
- S4 ALL WELD TYPES TO BE CATEGORY SF, WELDS SHALL CONFORM TO AS1554 AND WELDING ELECTRODES TO AS/NZS 4855. WELDING SHALL BE PERFORMED BY AN EXPERIENCED OPERATOR. THE INSPECTION/TESTING OF ALL WELDS SHALL BE CARRIED OUT IN ACCORDANCE WITH AS2214 AND NOTES ON THE DRAWING. WELD TYPES ARE DESIGNATED AS FOLLOWS:-
 - CFW - CONTINUOUS FILLET WELD
 - CFBW - COMPLETE PENETRATION BUTT WELD
 - A/R - ALL ROUND
- S5 HOT DIP GALVANISING SHALL BE IN ACCORDANCE WITH RELEVANT AUSTRALIAN STANDARDS AS1214, AS 559, AS4660, AS4791 & AS4792. REPAINTING/REPAIR OF DAMAGED GALVANISED SURFACES (EG. SITE WELDS) TO BE PAINTED WITH 2 COATS OF APPROVED ZINC RICH PAINT.
- S6 CATHODIC PROTECTION SHALL BE INSTALLED IN ACCORDANCE WITH AS 2832.
- S7 APPROPRIATE CORROSION RESISTANT FITTINGS AND FIXTURES TO BE USED.

PRECAST CONCRETE

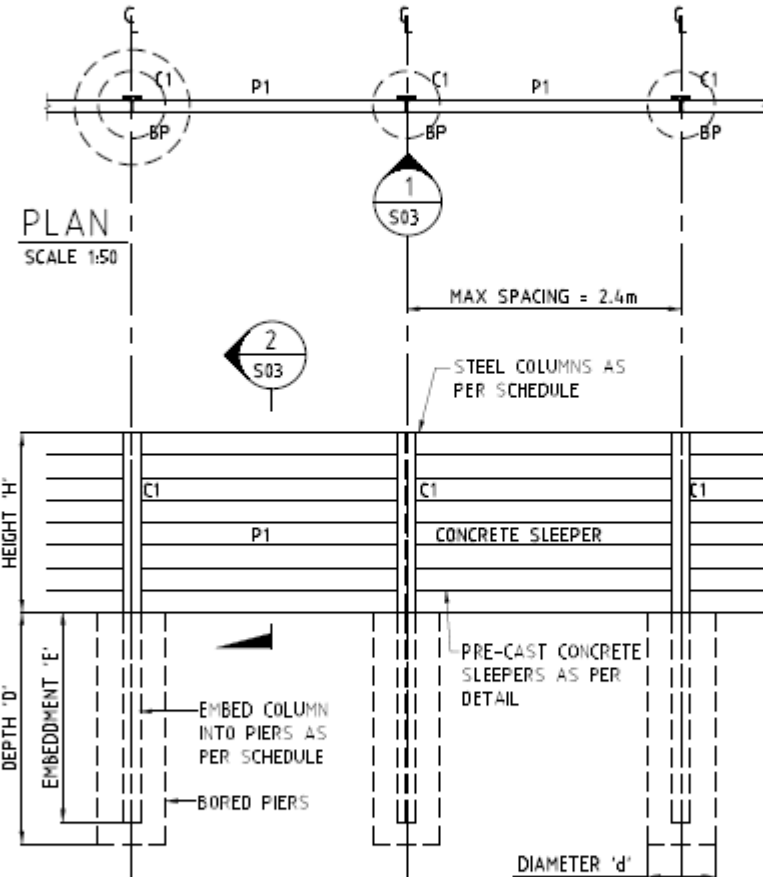
- P1 ALL PRECAST CONCRETE IS TO COMPLY WITH THE CONCRETE NOTES ON THESE DRAWINGS, AS 3600 AND AS2450.
- P2 THE CONCRETE IN THE SLEEPERS IS TO HAVE A MINIMUM CHARACTERISTIC STRENGTH F_{ck} = 45 MPa. THE CONCRETE STRENGTH AT REMOVAL FROM MOULDS IS TO BE A MINIMUM OF 15 MPa.
- P3 ALL SLEEPERS ARE TO BE CONSTRUCTED FROM NORMAL WEIGHT CONCRETE.
- P4 THE SLEEPERS HAVE BEEN DESIGNED FOR THE IN PLACE CONDITION (I.E. LOADS THE PRECAST SLEEPERS ARE SUBJECTED TO AFTER ERECTION ON SITE) AND THE PROPONENT MUST MAKE HIS OWN ASSESSMENT AS TO ANY EXTRA REINFORCEMENT, LIFTING FITTINGS, STRINGSBACKS, ETC. THAT MAY BE REQUIRED TO SUIT HIS PROPOSED STRIPPING, LIFTING, STACKING, TRANSPORTATION, HANDLING AND ERECTION METHODS. IT IS THE RESPONSIBILITY OF THE PROPONENT TO PROVIDE SUCH ADDITIONAL DETAILS AND REINFORCEMENT IN THE SLEEPERS SUCH THAT CONCRETE STRESSES THROUGHOUT HANDLING SHALL NOT CAUSE CRACKING.
- P5 ALL SHOP DRAWINGS ARE TO BE APPROVED BY THE CERTIFYING ENGINEER PRIOR TO CONSTRUCTION COMMENCING. THE PROPONENT SHALL BE RESPONSIBLE FOR ALL DIMENSIONAL CHECKS AND THE FABRICATED ELEMENT IS SUITABLE FOR CONSTRUCTION.
- P6 LIFTING FIXINGS ARE NOT SHOWN ON THESE DRAWINGS. THE PROPONENT SHALL SUPPLY AND FIT HOT DIP GALVANISED OR OTHERWISE APPROVED LIFTING FIXINGS AS REQUIRED. THESE SHALL TAKE THE FORM OF CAST IN CABLES OR FERRULES. THEY SHALL NOT BE LOCATED IN THE FACE WHICH IS EXPOSED TO VIEW IN THE FINAL CONDITION AND AFTER USE SHALL BE PROTECTED TO AVOID CORROSION AND STAINING. TESTS PROVING ANCHORAGE CAPACITY OF LIFTING FERRULES ARE TO BE CONDUCTED.

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REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED	
A	16/10/2020	Page 2 Ret Notes, S2 - Update AS1204 to AS 3879.1					
				GCM 417/054 CORP. NO. 2871/2007	GOULBURN MURRAY RURAL WATER AUTHORITY 40 CAKEY STREET (PO BOX 165), TATURA VIC. 3616 Telephone (03) 5826 3500 Fax (03) 5826 3501	GAO DRAWING NO: 485813 SHEET NUMBER: 02 of 04 DRAWING NUMBER: 485813 REVISION: A	

RETAINING WALL SCHEDULE @ MAX 2400 CTRS

HEIGHT "H"	DEPTH "D"	EMBED "E"	DIAMETER "d"	COLUMN SIZE C1	CORNER COLUMN SIZE C2
<700	1000	800	600	100 UC15	150 PFC
900	1200	1000	600	100 UC15	150 PFC
1100	1500	1300	600	100 UC15	150 PFC
1300	1700	1500	600	100 UC15	150 PFC
1500	2000	1800	600	150 UC23	180 PFC

THESE RETAINING WALL DETAILS ARE GENERIC ONLY AND ARE APPLICABLE TO THE SOIL CONDITIONS IN NOTE W1 ON SHEET 1. THESE DESIGN DRAWINGS SHOULD BE CERTIFIED BY A QUALIFIED ENGINEER TO ENSURE THE GROUND AND LOADING CONDITIONS ARE SUITABLE FOR EACH INDIVIDUAL SITE.

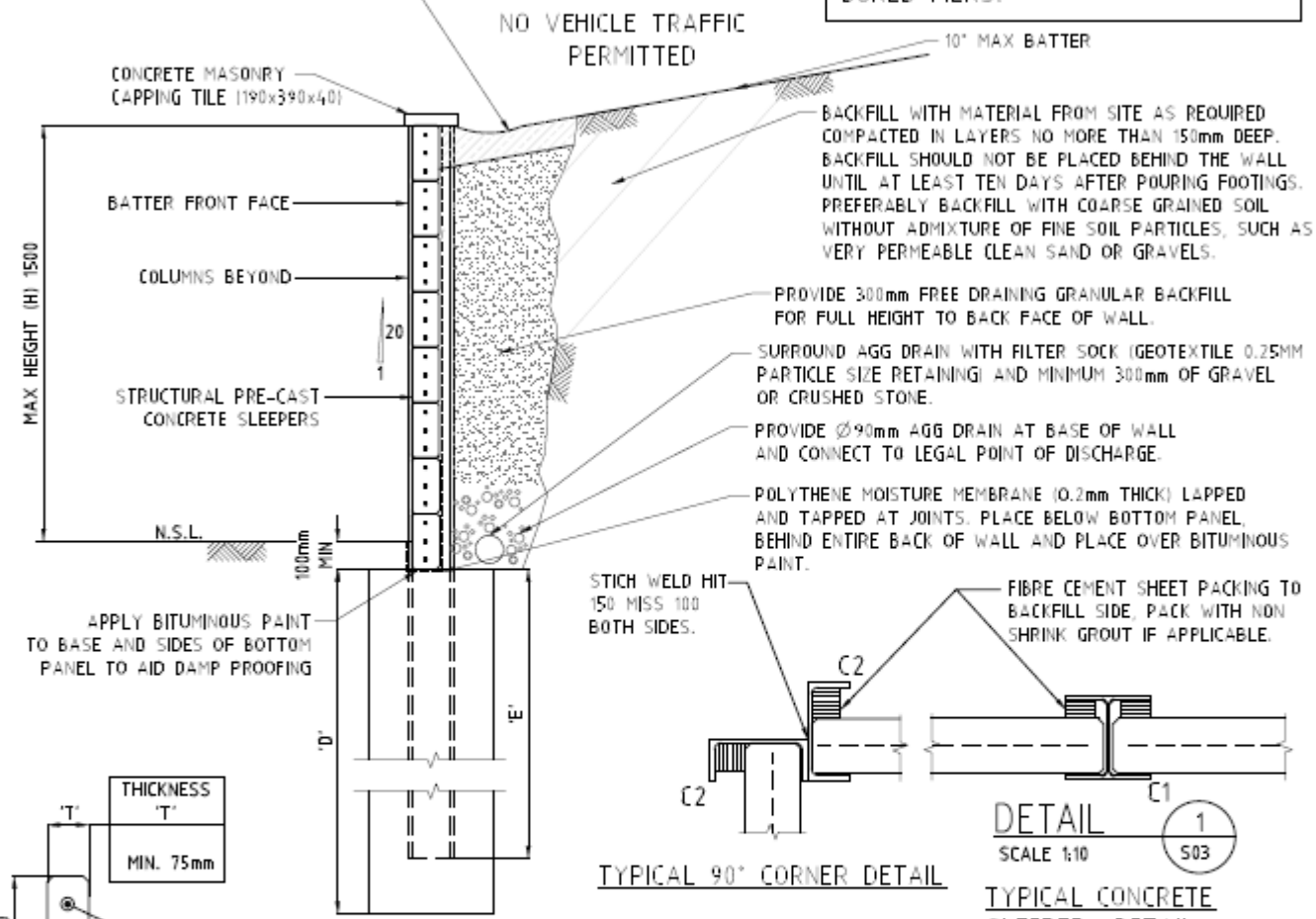


TYPICAL CONCRETE SLEEPER RETAINING WALL SCALE 1:50

NOTE:

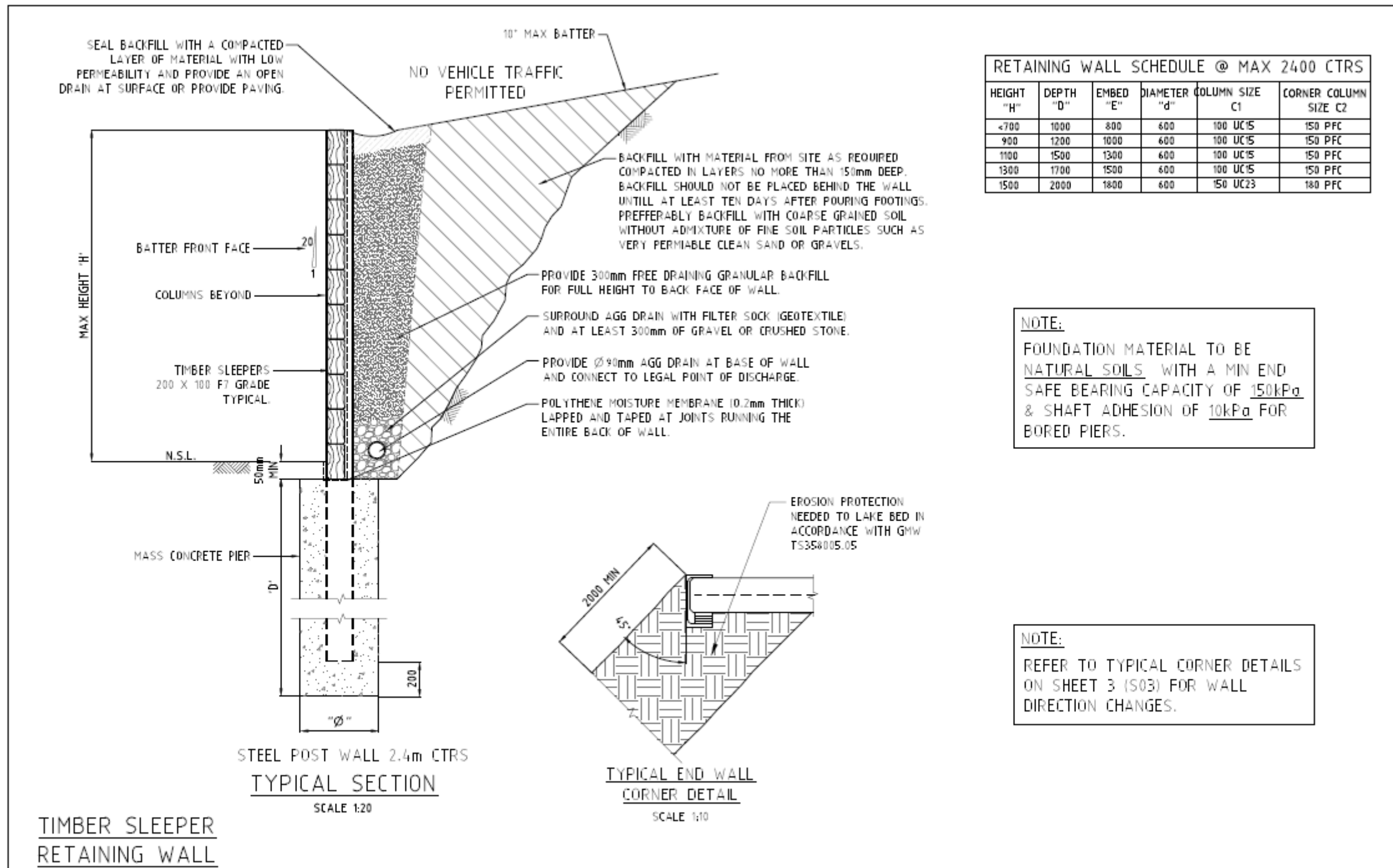
LADDERS AND HANDRAILS WILL BE ASSESSED ACCORDING TO THE RISK ASSESSMENT CRITERIA & TO AS1657.

SEAL BACKFILL WITH A COMPACTED LAYER OF MATERIAL WITH LOW PERMEABILITY AND PROVIDE AN OPEN DRAIN AT SURFACE OR PROVIDE PAVING.



NOTE:
FOUNDATION MATERIAL TO BE NATURAL SOILS WITH A MIN END SAFE BEARING CAPACITY OF 150kPa & SHAFT ADHESION OF 10kPa FOR BORED PIERS.

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DRAWN	DC	CHECKED	AK	DATE	20/11/2023	GOULBURN MURRAY RURAL WATER AUTHORITY	40 CADEY STREET (PO BOX 180), TATURA VIC 3616
DATE	14/10/2023	DATE	14/10/2023	CAD DRAWING NO:	485813	SHEET NUMBER:	03 of 04
DATE	14/10/2023	DATE	14/10/2023	DRAWING NUMBER:	485813	REVISION:	A



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A	14/10/2024	Page 3 Ref Notes, S2 - Update AS1204 to AS 3679.1					
			DESIGN	DRAWN	CHECKED	APPROVED	
			SUBJECT	CITY/STATE	JOB NUMBER		
					GOULBURN MURRAY WATER AUTHORITY 40 CAREY STREET (PO BOX 185), TATURA VIC 3616 Telephone (03) 5826 3500 Fax (03) 5826 3501		CAD DRAWING INDEX 485813
			M. LON HO NEE SENIOR ENGINEER & MAINTENANCE ENGINEER		GMR 4/9/2024 CORR. NO. 2017/066/1	SHEET NUMBER 04 of 04	DRAWING NUMBER 485813
							REVISION A

END OF TS 35 42 53.05