



VOLUME

**6**

**Community Access**

**Manual B1:**

**Standard Designs For Rural Transport Infrastructure**



## ACKNOWLEDGEMENTS

These manuals have been prepared by the Ministry of Works and Transport, Uganda.

The aim of the manuals is to complement the Ministry's effort in providing guidance and building capacity of Local Governments to enable them to handle their mandated roles in planning and management of the road and transport sector development.

This manual is part of a set titled District Road Works and Community Access. The set consists of 6 Volumes, each volume comprising a series of manuals covering varying aspects under the following headings:

- Volume 1 Planning Manuals
- Volume 2 Contract Management Manuals
- Volume 3 Implementation and Monitoring Manuals
- Volume 4 Technical Manuals
- Volume 5 District Administrative and Operational Guidelines
- Volume 6 Community Access

The Manuals describe in detail the organization and techniques for planning, implementation and administration of a district road network, community access and rural transport infrastructure. The manuals support Government strategies on sustainable maintenance of district roads, community access and rural transport infrastructure; they encourage community participation, promote use of labour based methods and gender balance, ensure protection of the environment, foster work place safety and health in implementation of road works by adopting appropriate contracting practices and support the local construction industry.

They are primarily aimed at Road Engineers, Planners, Managers and Community Members involved in the planning and management of district road works, community access and rural transport infrastructure.

In line with the topics covered in these manuals, related training modules have been designed and are incorporated in the curriculum of the Mount Elgon Labour Based Training Centre.

The manuals are the property of the Ministry of Works and Transport but copying and local distribution is not restricted.

We wish to acknowledge the efforts of COWI A/S and COWI Uganda who assisted in the compilation of the Drafts and the invaluable support of the Danish International Development Agency for the financial assistance extended to the Ministry in preparing the manuals.

Engineer in Chief/DE

**Volume 6 Manual C1**  
**Standard Design Manual For Rural Transport Infrastructure**

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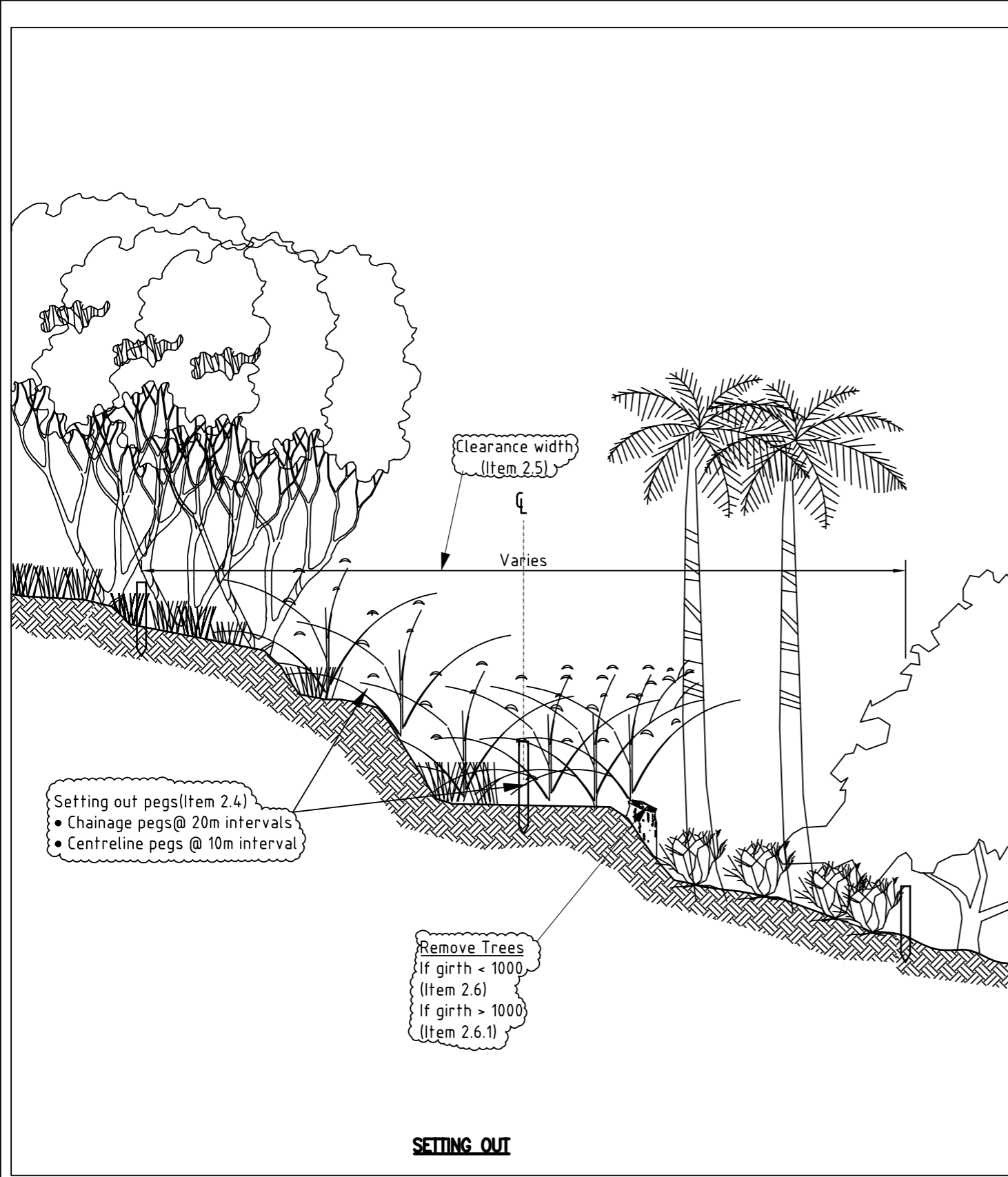
## Section A-1

### Rural Access Roads, Site Works

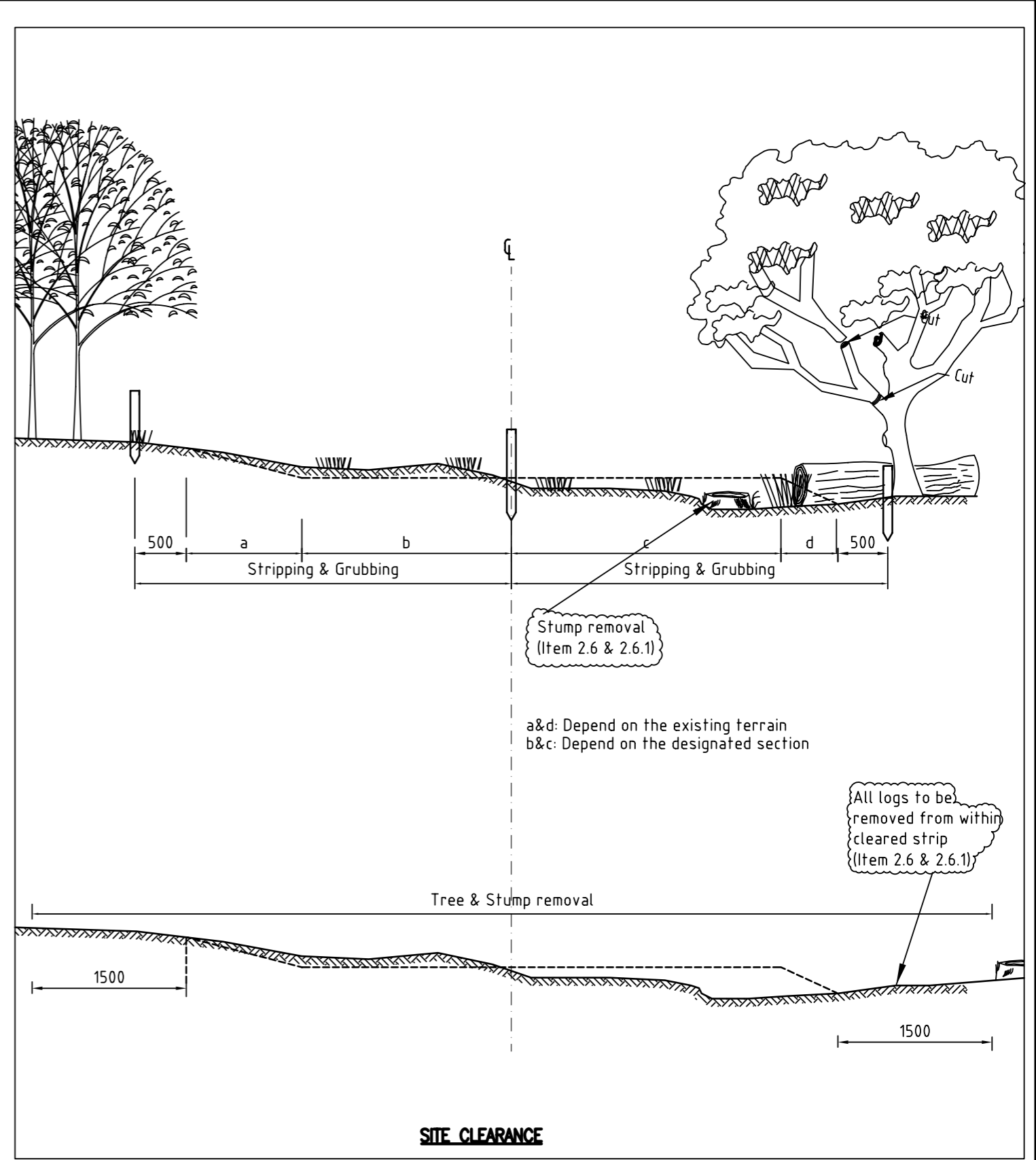
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Drawing Title	Drawing Number
Tracks and Footpaths: Setting out and site clearance works	RA 001
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**SETTING OUT**



**SITE CLEARANCE**

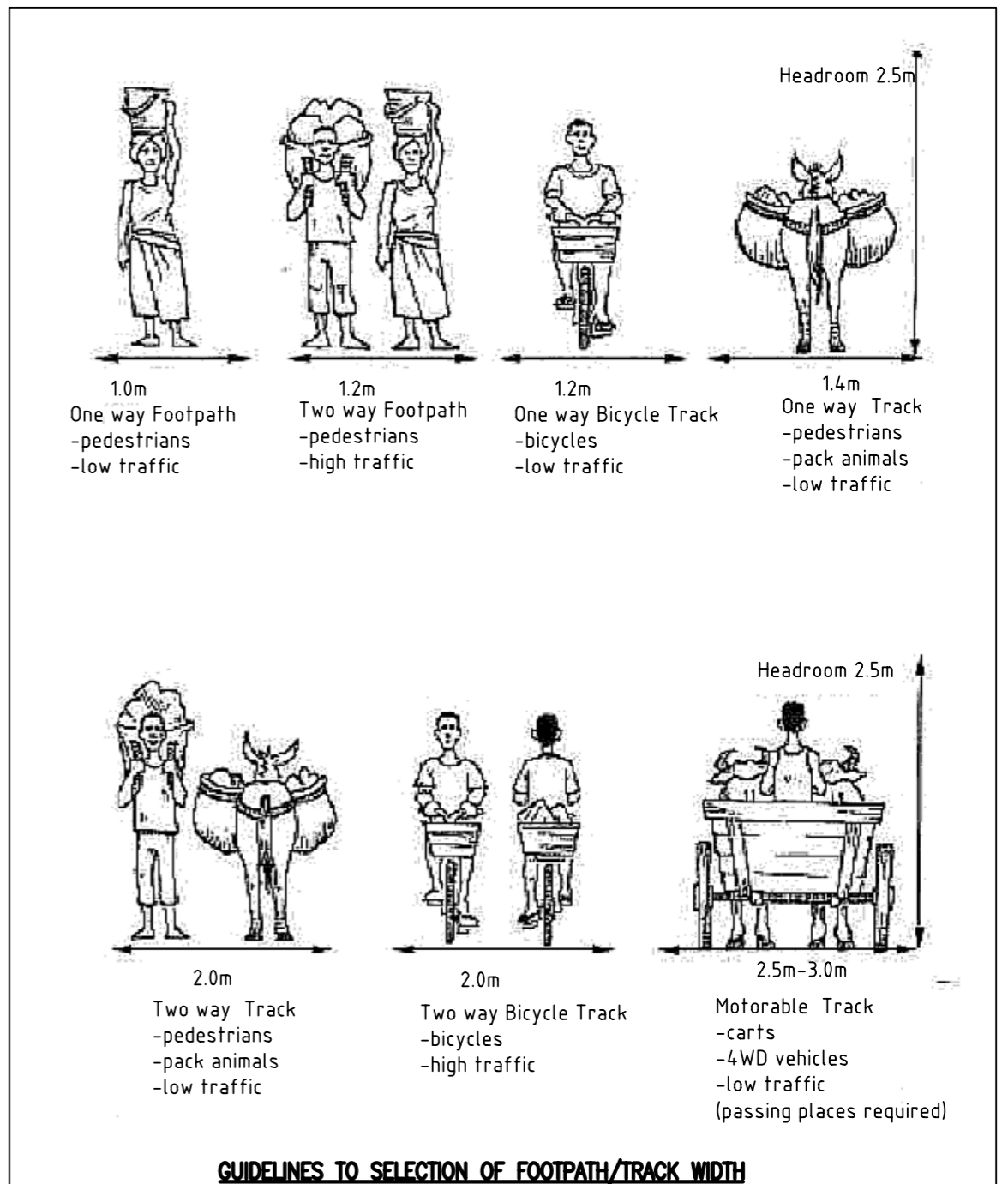
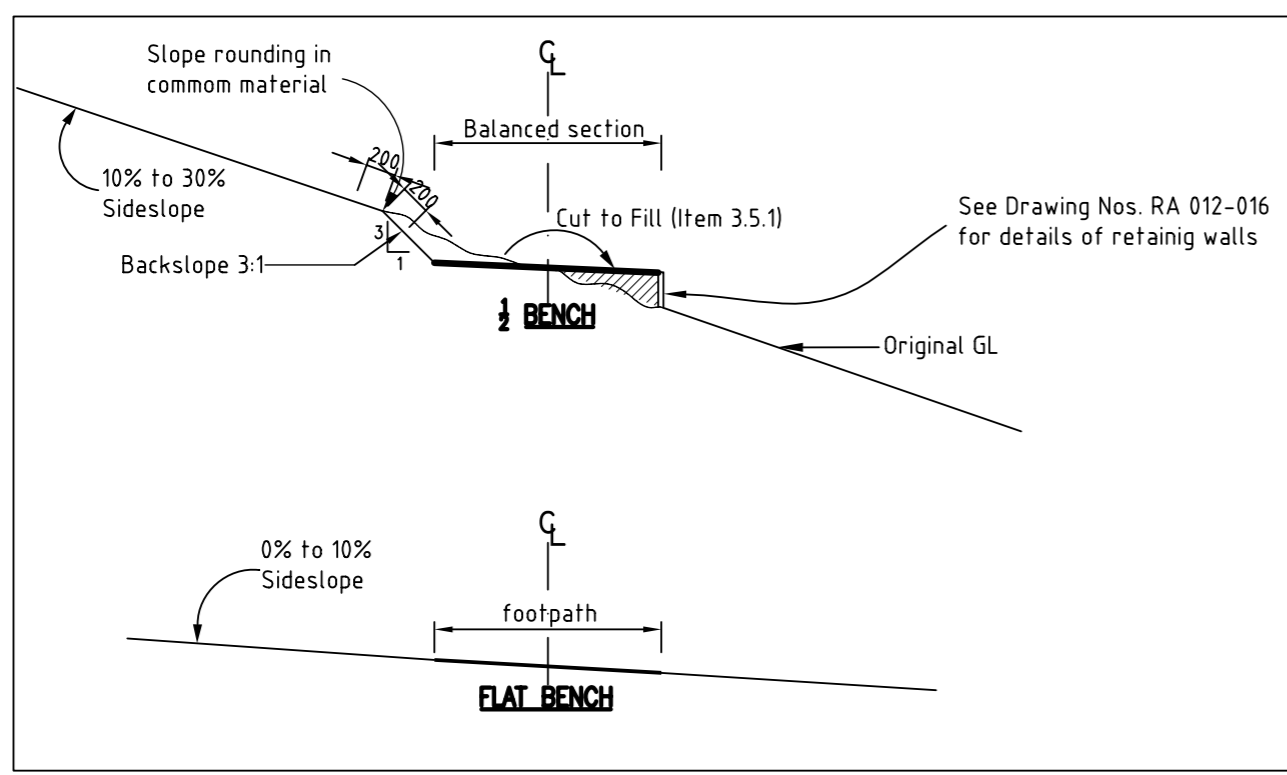
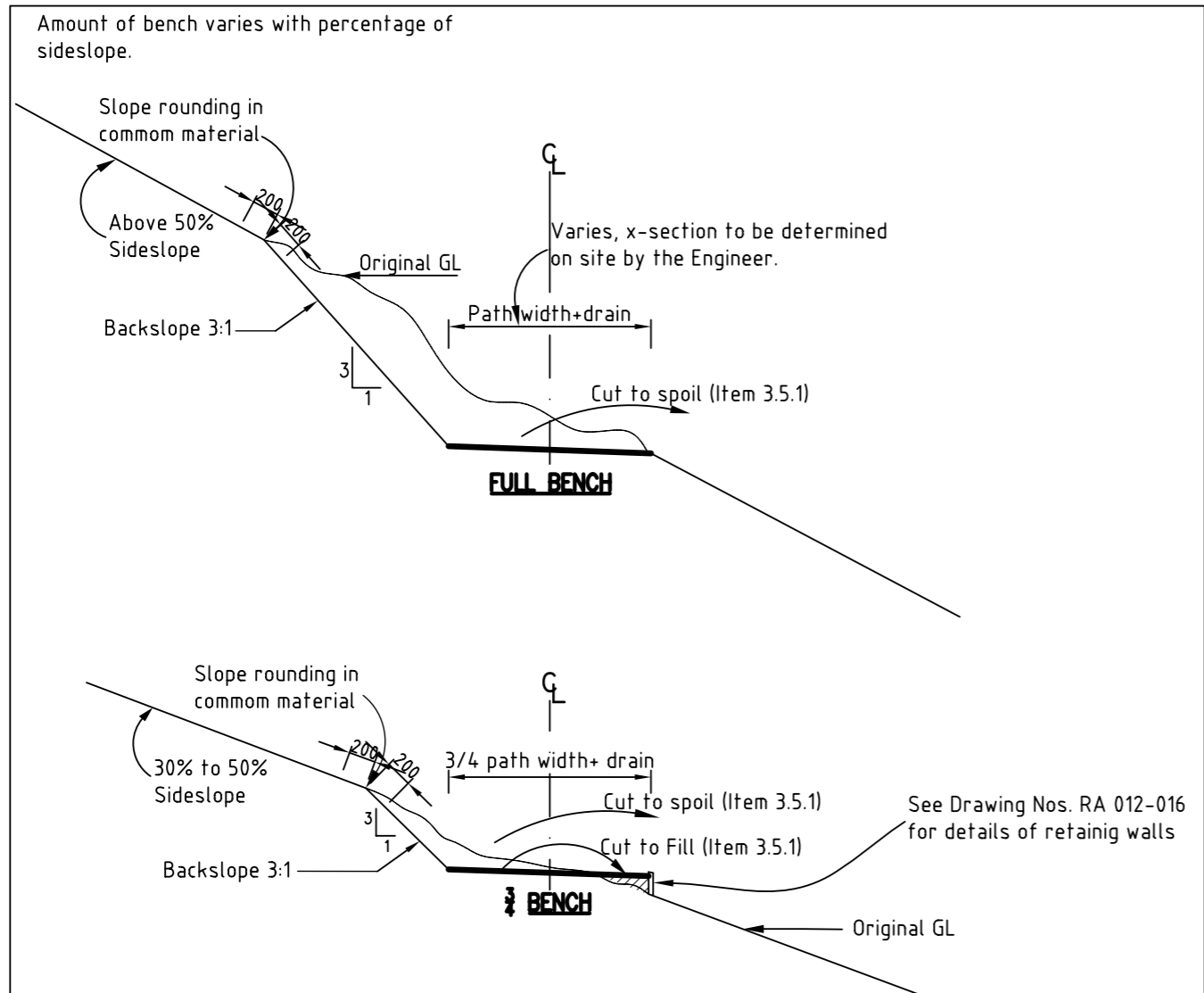
**NOTES ON DESIGN AND CONSTRUCTION**

1. Site clearance is usually an activity undertaken by community members.
2. When site clearance is a community based activity it must be undertaken in a timely manner so as not to impact on the subsequent contractor based activities. This is the responsibility of the Client/Engineer not the Contractor.
3. Contractors are always responsible for 'setting out'. This is an activity that must be undertaken before community members can clear the footpath/track corridor

4. When site clearance is a contractor activity it should be indicated on strip maps
5. The width of the cleared strip depends on footpath width and existing ground slopes. See drwg no. RA003 for details
6. Specifications, method of work and method of measurement and bill item descriptions for the following bill items are included at the back of this manual; items 2.4, 2.5, 2.6, 2.6.1

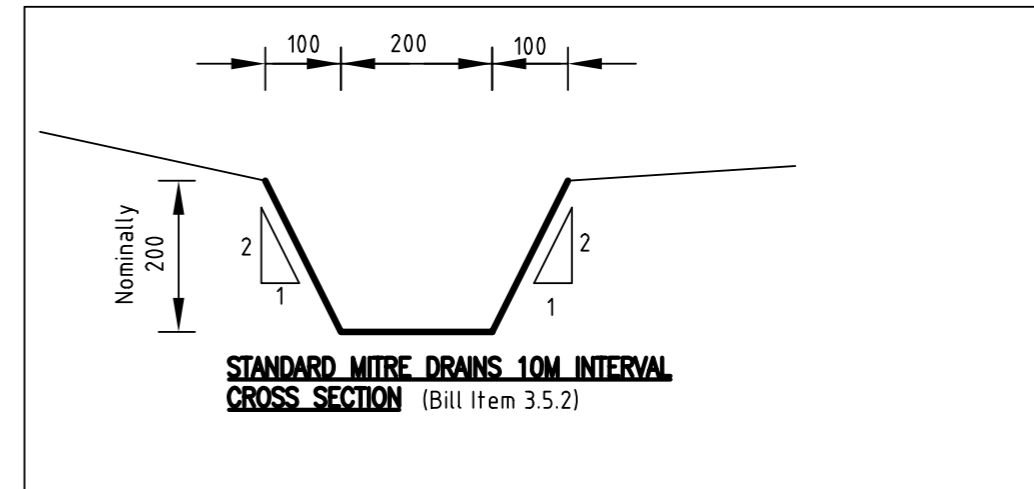
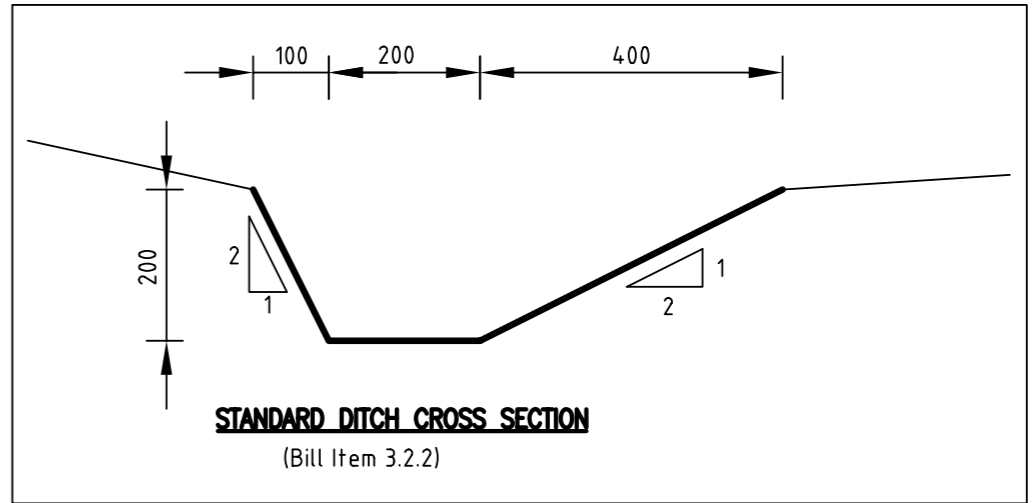
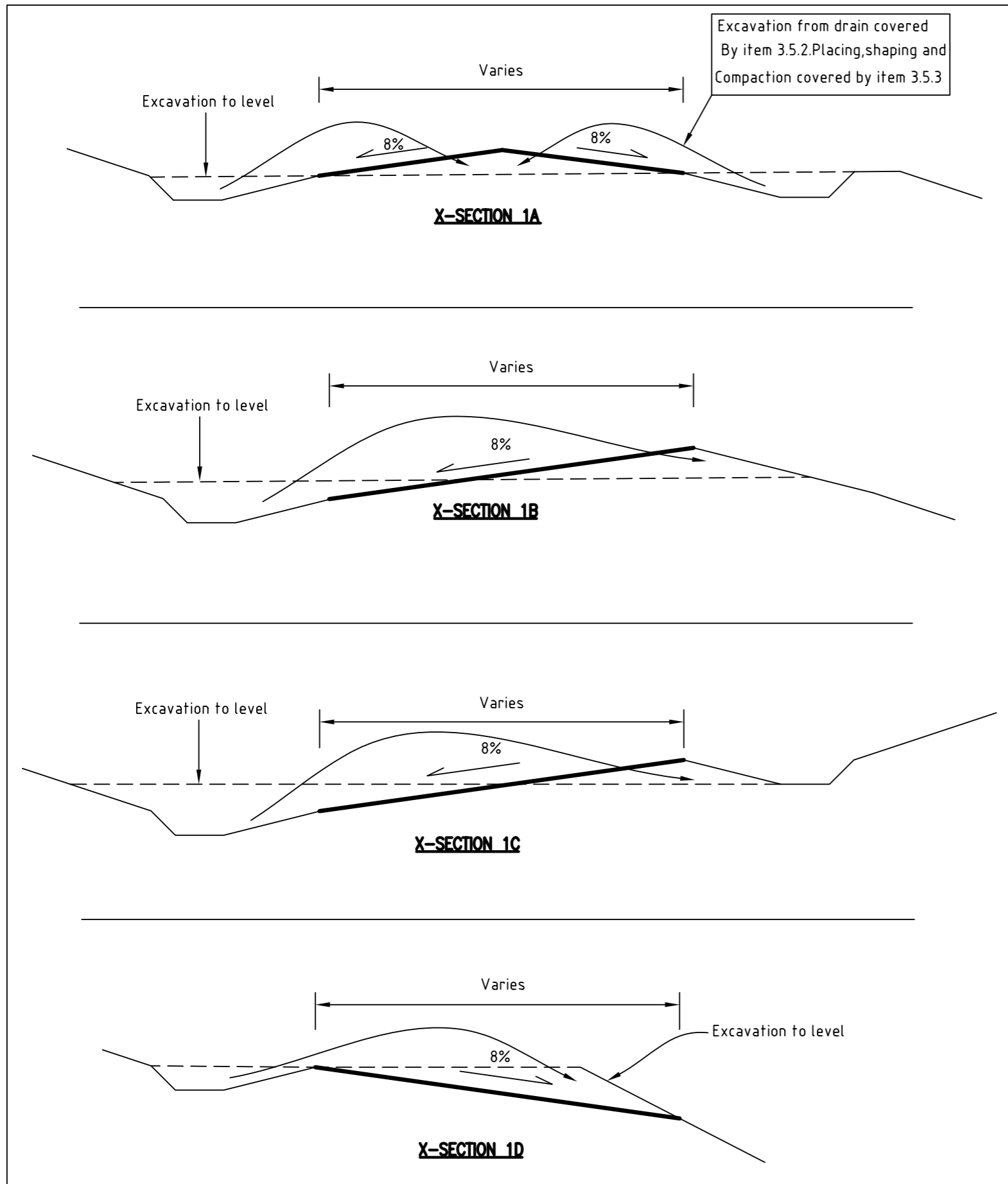


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Project No.		Sheet:	Drawing No. <b>RA 001</b>
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
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- NOTES:**
- In hilly terrain, where ground slopes exceed 10% "cut to fill" or "borrow to fill" earthwork activities should either be avoided by using full bench construction (cut to spoil) or, fill should be placed behind a retaining wall (see drawing numbers RA 012-015 for details).
  - Materials arising from 'cut to spoil' operations should be disposed of on the low side of the path/track corridor, outside of the cleared strip and in a location directed by the Engineers' Representative.
  - Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual. Item 3.5.1.

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Drawn by: IOY	Checked by: JC	Approved by:			
Rev. no	Revision note	Date	Sign	Chkd	



- NOTES**
1. Selection of cross section type depends on topography in the vicinity of the footpath
  2. Cross section type is indicated on the strip map
  3. All cross section types indicated are shown as balanced sections. i.e. cut to fill. Refer to RA 002 for alternatives
  4. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual; Items 3.5.2 and 3.5.3

 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX : 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scales:			
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Rev. no	Revision note				Date	Sign	Chkd

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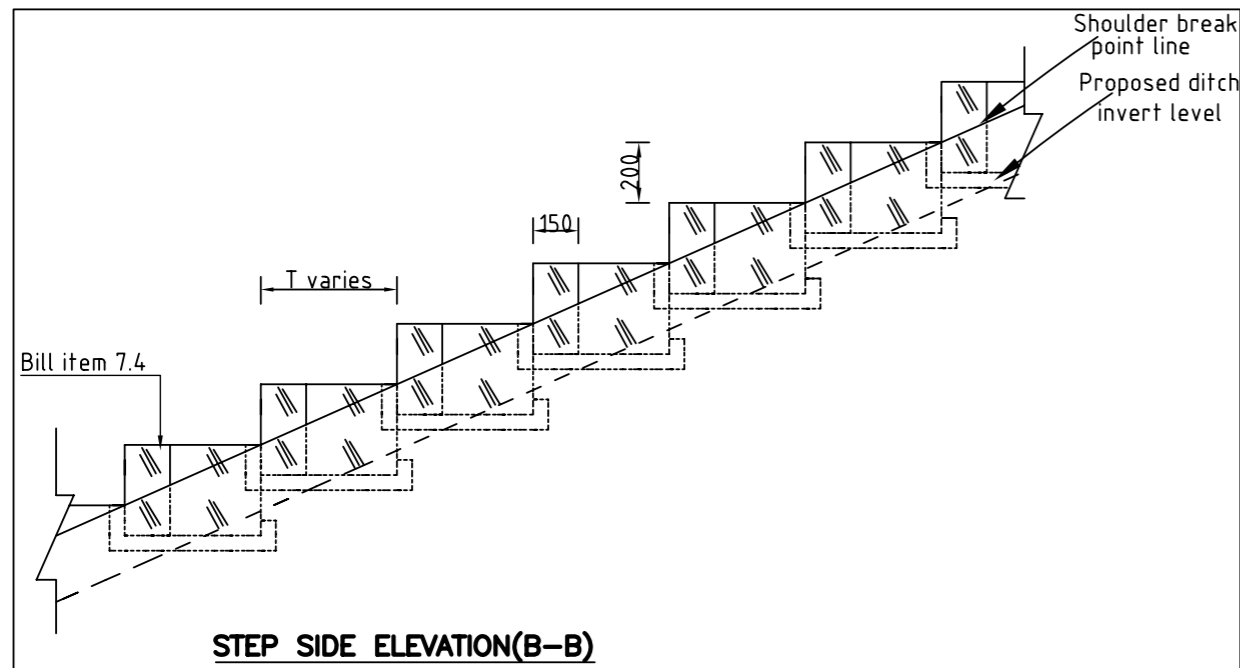
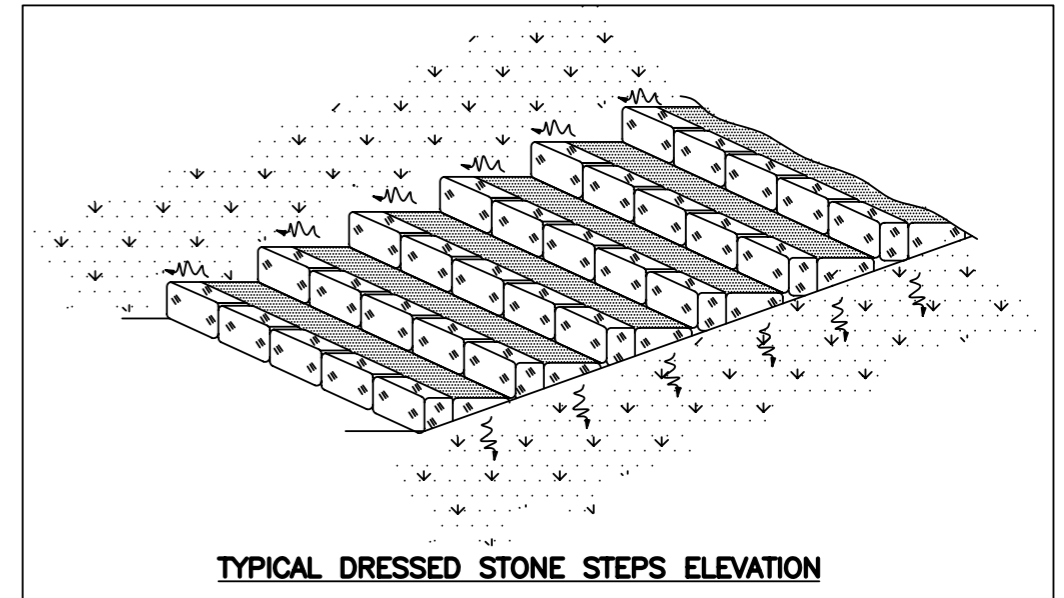
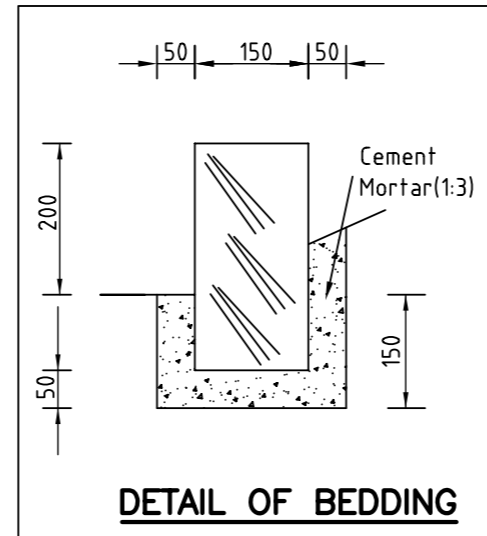
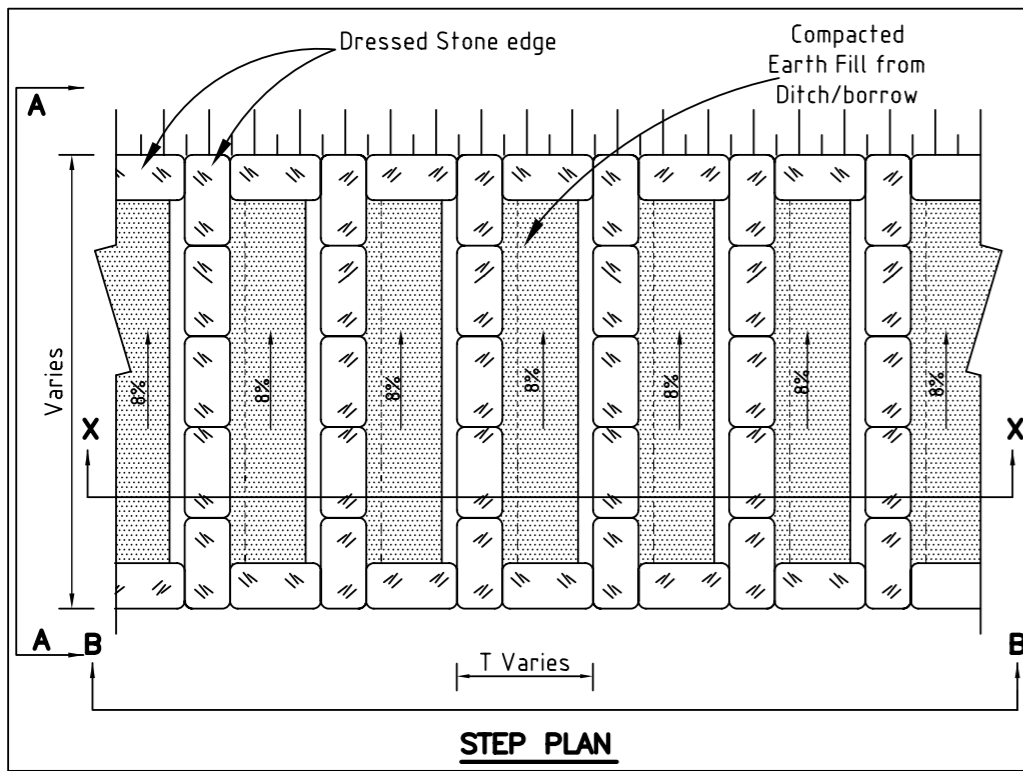
## Section A-2

### Rural Access Roads: Tracks and Footpaths, Typical steps designs

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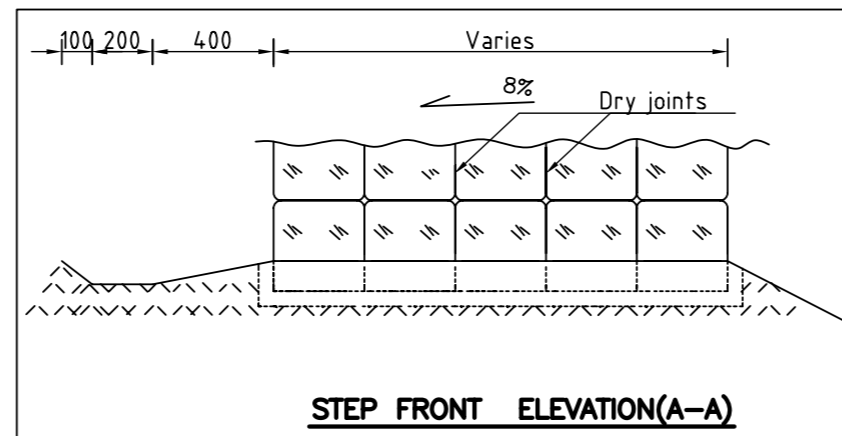
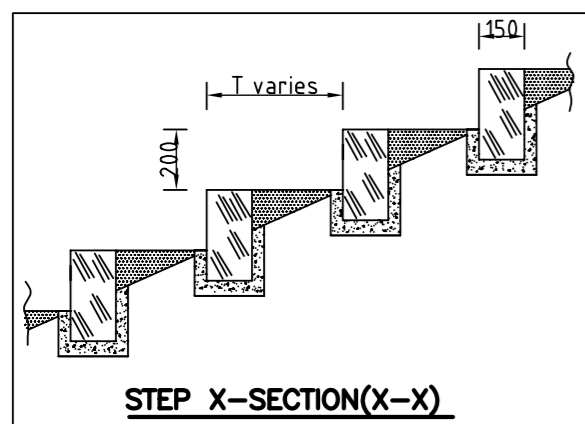
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Tracks and Footpaths: Typical Steps Design, Dressed Stone Edged Steps	RA 004
Tracks and Footpaths: Typical Steps Design, Grouted Stone Steps	RA 005
Tracks and Footpaths: Typical Steps Design, Grouted Stone Steps	RA 006
Tracks and Footpaths: Typical Steps Design, Log Edged Steps	RA 007
Tracks and Footpaths: Sawn Timber Ladders Option 1(Double member details)	RA 008
Tracks and Footpaths: Sawn Timber Ladders Option 2(Single member details)	RA 009
Tracks and Footpaths: Sawn Timber Ladders, General Connection details)	RA 010
Tracks and Footpaths: Resting Area and Handrail details	RA 011



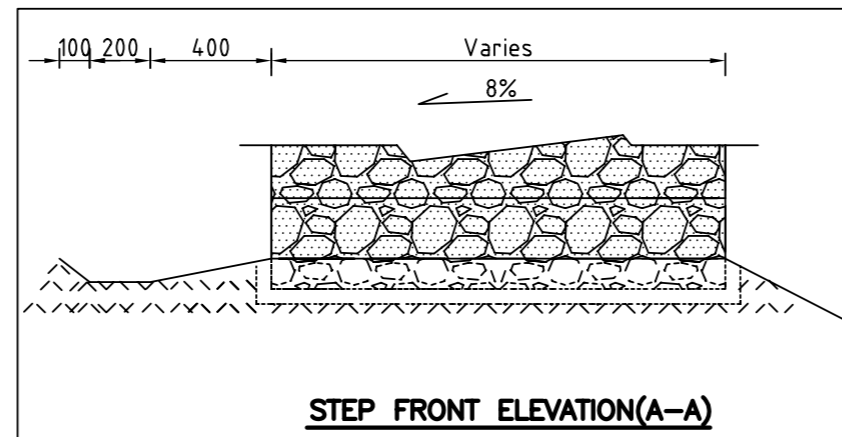
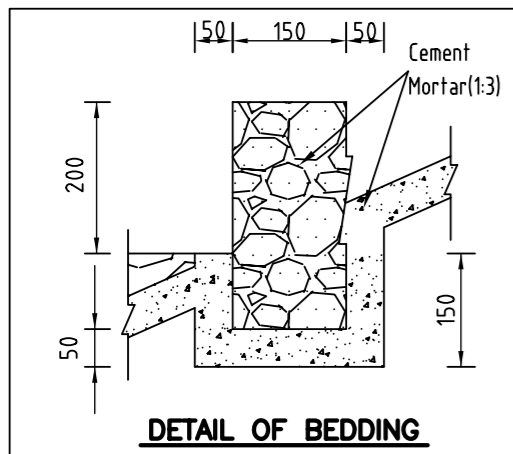
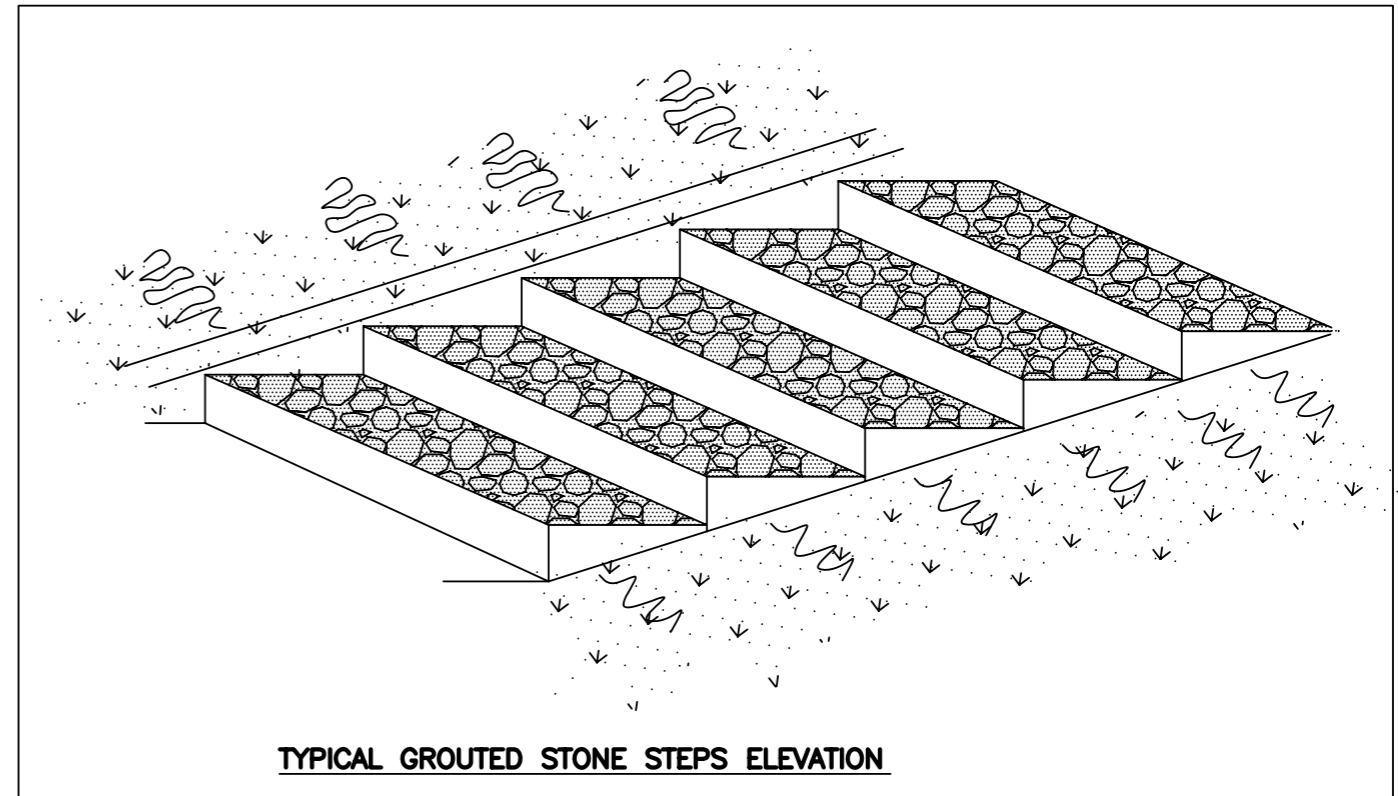
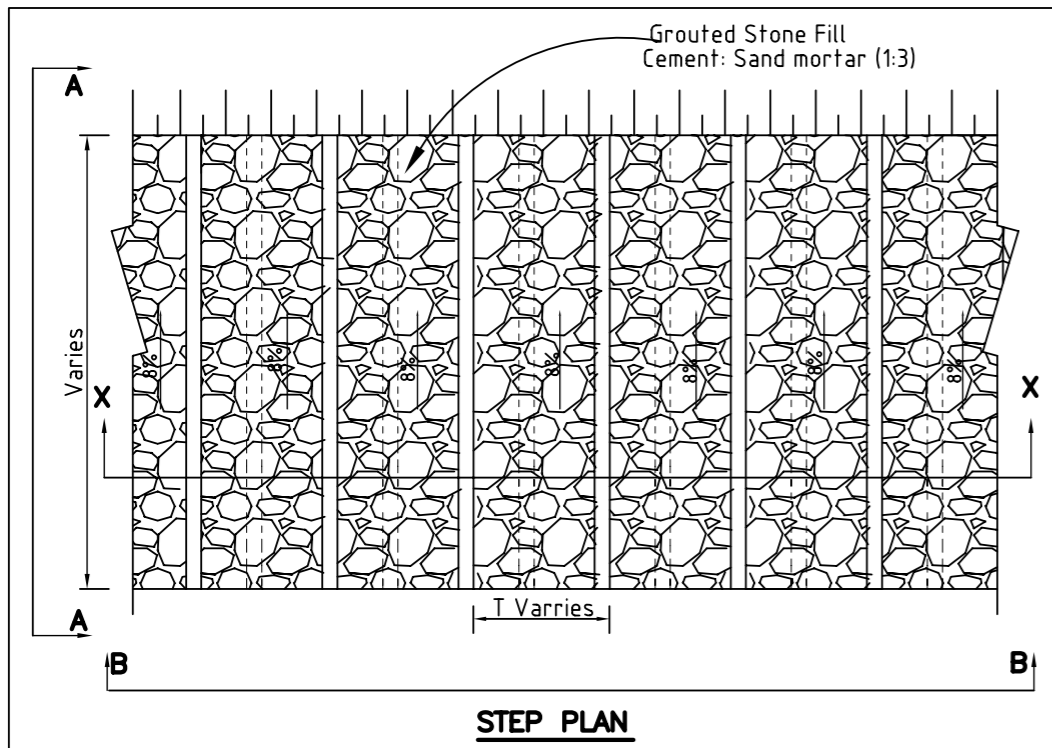


**NOTES FOR DESIGN AND CONSTRUCTION:**

1. The use of dressed stone edged steps should be restricted to areas where both suitable stone and skilled artisans are available.
2. The step is relatively expensive but very durable.
3. The stone should be shaped with a masonry hammer such that all angles are nominally 90 degrees. Dressed blocks should have a minimum weight of 30 kgs.
4. The stone should be durable but soft enough to dress.
5. The drawings indicate steps are restrained on both sides as well as at the front. Side restraints may be omitted. This reduces cost but increases maintenance.
6. The tenderers should be presented with a sample dressed stone block on the pretender site visit. The block should be retained by The Engineer's Representative and used as a standard by which The Contractor's stone is judged for suitability of use. The tenderers should be shown examples of dressed stone steps during the pretender site visits.
7. Specifications, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 7.4 and 7.5

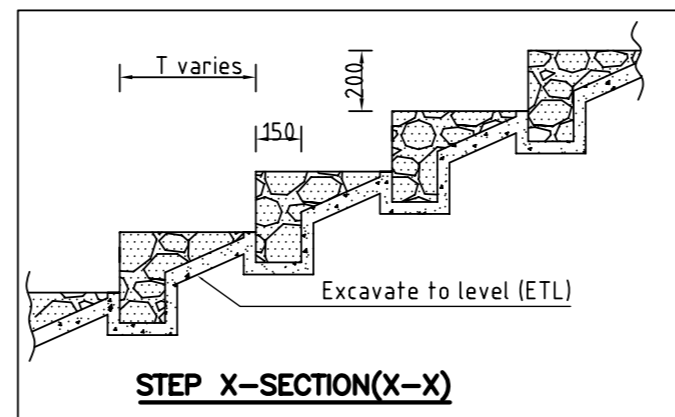
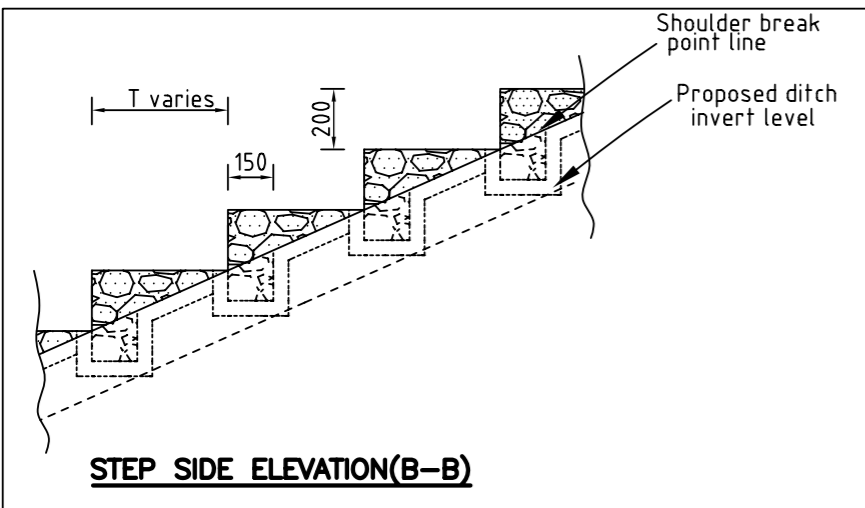


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Drawn by: IOY	Checked by: JC	Approved by:
Rev. no	Revision note	Date Sign Chkd



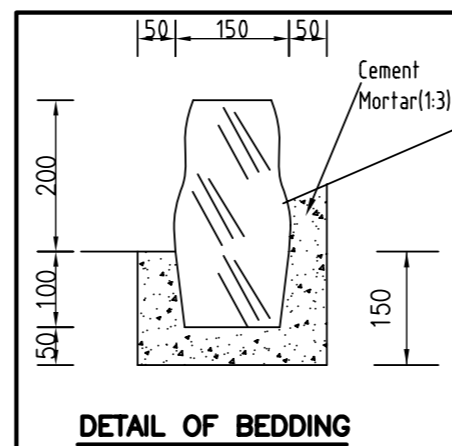
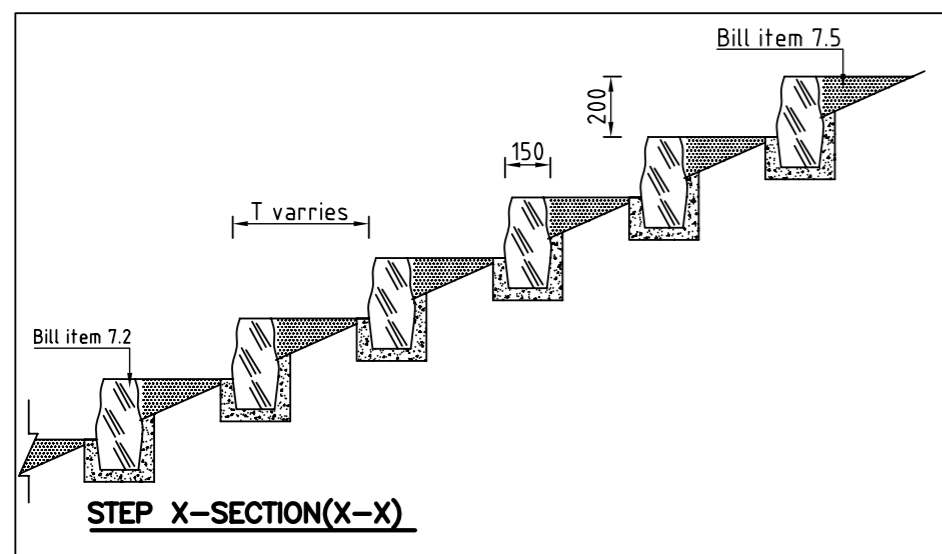
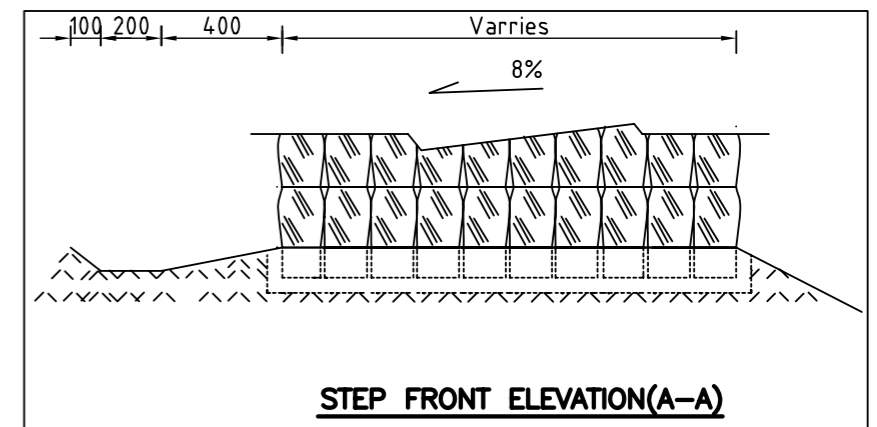
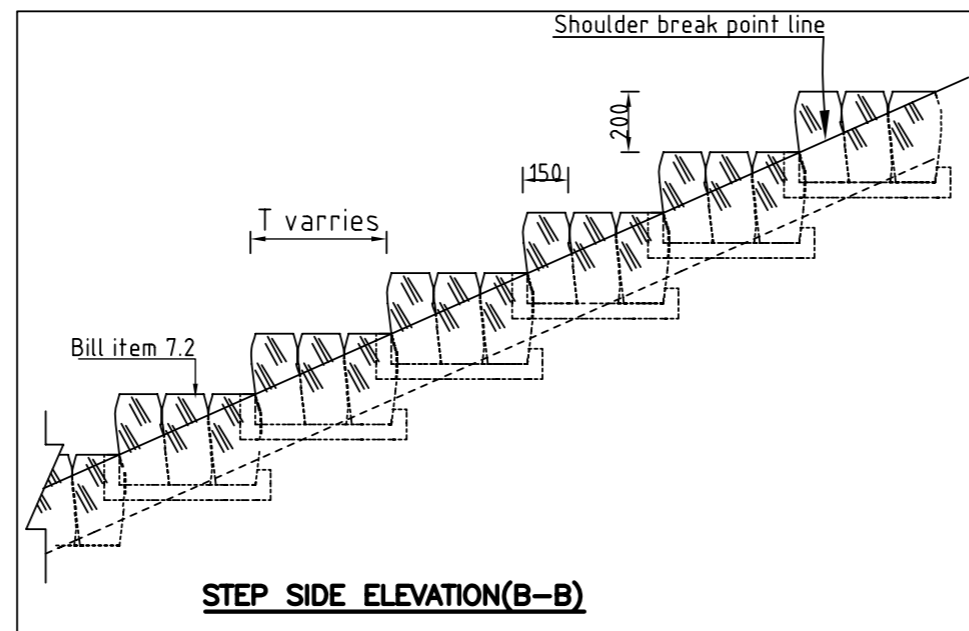
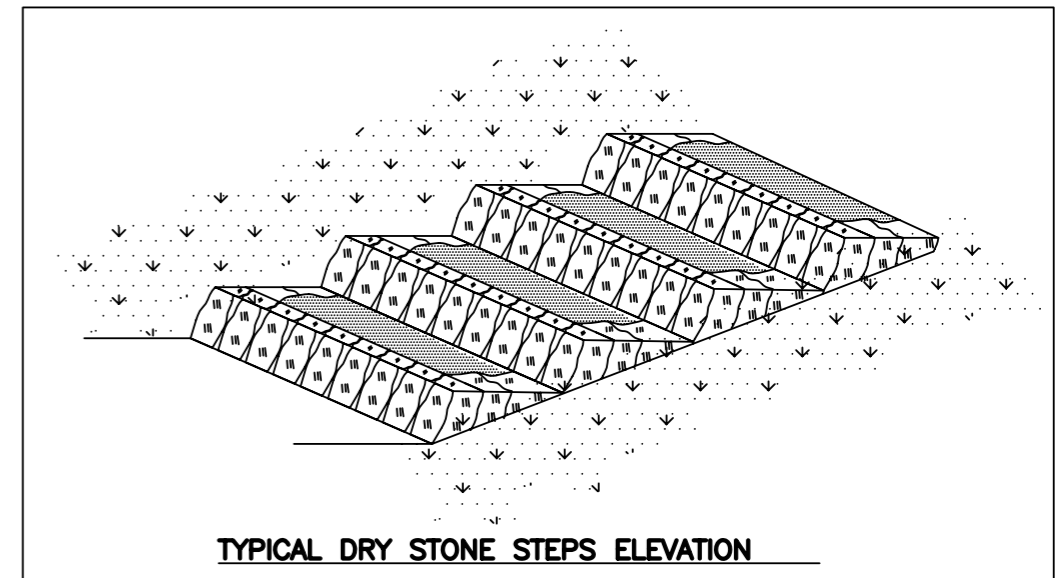
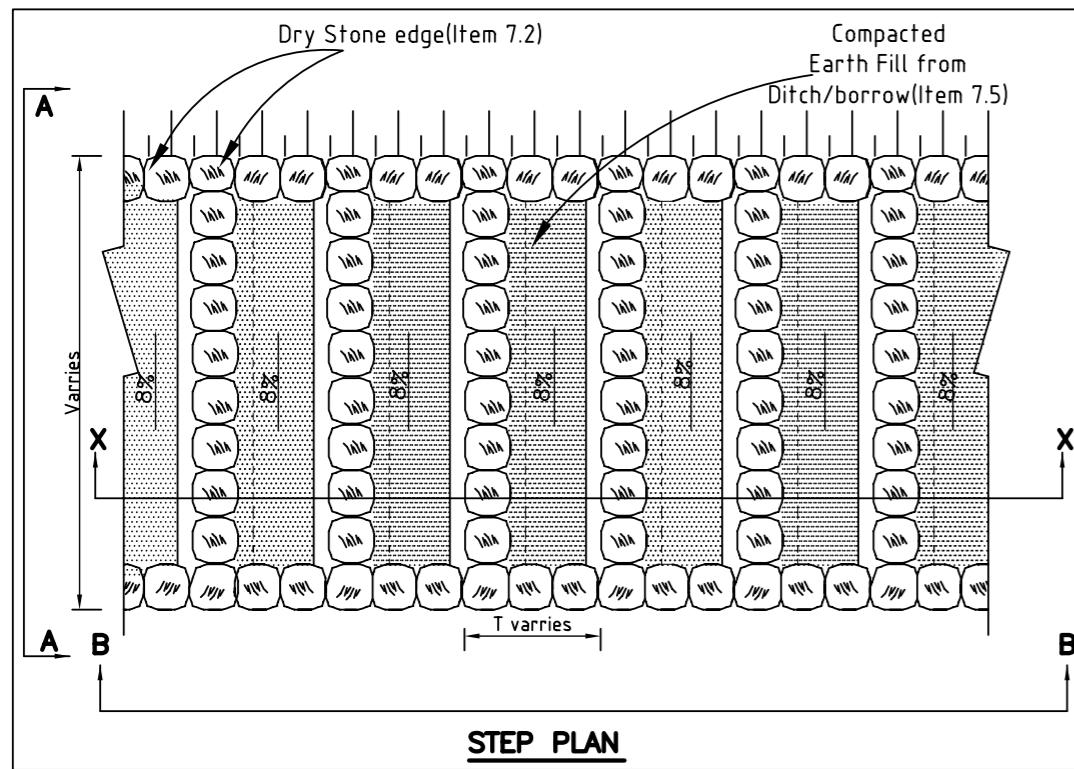
**NOTES FOR DESIGN AND CONSTRUCTION**

1. Grouted stone steps may be used in any area where suitably shaped stones exist. It is particularly suited to areas where rock outcrops regularly and outcrops are already used for crude steps. In such areas existing rock can be shaped to form part of whole steps.
2. The formed steps should have vertical risers and flat treads.
3. Stones should be selected to minimise the amount of mortar used.
4. The tenderers should be shown examples of grouted stone steps during the pre-tender site visit.
5. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 7.3



  
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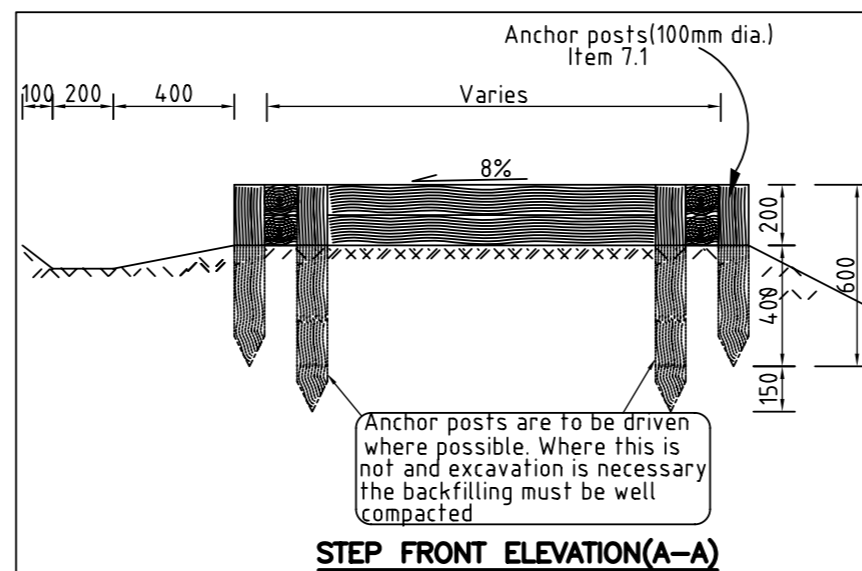
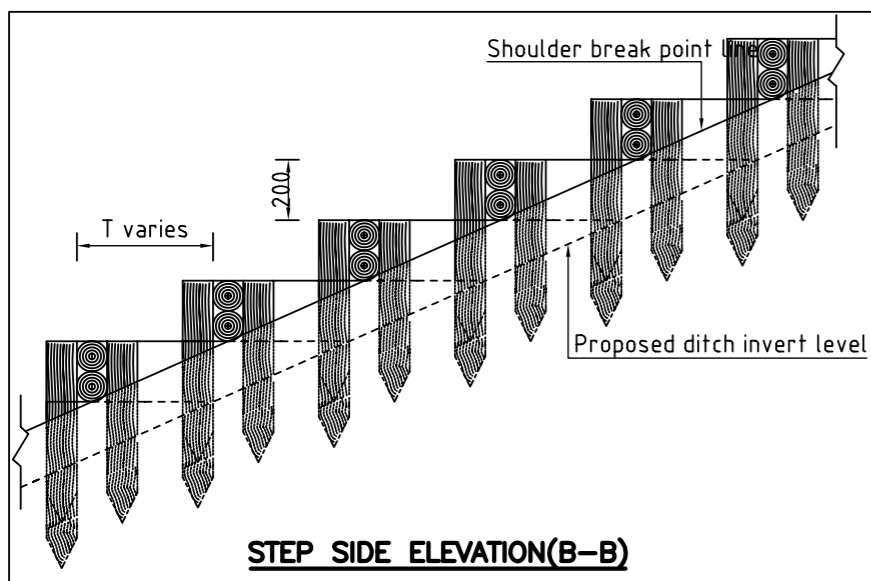
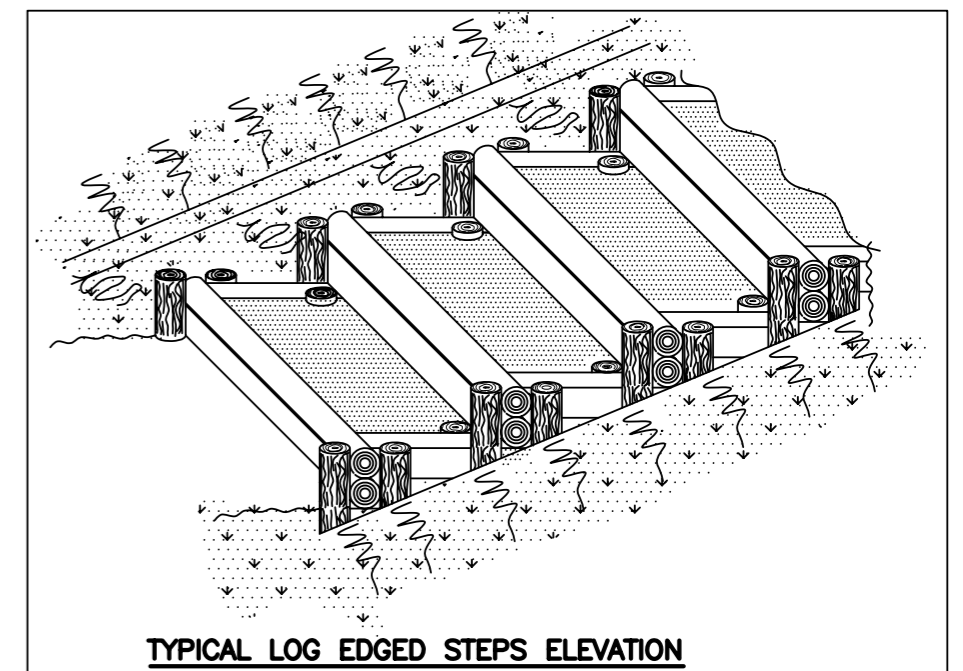
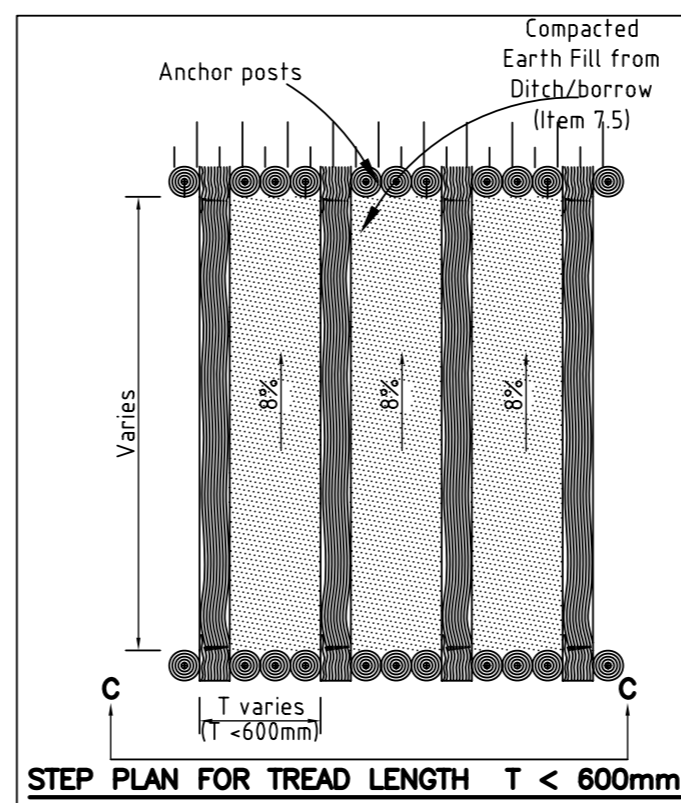
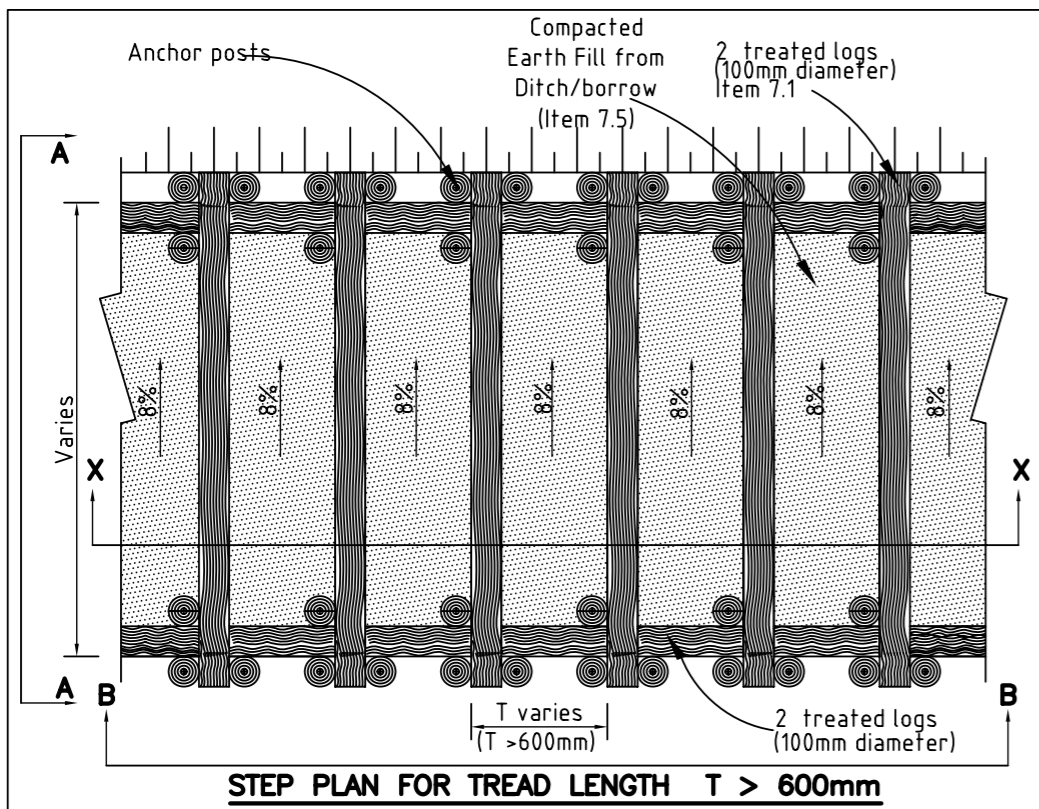


**NOTES FOR DESIGN AND CONSTRUCTION:**

1. The use of dry stone steps is most suited to areas where suitably shaped and sized boulders exist. Some shaping may be required to the exposed side and top of the boulder. Stones should have a minimum weight of 30 kgs.
2. The stone should be durable and soft enough to shape if necessary.
3. The steps should have vertical risers and flat horizontal surfaces.
4. The drawings indicate steps are restrained on both sides as well as at the front. Side restraints may be omitted. This reduces cost but increases maintenance.
5. The tenderers should be shown examples of boulders suitable for the steps and examples of completed steps as a part of the pretender site visits. Specifications, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 7.2 and 7.5.

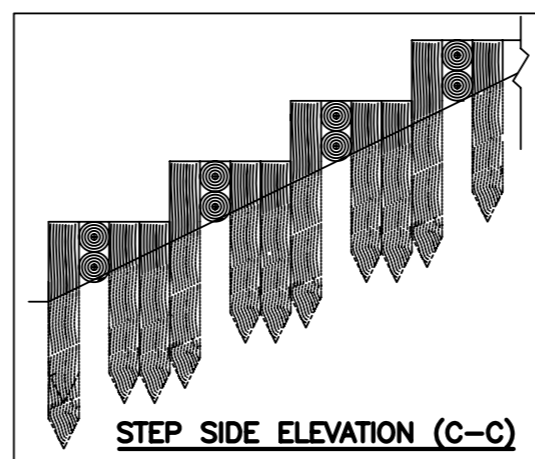
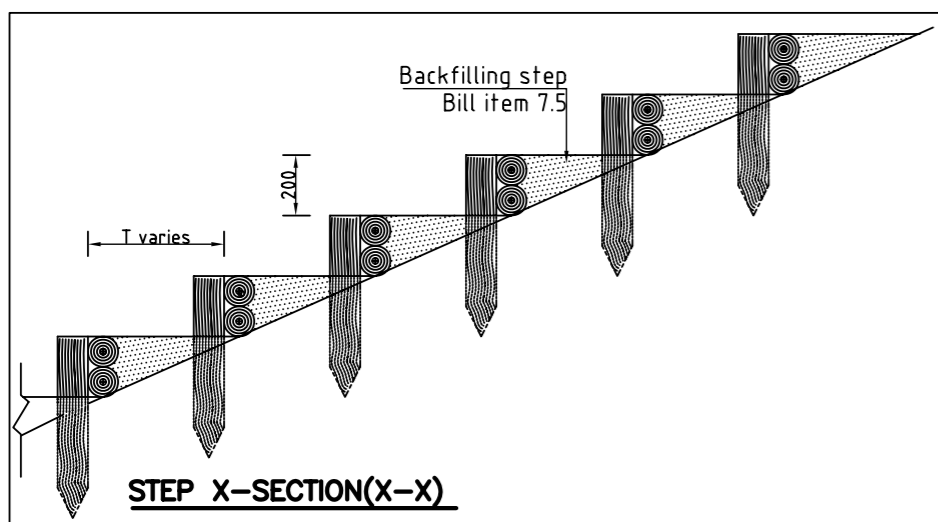
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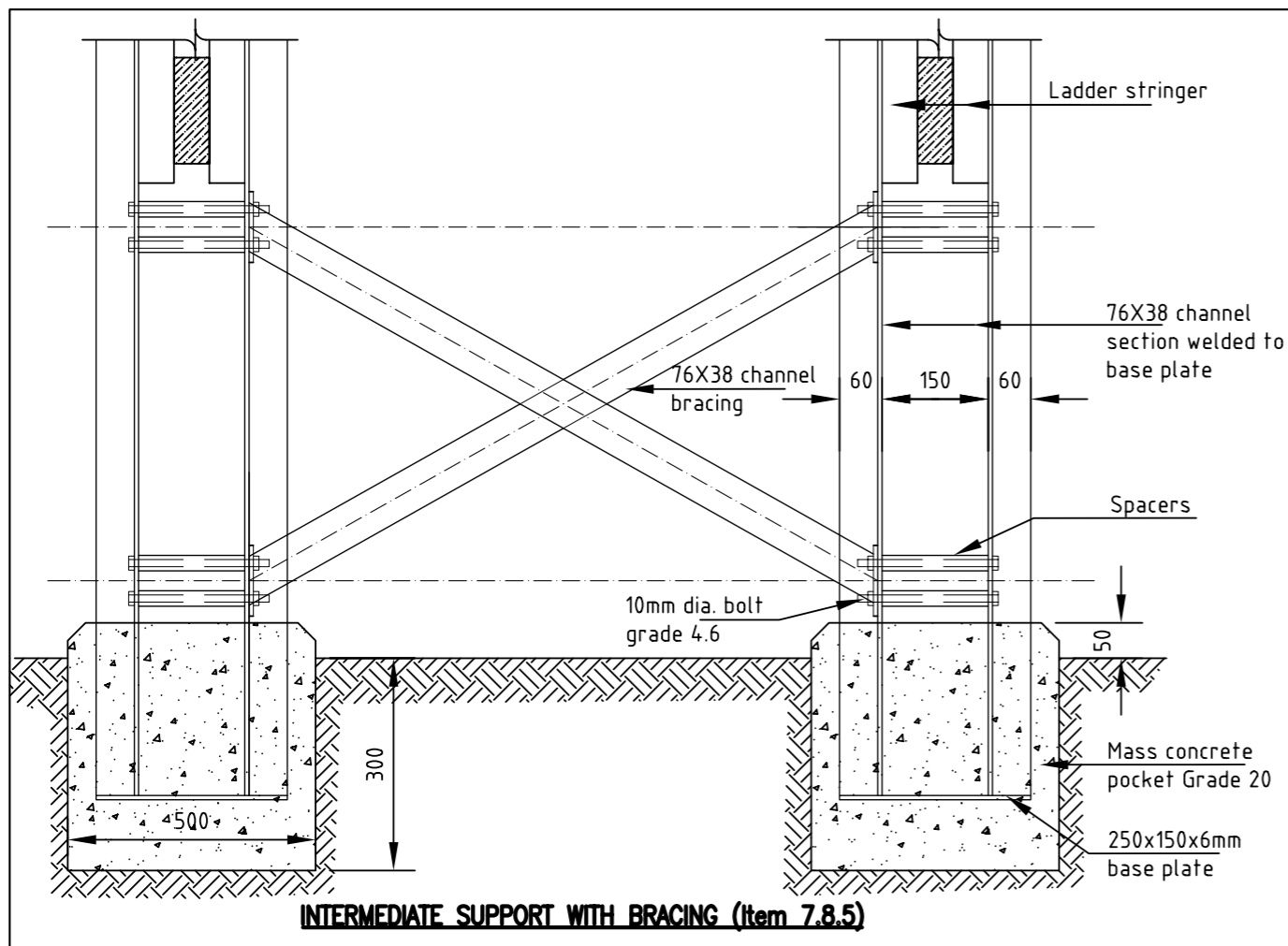
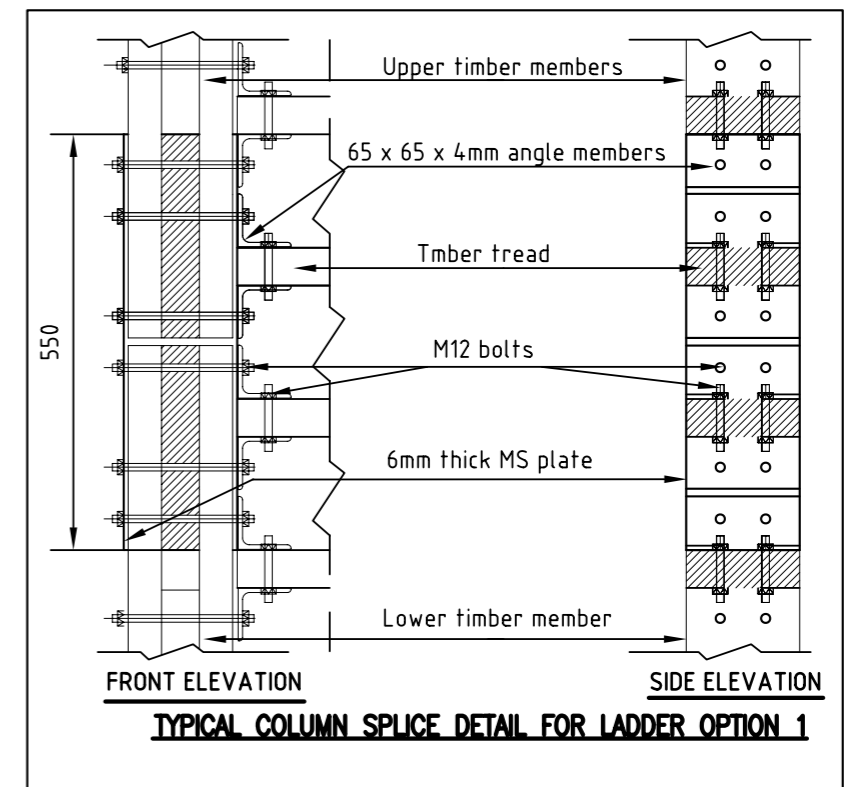
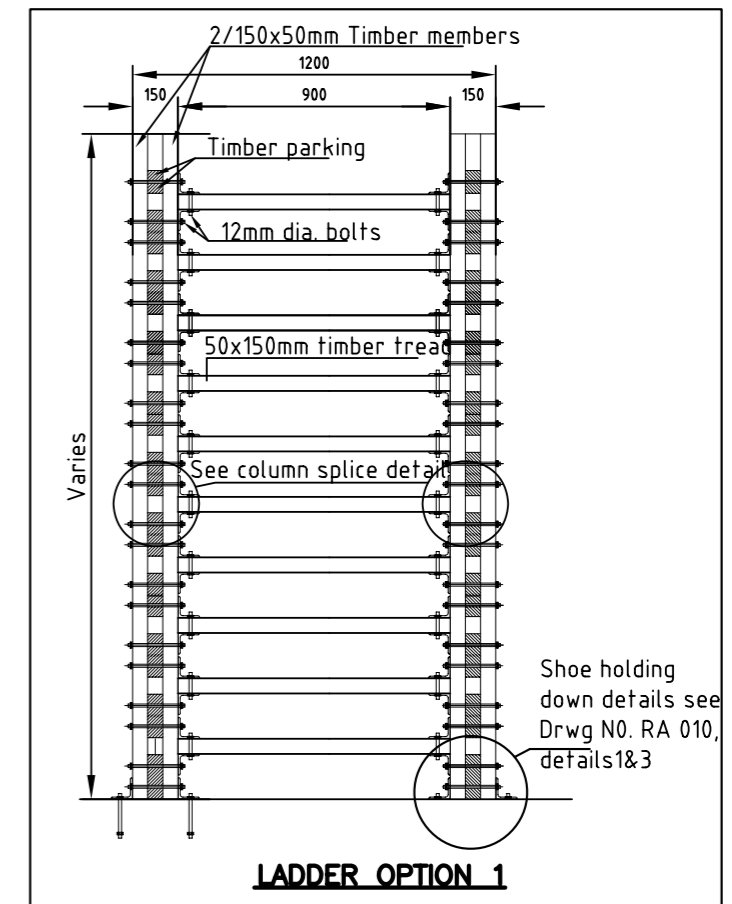
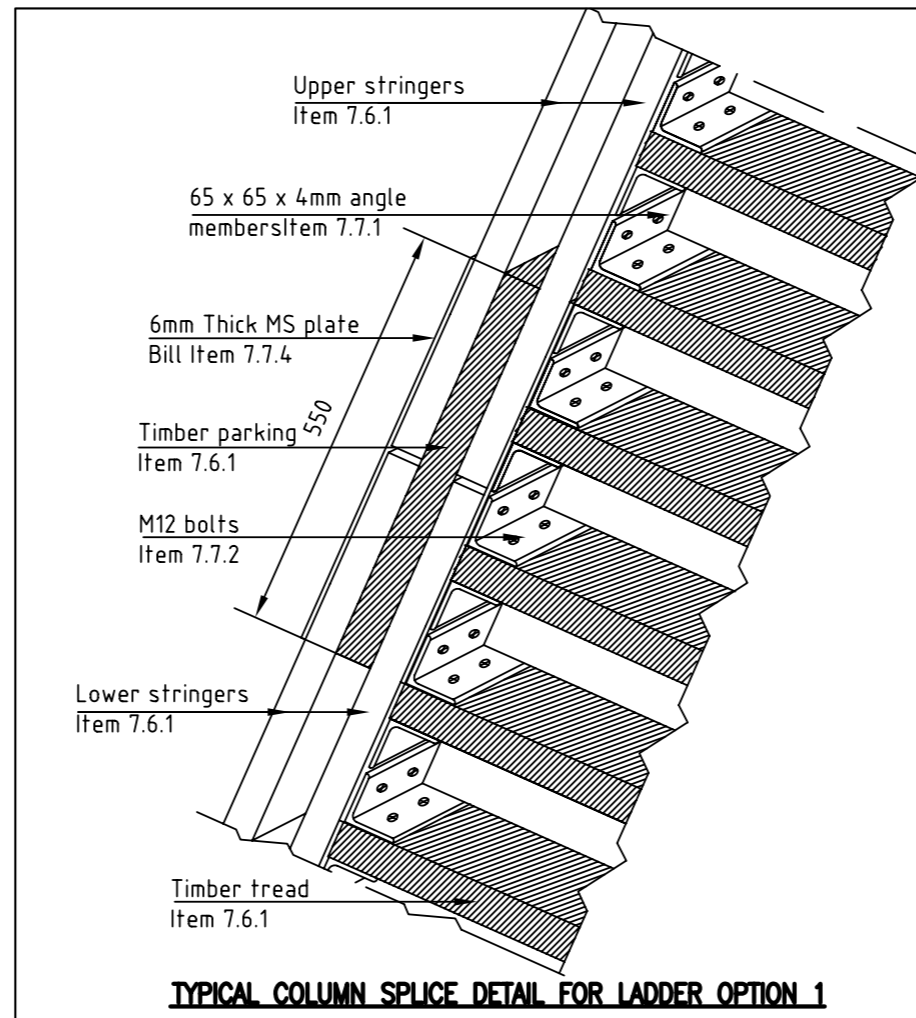
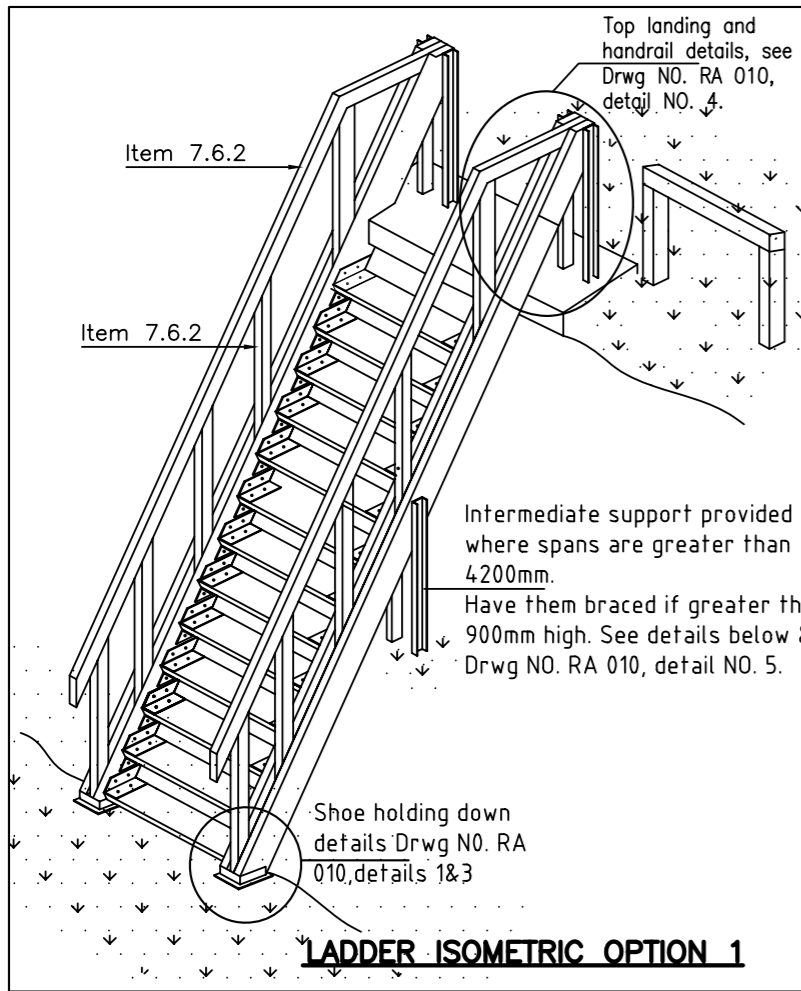
**NOTES FOR DESIGN AND CONSTRUCTION:**

1. The use of log edged steps is most suited to areas where soils are soft enough to allow for the anchor posts to be driven, suitable timber is plentiful and no other alternative materials are available.
2. The drawings indicate steps are restrained on both sides as well as at the front. Side restraints may be omitted. This reduces cost but increases maintenance.
3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 7.1, 7.5 and 4.11.2

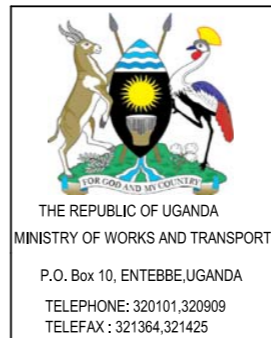
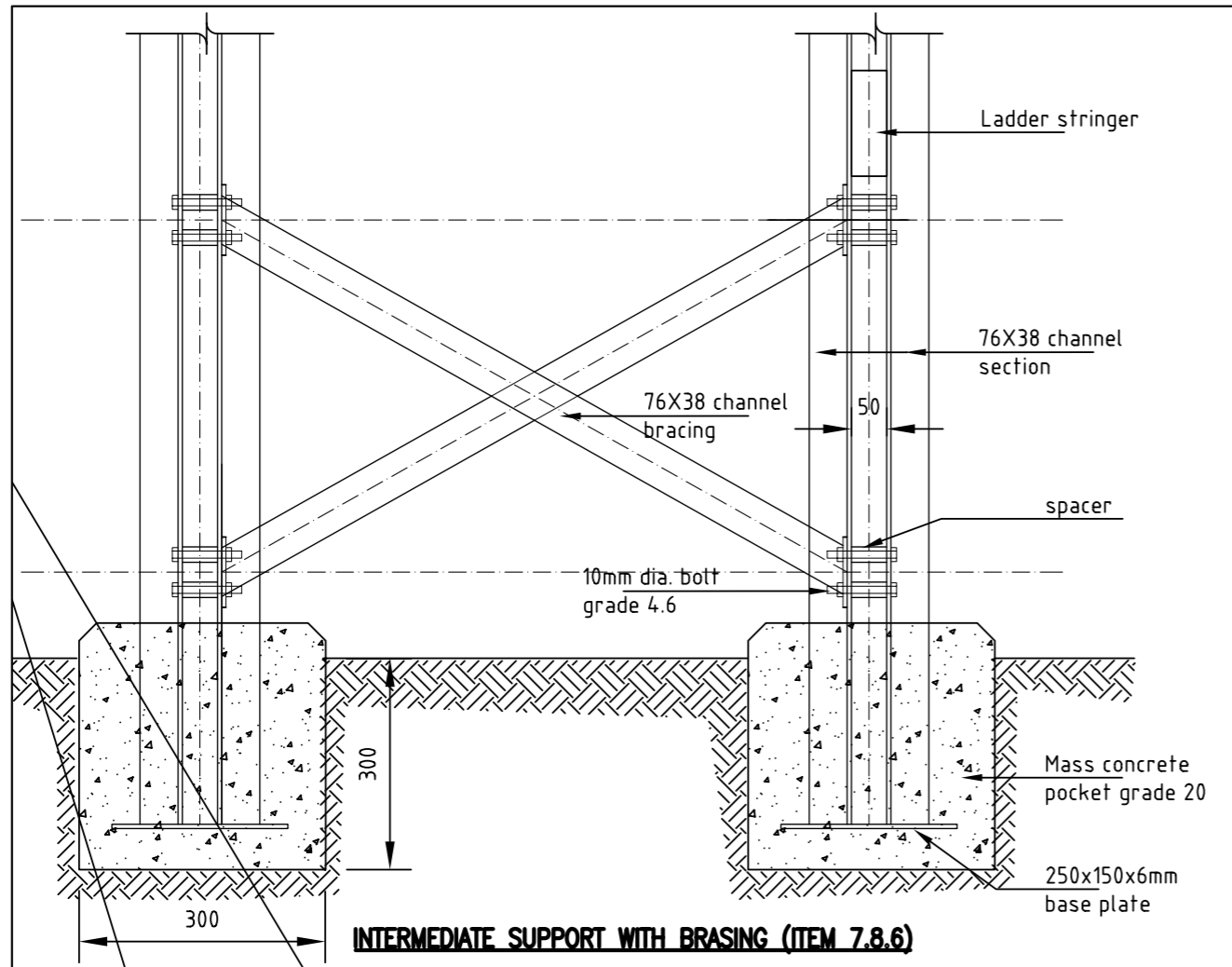
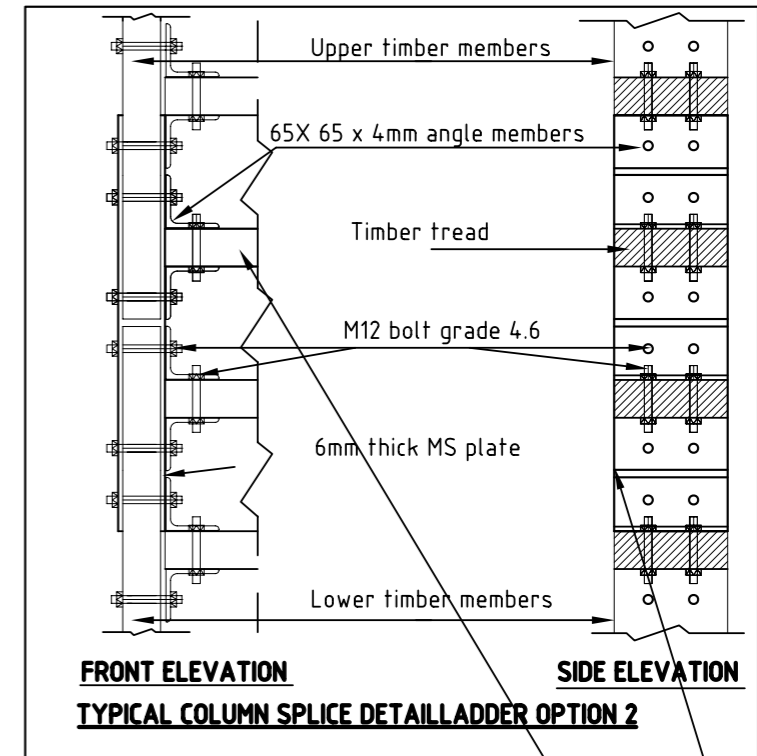
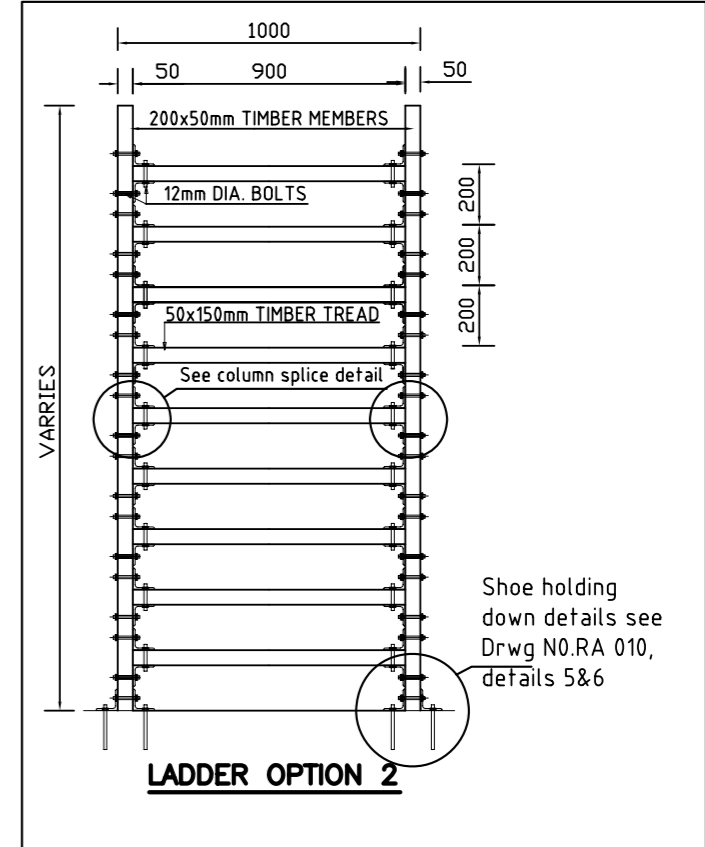
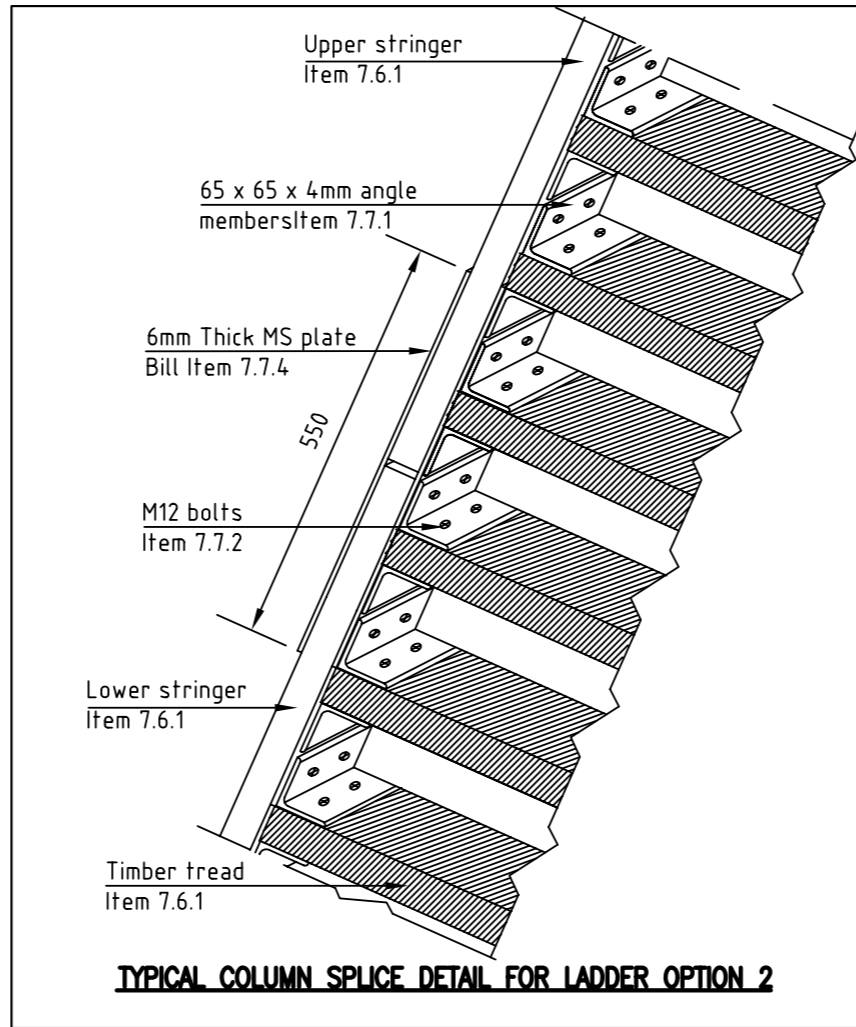
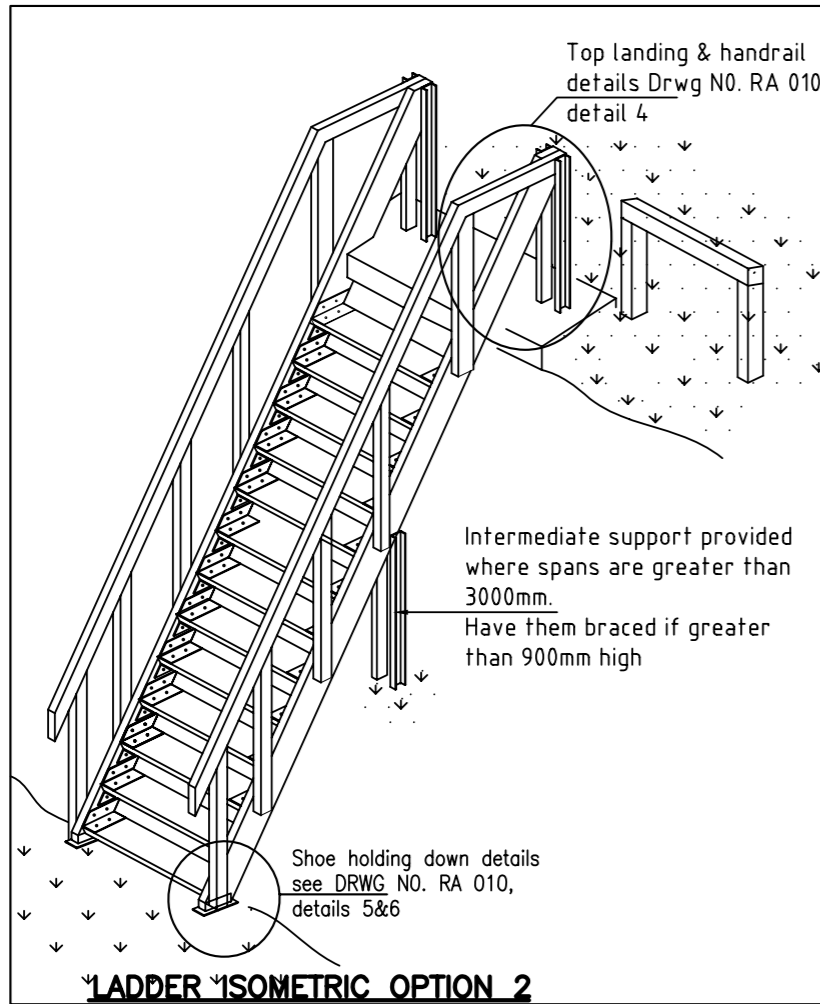


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Rev. no		Revision note		Date		Sign		Chkd	

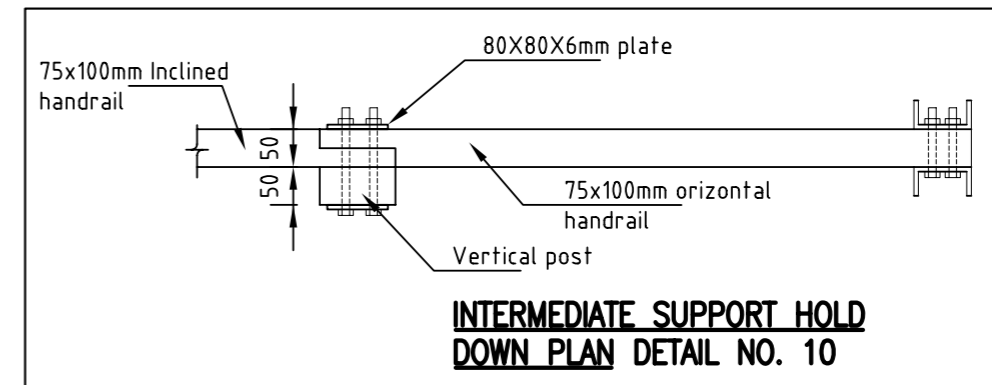
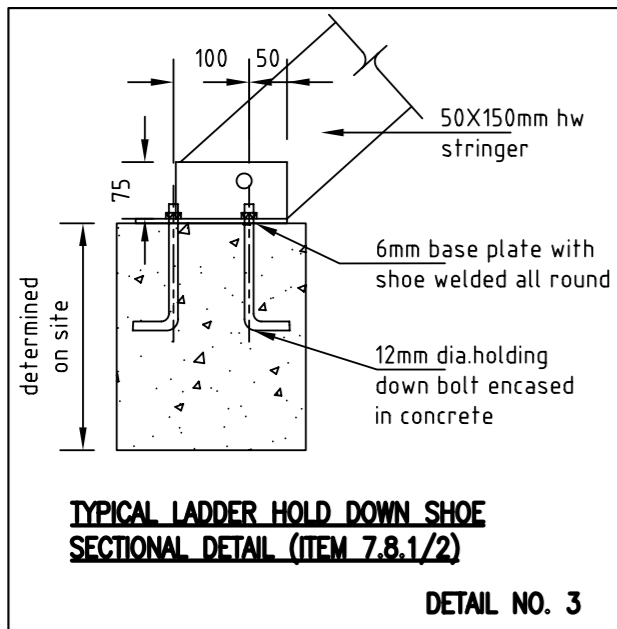
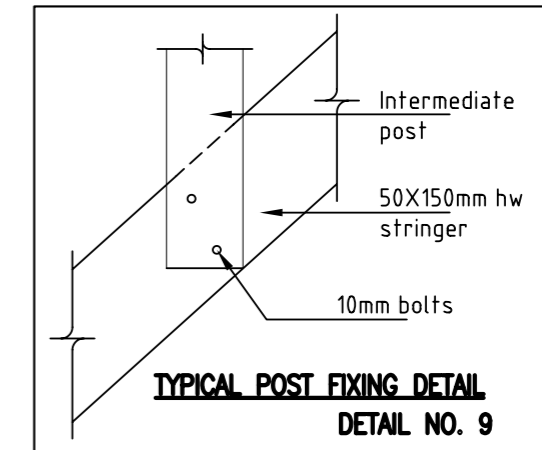
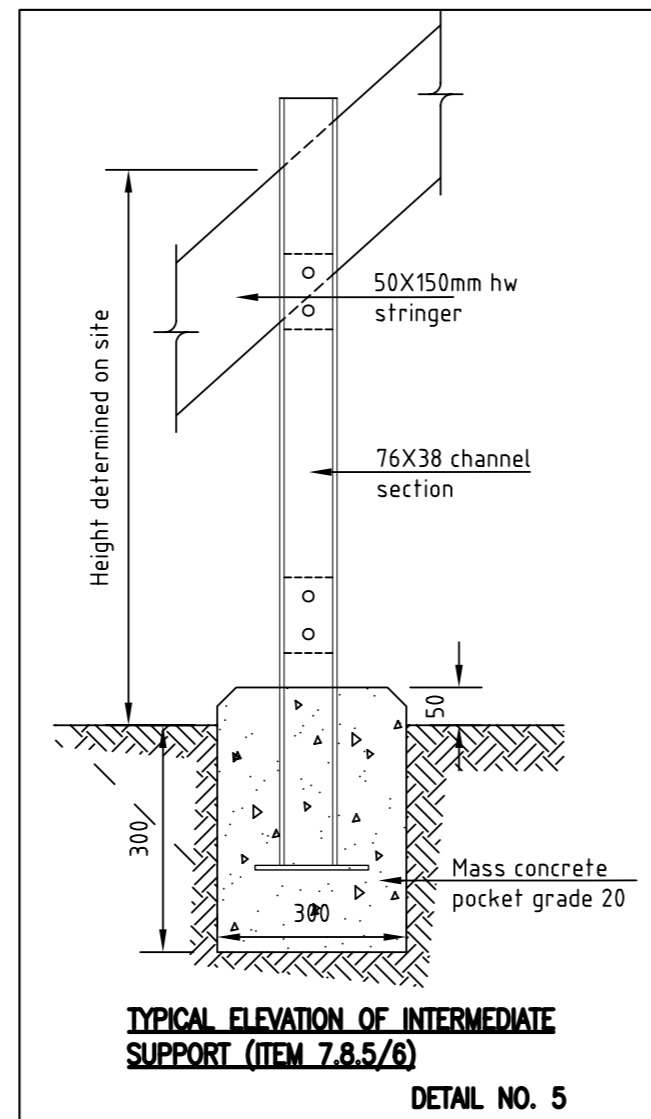
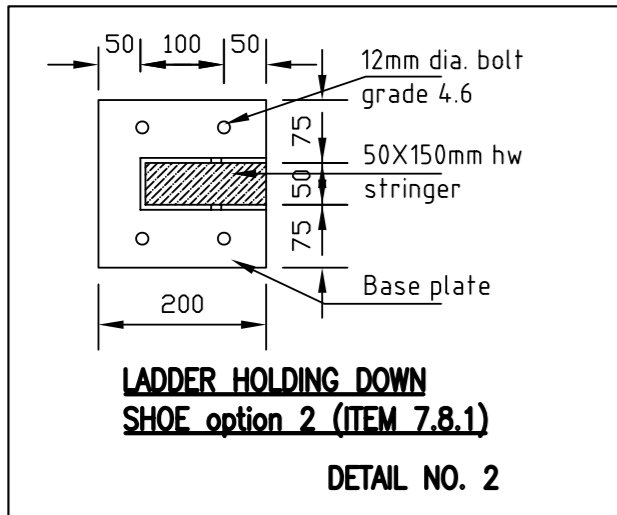
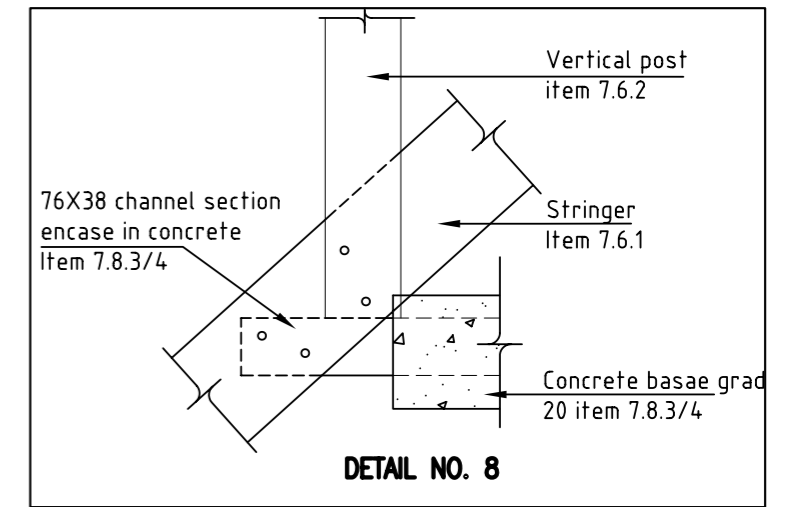
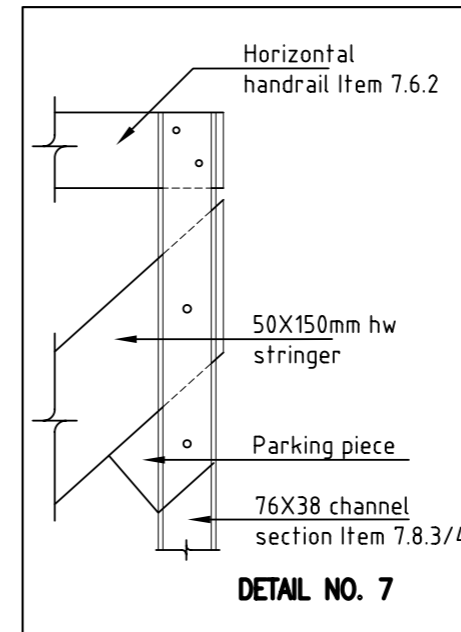
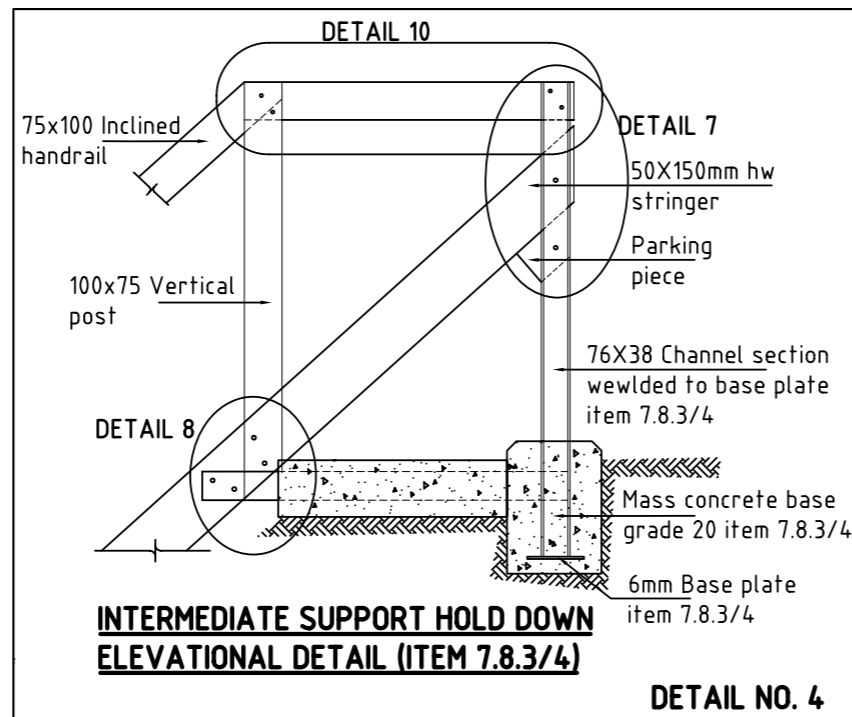
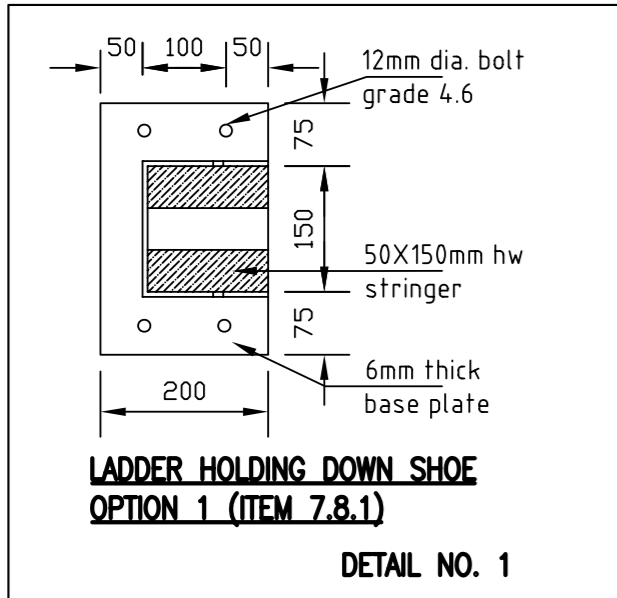





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	Project No.		Sheet:		Date: Sept '06		
	Drawing No. <b>RA 008</b>		Drawn by: ODan		Checked by: JC		
Approved by:		Date		Sign		Chkd	
Rev. no	Revision note						



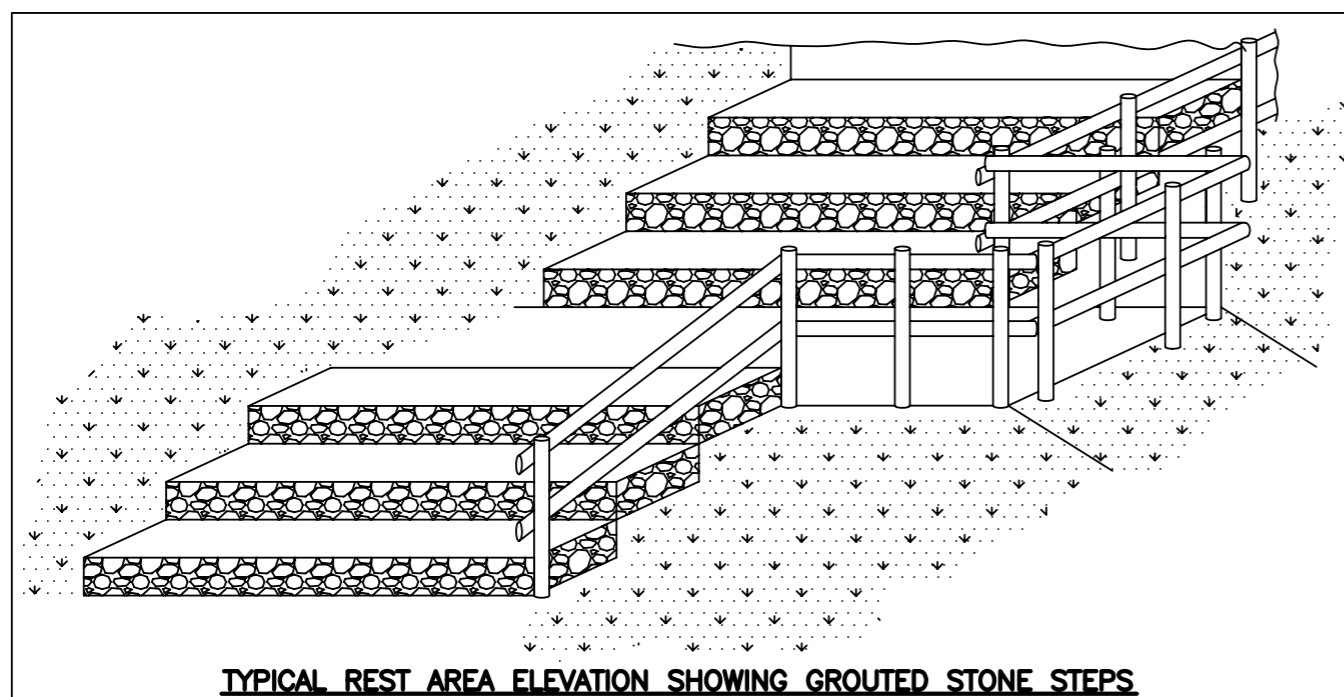
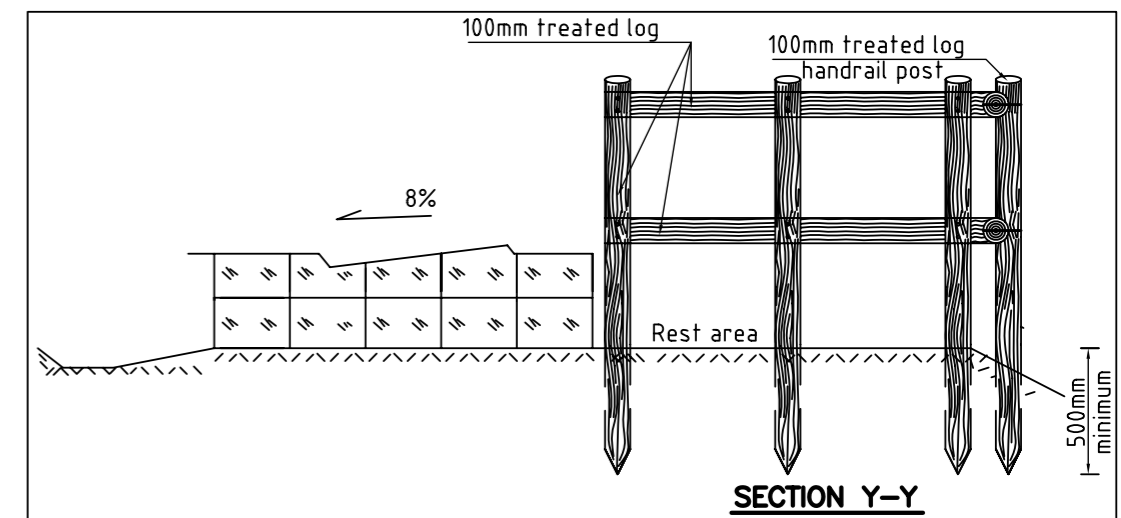
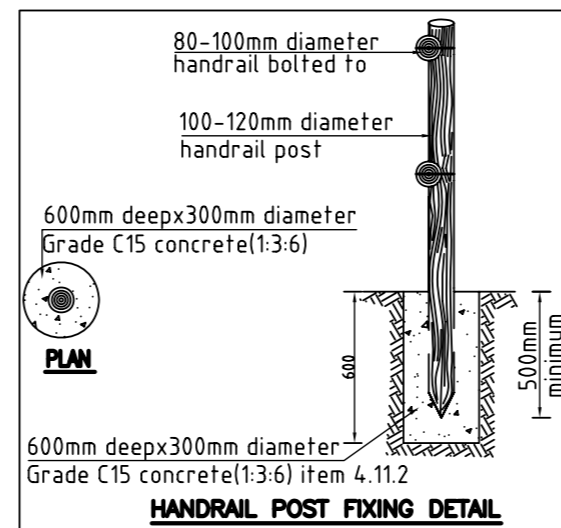
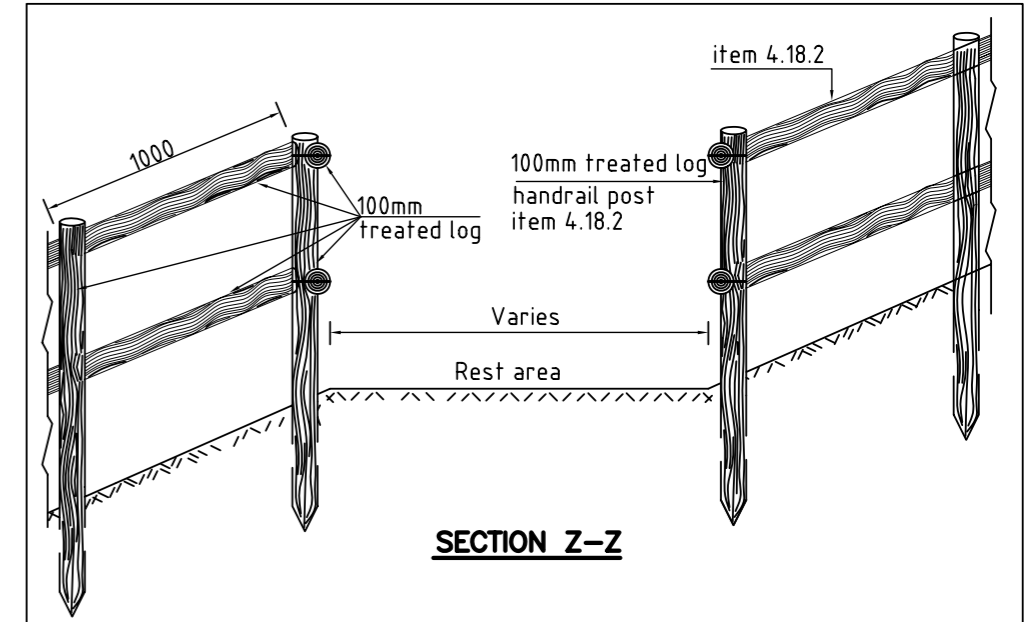
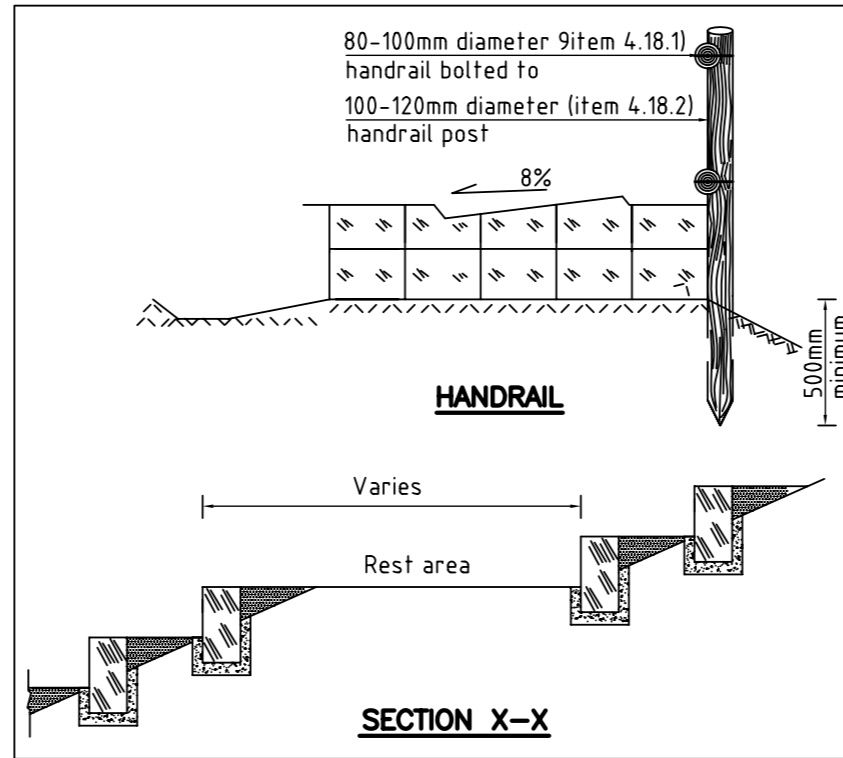
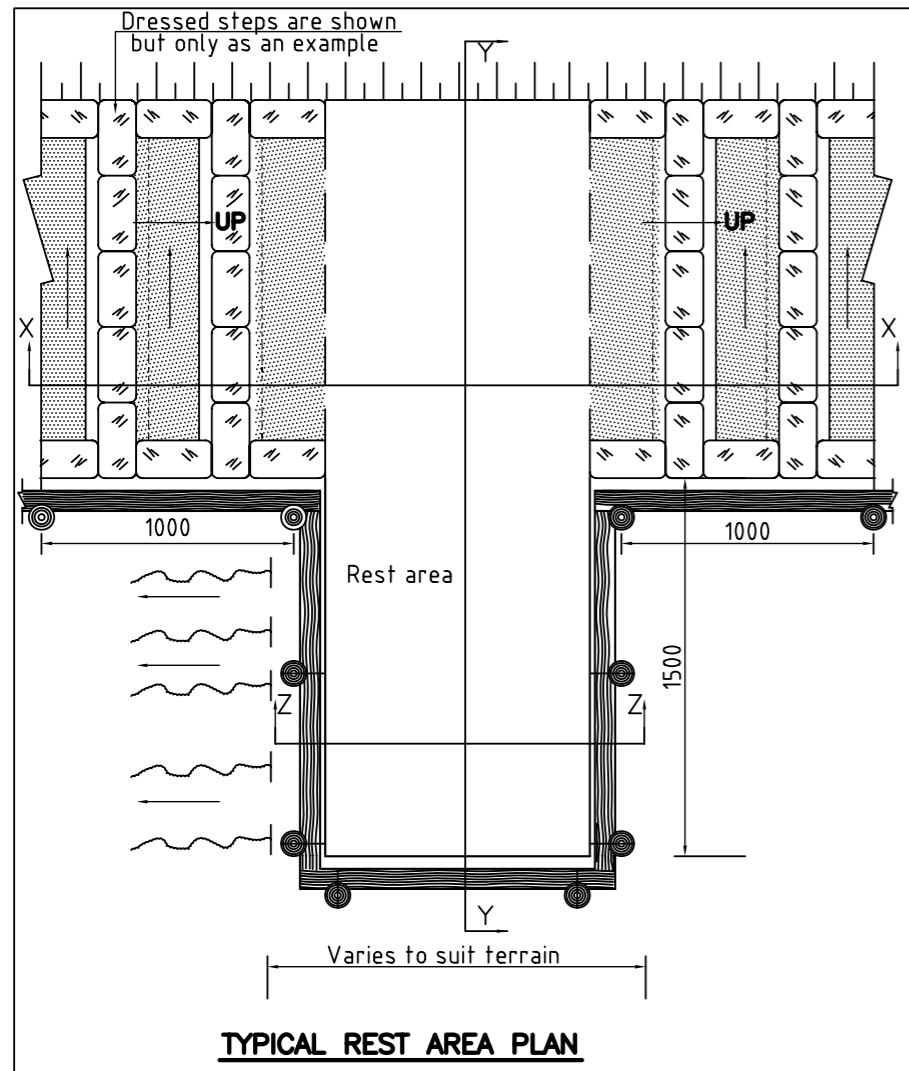
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Title: <b>TRACKS &amp; FOOTPATHS SAWN TIMBER LADDER OPTION 2 (SINGLE MEMBER DETAILS)</b>		Date: Sept '06	
Project No.		Sheet:	Drawing No. <b>RA 009</b>
Drawn by: ODan	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



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	Title: <b>STANDARD CAS MANUAL</b>		Tracks & FOOTPATHS SAWN TIMBER LADDERS (GENERAL CONNECTION DETAILS)	
	Project No.	Sheet:	Drawing No.	
	Drawn by: ODan	Checked by: JC	Approved by:	
Rev. no		Revision note		Date
				Sign
				Chkd

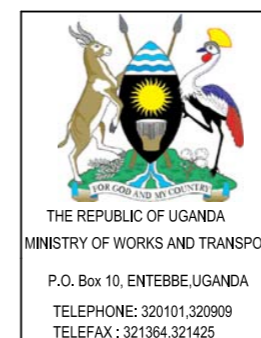
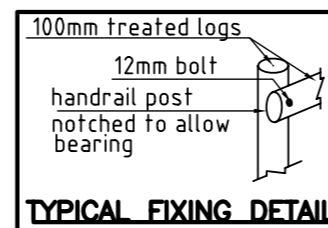
**RA 010**





**NOTES:**

- Rest areas are situated at regular intervals on steep inclines particularly if pedestrian traffic carries heavy loads. The geometry of the rest area should accommodate the availability of space.
- Earthworks associated with the provision of rest areas should be covered under bill 3 items as appropriate.
- Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual. Items 4.18, 4.18.2, 4.11.2



Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scale:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Title: <b>TRACKS AND FOOTPATHS RESTING AREA AND HANDRAIL DETAILS</b>		Date: Sept. '06'	
Project No.	Sheet:	Drawing No. <b>RA 011</b>	
Drawn by: IOY	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



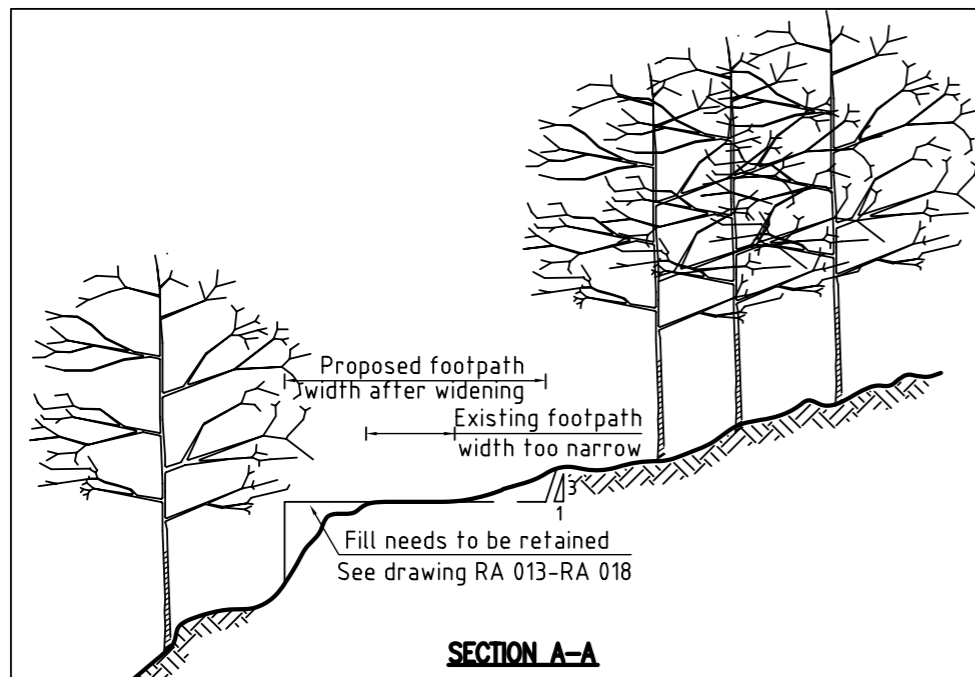
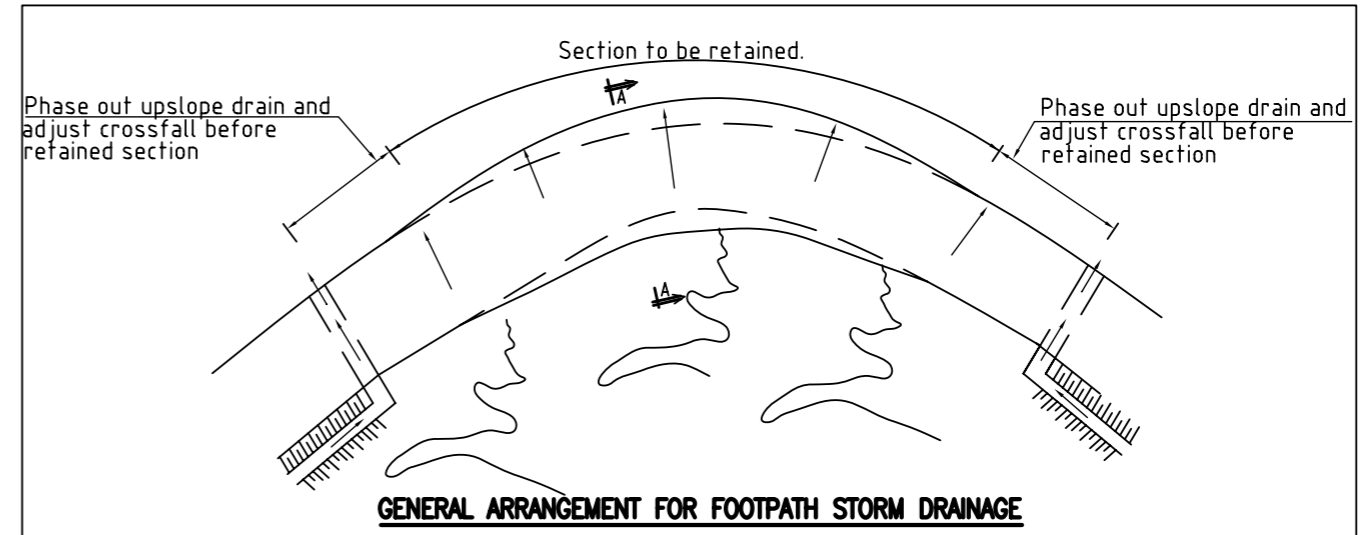
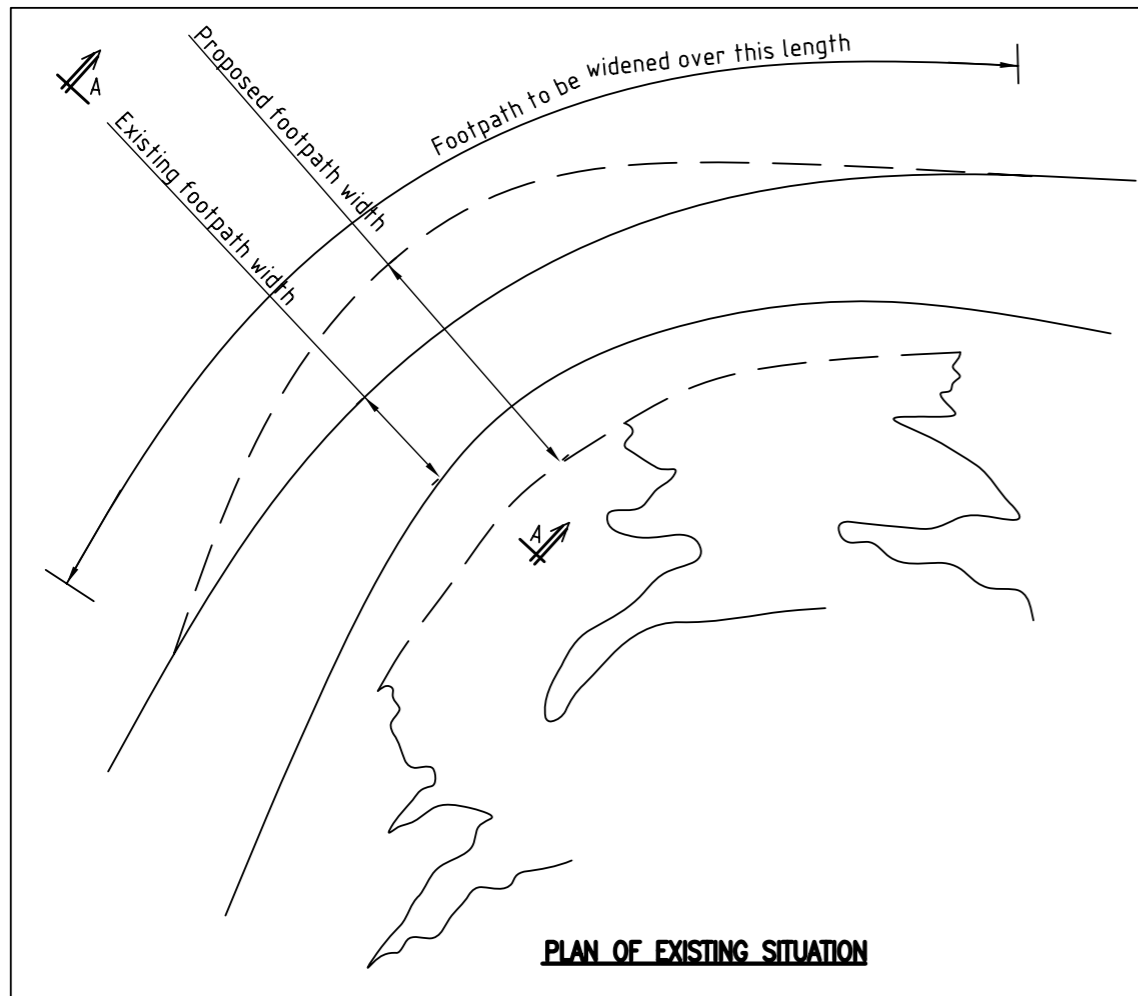
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## Section A-3

### Rural Access Roads: Tracks and Footpaths, Footpath widening


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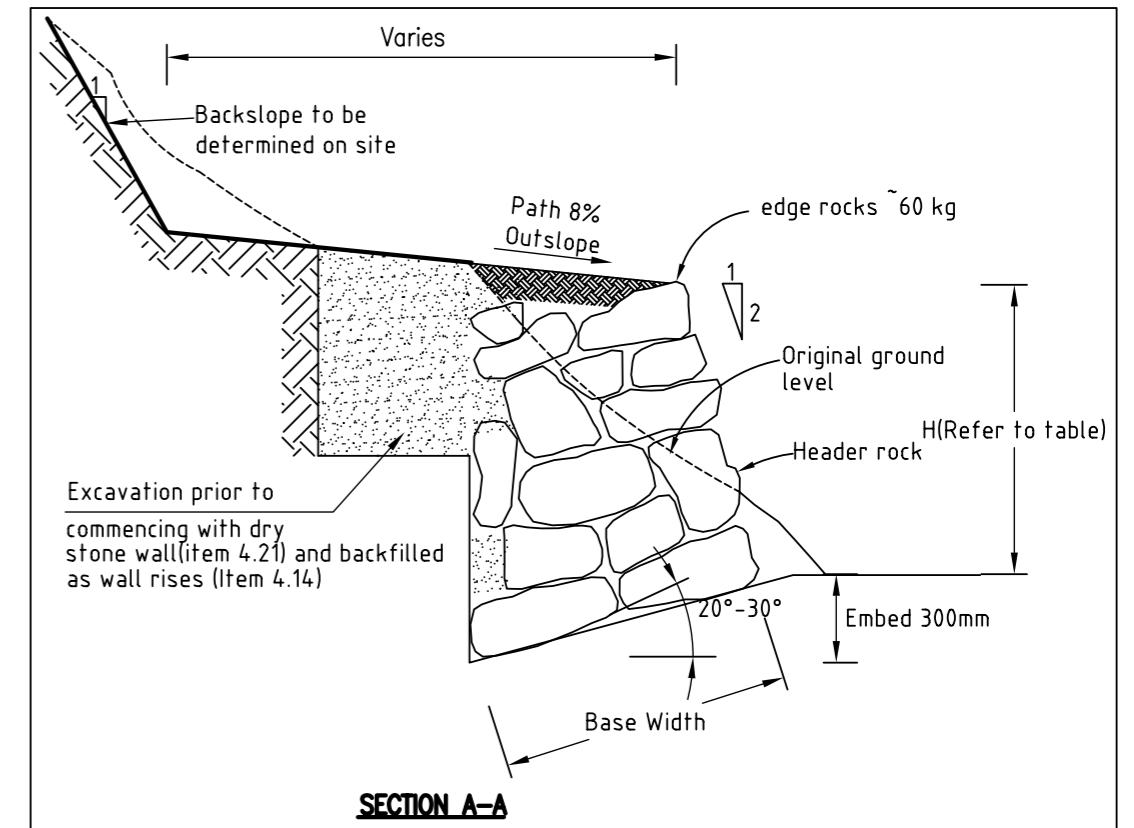
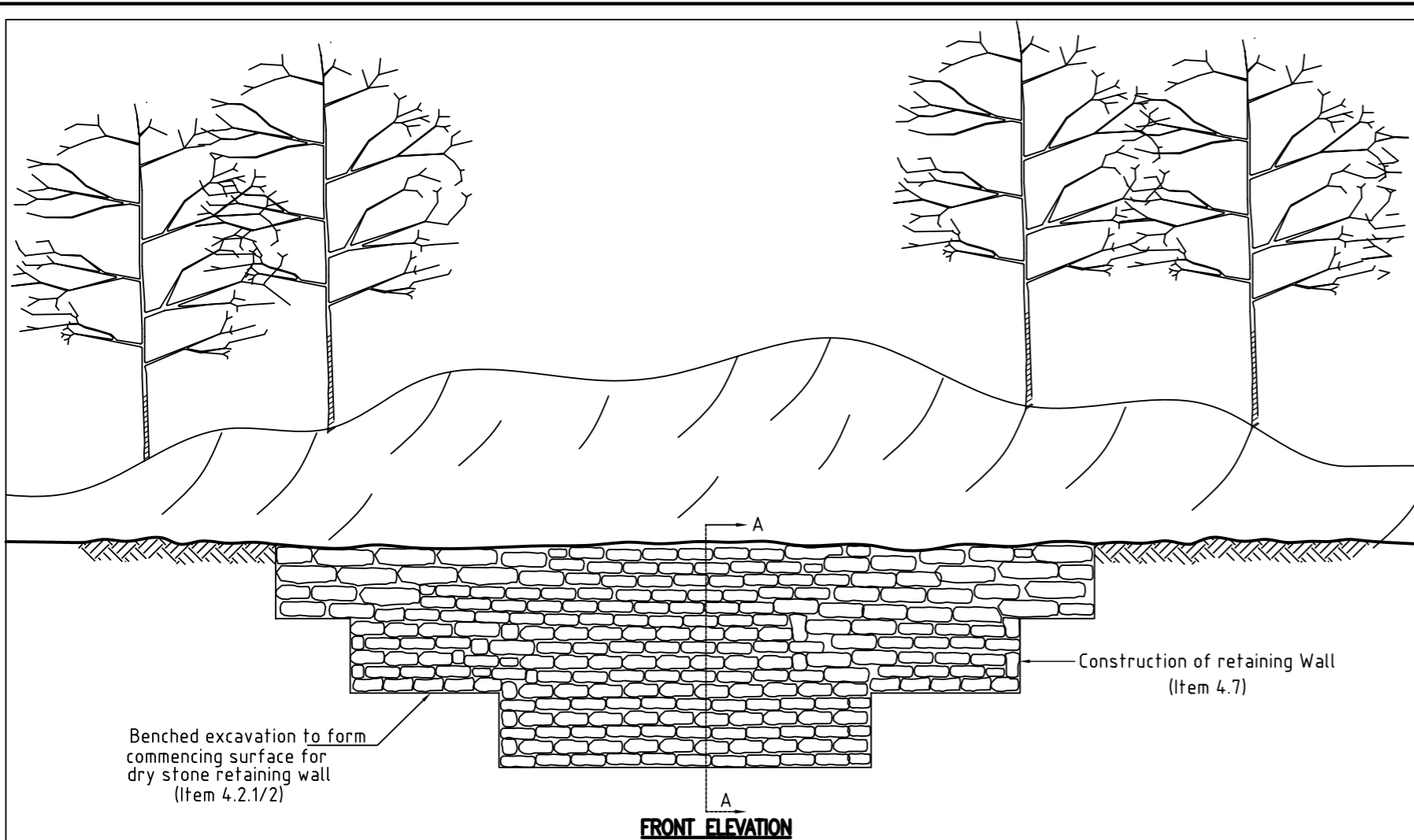
<b>Drawing Title</b>	<b>Drawing Number</b>
Tracks and Footpaths: Footpath widening, General Arrangements	RA 012
Tracks and Footpaths: Footpath widening Option 1(Dry Stone Retaining Wall)	RA 013
Tracks and Footpaths: Footpath widening; Retaining Wall Option 2(Log)	RA 014
Tracks and Footpaths: Footpath widening; Retaining Wall Option 3(Gabions)	RA 015
Tracks and Footpaths: Footpath widening; Retaining Wall Option 2(Sandbags)	RA 016



**NOTES:**

1. In situations where it is necessary to widen tracks or footpaths and it is not possible to use a full bench (see drwg no. RA002 for details) it is necessary to retain fill sections drawings RA 013- 016 illustrate options for this.
2. The storm drainage arrangement indicated above applies to all options

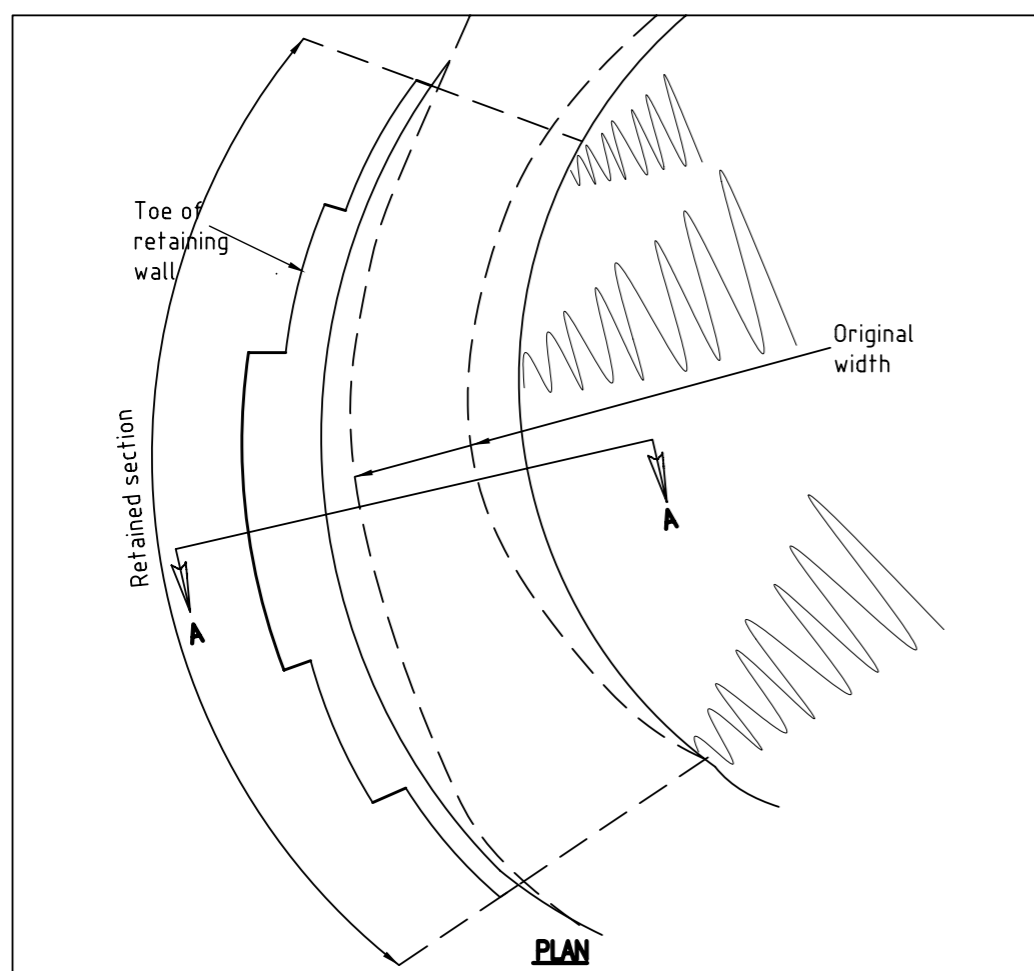
 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX : 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scales:		
	Title: <b>STANDARD CAS MANUAL</b>		<b>TRACKS AND FOOTPATHS FOOTPATH WIDENING GENERAL ARRANGEMENTS</b>		Dimension: mm	
	Project No.	Sheet:	Drawing No. <b>RA 012</b>		Date: Sept '06	
	Drawn by: IOY	Checked by: JC	Approved by:			
Rev. no	Revision note			Date	Sign	Chkd




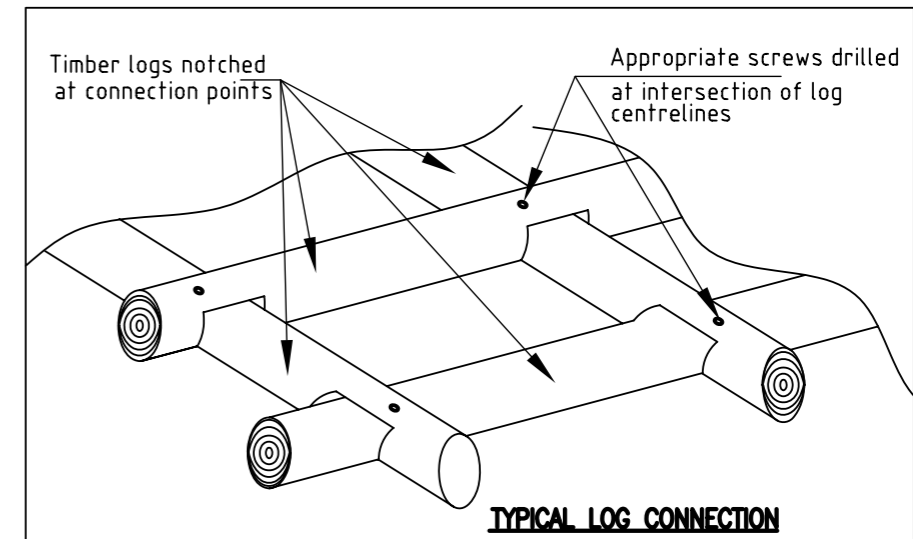
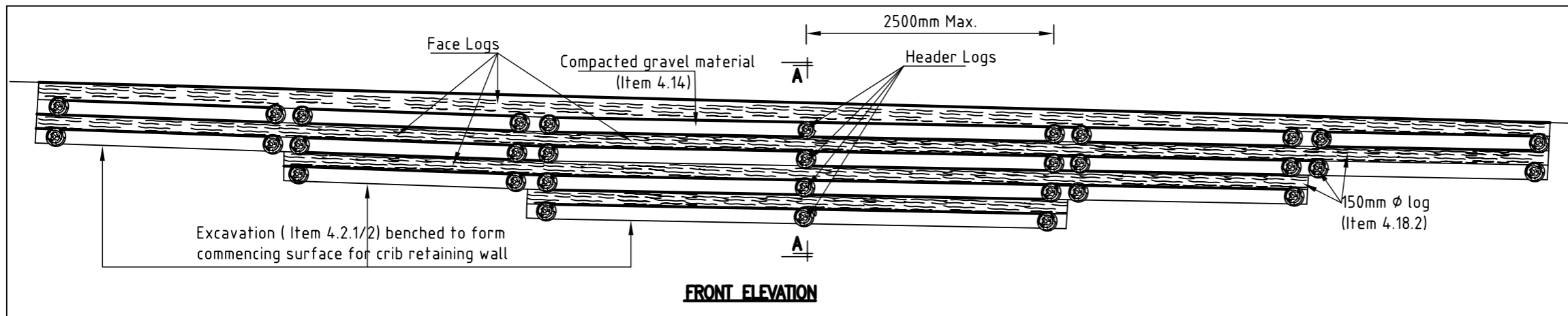
Slope	Wall Height	Base width	Top width
30 - 35° (58-70%)	1.5 - 2.0m	1.25 - 1.5m	0.75m
35 - 40° (70-85%)	2.0 - 2.5m	1.5 - 2.0m	0.75 - 1.0m
40 - 45° (85-100%)	2.5 - 3.0m	2.0 - 2.3m	1.0m

**NOTES:**

1. Length of retained section and the depth of the retaining wall are to be determined following detailed site investigation.
2. Excavation earthworks necessary to commence work on the dry stone wall, longitudinally and laterally, shall be benched if in the opinion of the Engineer this is required
3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual.  
Items 4.2.1/2, 4.7 & 4.14

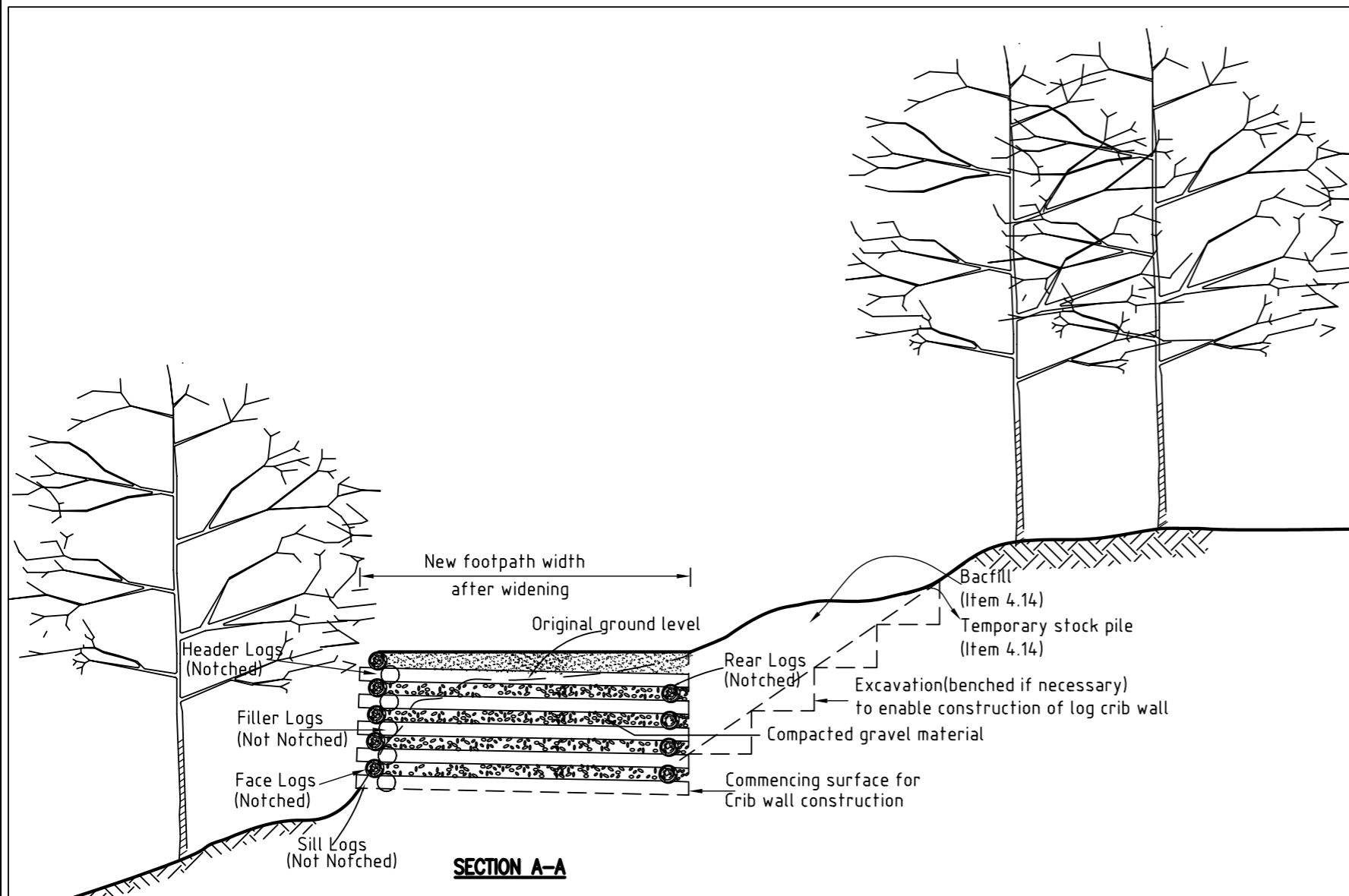



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	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
	Title: <b>TRACKS &amp; FOOTPATHS FOOTPATH WIDENING OPTION 1 (DRY STONE RETAINING WALL)</b>		Date: Sept '06	
	Project No.	Sheet:	Drawing No. <b>RA 013</b>	
Drawn by: JAK	Checked by: JC	Approved by:		
Rev. no	Revision note	Date	Sign	Chkd



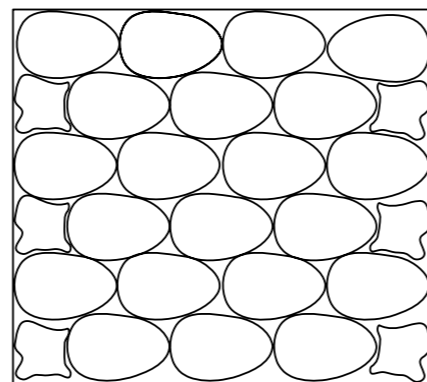
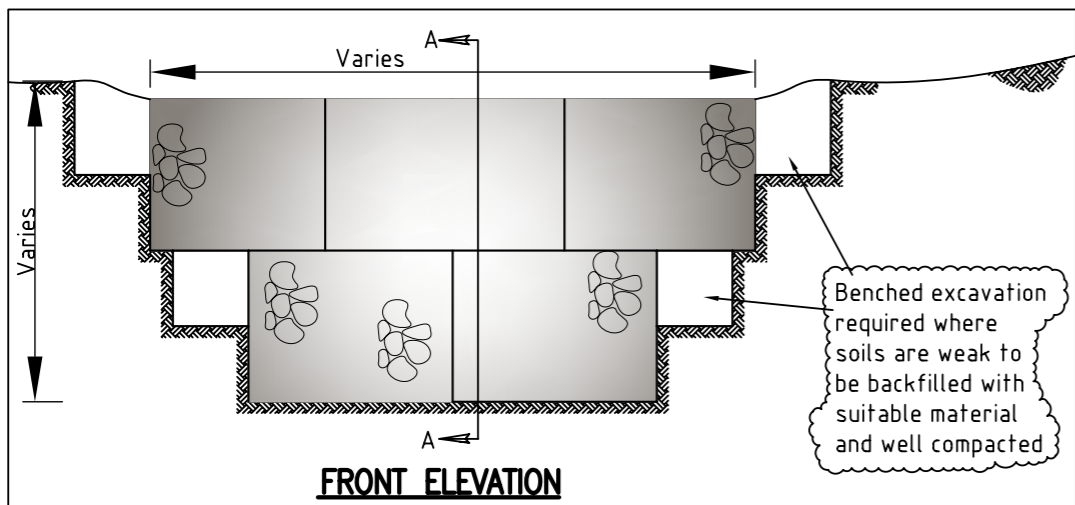
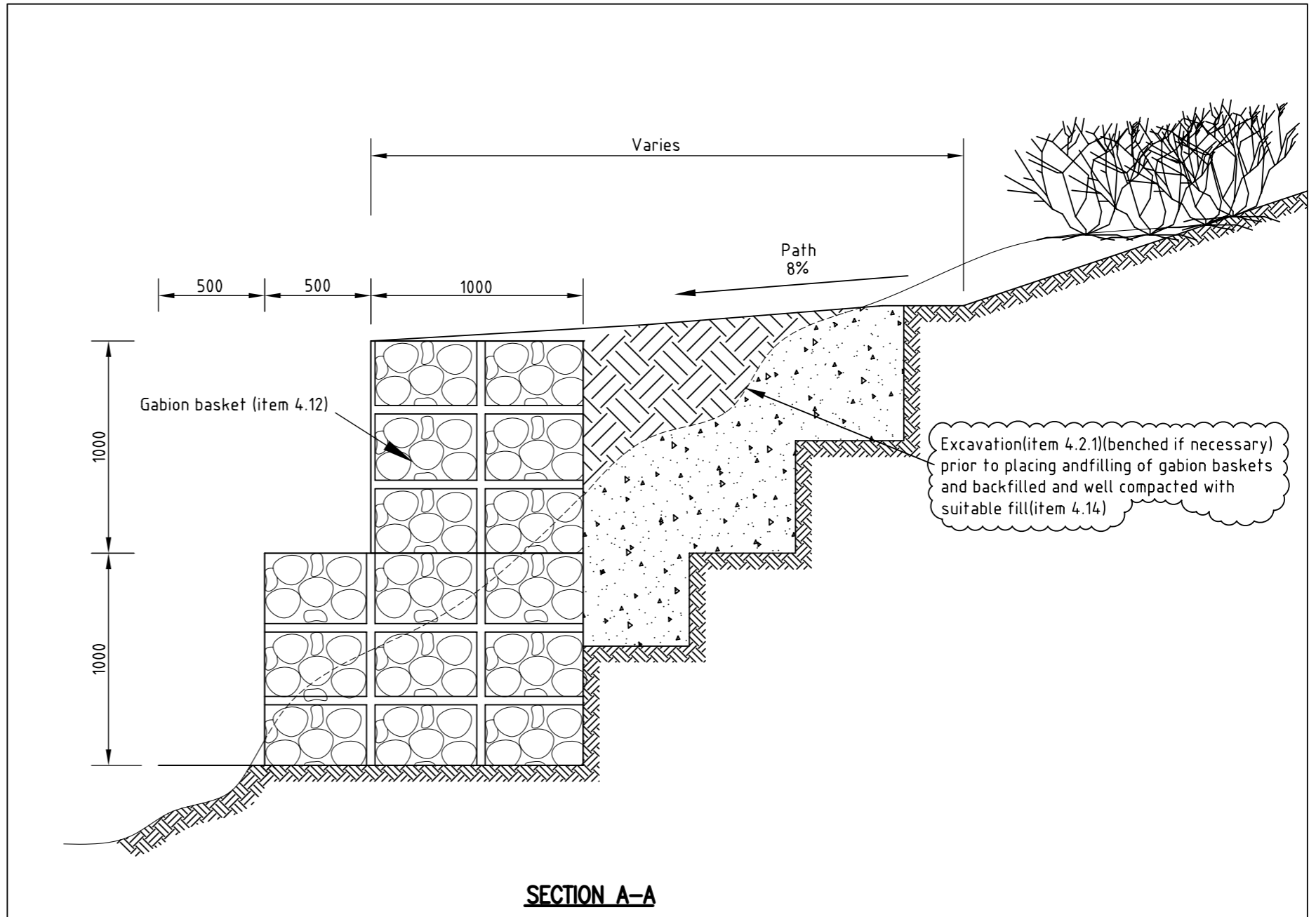
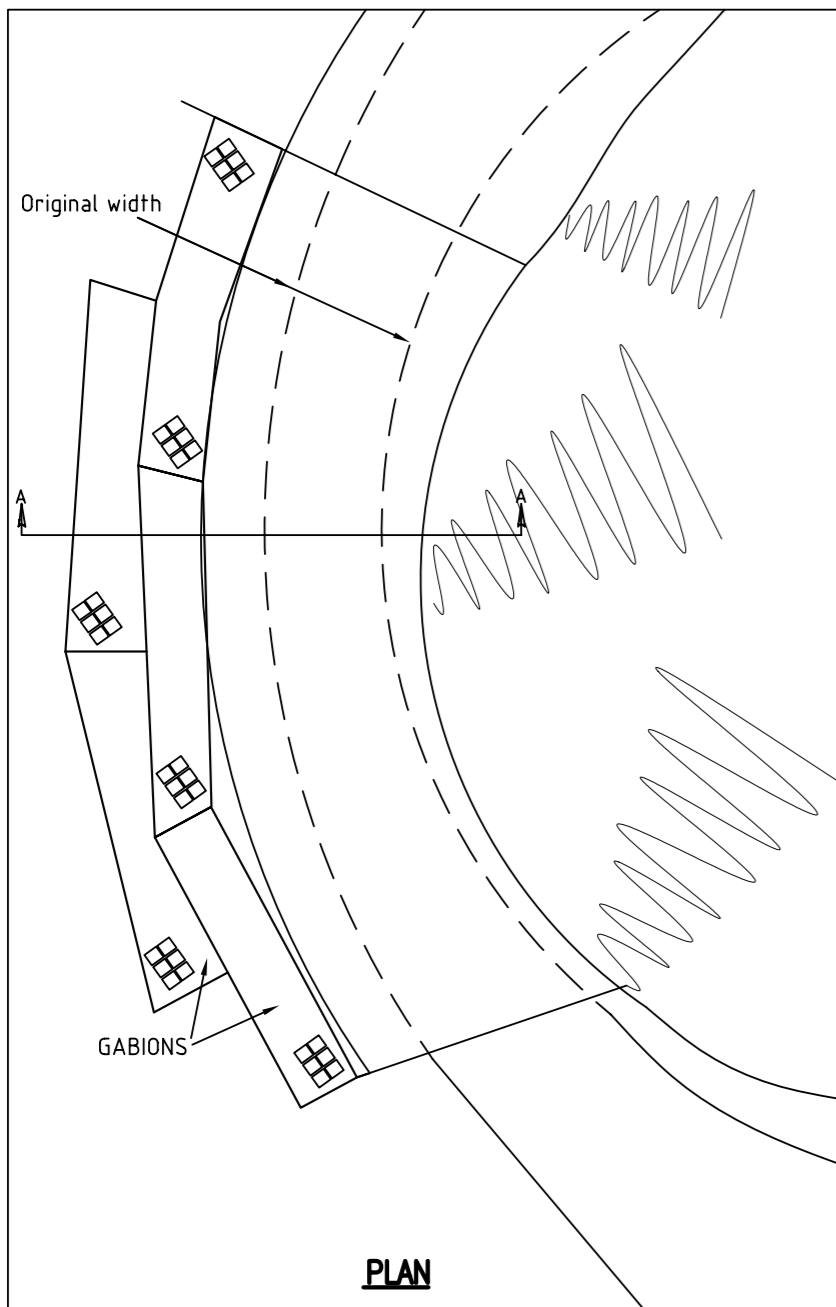
**NOTES:**

1. Length of retained section and the depth of the retaining wall are to be determined following detailed site investigation.
2. Excavation earthworks necessary to commence work on the log crib wall, longitudinally and laterally, shall be benched if in the opinion of the Engineer this is required
3. Fixing detail shall be pre drilled 10mm wood bolts unless instructed otherwise.
4. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual.  
Items 4.2.1/2, 4.14 & 4.18.2



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	Title: <b>STANDARD CAS MANUAL</b>		<b>TRACKS AND FOOTPATHS FOOTPATH WIDENING RETAINING WALL OPTION 2(LOG)</b>		Dimension: mm	
	Project No.	Sheet:	Drawing No. <b>RA 014</b>		Date: Sept '06	
	Drawn by: JAK	Checked by: JC	Approved by:			
Rev. no	Revision note			Date	Sign	Chkd





**CORRECTLY FILLED GABION**

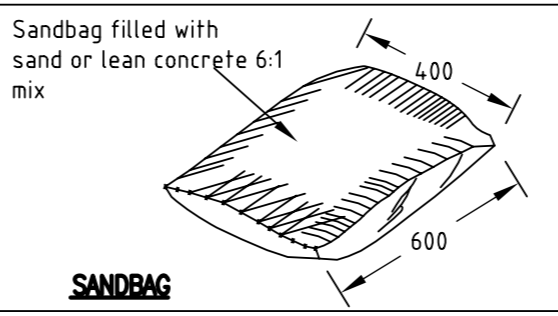
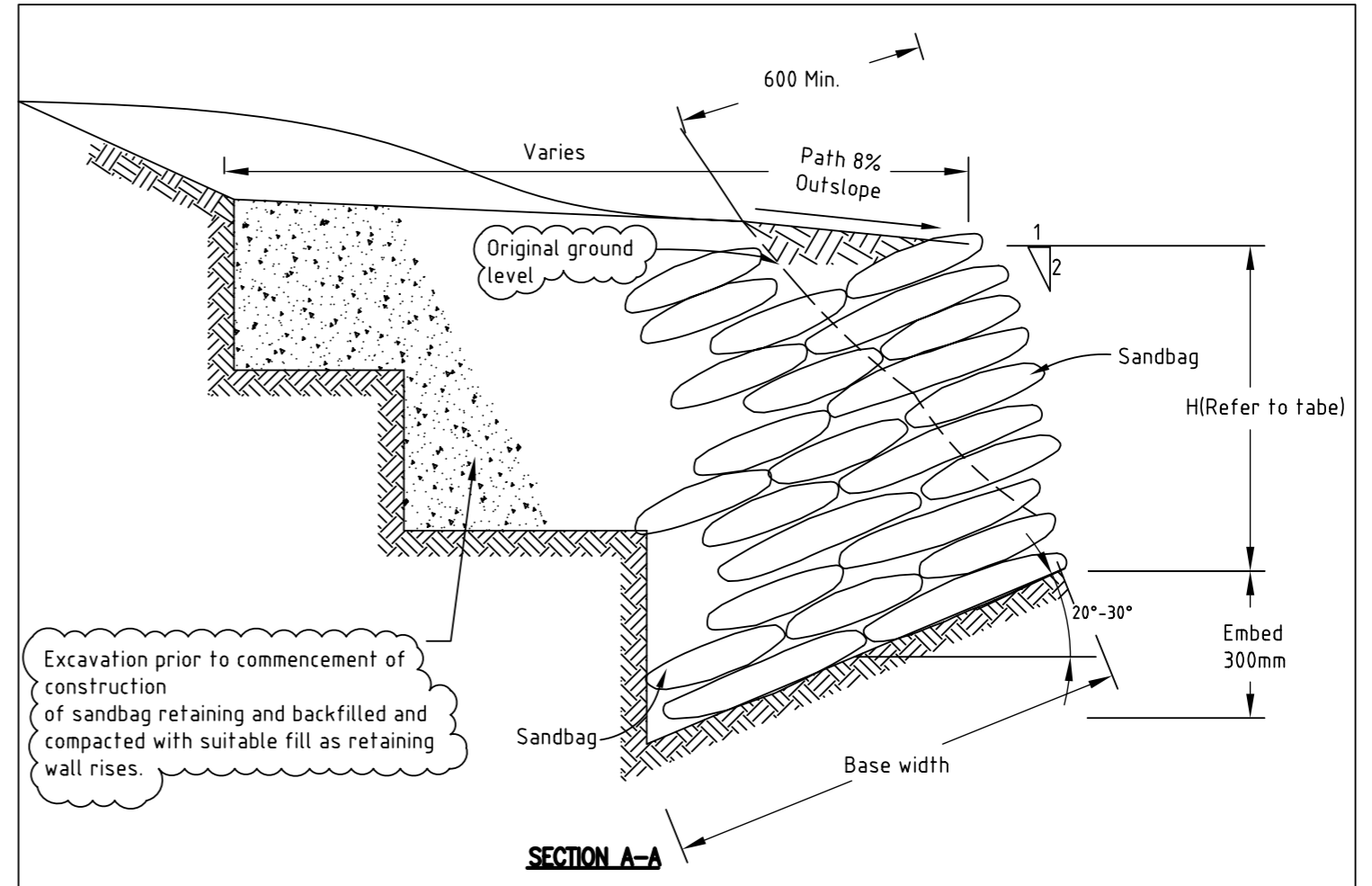
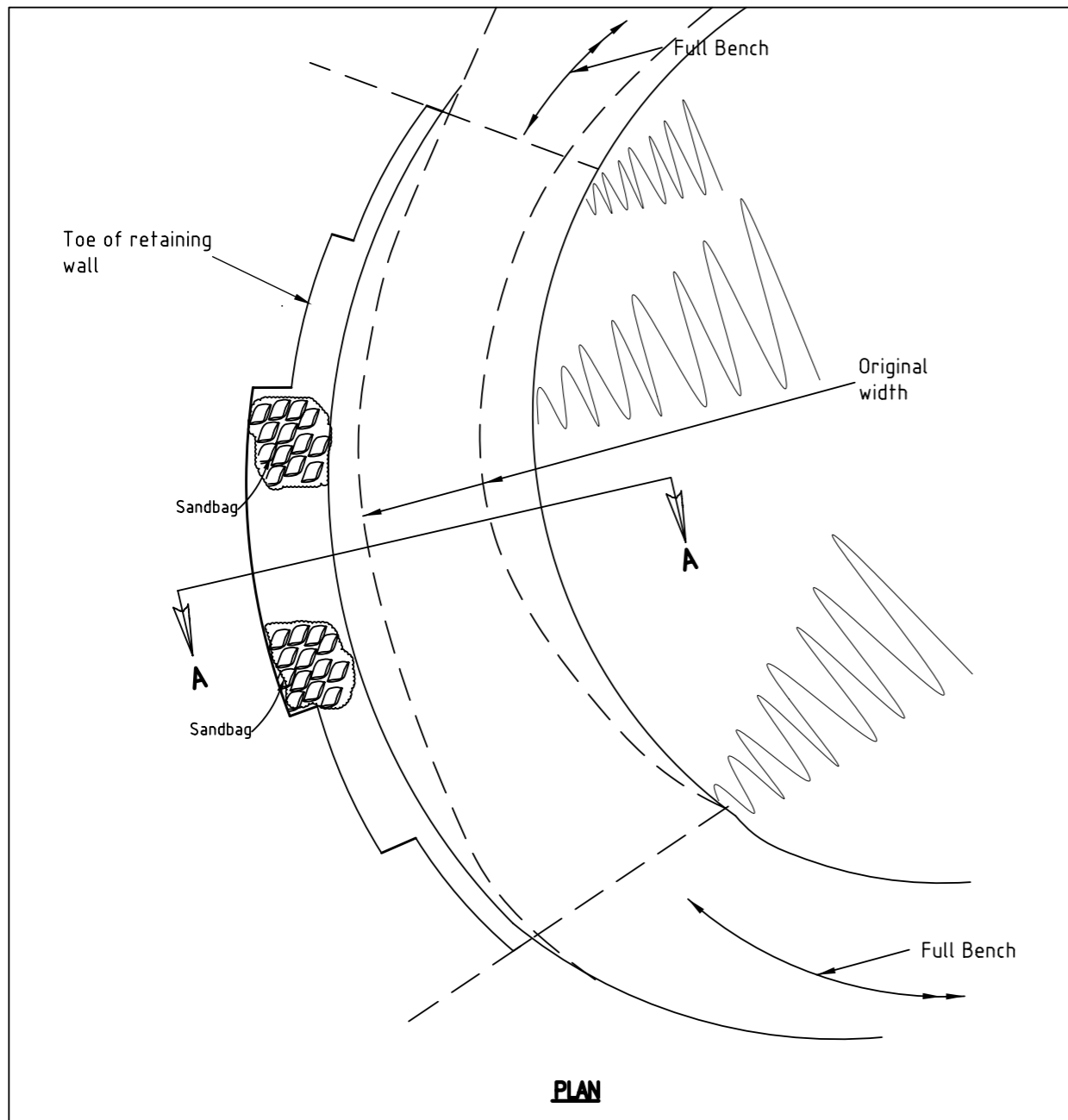
- Correct size stones.
- Correct shaped stones.
- Correct surface roughness.
- Hand packed.

**NOTES:**

- 1 Length of retained section and the depth of the retaining wall are to be determined following detailed site investigation.
- 2 Excavation earthworks necessary to commence work on the log crib wall, longitudinally and laterally, shall be benched in the opinion of the Engineer this is required
- 3 Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual.  
Items 4.2.1/2, 4.12, 4.14

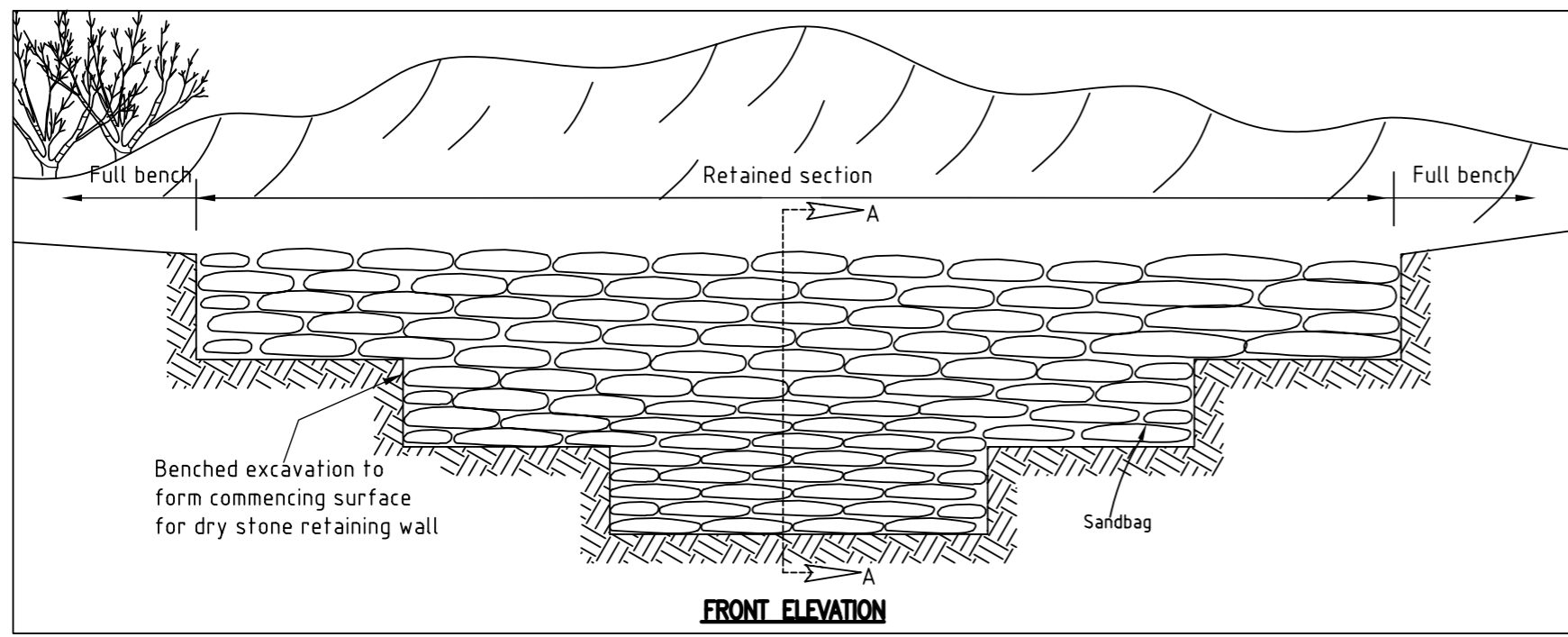


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Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
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Project No.	Sheet:	Drawing No. <b>RA 015</b>	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



Slope	Wall Height	Base width	Top width
30 - 35° (58-70%)	1.5 - 2.0m	1.25 - 1.5m	0.75m
35 - 40° (70-85%)	2.0 - 2.5m	1.5 - 2.0m	0.75 - 1.0m
40 - 45° (85-100%)	2.5 - 3.0m	2.0 - 2.3m	1.0m

**NOTES:**  
 1 Length of retained section and the depth of the retaining wall are to be determined following detailed site investigation.  
 2 Specifications, method of measurement and bill item descriptions for this structure have yet to be formulated.



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Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
		Date: Sept.'06'	
Project No.		Sheet:	Drawing No.
Drawn by: JAK	Checked by: JC	Approved by:	RA 016
Rev. no	Revision note	Date	Sign Chkd

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## Section A-4

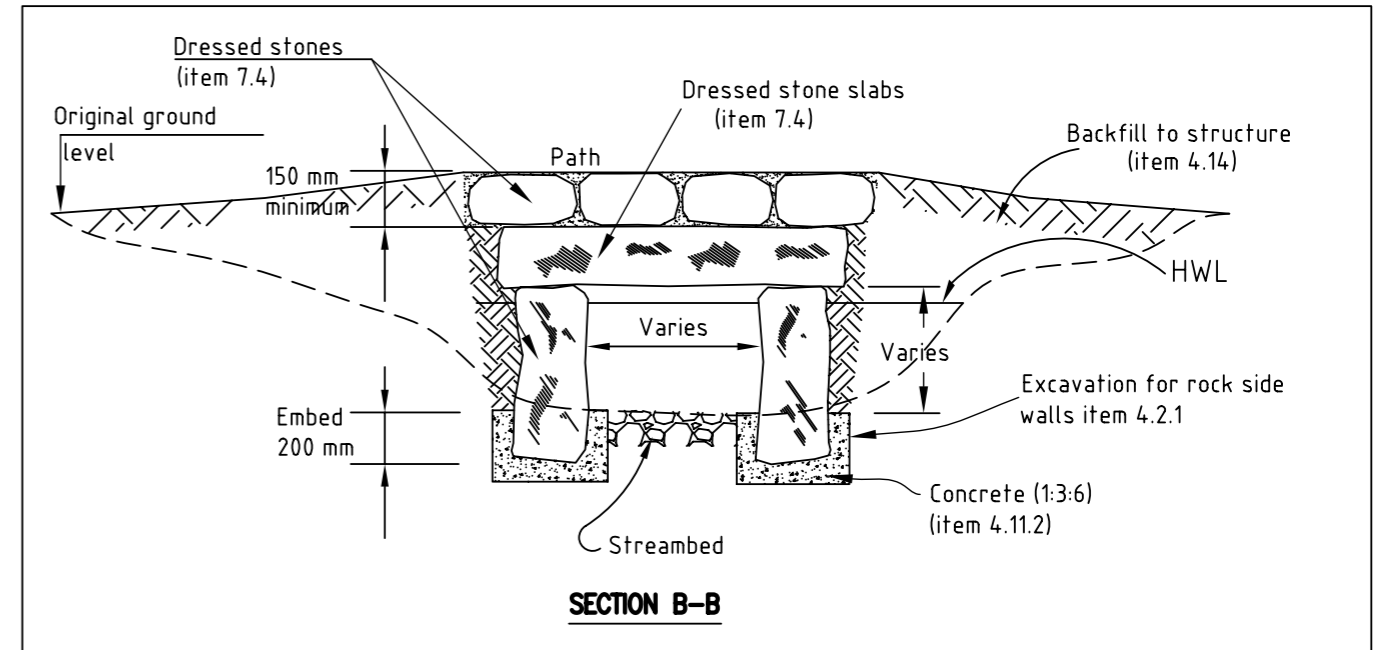
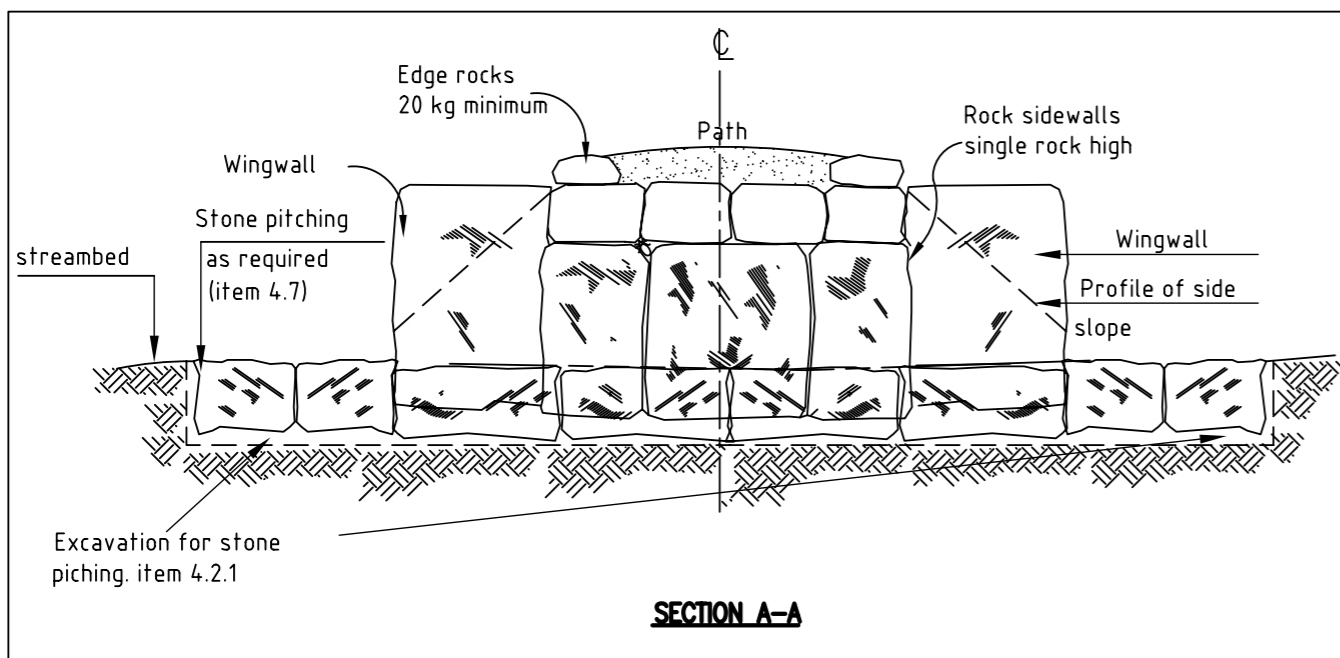
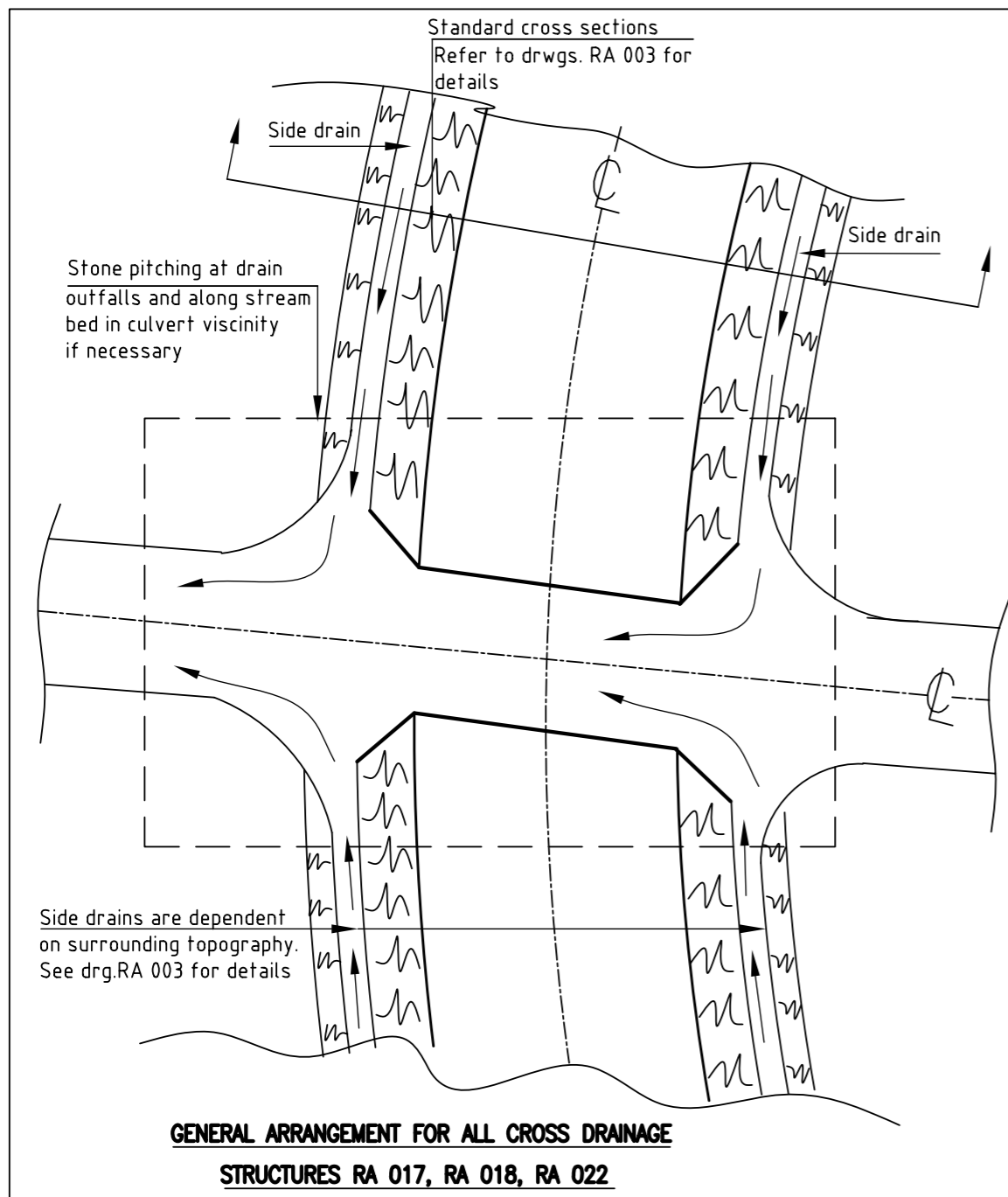
### Rural Access Roads: Tracks and Footpaths, Cross Drainage Structures

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<b>Drawing Title</b>	<b>Drawing Number</b>
Tracks and Footpaths: Cross Drainage Structures, Culvert Option 1 (Rock)	RA 017
Tracks and Footpaths: Cross Drainage Structures, Culvert Option 2 (Log)	RA 018
Tracks and Footpaths: Cross Drainage Structures, Culvert Option 3, Composite	RA 019
Tracks and Footpaths: Cross Drainage Structures, Stepping Stones Shallow Water Crossing Rock Structure	RA 020
Tracks and Footpaths: Cross Drainage Structures, Waterway Protection (Scour checks)	RA 021
Tracks and Footpaths: Cross Drainage Structures, French Drain	RA 022
Tracks and Footpaths: Cross Drainage Structures, Splash for Low Water Crossing	RA 023
Tracks and Footpaths: Cross Drainage Structures, Stone Lined Drain	RA 024

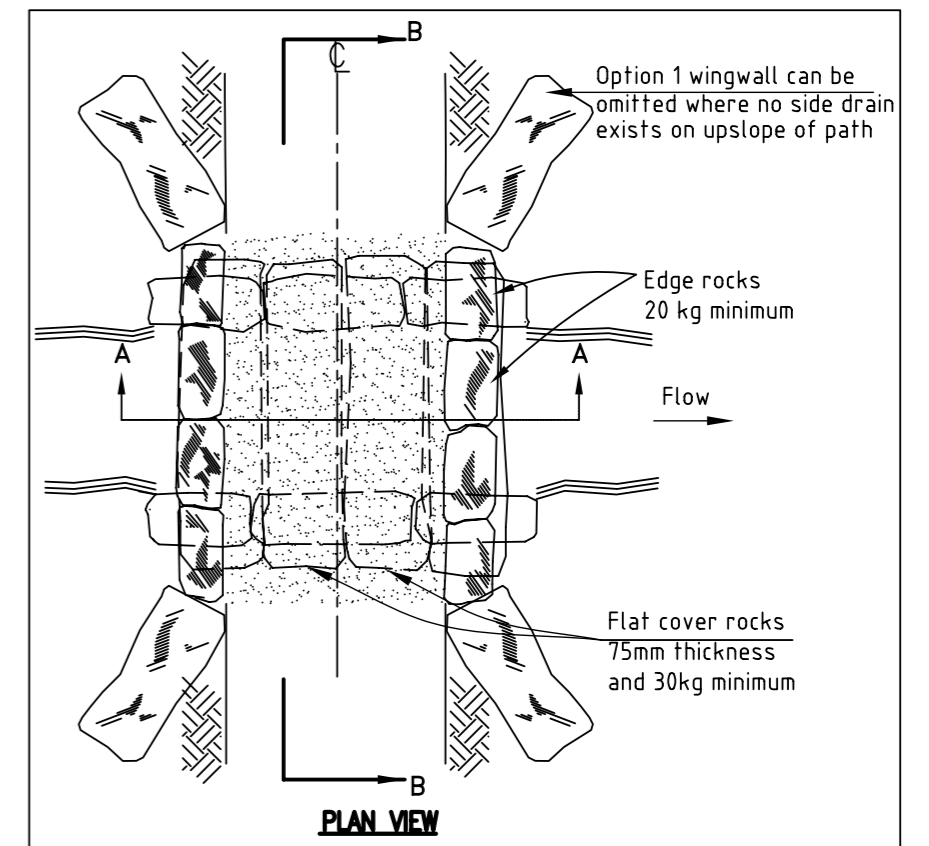
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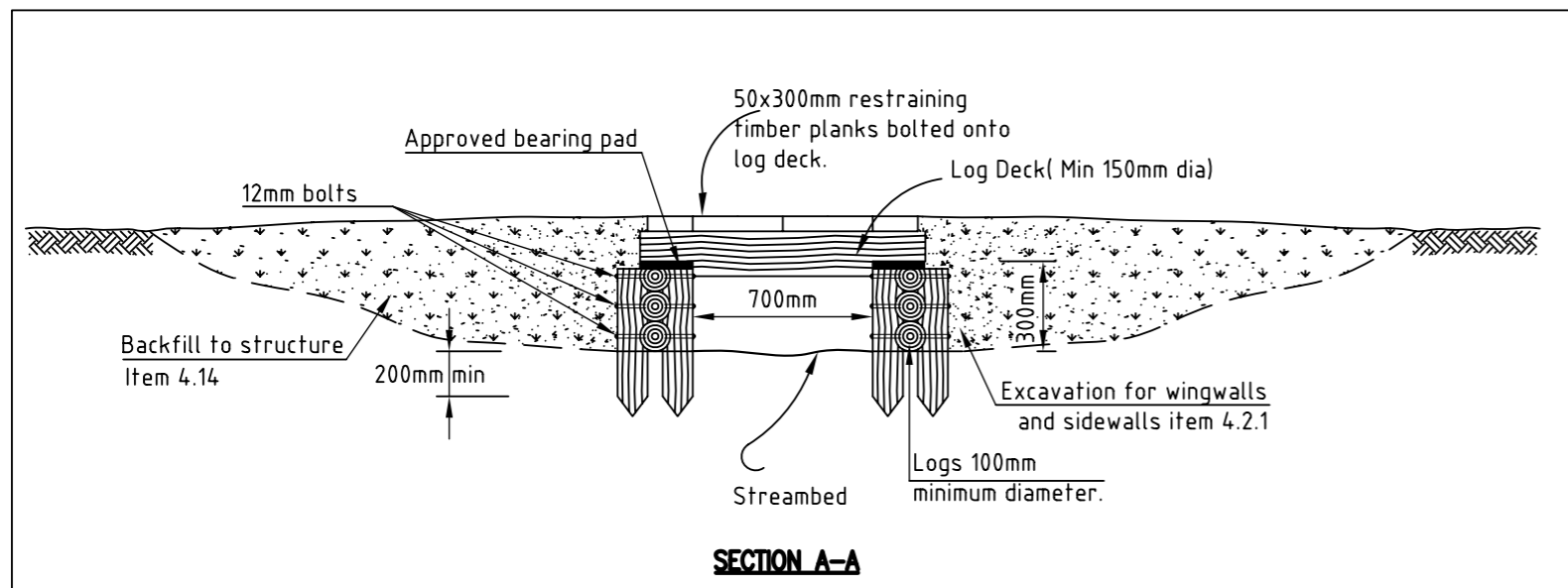
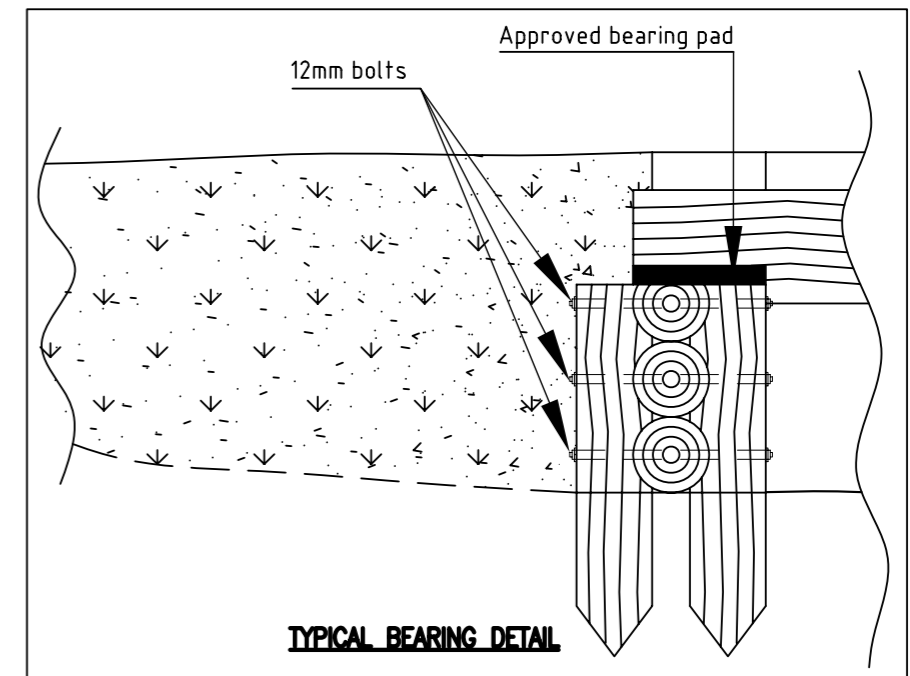
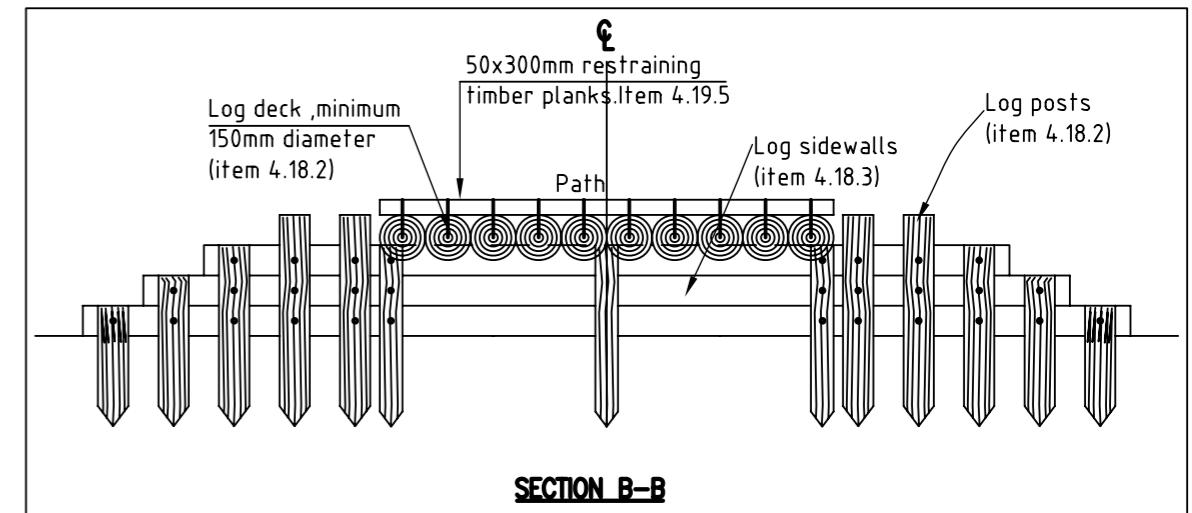
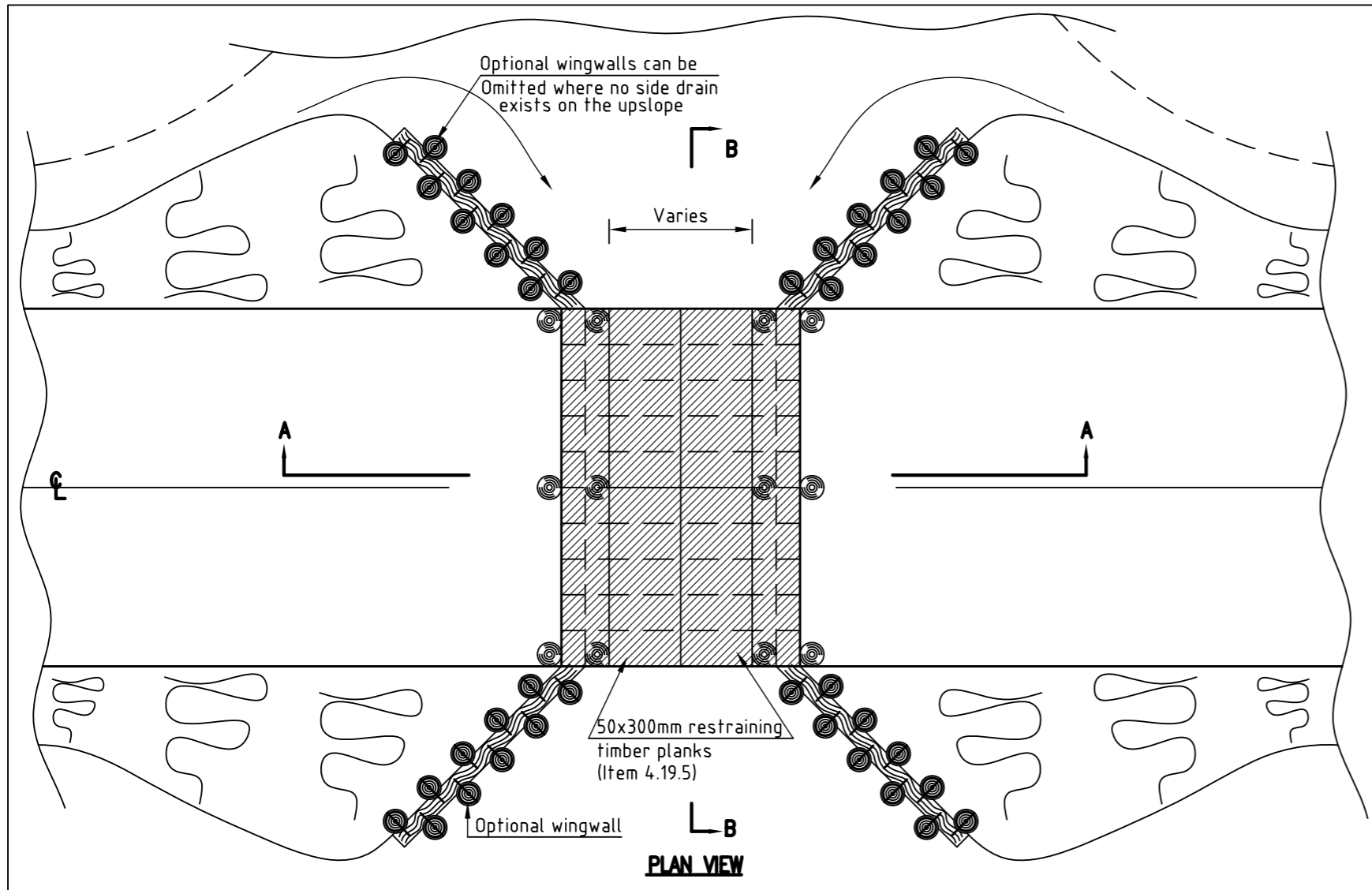


**NOTES:**

- 1 The width and depth of the culvert can be determined only after detailed investigation of the water course hydrology and the topography of the setting.
- 2 The need to construct wing walls depends on site conditions.
- 3 Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual, Items 4.2.1, 4.7, 4.11.2, 4.14 & 7.4



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	Title: <b>STANDARD CAS MANUAL</b>			Dimension: mm		
	Title: <b>TRACKS AND FOOTPATHS CROSS DRAINAGE STRUCTURES CULVERT OPTION 1 (ROCK)</b>			Date: Sept. '06'		
	Project No.	Sheet:	Drawing No.	<b>RA 017</b>		
Drawn by: IOY	Checked by: JC	Approved by:				
Rev. no	Revision note	Date	Sign	Chkd		

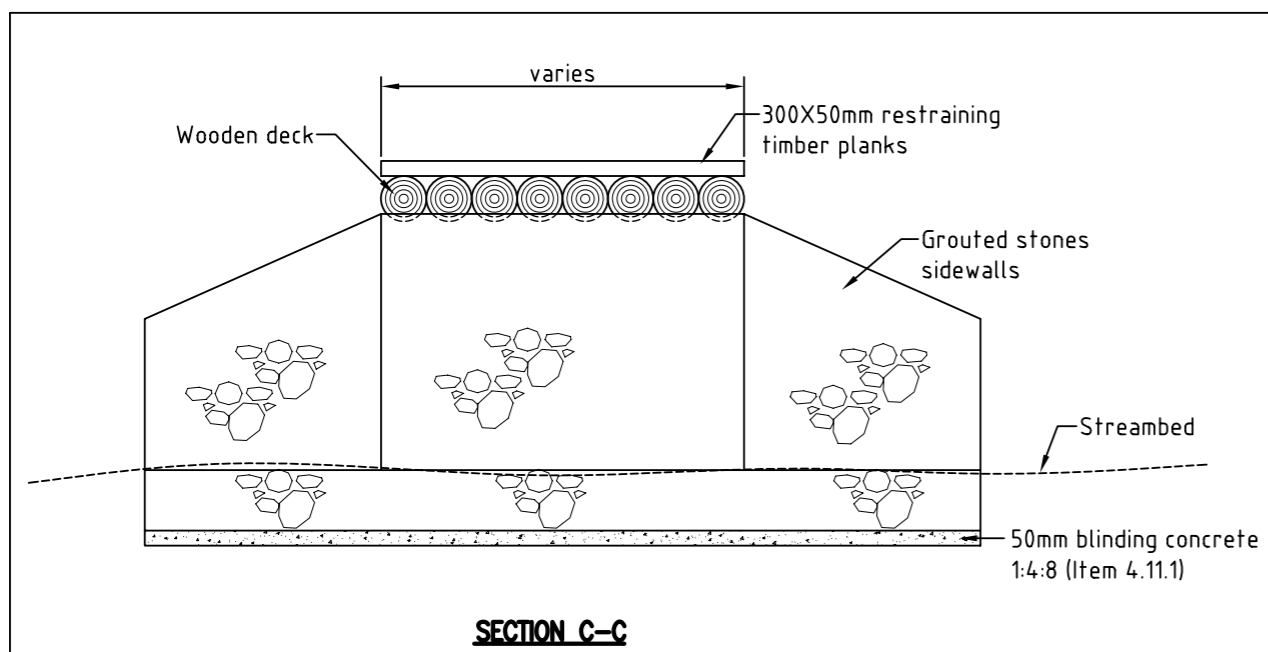
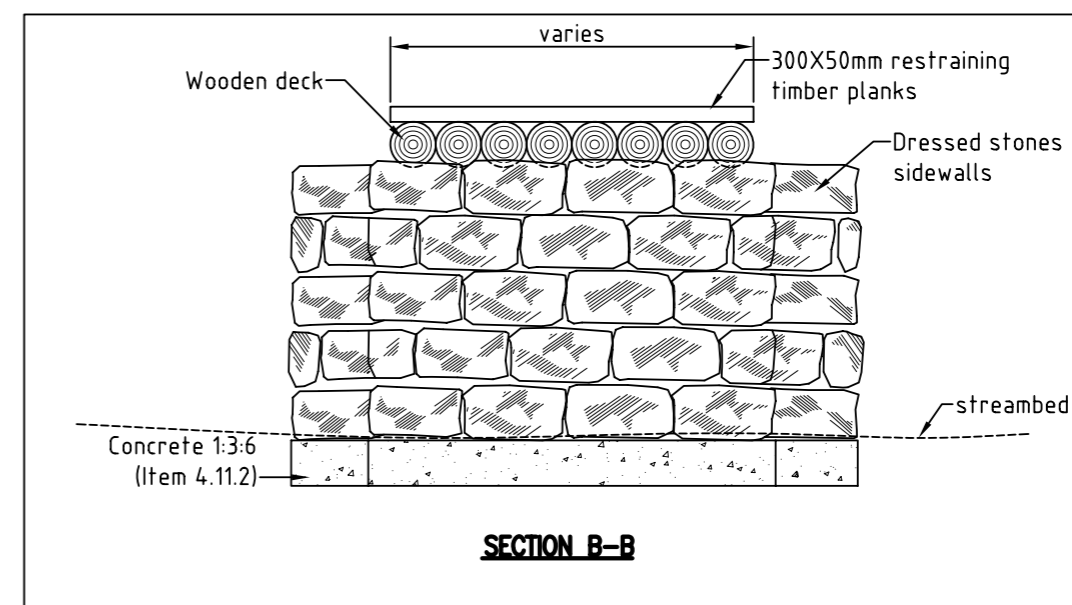
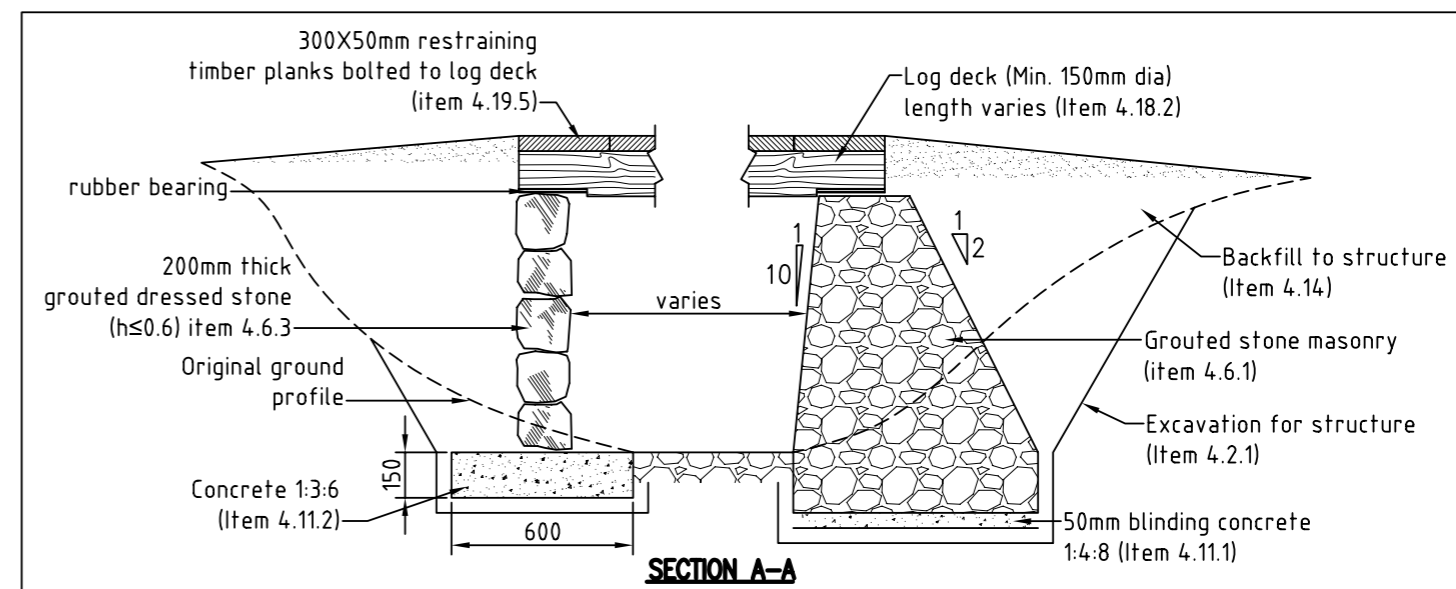
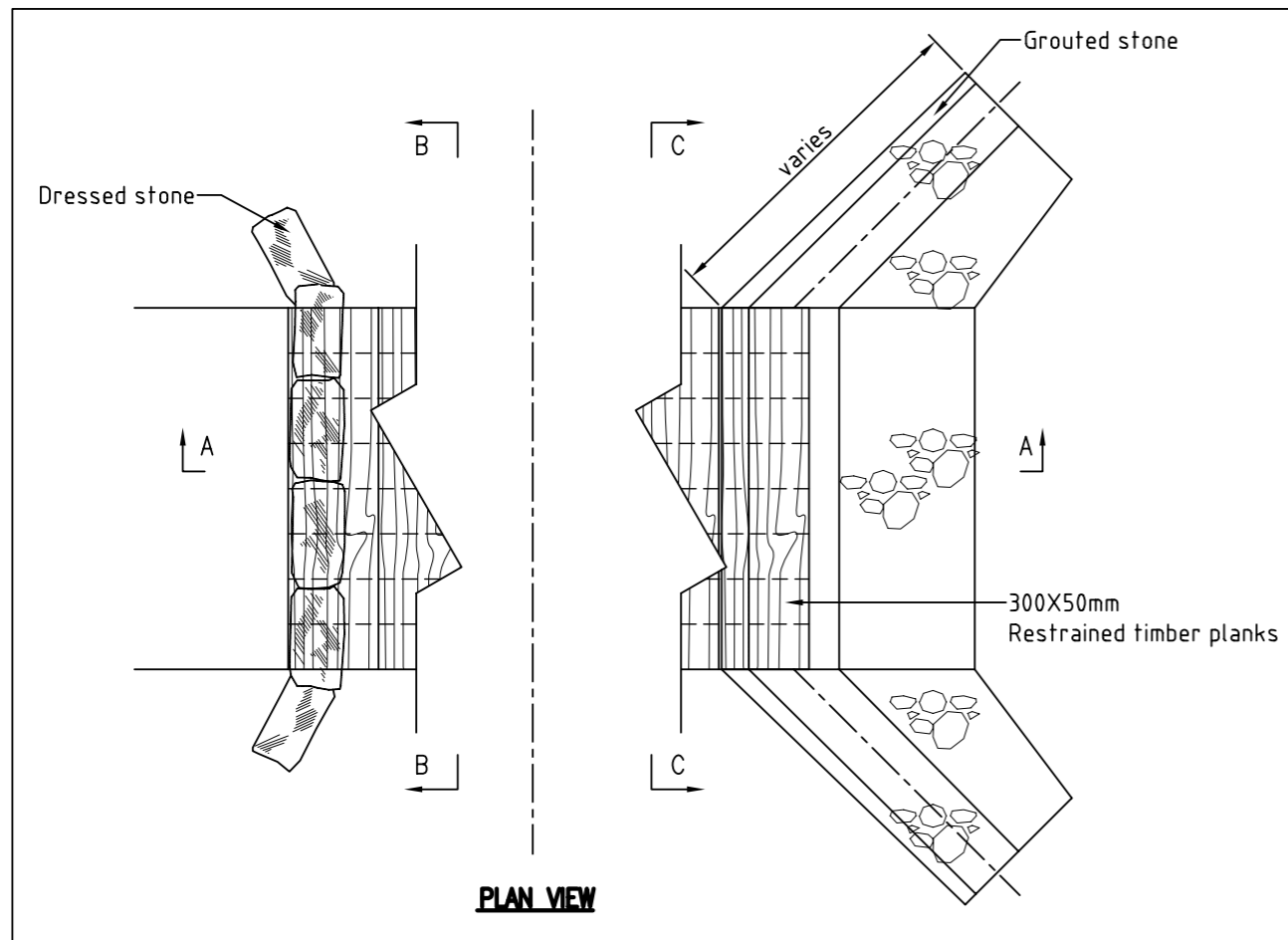


**Notes**

- 1 The width and depth of the culvert can be determined only after detailed investigation of the water course hydrology and the topography of the setting
- 2 For storm drainage details see drawing no RA017
- 3 Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual:  
Items 4.2.1, 4.14, 4.18.2, 4.18.3 & 4.19.5




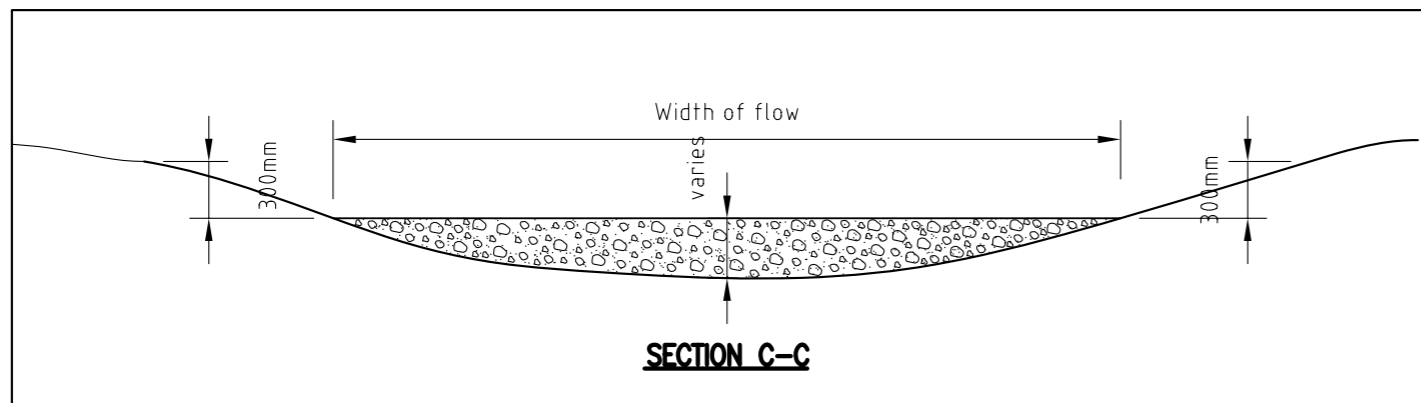
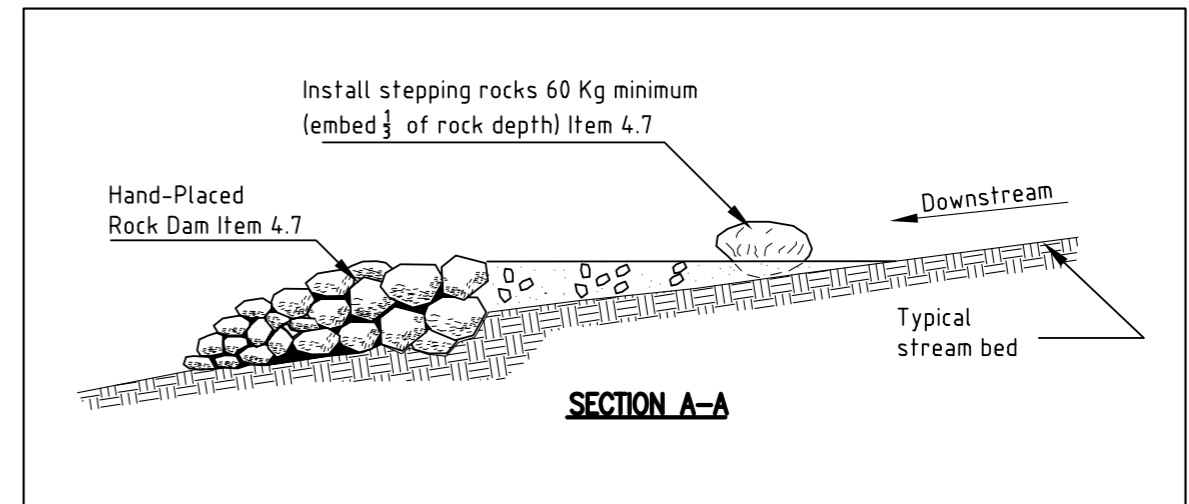
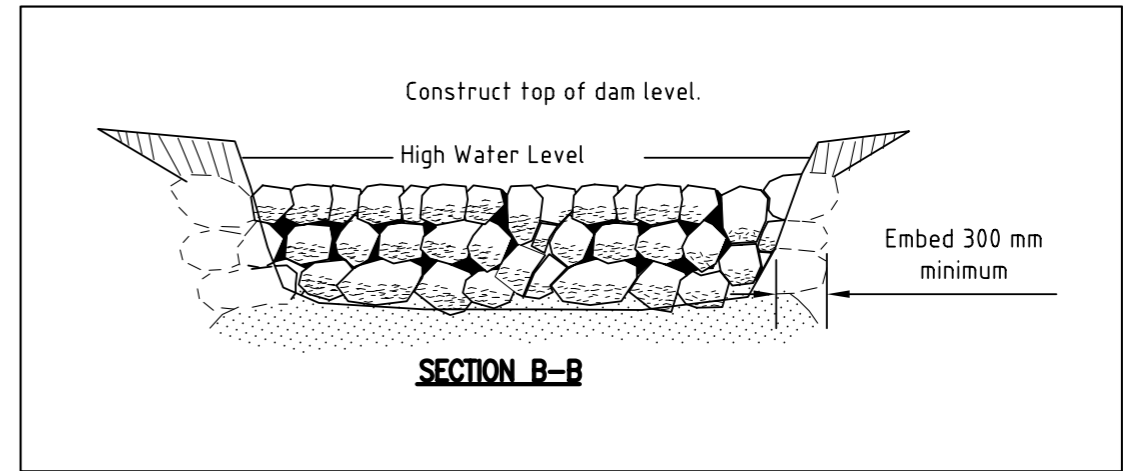
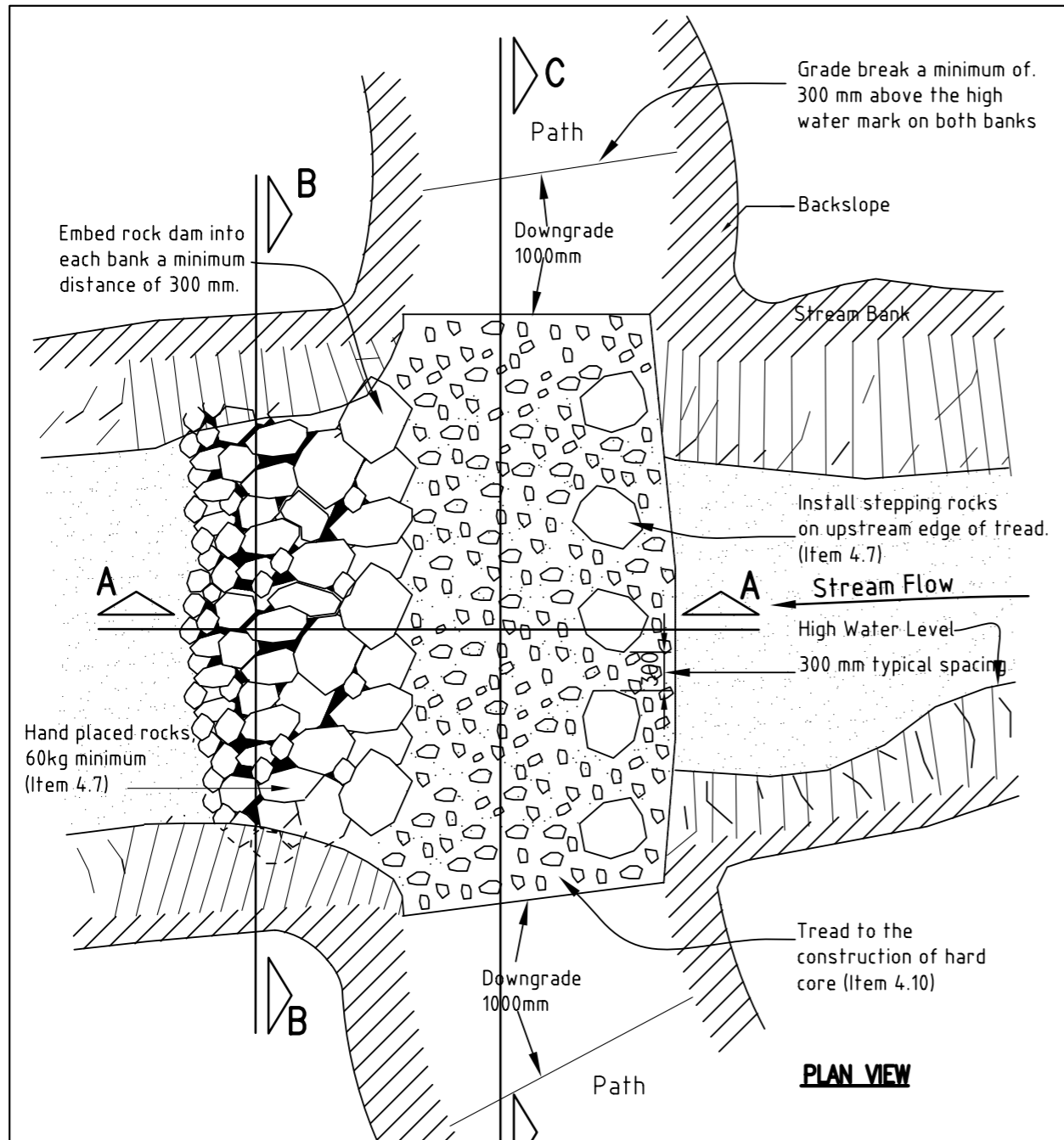
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Project No.	Sheet:	Drawing No. <b>RA 018</b>	
Drawn by: IOY	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd




**NOTES:**

1. The width and depth of the culvert can be determined after detailed investigation of the water course hydrology and the topography of the site
2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual:  
Items 4.2.1, 4.6.1, 4.6.3, 4.11.1, 4.11.2, 4.14, 4.18.2, 4.18.3, & 4.19.5

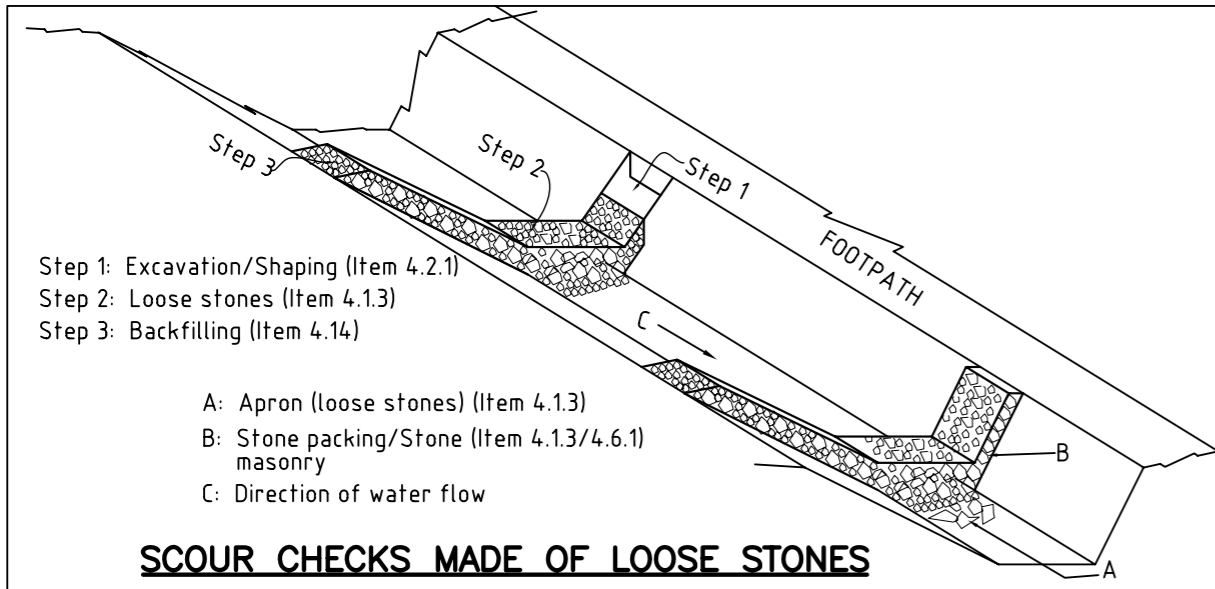
 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scale:	
	Title: <b>STANDARD CAS MANUAL</b>		<b>TRACKS AND FOOTPATHS CULVERT OPTION 3 COMPOSITE</b>		Dimension: mm
	Project No.		Sheet:	Drawing No.	
	Drawn by: RL	Checked by: JC	Approved by:		<b>RA 019</b>
Rev. no	Revision note	Date	Sign	Chkd	



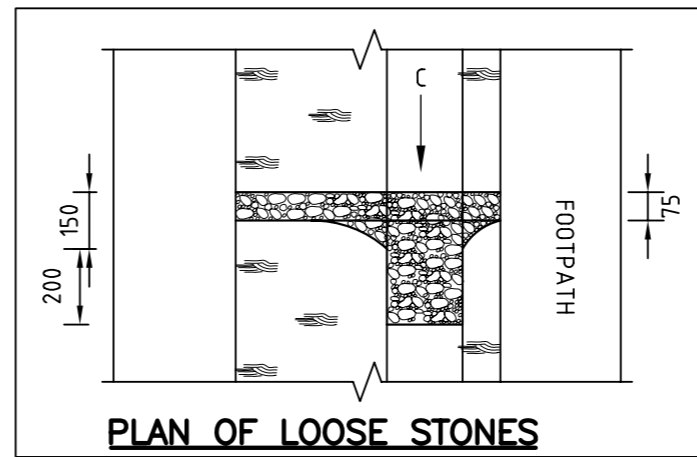
- NOTES:**
1. The geometry of cross drainage structure can be determined only after only after detailed investigations of water course hydrology and the topography of the setting..
  2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manualtem 4.2.1, 4.7, & 4.10

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	Title: <b>STANDARD CAS MANUAL</b>		<b>STEPPING STONES SHALLOW WATER CROSSING ROCK STRUCTURE</b>			Dimension: mm
	Project No.		Sheet:		Drawing No. <b>RA 020</b>	
	Drawn by: ODan	Checked by: JC	Approved by:			
Rev. no	Revision note			Date	Sign	Chkd

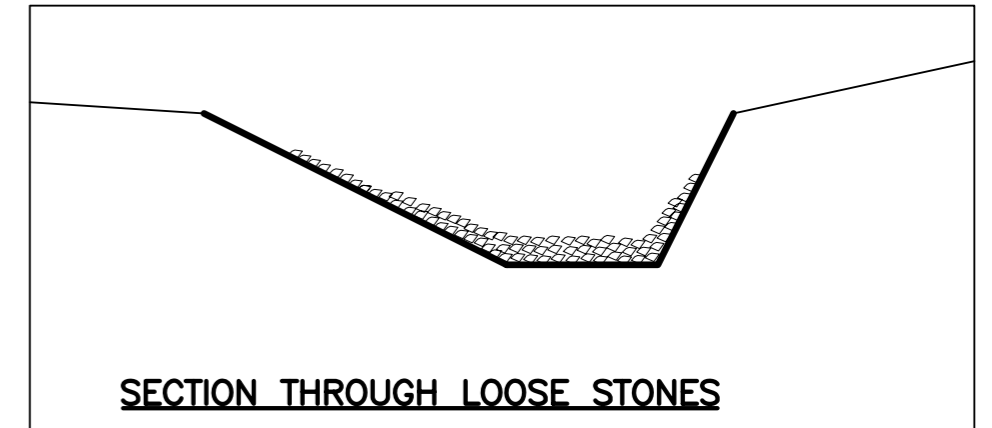




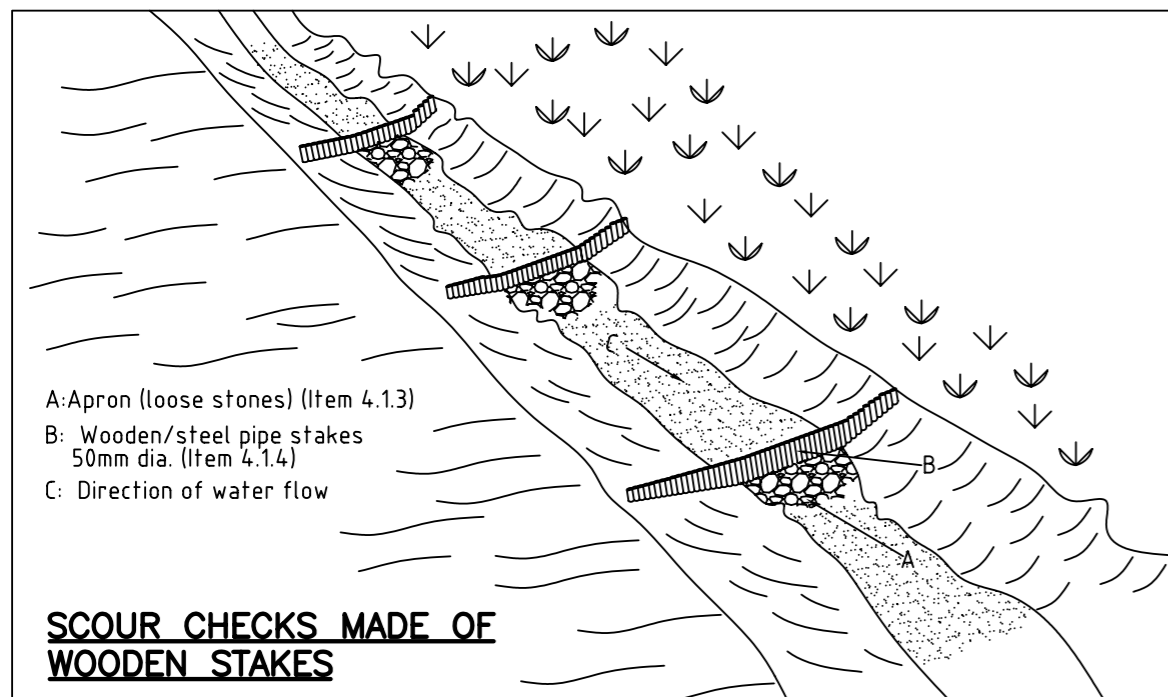
**SCOUR CHECKS MADE OF LOOSE STONES**



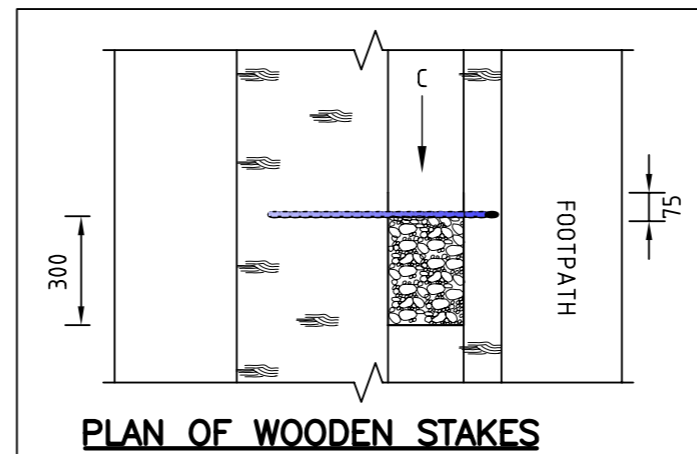
**PLAN OF LOOSE STONES**



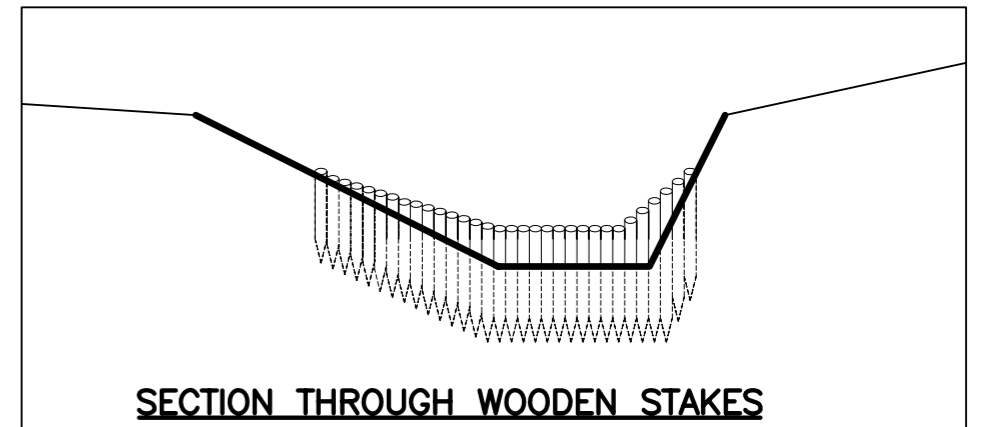
**SECTION THROUGH LOOSE STONES**



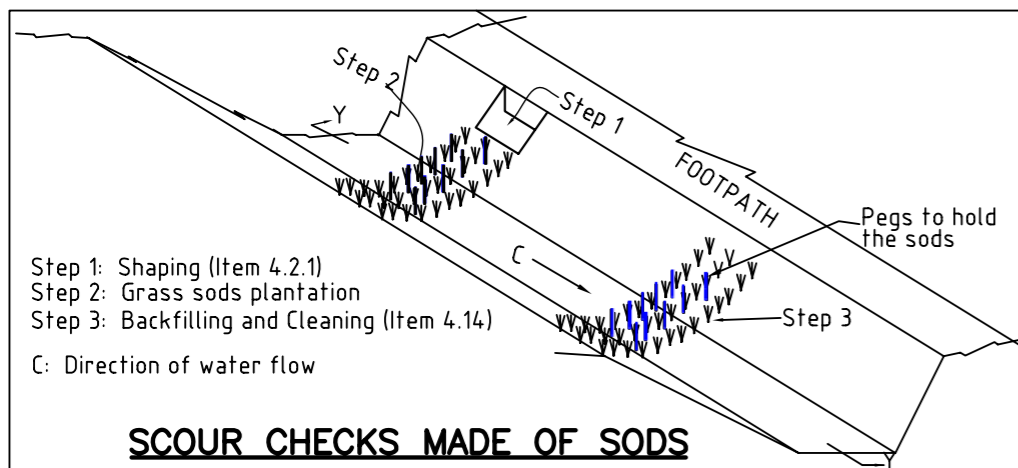
**SCOUR CHECKS MADE OF WOODEN STAKES**



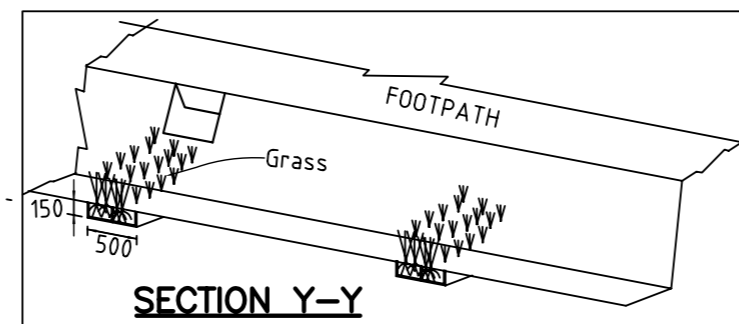
**PLAN OF WOODEN STAKES**



**SECTION THROUGH WOODEN STAKES**



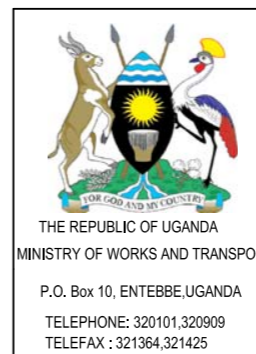
**SCOUR CHECKS MADE OF SODS**



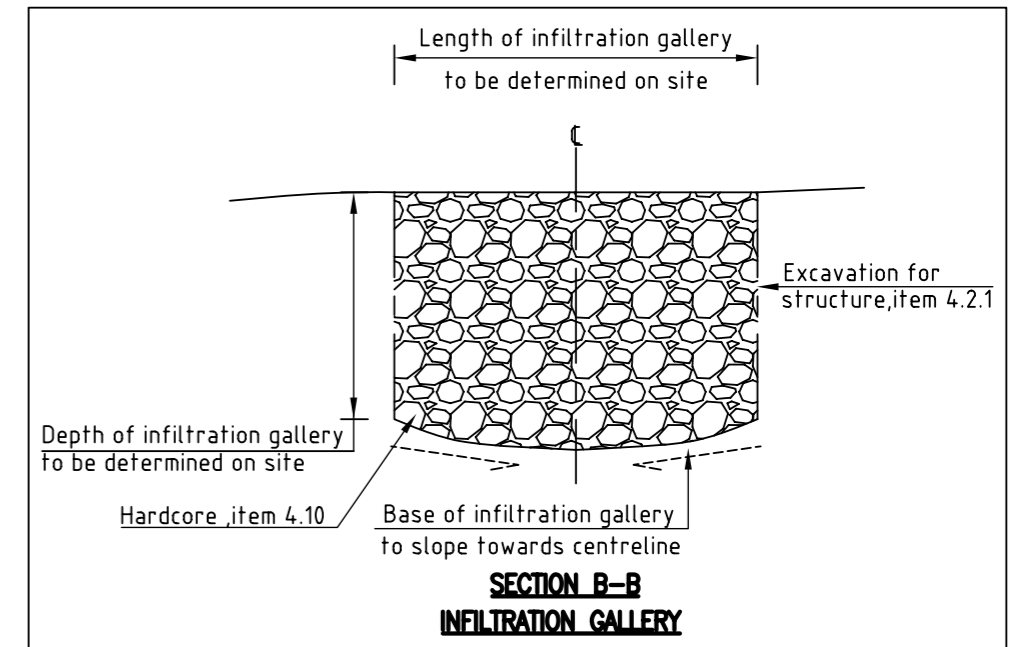
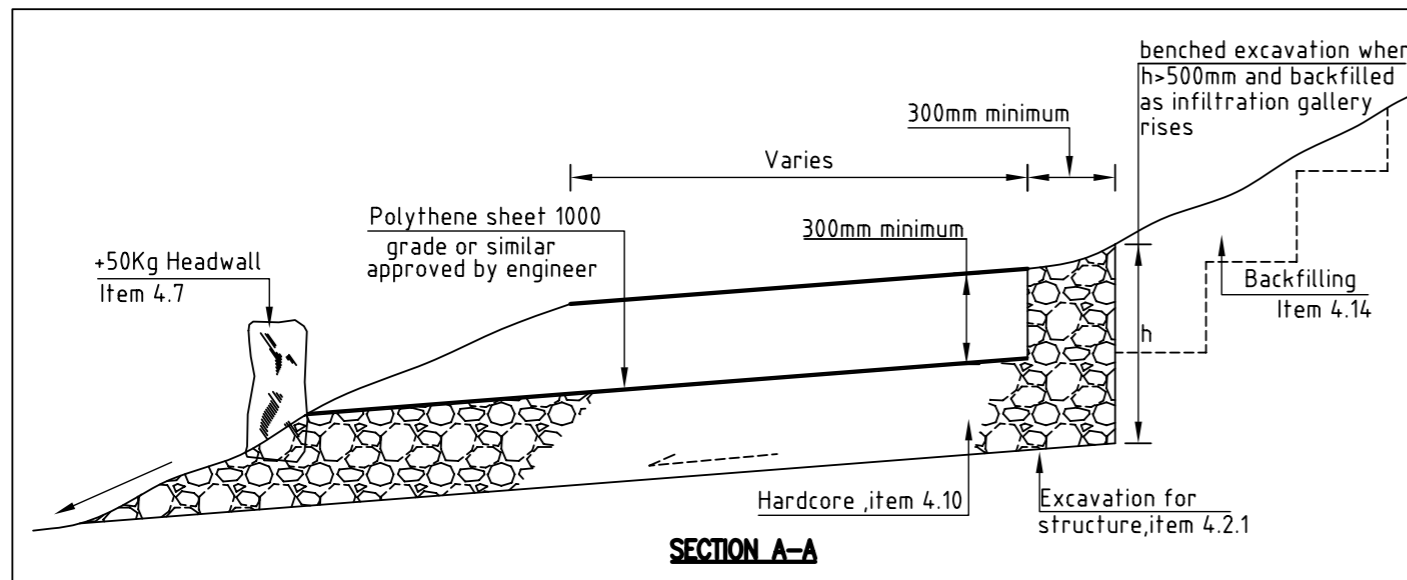
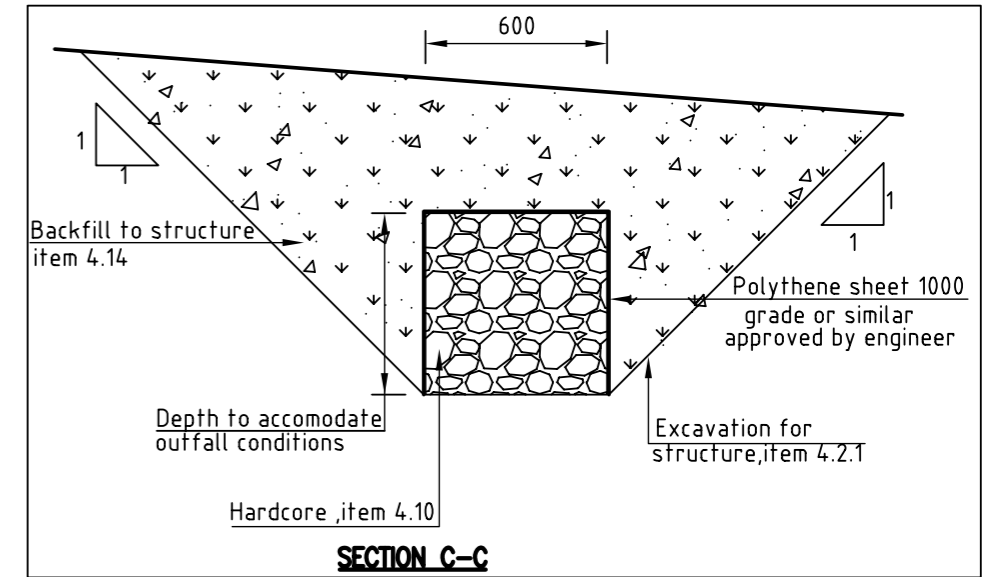
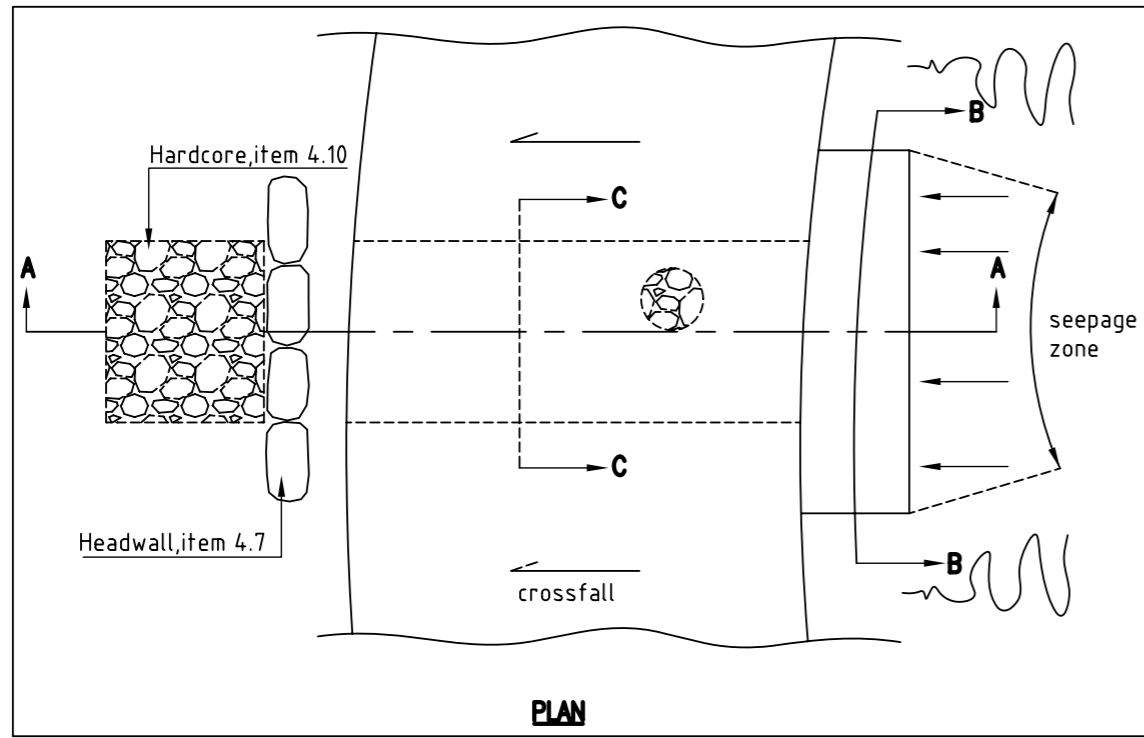
**SECTION Y-Y**

Gradient (%)	4 or less	5	6	7	8	9	10	>10
Maximum spacing of Scour checks (m)	Not applicable	20	15	10	7.5	6	5	4

**NOTES:**  
 1. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 4.1.3, 4.1.4, 4.2.1, & 4.14




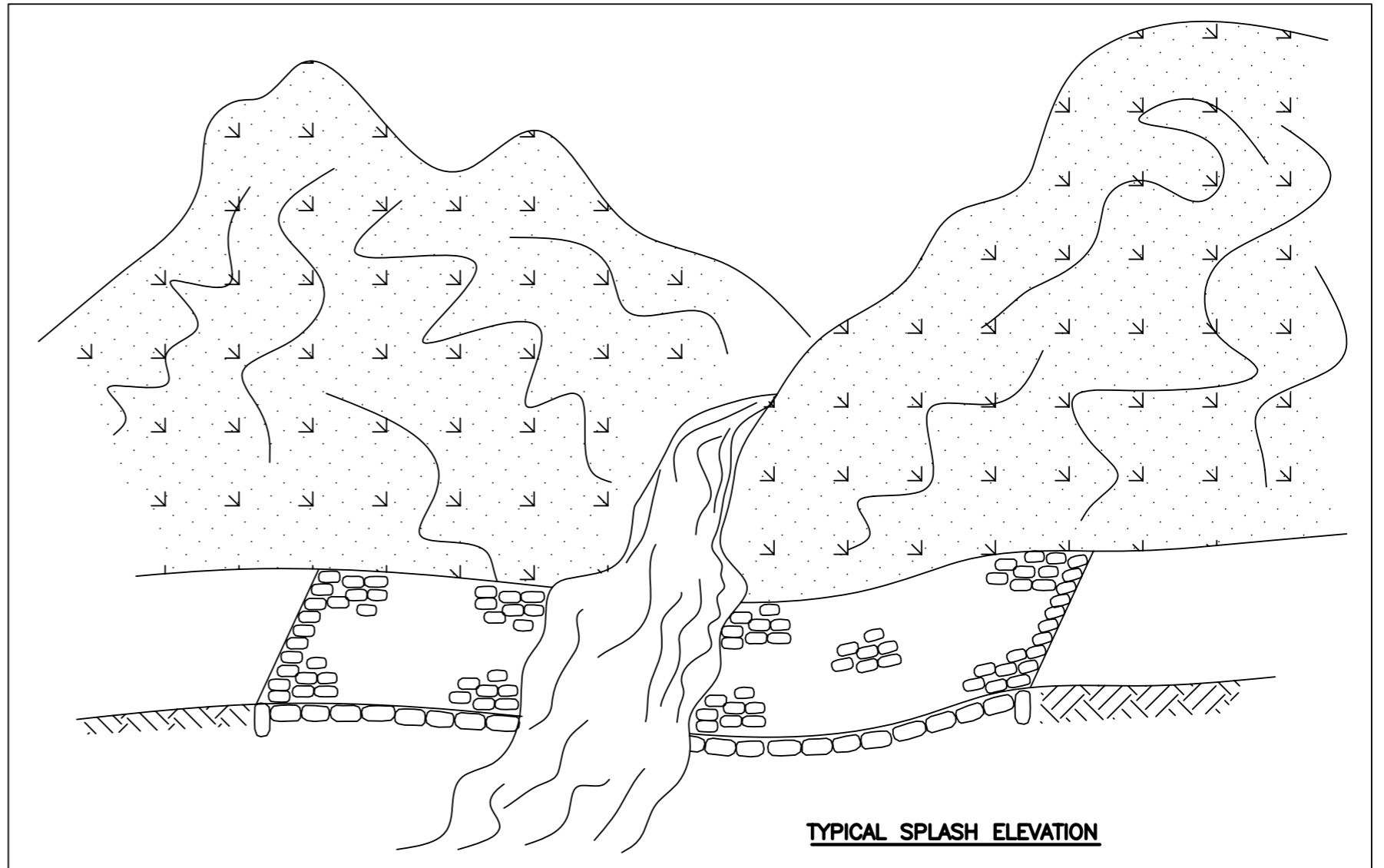
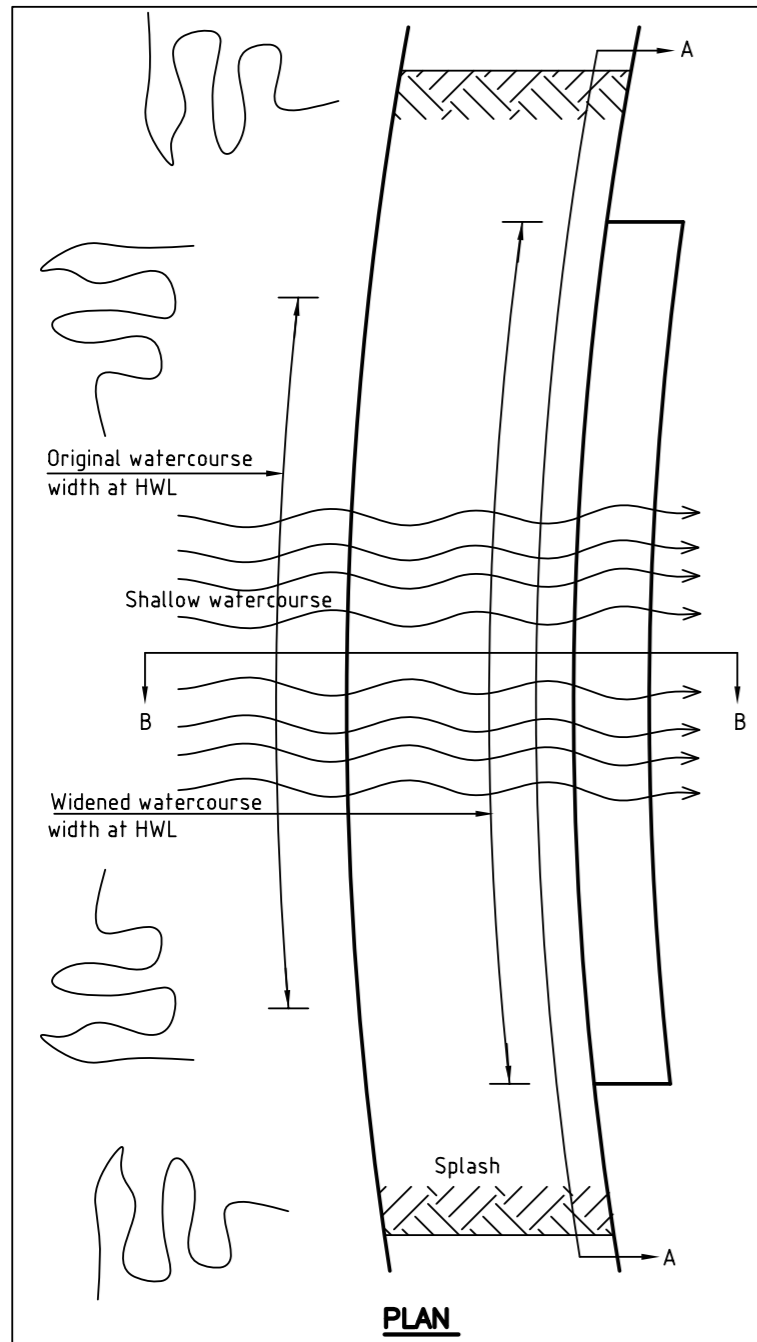
Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
<b>TRACKS AND FOOTPATHS WATER WAY PROTECTION (SCOUR CHECKS)</b>		Date: Sept.'06'	
Project No.	Sheet:	Drawing No. <b>RA 021</b>	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



**NOTES:**

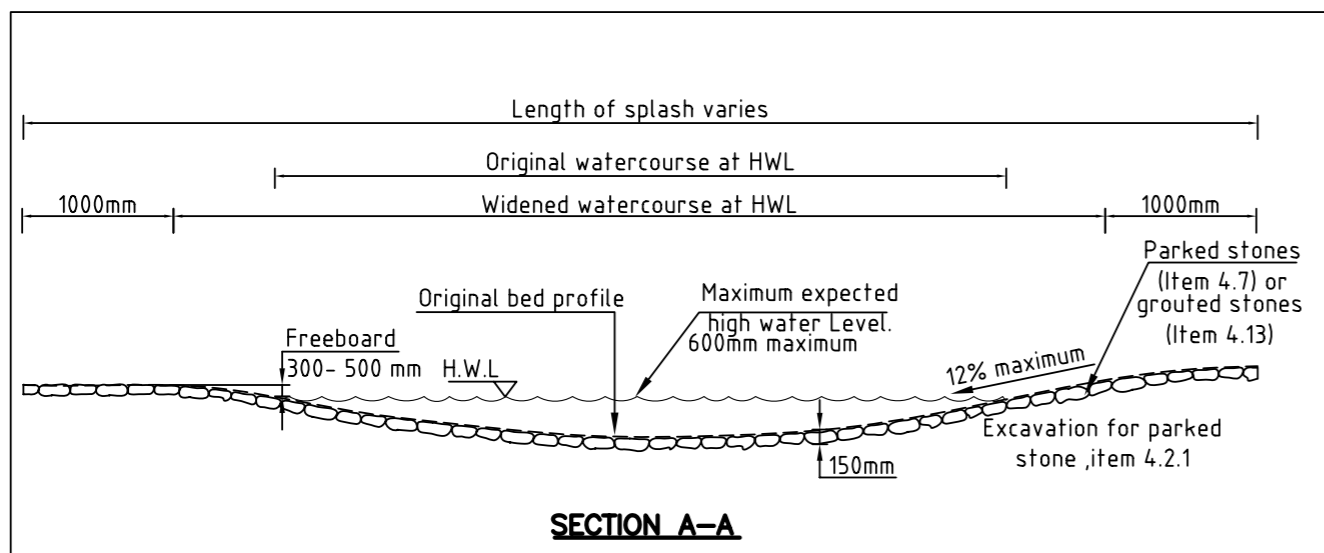
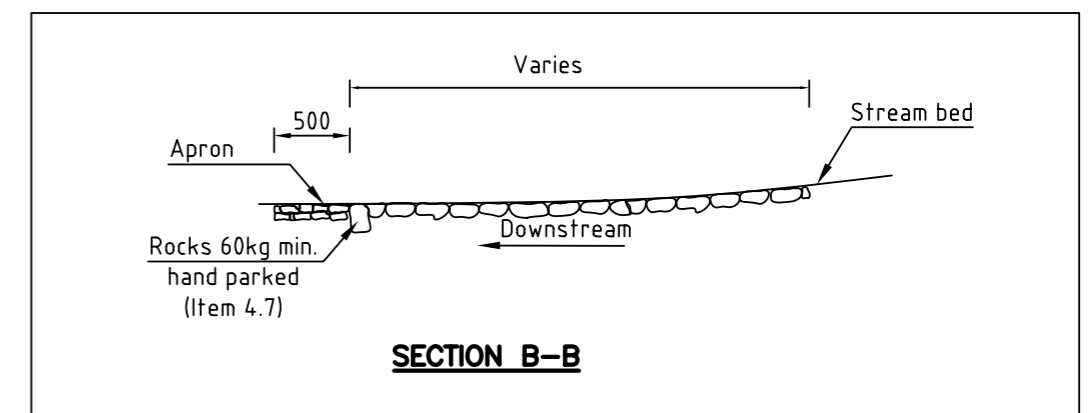
1. French drain must only be used where inflowing water is relatively free of suspended solids. It should not be used to convey surface water.
2. The length and depth of the infiltration gallery and the geometry of the French drain must be chosen to suit specific site conditions.
3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual:  
Items 4.2.1, 4.7, 4.10, 4.14

 <p>THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT</p> <p>P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425</p>	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
	<b>TRACKS AND FOOTPATHS CROSS DRAINAGE STRUCTURES FRENCH DRAIN</b>		Date: Sept. '06'	
	Project No.	Sheet:	Drawing No. <b>RA 022</b>	
Drawn by: IOY	Checked by: JC	Approved by:		
Rev. no	Revision note	Date	Sign	Chkd

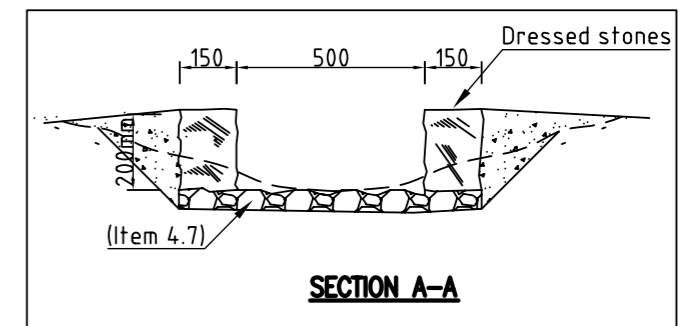
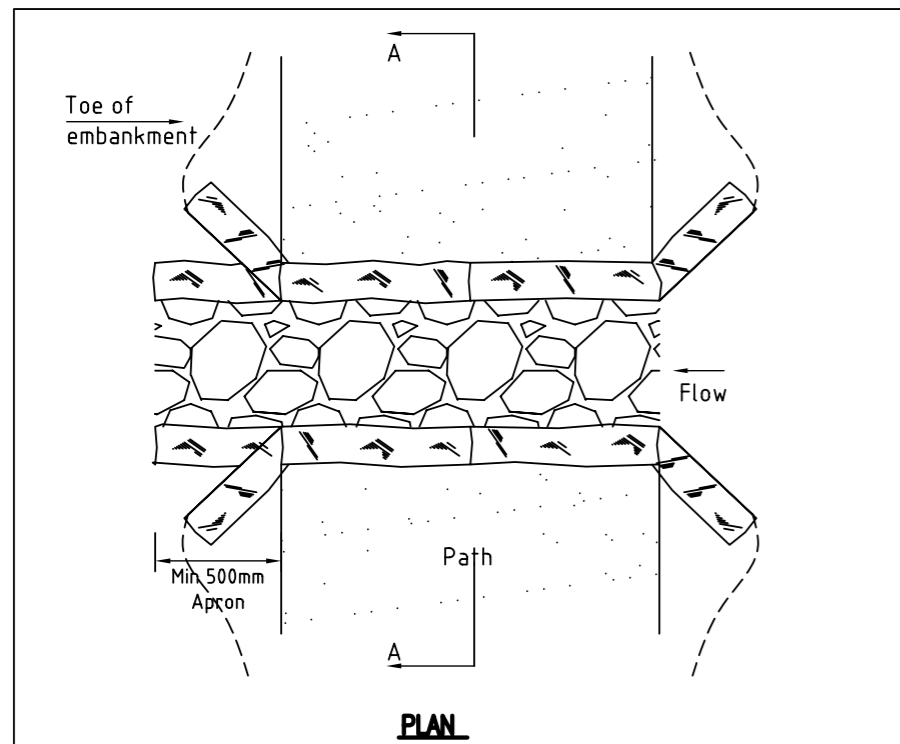
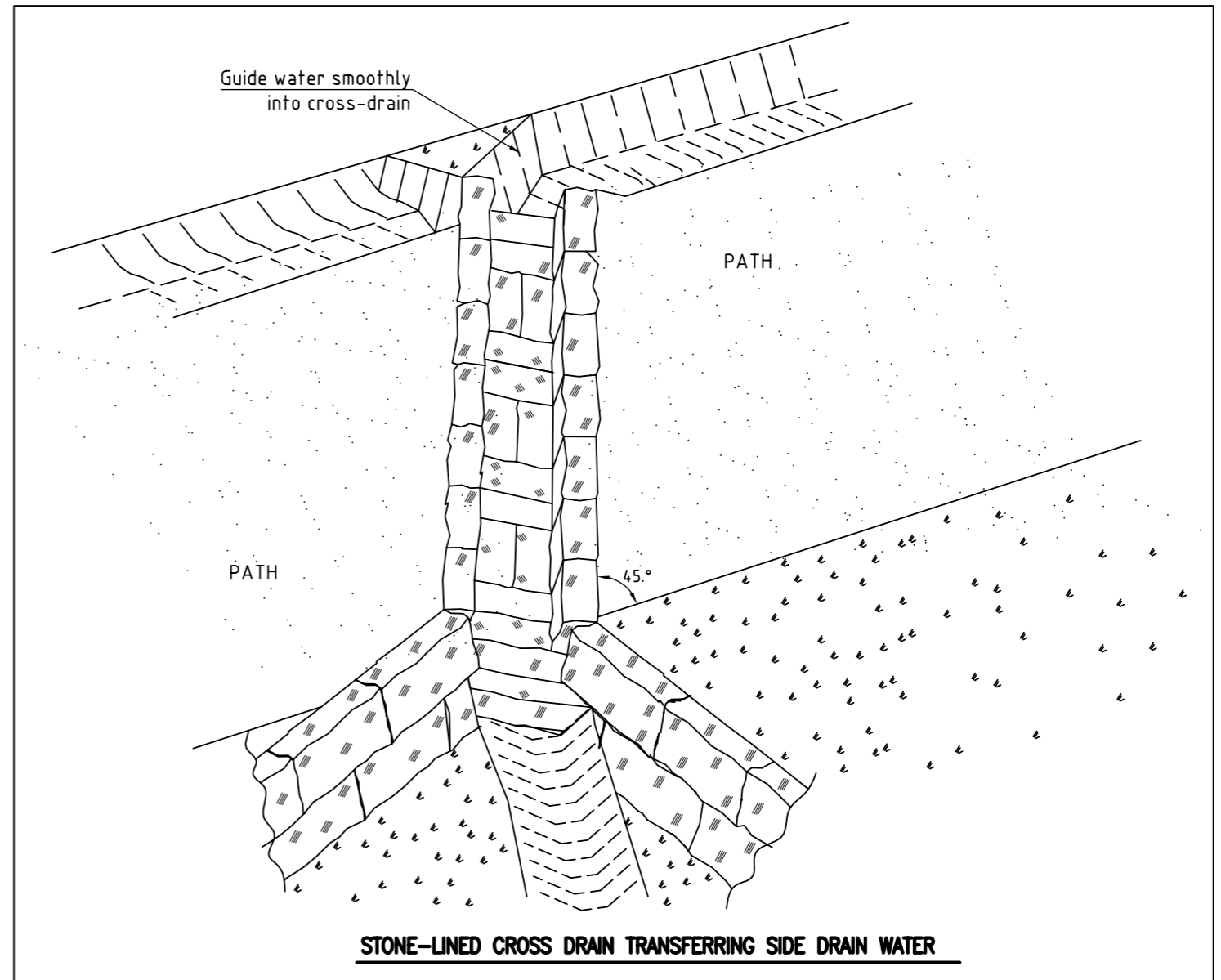
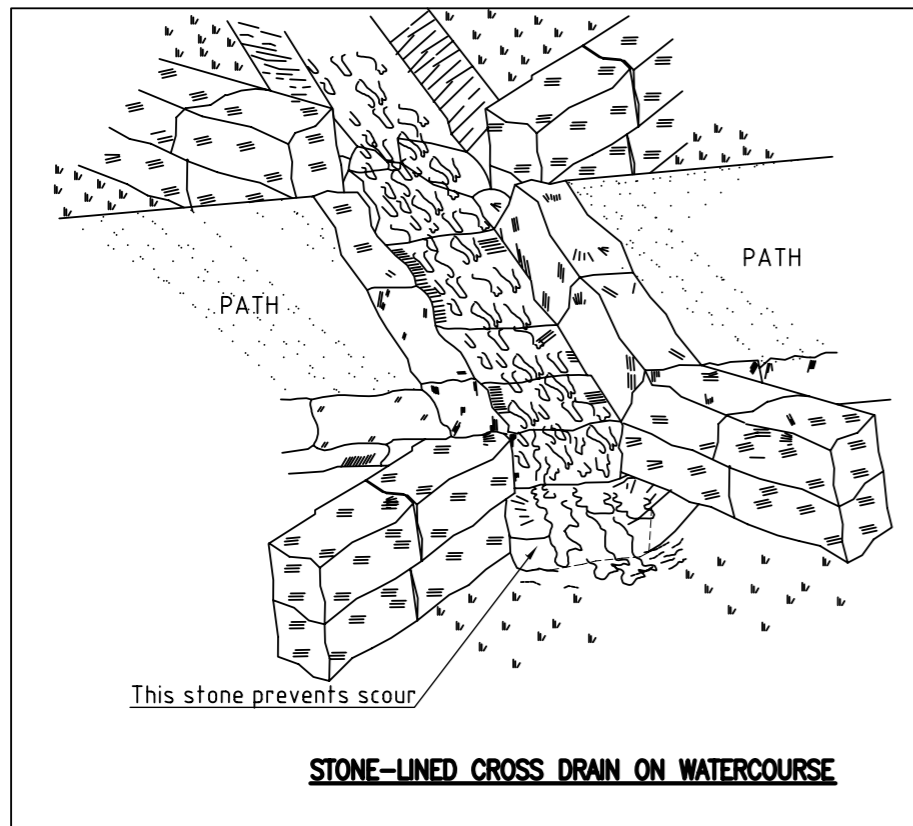


**NOTES:**


- 1 The geometry of the splash is dependant on the hydrology of the water course and the topography of the setting
- 2 Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 4.2.1, 4.7, 4.10 & 4.14



<p>THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425</p>	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scale:
	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm
	Title: <b>TRACKS AND FOOTPATHS CROSS DRAINAGE STRUCTURES SPLASH FOR LOW WATER CROSSING</b>		Date: Sept. '06'
	Project No.	Sheet:	Drawing No. <b>RA 023</b>
Drawn by: IOY	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



**NOTES:**  
 1. Specifications, method of measurement and bill item descriptions for this structure have yet to be formulated.

 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scale:	
	Title: <b>STANDARD CAS MANUAL</b>		<b>TRACKS AND FOOTPATHS CROSS DRAINAGE STRUCTURES</b>		Dimension: mm
			<b>STONE LINED DRAIN</b>		Date: Sept. '06'
	Project No.	Sheet:	Drawing No. <b>RA 024</b>		
Drawn by: IOY	Checked by: JC	Approved by:			
Rev. no	Revision note	Date	Sign	Chkd	



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## Section A-5

### Rural Access Roads: Tracks and Footpaths, Footbridges

**Drawing Title****Drawing Number**

Tracks and Footpaths: Footbridges, Sill and Crib Log abutments

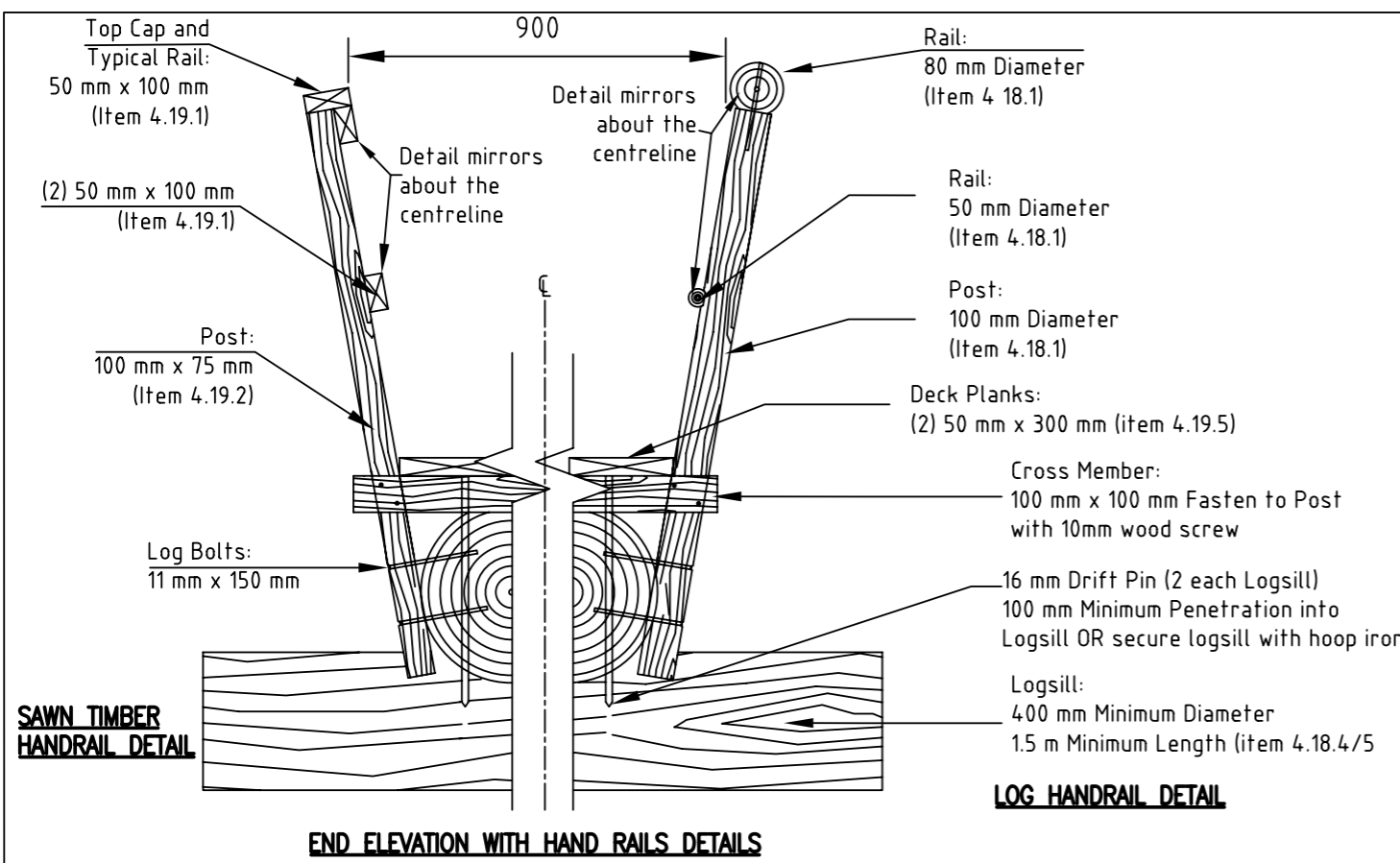
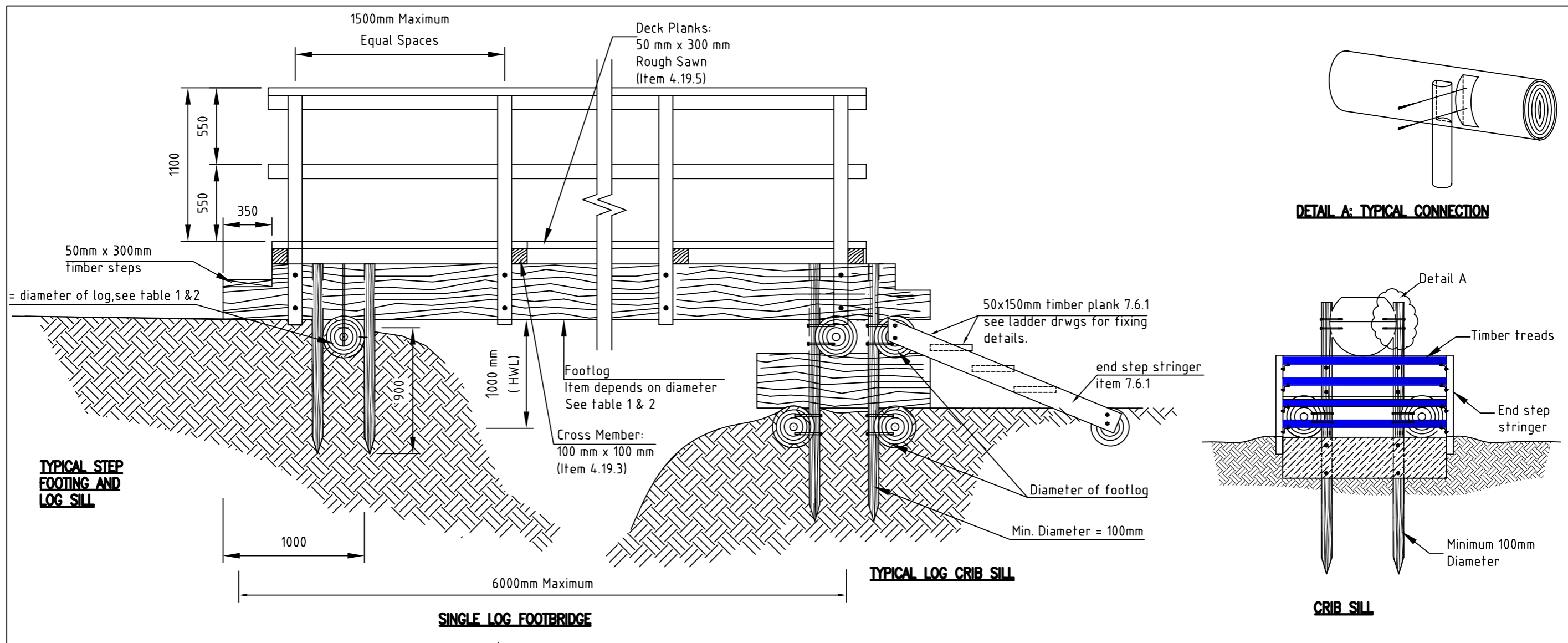
RA 025

Tracks and Footpaths: Footbridges, Multiple Log/Masonry/Gabion abutments

RA 026

Tracks and Footpaths: Footbridges, Log bridge Handrail details

RA 027



**NOTES:**

1. Abutment types are not limited to those indicated. See DRWG No. 026 for alternatives.
2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual:

Minimum Log Diameter at Midspan	
Span (m)	Minimum Diameter (mm)
> 5	350
5.0	375
5.5	425
6.0	475

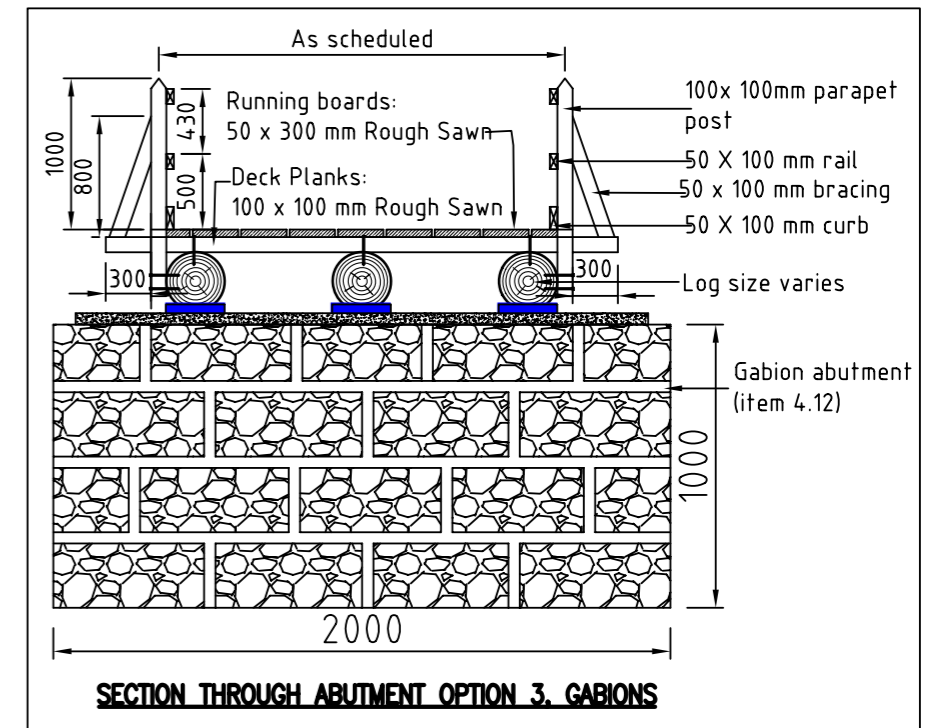
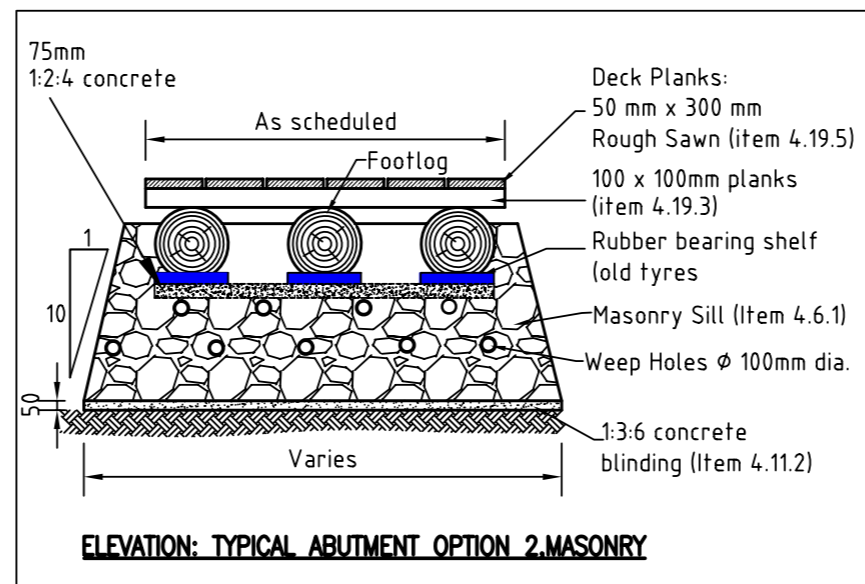
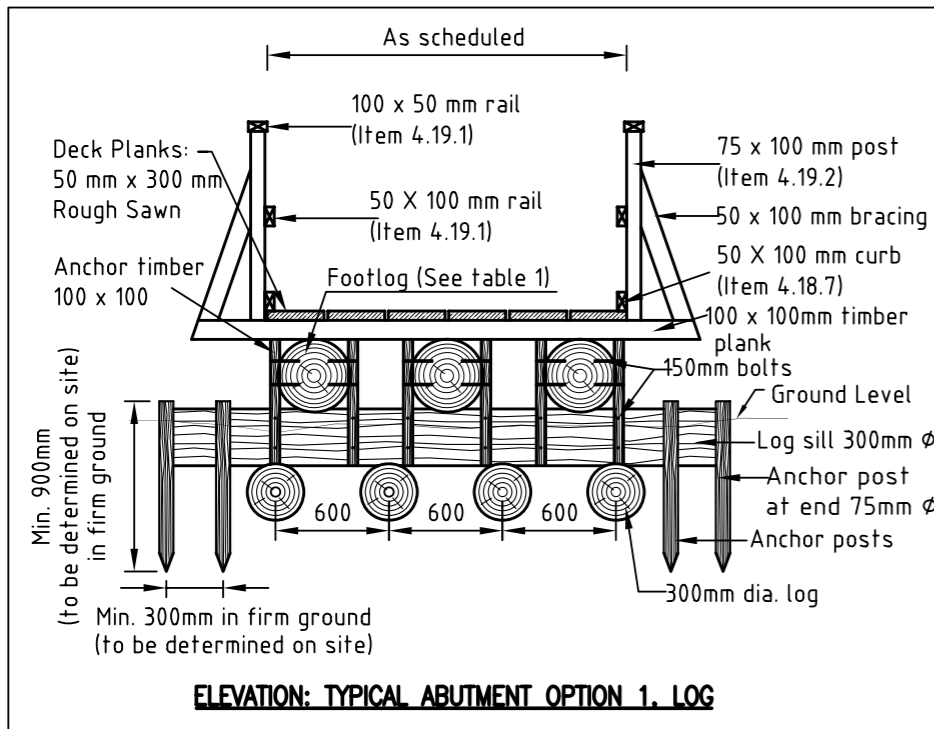
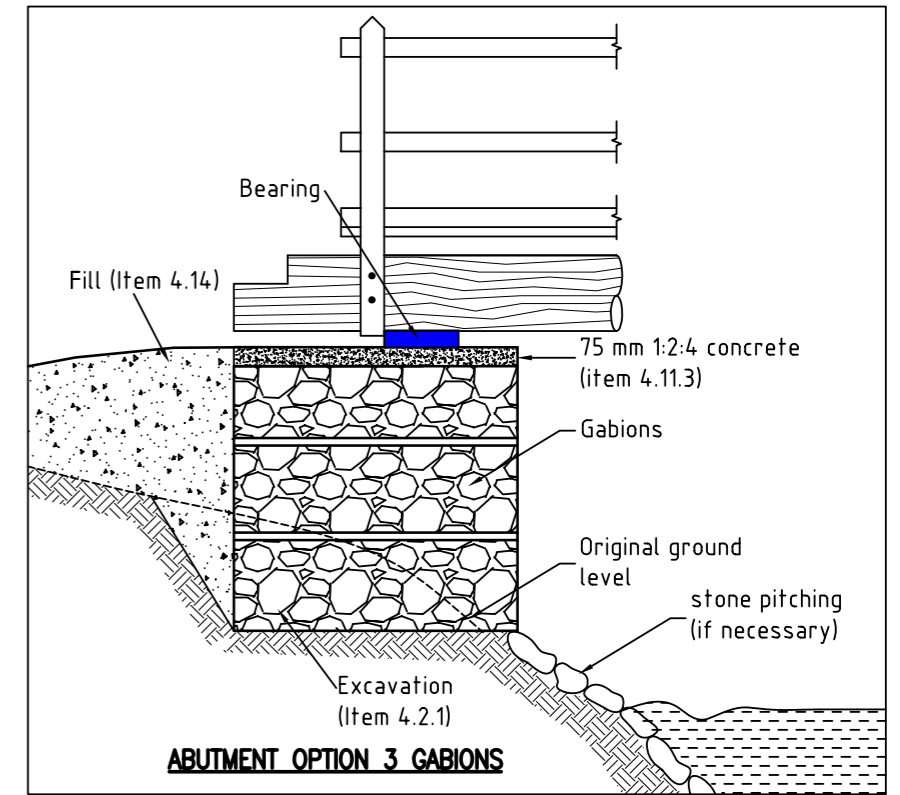
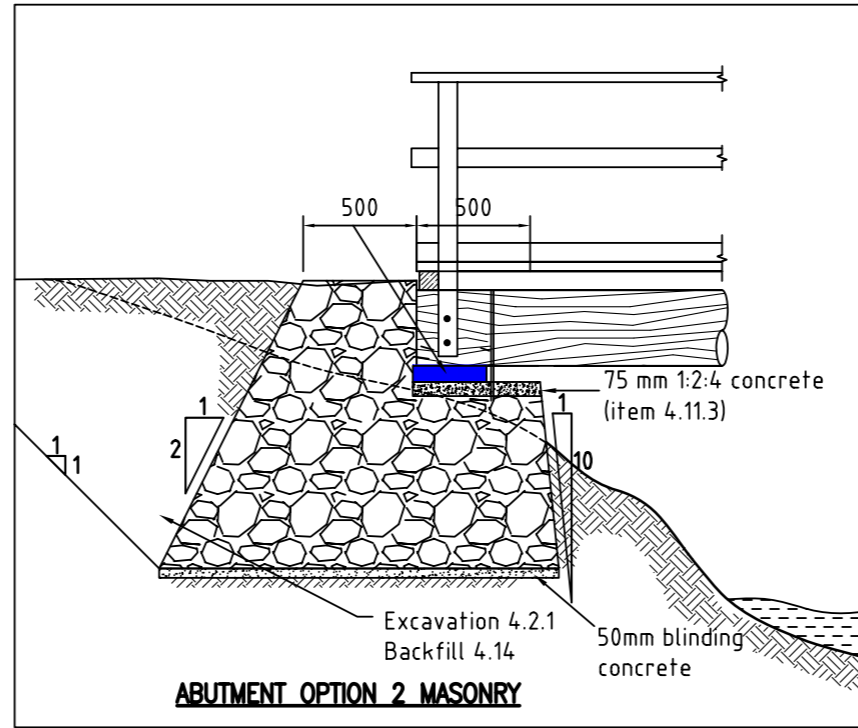
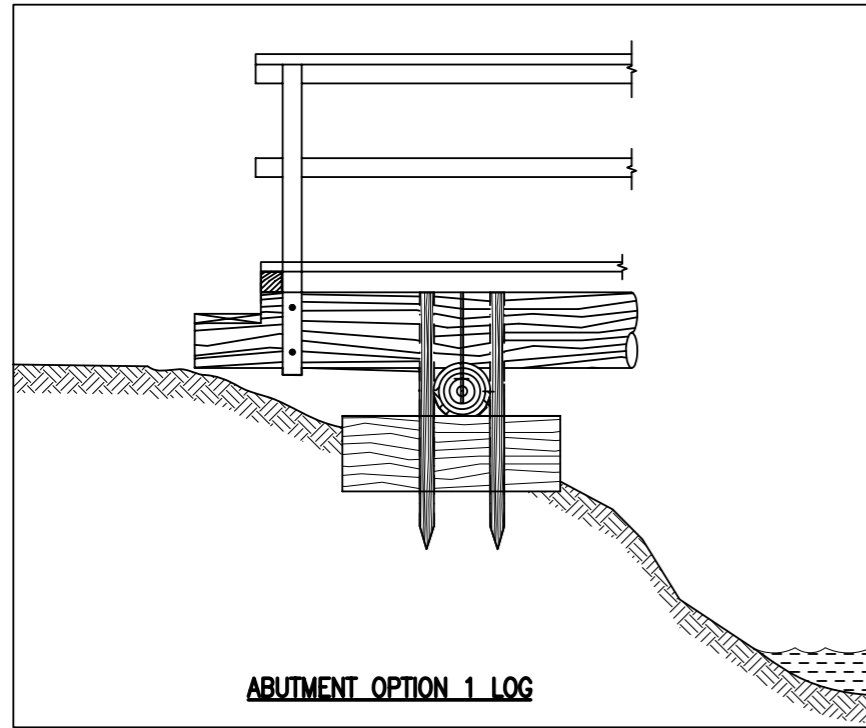
LOG	
log Dia	Bill item No.
50-100	4.18.1
101-200	4.18.2
201-300	4.18.3
301-400	4.18.4
401-500	4.18.5

SAWN TIMBER	
Dimensions	Bill item No.
75 x 100	7.6.1
50 x 300	7.6.2

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Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
TRACKS AND FOOTPATHS FOOT BRIDGE SILL AND CRIB LOG ABUTMENTS		Date: Sept. '06	
Project No.	Sheet:	Drawing No. <b>RA 025</b>	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign



**Notes:**

1. Abutment types are not limited to those indicated. See DRWG No. 026 for alternatives.
2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual:

Span m	Size and Spacing of Logs			
	Upto 1.0m wide	Upto 1.4m wide	Upto 2.1m wide	
	2 logs at 600mm (size mm)	3 logs at 600mm (size mm)	3 logs at 800mm (size mm)	4 logs at 600mm (size mm)
4	225	200	250	220
6	275	250	300	275
8	325	300	350	325
10	375	350	400	375
12	425	400	450	425

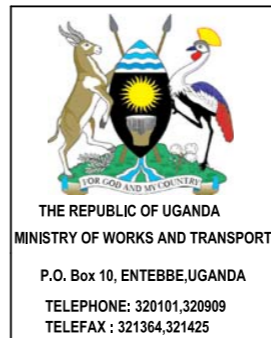
**TABLE 1**

LOG	
log Dia	Bill item No.
50-100	4.18.1
101-200	4.18.2
201-300	4.18.3
301-400	4.18.4
401-500	4.18.5

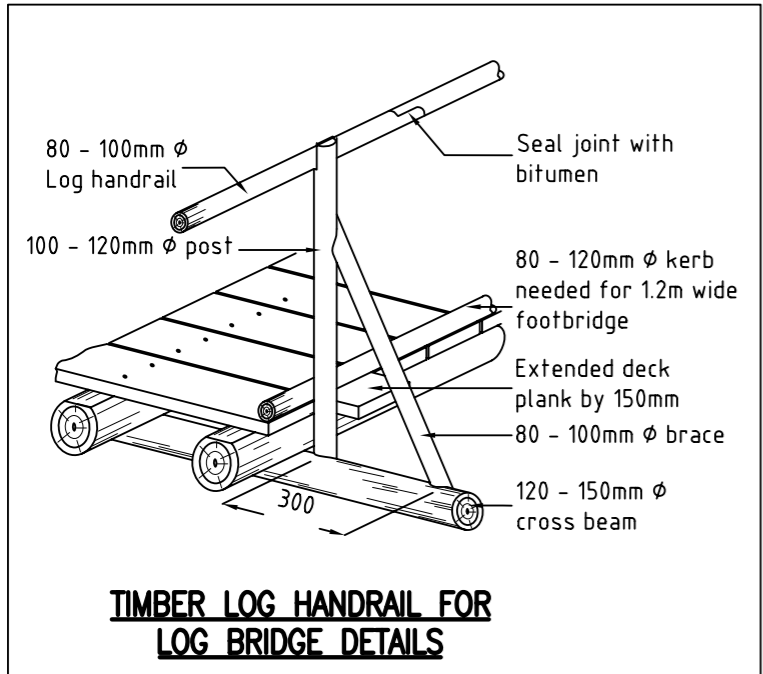
**TABLE 2**

SAWN TIMBER	
Dimensions	Bill item No.
75 x 100	7.6.1
50 x 300	7.6.2

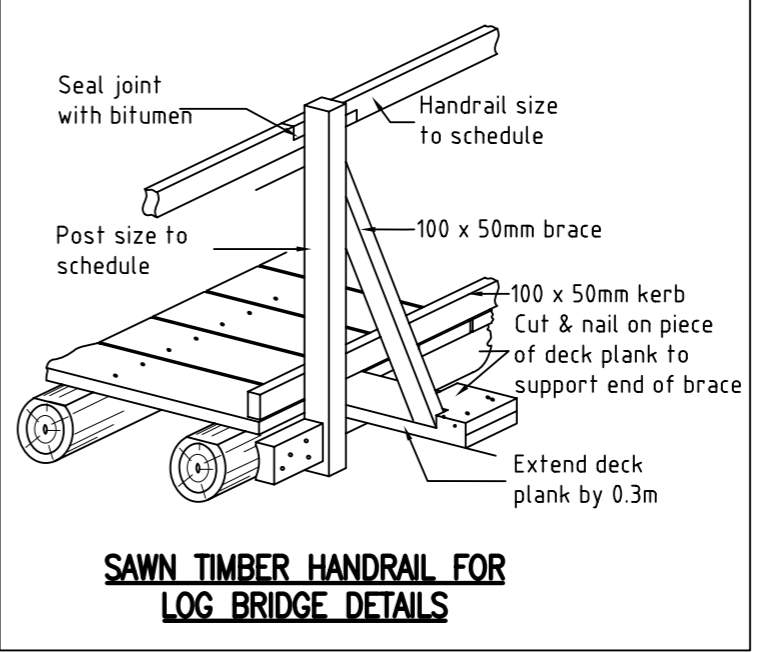
**TABLE 3**



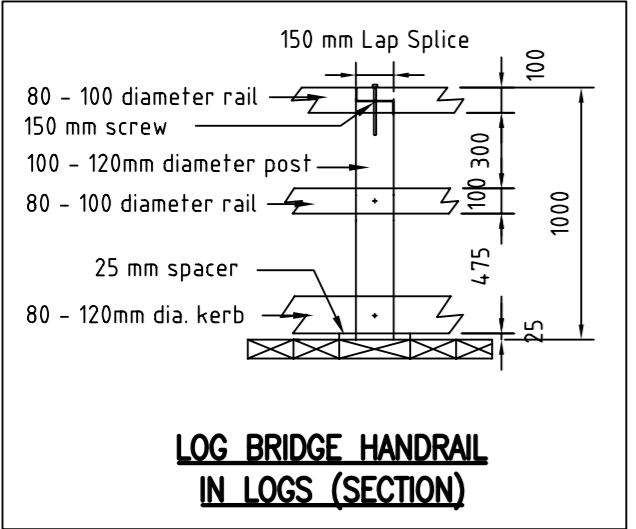
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Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Title: <b>TRACKS AND FOOTPATHS FOOT BRIDGE</b>		Date: Sept.'06'	
Title: <b>MULTIPLE LOG/MASONRY/GABION ABUTMENTS</b>		Drawing No. <b>RA 026</b>	
Project No.	Sheet:	Drawing No.	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



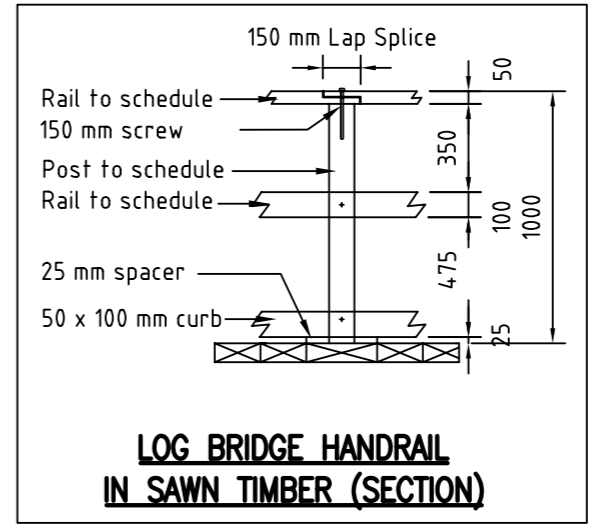
**TIMBER LOG HANDRAIL FOR LOG BRIDGE DETAILS**



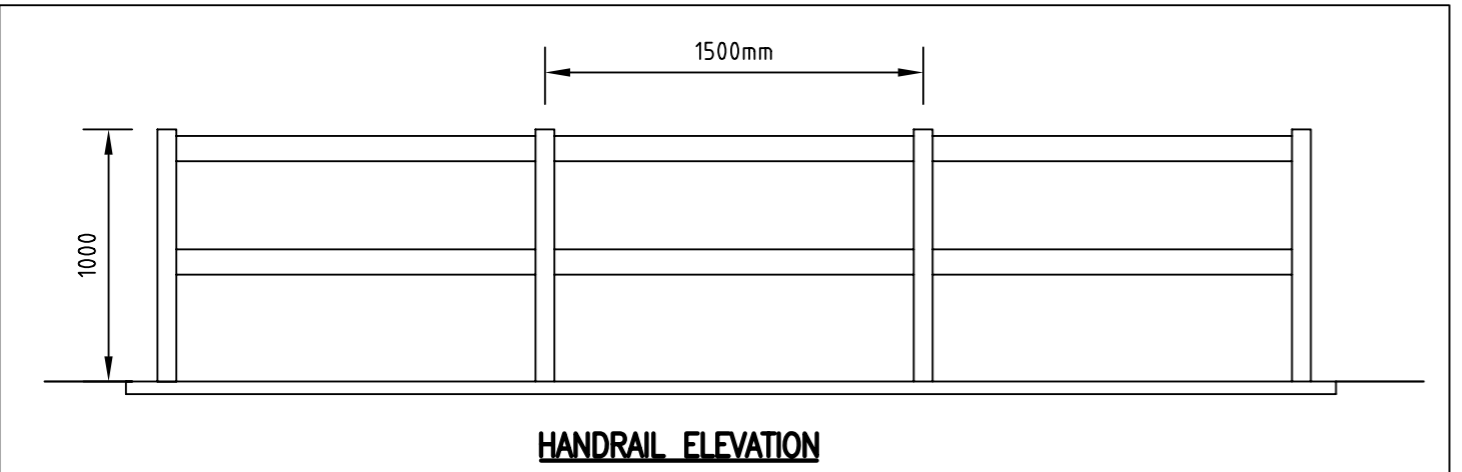
**SAWN TIMBER HANDRAIL FOR LOG BRIDGE DETAILS**



**LOG BRIDGE HANDRAIL IN LOGS (SECTION)**



**LOG BRIDGE HANDRAIL IN SAWN TIMBER (SECTION)**




**HANDRAIL ELEVATION**

LOG	
log Dia	Bill item No.
50-100	4.18.1
101-200	4.18.2
201-300	4.18.3
301-400	4.18.4
401-500	4.18.5

**TABLE 2**

SAWN TIMBER	
Dimensions	Bill item No.
75 x 100	7.6.1
50 x 300	7.6.2

**TABLE 3**

 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scales:	
	Title: <b>STANDARD CAS MANUAL</b>		<b>TRACKS AND FOOTPATHS FOOTBRIDGE LOG BRIDGE HANDRAIL DETAILS</b>		Dimension: mm
	Project No.	Sheet:	Drawing No.		<b>RA 027</b>
	Drawn by: JAK	Checked by: JC	Approved by:		Date: Sept. '06'
Rev. no	Revision note	Date	Sign	Chkd	



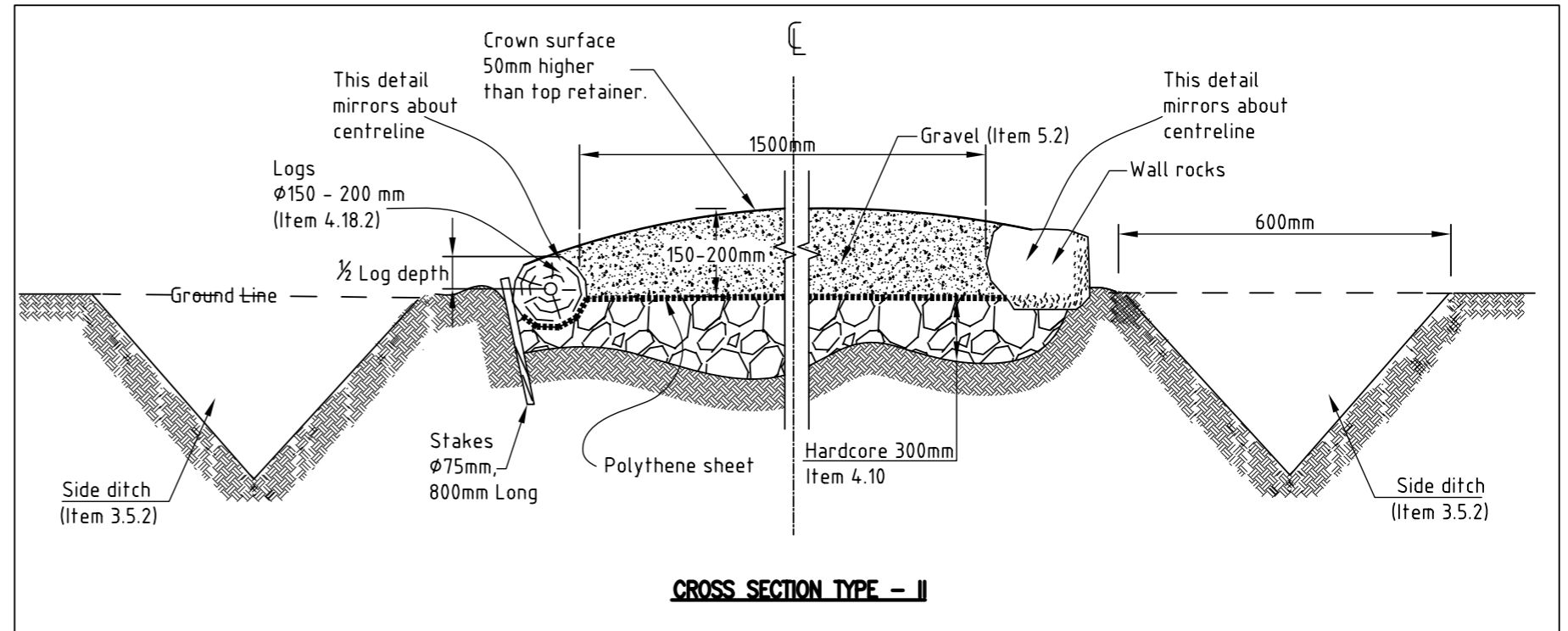
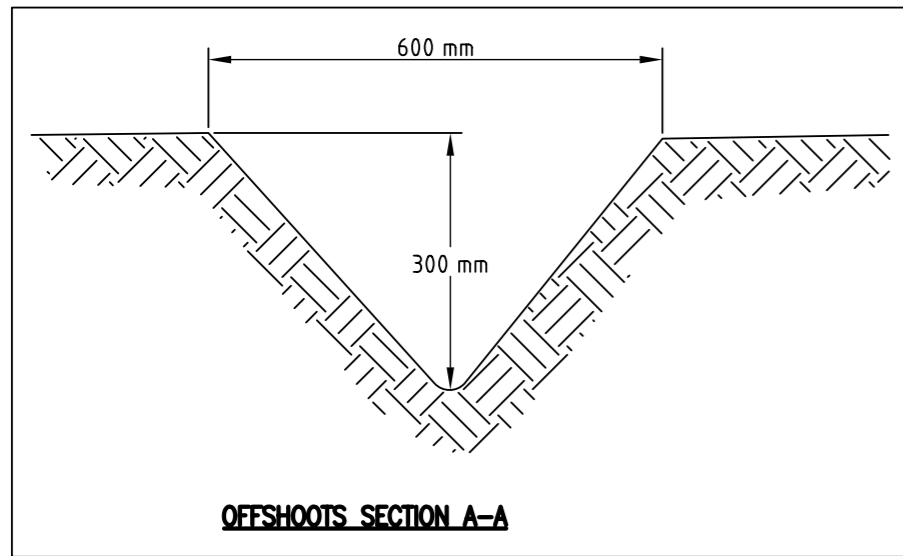
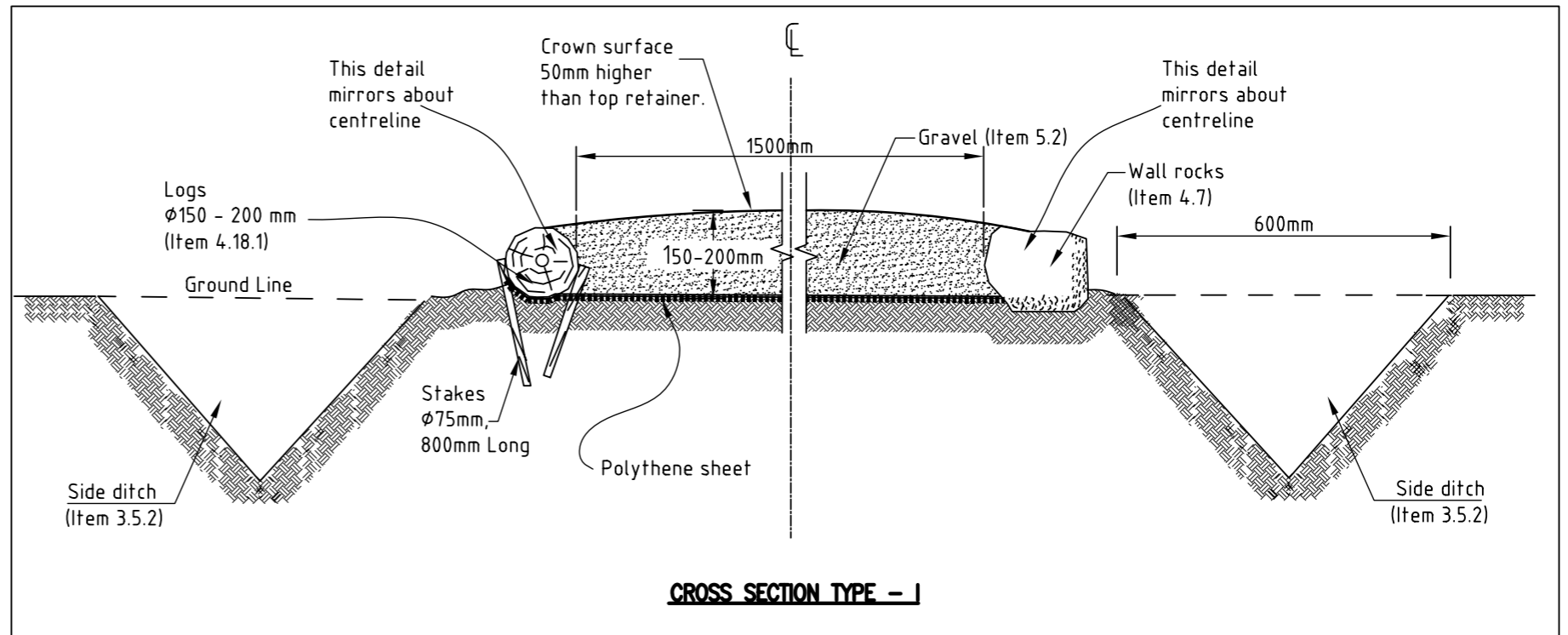
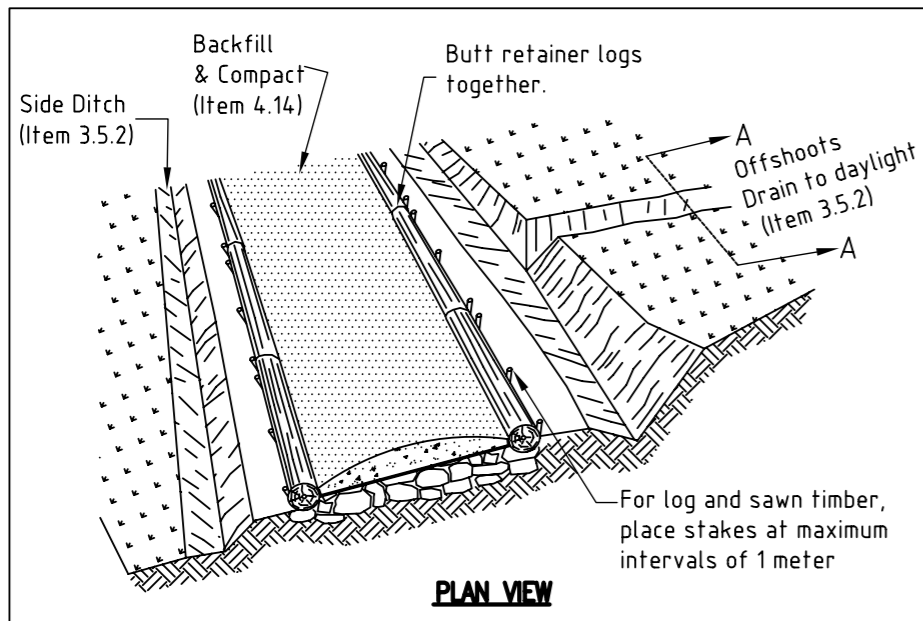
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## Section A-6

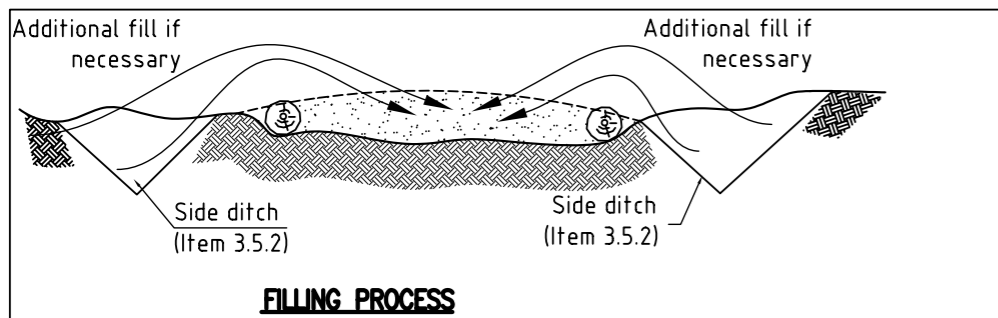
### Rural Access Roads: Tracks and Footpaths, Wetland Structures


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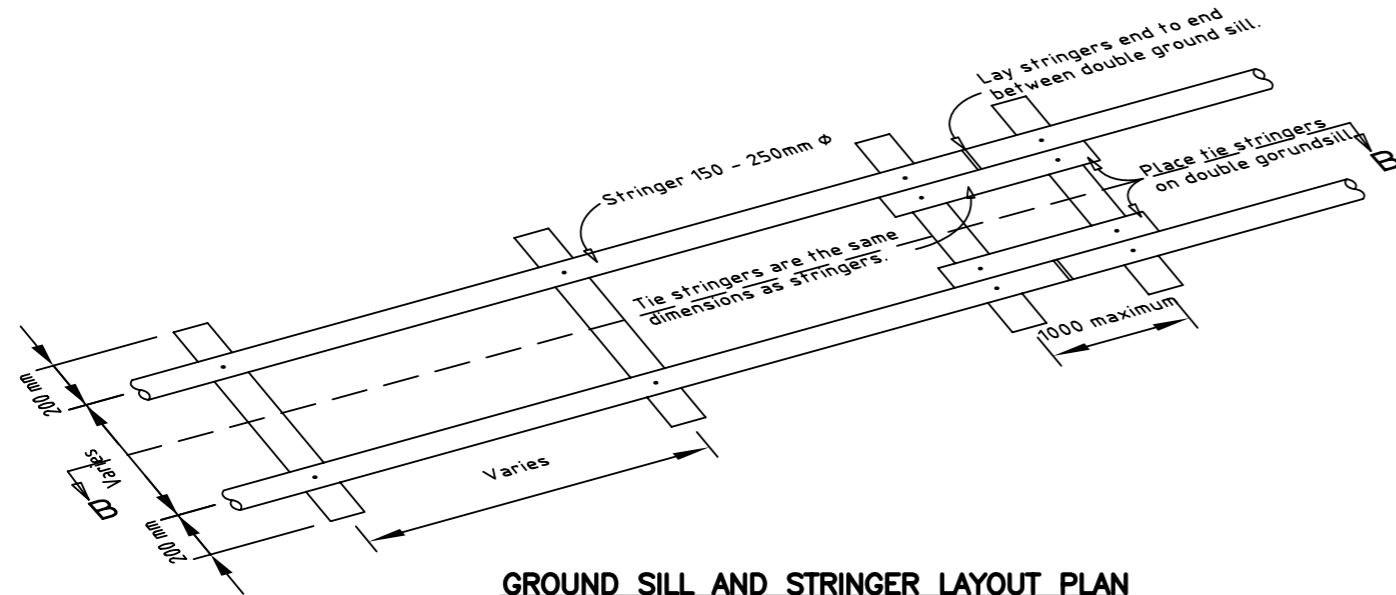
<b>Drawing Title</b>	<b>Drawing Number</b>
Tracks and Footpaths: Wetland Structures, Raised Footpath	RA 028
Tracks and Footpaths: Wetland Structures, Boardwalk Type 1 on Sill with Decking	RA 029
Tracks and Footpaths: Wetland Structures, Boardwalk Type 2A(Log Deck) & 2B(Sawn Deck) on Sill without Decking	RA 030
Tracks and Footpaths: Wetland Structures, Boardwalk Type Across Shallow Swamp	RA 031
Tracks and Footpaths: Wetland Structures, Sandbags as Stepping Stones and Continuous	RA 032



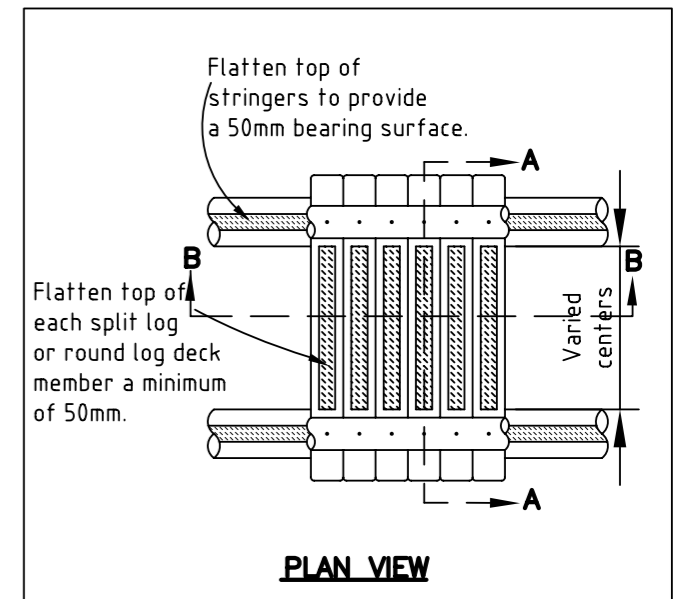
**NOTES:**  
1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated



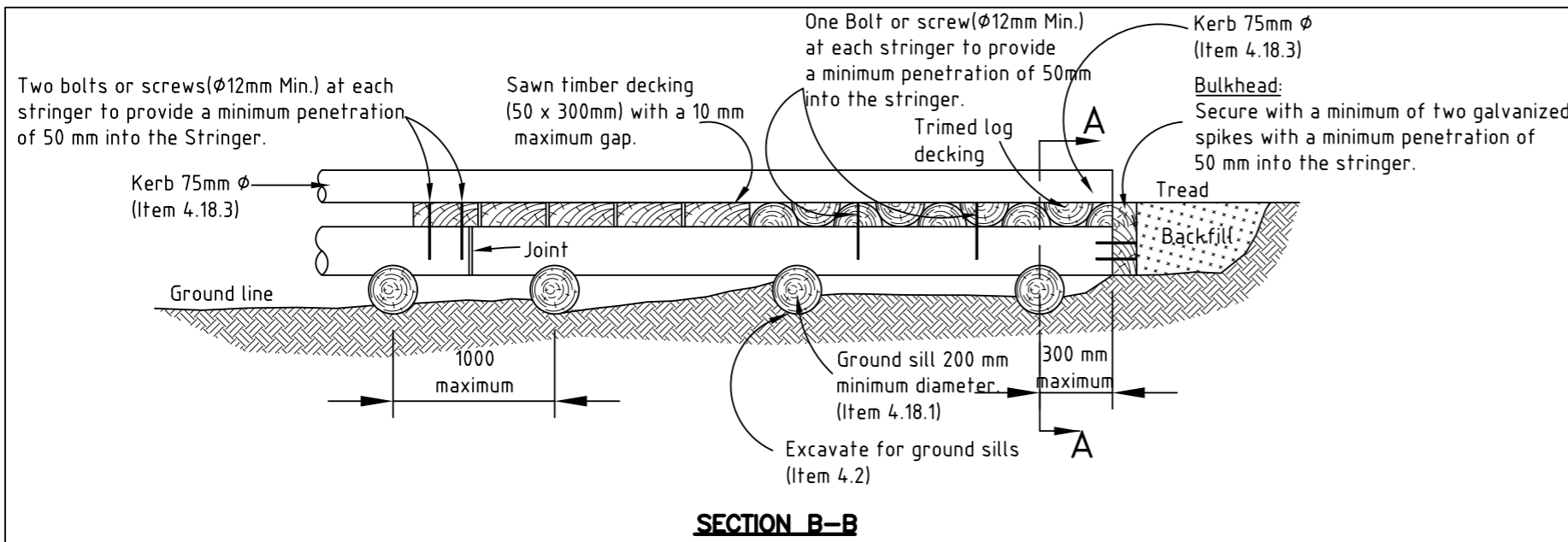
 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
	Title: <b>WETLAND STRUCTURES RAISED FOOTPATH</b>		Date: Sept. '06	
	Project No.	Sheet:	Drawing No.	
Drawn by: JAK	Checked by: JC	Approved by: <b>RA 028</b>		
Rev. no	Revision note	Date	Sign	Chkd



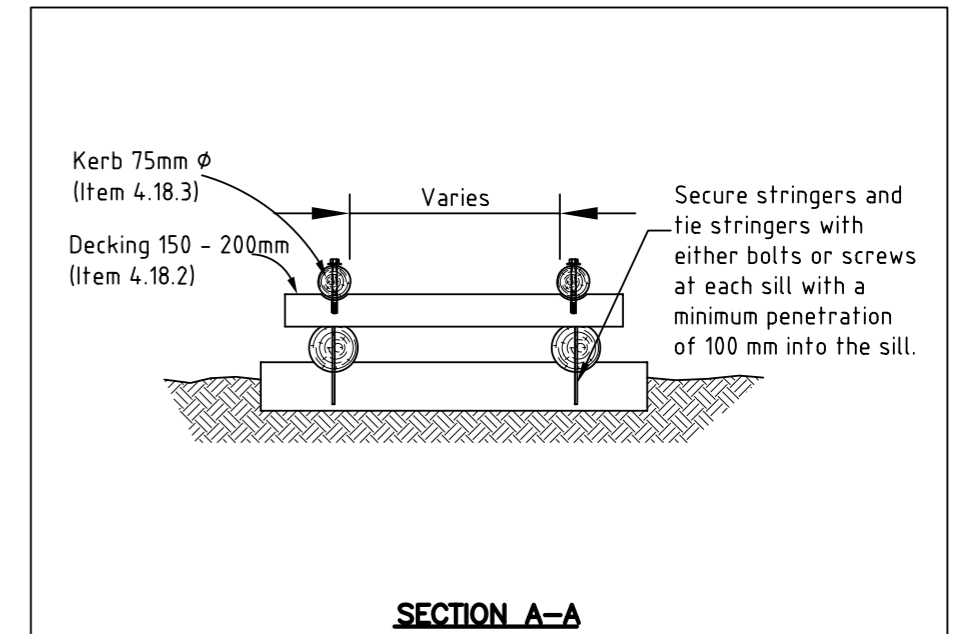
**GROUND SILL AND STRINGER LAYOUT PLAN**



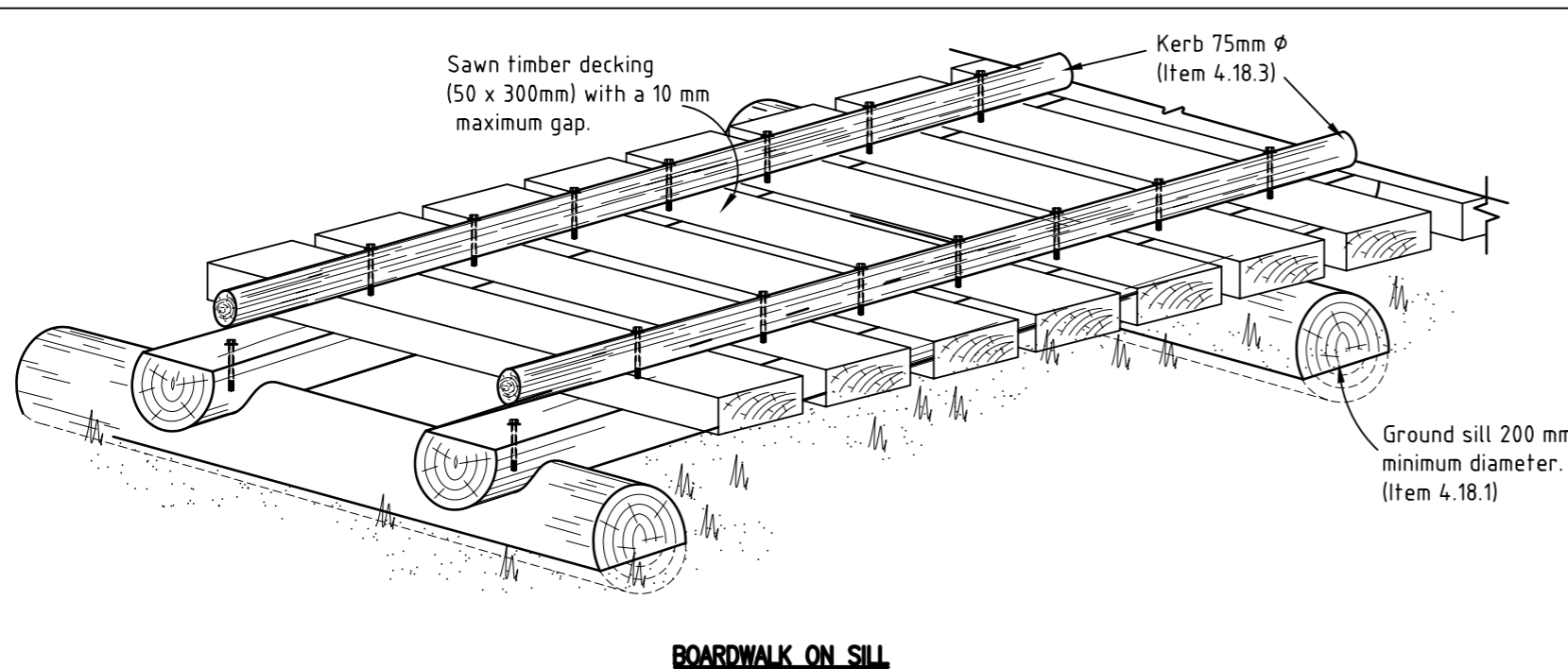
**PLAN VIEW**



**SECTION B-B**



**SECTION A-A**




**BOARDWALK ON SILL**

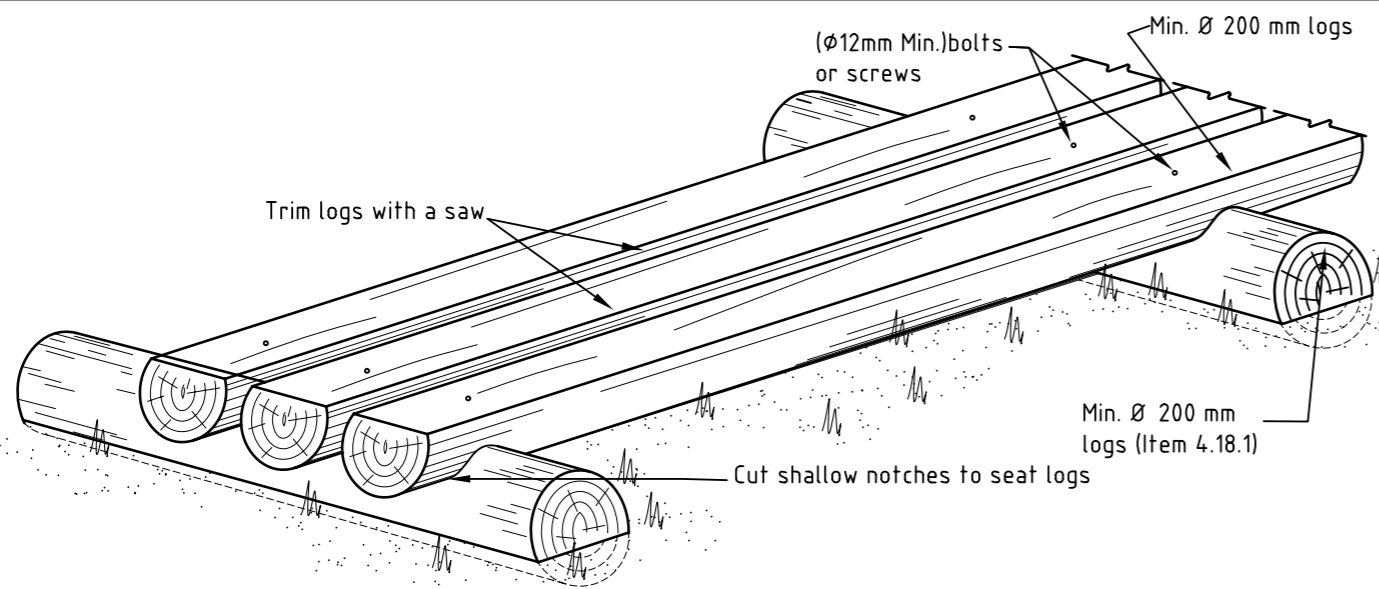
1. For timber decking, use 300 x 50mm planks
2. For stringers, use 150 x 250mm dia. logs.
3. For round log decking, use 50 x 100.. dia. logs.

**NOTES:**

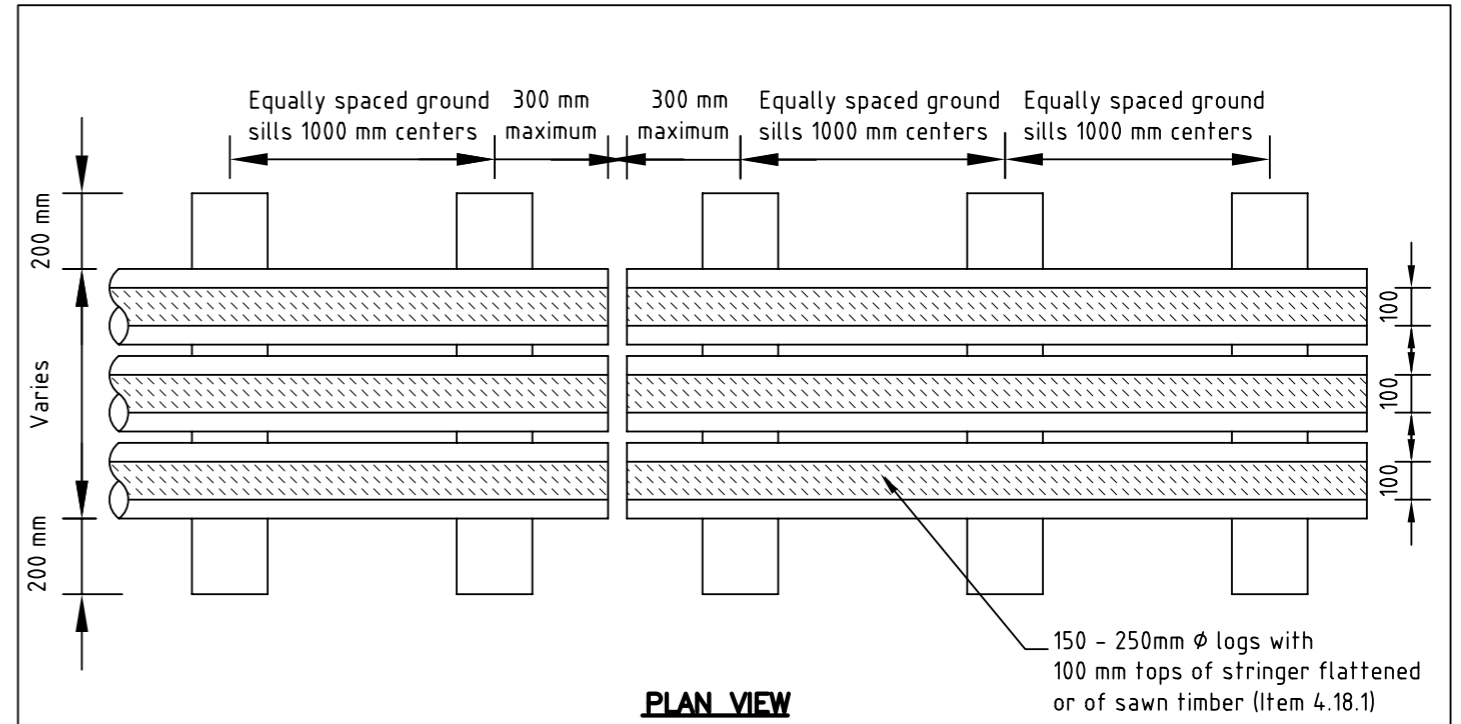
1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated

 <p>THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT</p> <p>P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425</p>	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scales:			
	Title: <b>STANDARD CAS MANUAL</b>			WETLAND STRUCTURES BOARDWALK TYPE 1 ON SILL WITH DECKING			
	Project No.		Sheet:		Drawing No.		
	Drawn by: JAK		Checked by: JC		Approved by:		
Rev. no	Revision note				Date	Sign	Chkd

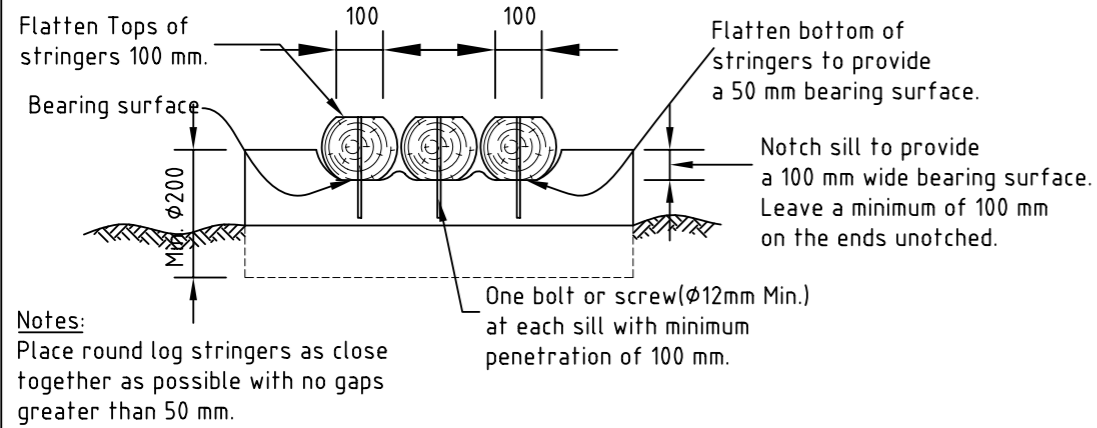
**RA 029**



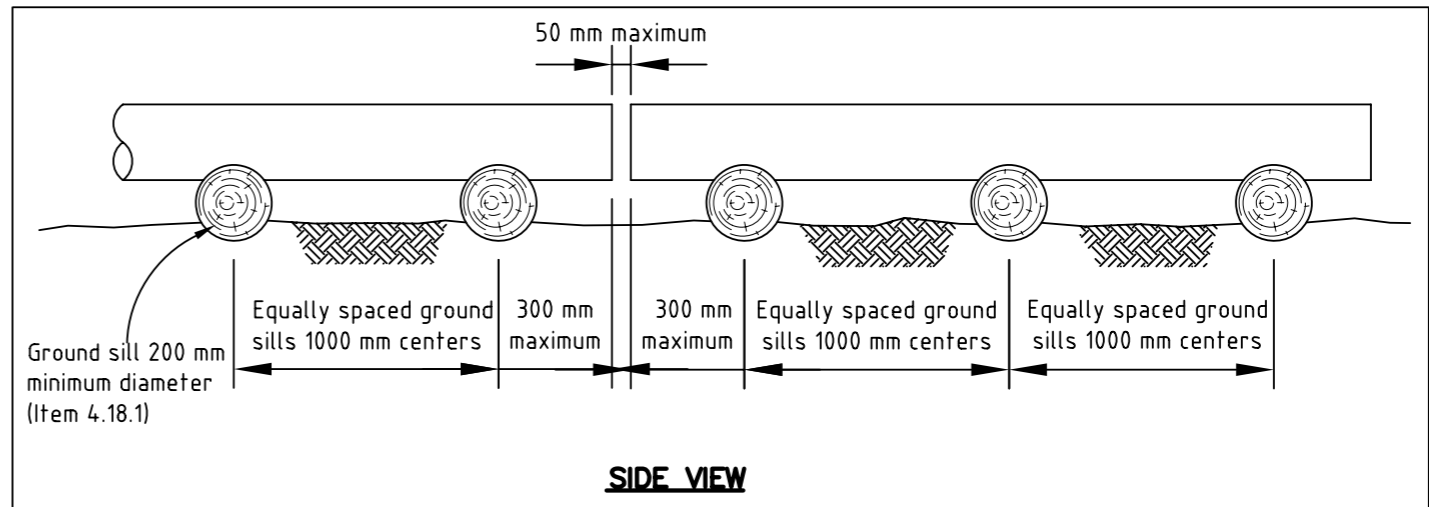
**BOARDWALK ON SILL**



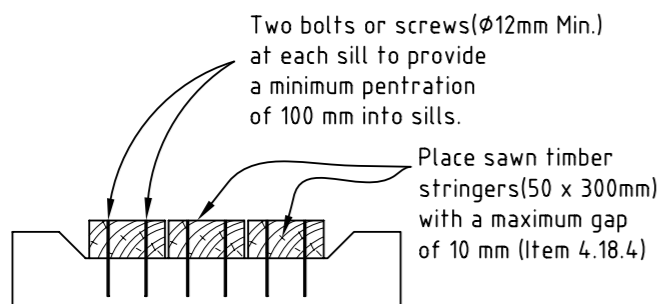
**PLAN VIEW**



**END VIEW LOG STRINGER**



**SIDE VIEW**



Notch sill to provide a 100 mm wide bearing surface. Leave a minimum of 100 mm on the ends unnotched.

**SAWN TIMBER STRINGER END VIEW**

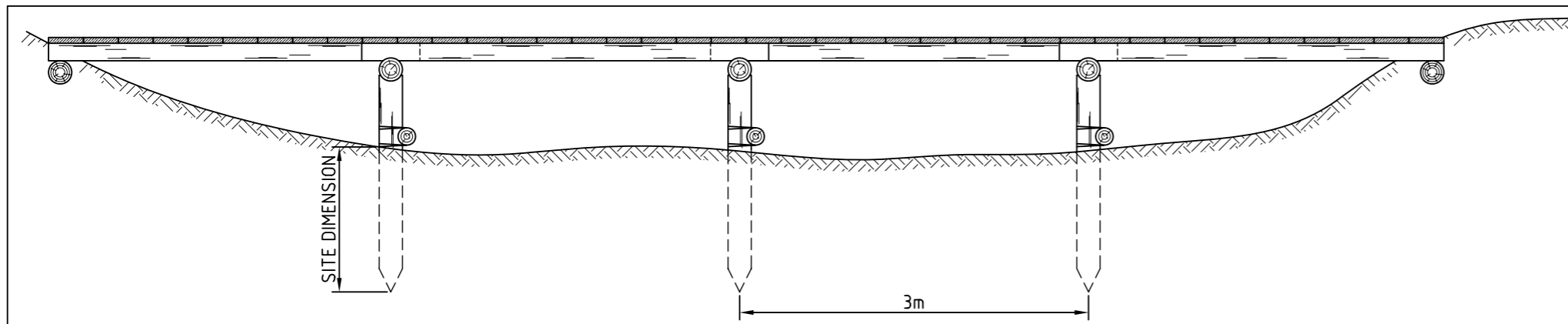
**NOTES:**

1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated

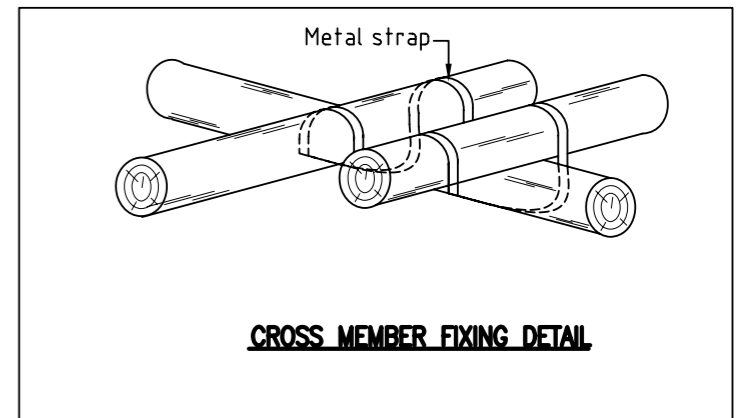


Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Title: <b>WETLAND STRUCTURES BOARDWALK TYPE 2A(LOG DECK) &amp; 2B(SAWN DECK) ON SILL WITHOUT DECKING</b>		Date: Sept. '06'	
Project No.	Sheet:	Drawing No. <b>RA 030</b>	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd

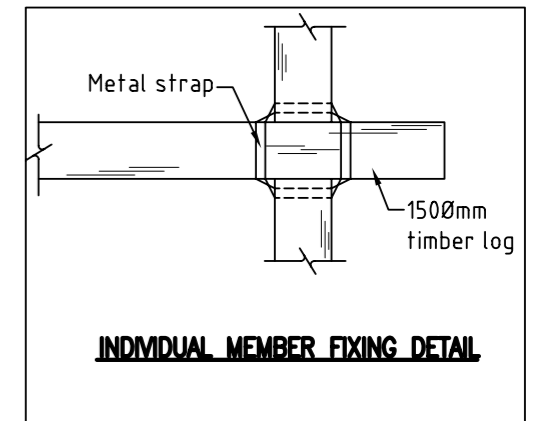




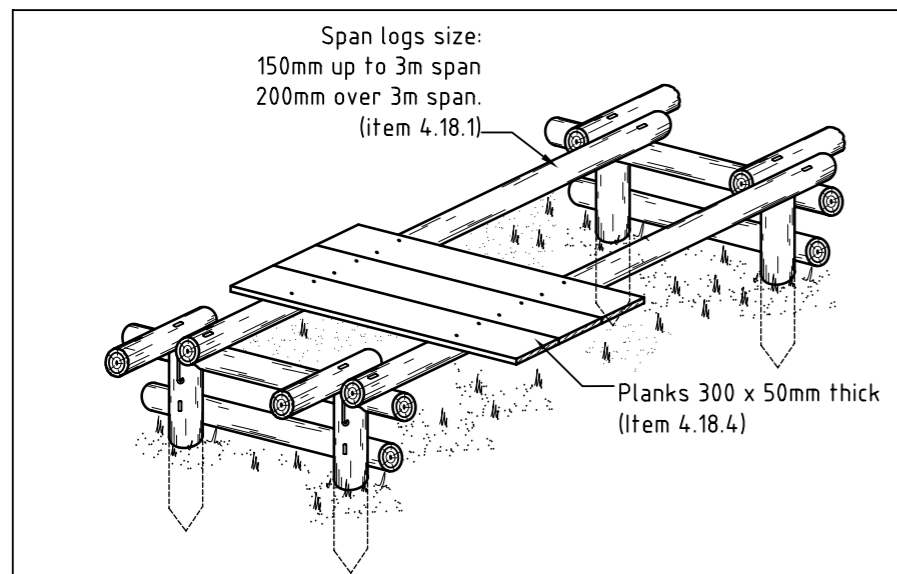
**BOARD WALK ACROSS SHALLOW SWAMP**



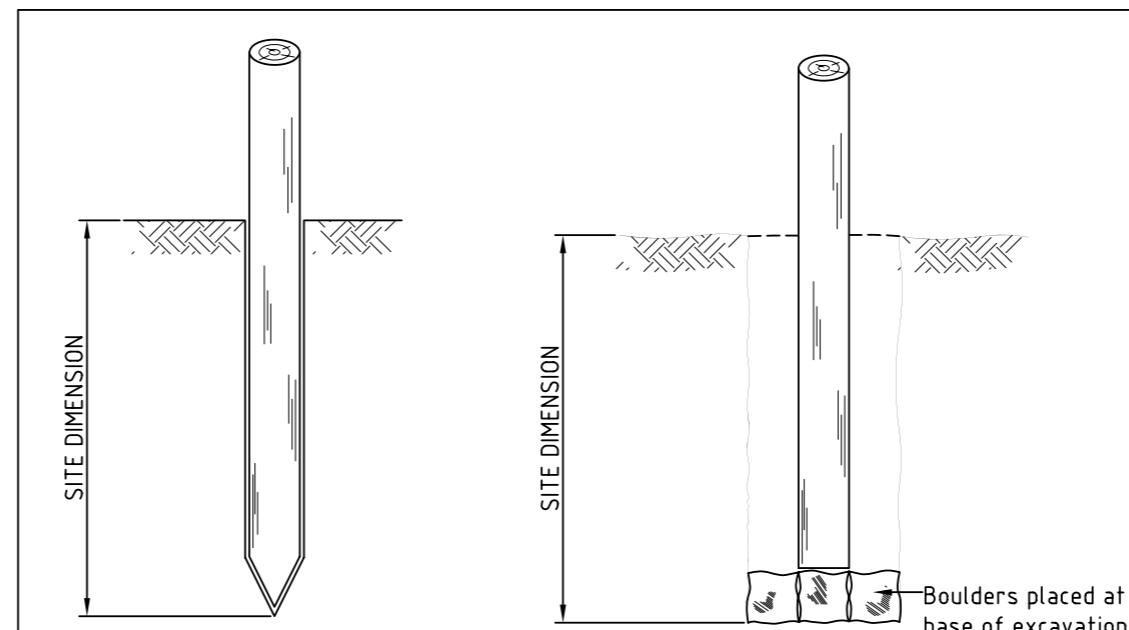
**CROSS MEMBER FIXING DETAIL**



**INDIVIDUAL MEMBER FIXING DETAIL**



**BOARDWALK ON WATER LOGGED GROUND**

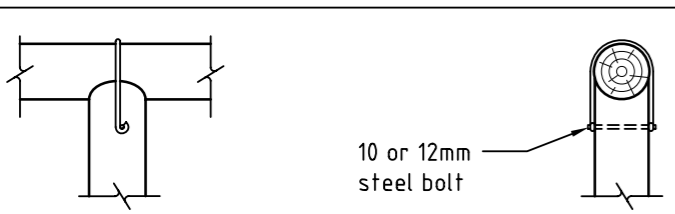


Using skin friction (driven during wet season or ground in saturated conditions)

Using end bearing

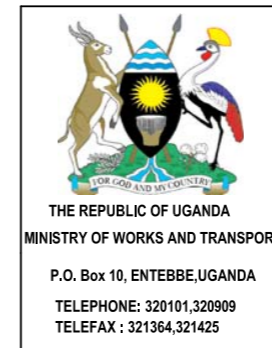
**POST FIXING DETAIL**

**NOTES:**  
1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated

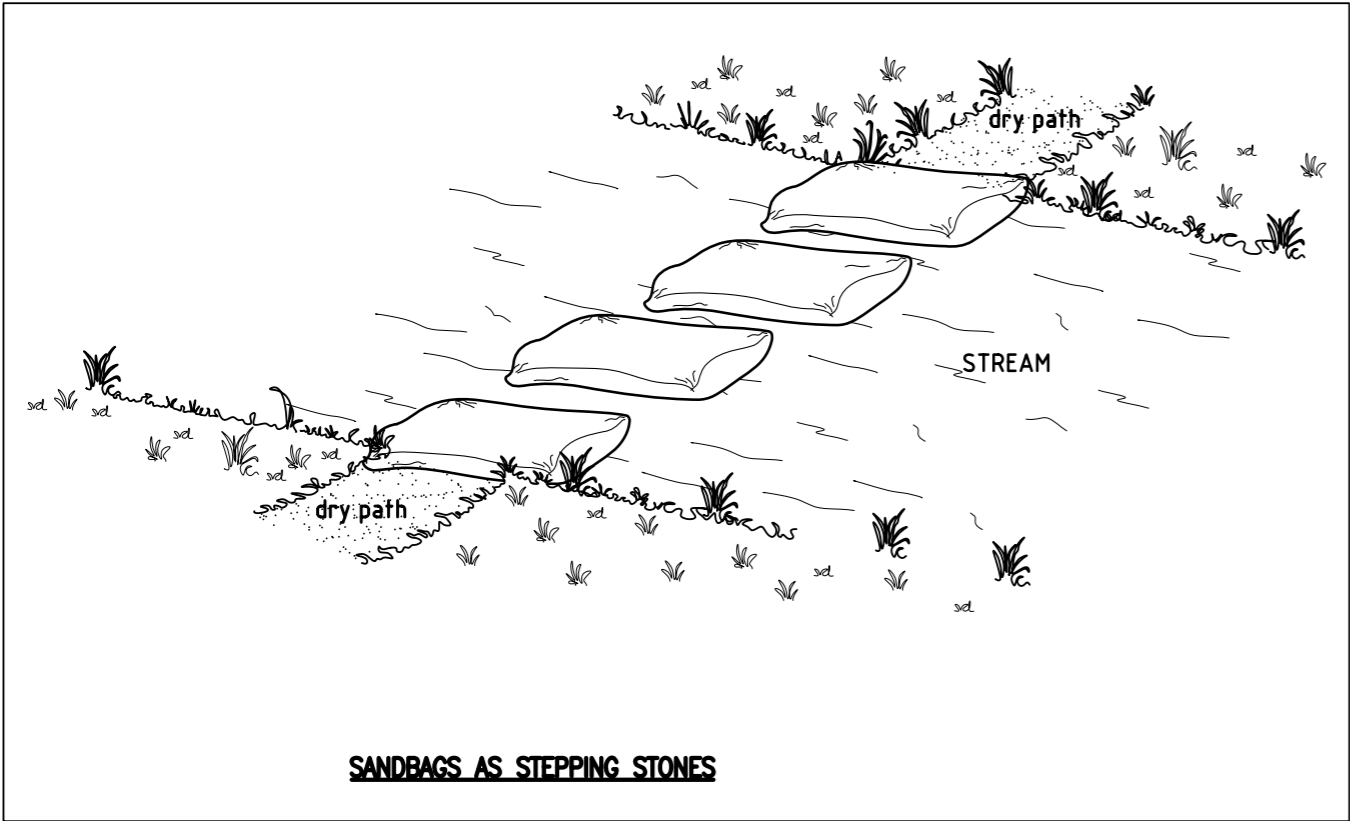


Clamping cross logs on top of posts  
- cut V-notch in top of post  
- bend 10mm steel bar over cross-bar and hammer ends round bar through post

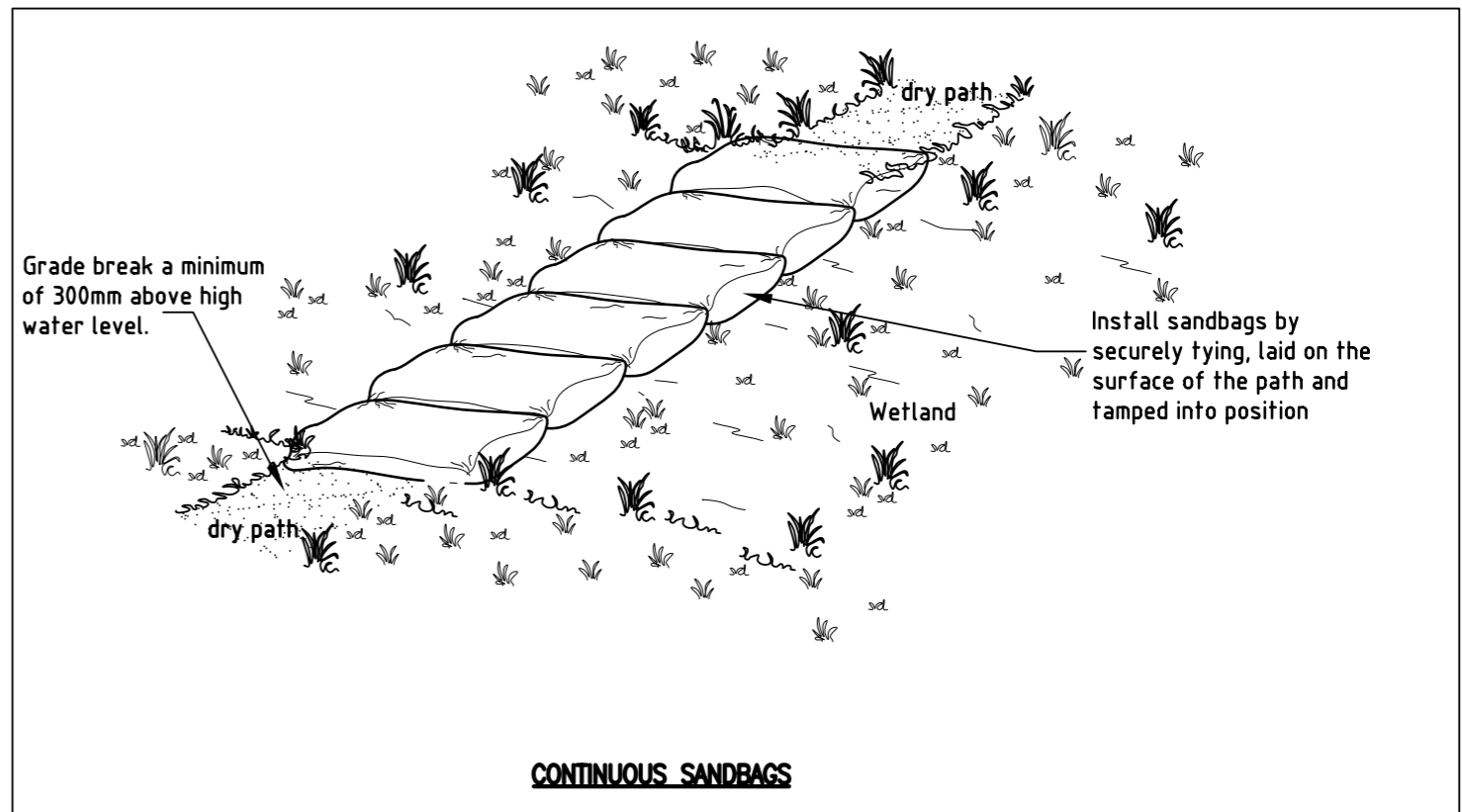
**Note:-** Boardwalk on water logged ground  
2 posts and 2 span logs are adequate for widths up to about 1.5m and walkers, bicycles and handcarts. For heavier traffic such as animal drawn carts, use 3 posts and 3 spans logs. Minimum depth into ground 1000mm.



Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Title: <b>WETLAND STRUCTURES BOARD WALK ACROSS SHALLOW SWAMP</b>		Date: Sept '06	
Project No.	Sheet:	Drawing No. <b>RA 031</b>	
Drawn by: RL	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd

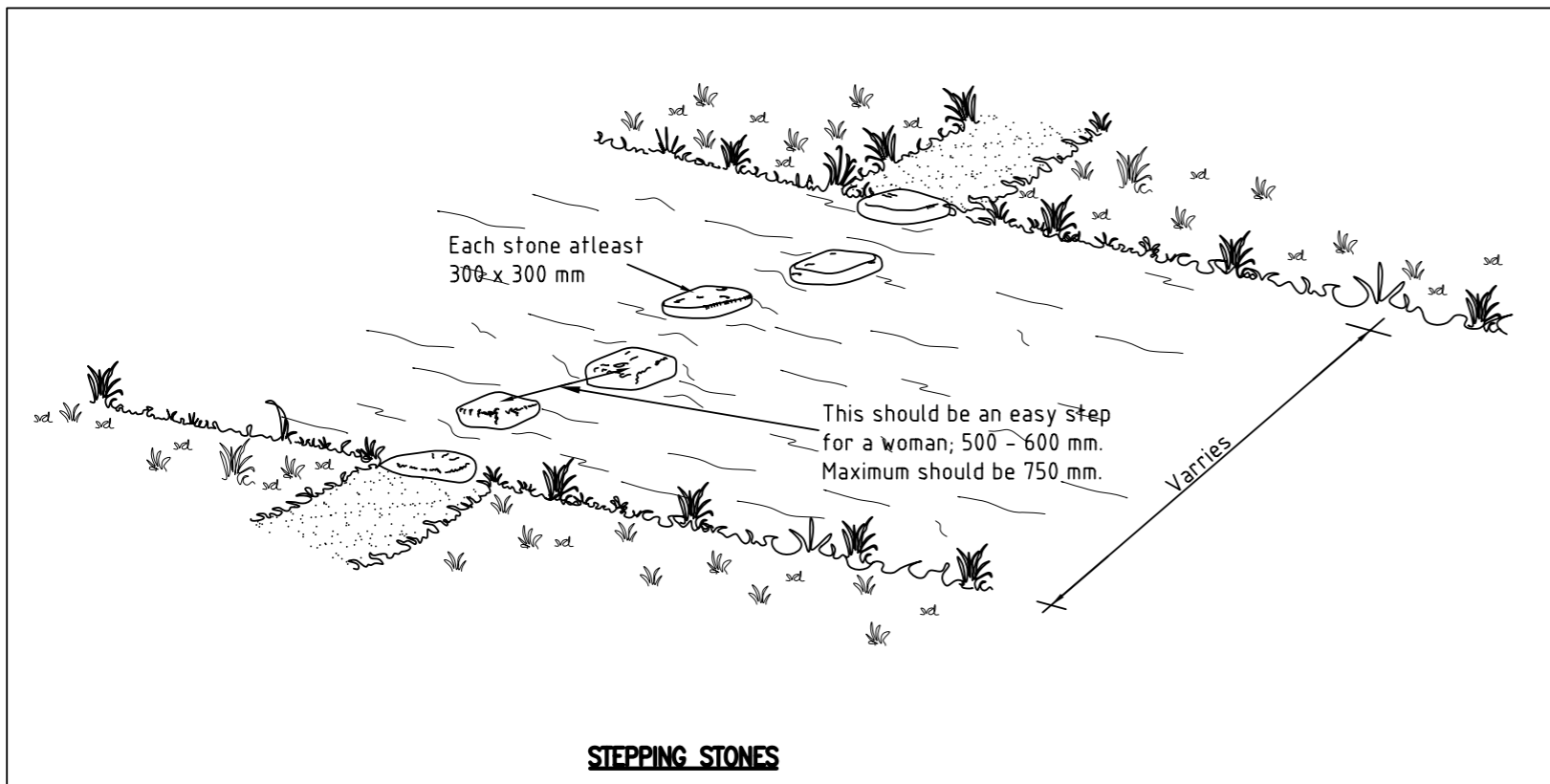


**SANDBAGS AS STEPPING STONES**




**CONTINUOUS SANDBAGS**

1. Sandbags should be filled with aggregate and cement in the proportion 6:1
2. Sandbags may be used as stepping stones or for continuous short section of path.
3. Bags are of standard size commonly available and made of synthetic plastic materials



**STEPPING STONES**

**NOTES:**  
 1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated

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	Project No.	Sheet:	Drawing No.		Date: Sept. '06'	
	Drawn by: IOY	Checked by: JC	Approved by:		<b>RA 032</b>	
Rev. no	Revision note			Date	Sign	Chkd

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Section A-7  
Bio- Engineering

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**Drawing Title**

Bio-Engineered Retaining Walls

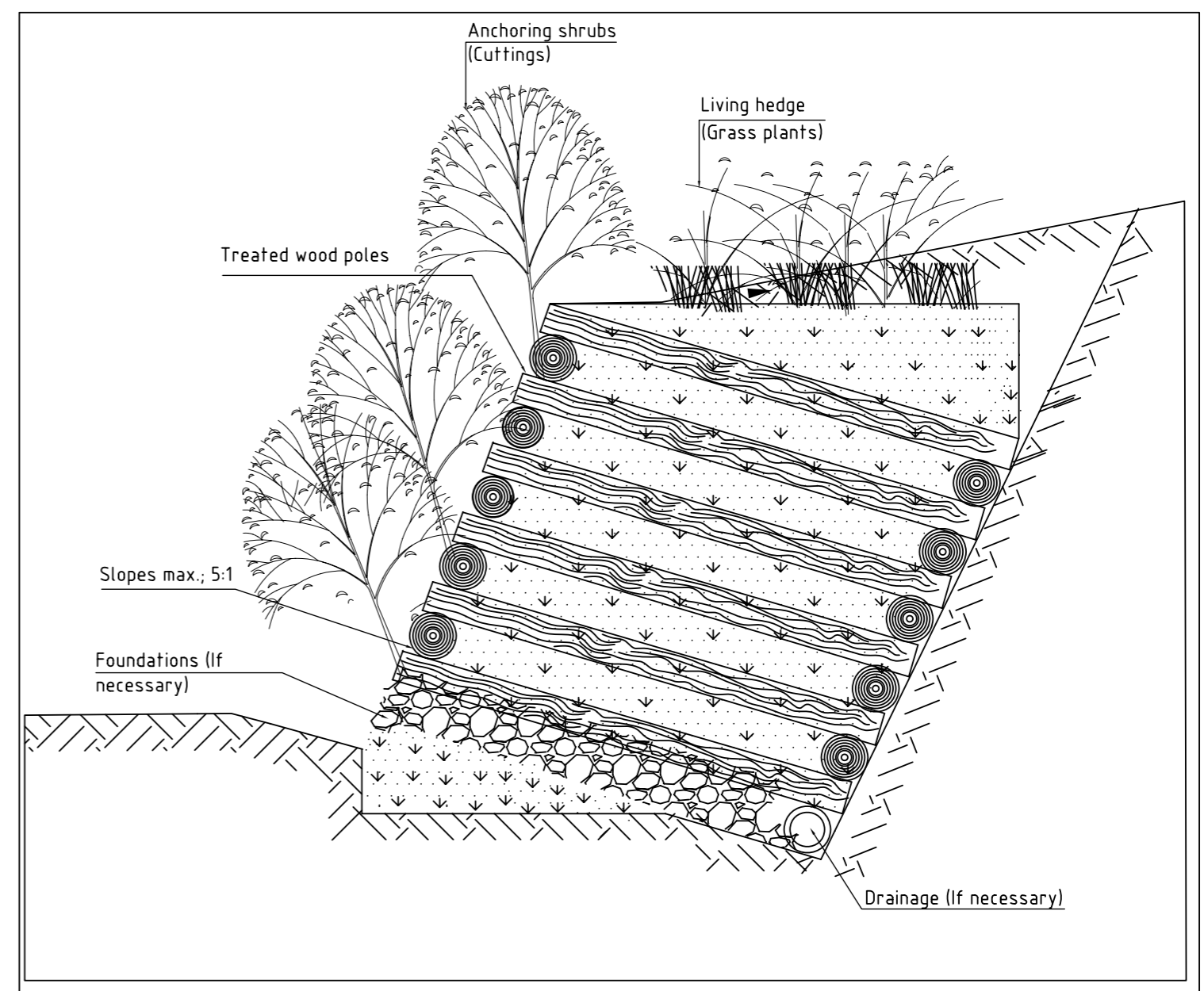
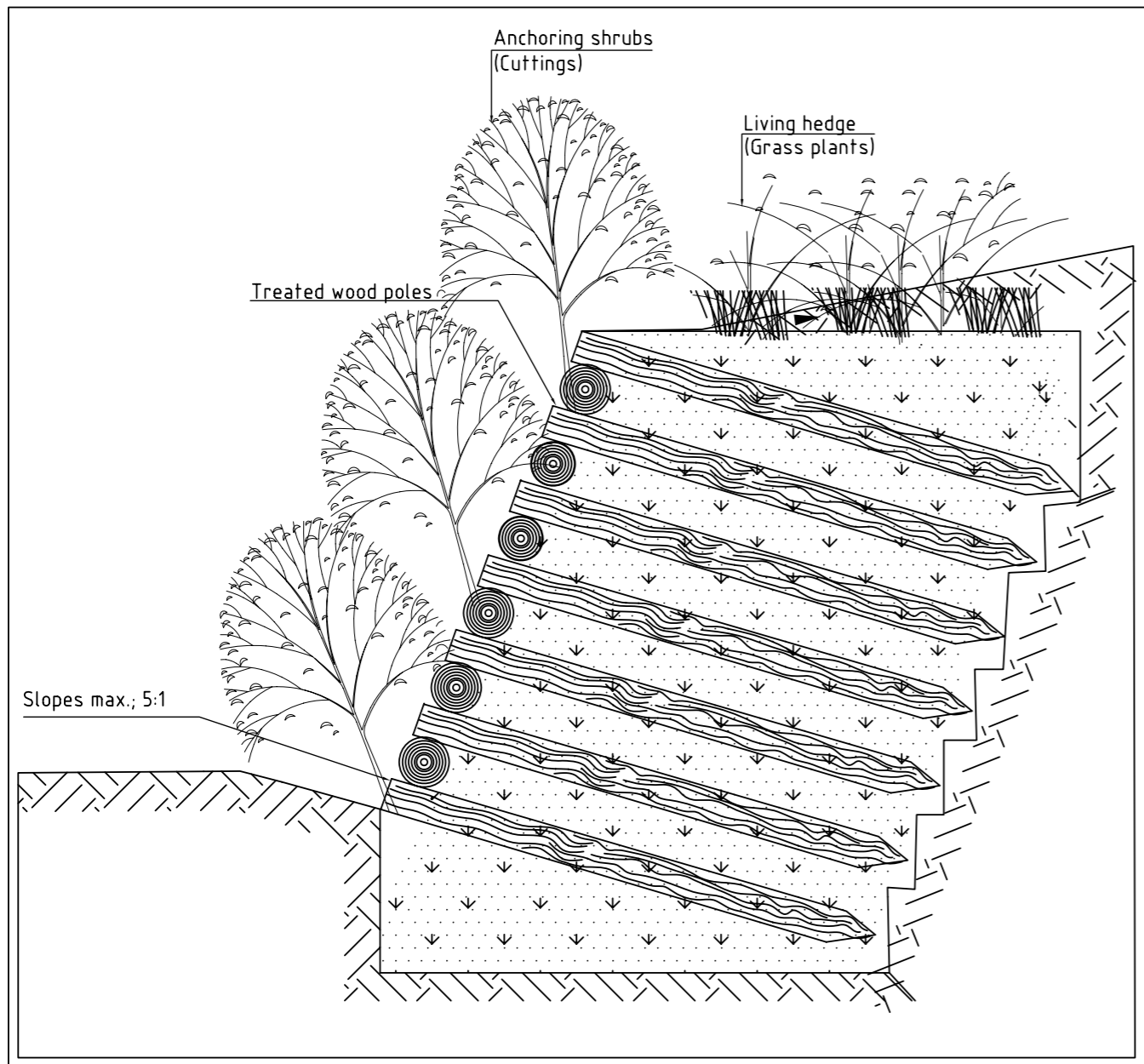
Bio-Engineered Slope Protection

**Drawing Number**


RA 033

RA 034

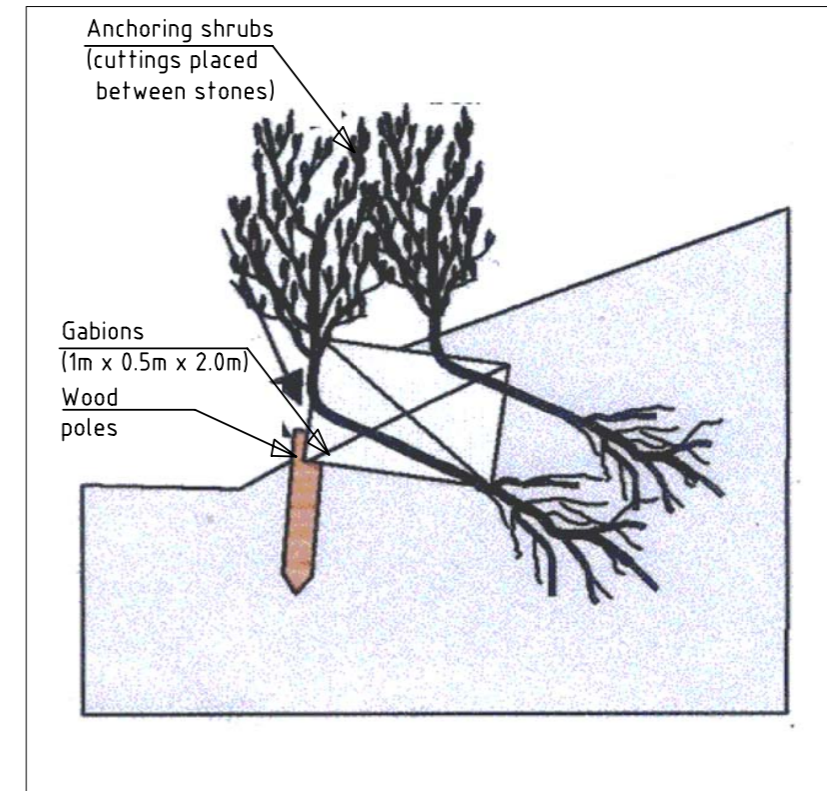
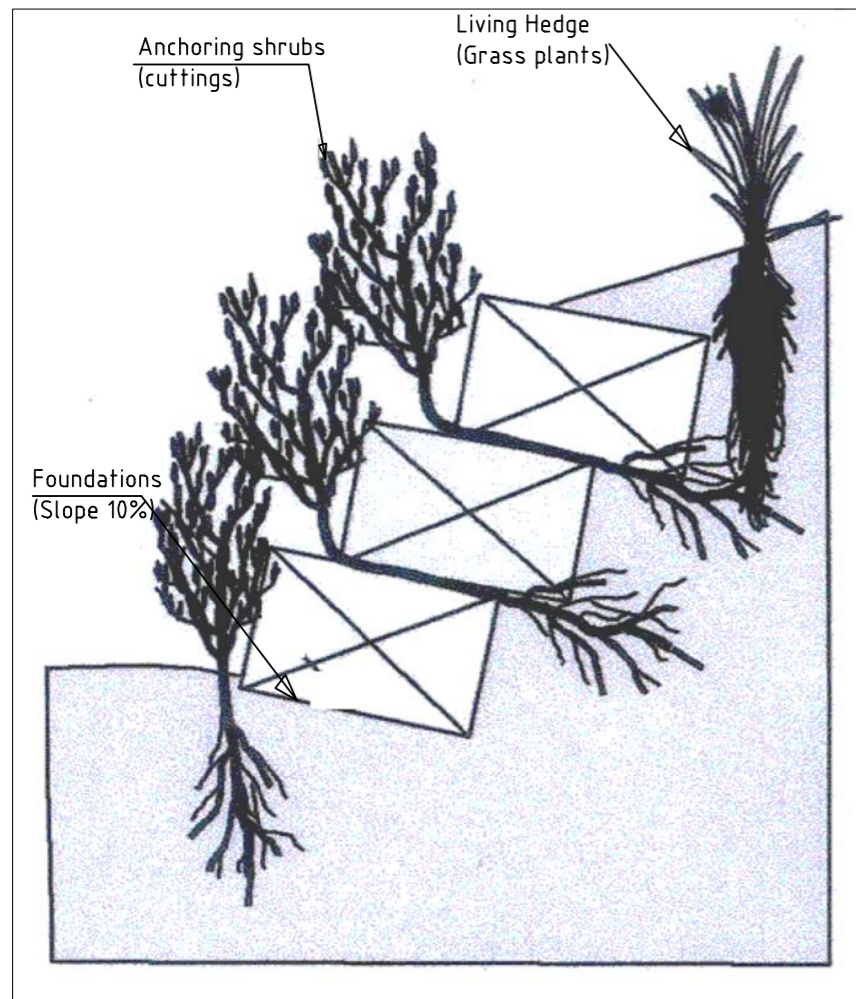
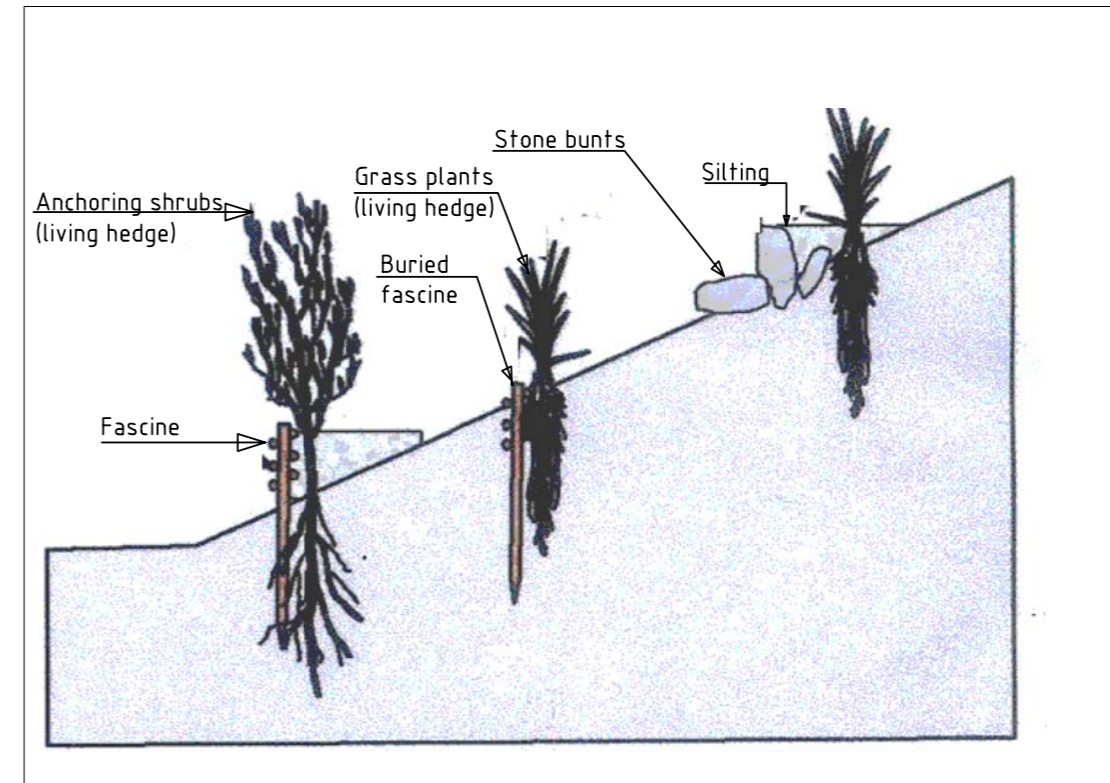
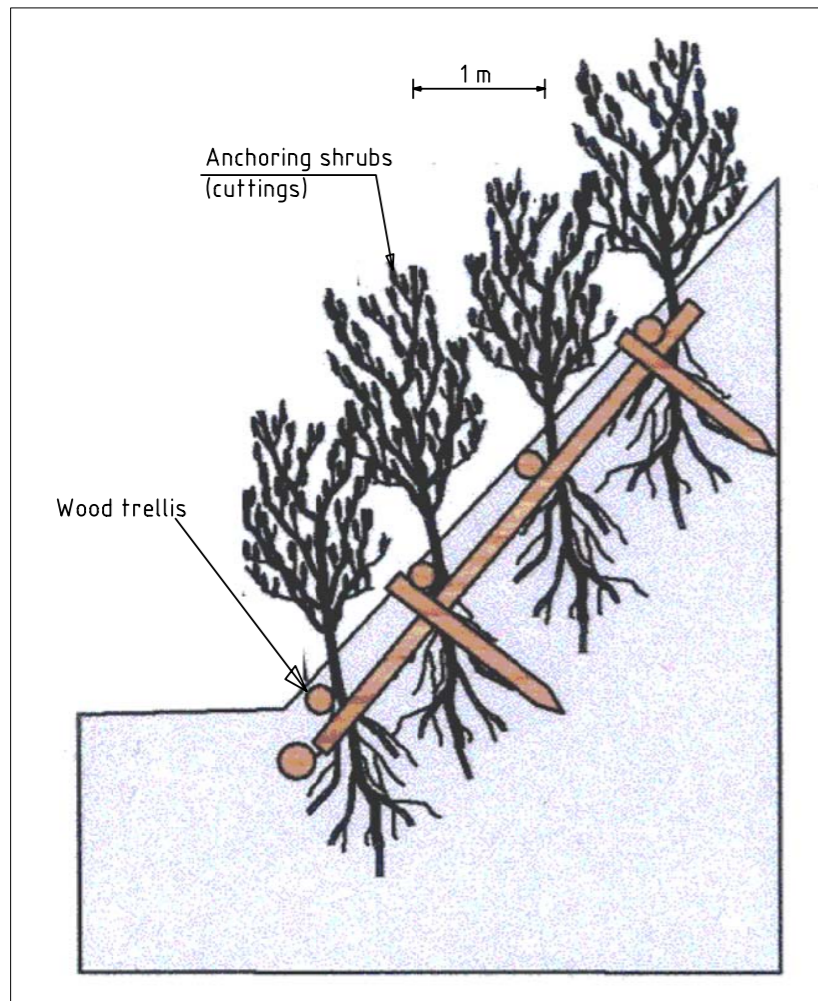
**SECTION A-7**




**NOTES:**  
 1. Specifications, method of measurement and bill item descriptions for these structures have yet to be formulated

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	Title: <b>STANDARD CAS MANUAL</b>		Title: <b>BIO-ENGINEERED RETAINING WALLS</b>		Dimension: mm
	Project No.		Sheet:	Drawing No. <b>RA 033</b>	
	Drawn by: IOY	Checked by: JC	Approved by:		Date:
Rev. no	Revision note	Date	Sign	Chkd	





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	Title: <b>BIO-ENGINEERED SLOPE PROTECTION</b>		Date: Sept. '06'	
	Project No.	Sheet:	Drawing No. <b>RA 034</b>	
Drawn by: IOY	Checked by: JC	Approved by:		
Rev. no	Revision note	Date	Sign	Chkd

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**Section A-8**  
**Community Access Roads, Site Works**

---

**Drawing Title**

**Drawing Number**

Setting out and Site Clearance Works

CAR 001

Standard Cross Sections

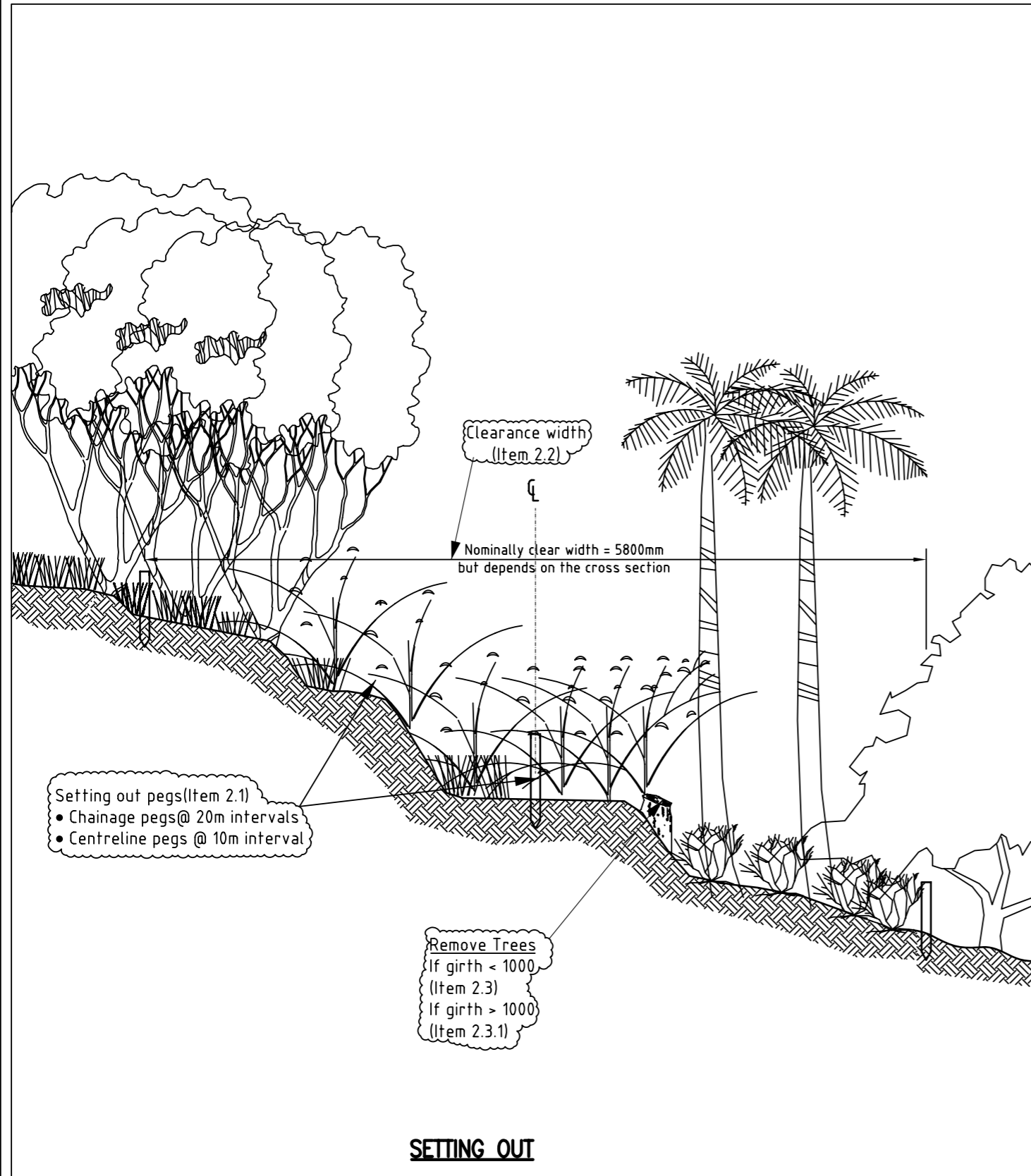
CAR 002

Earthworks

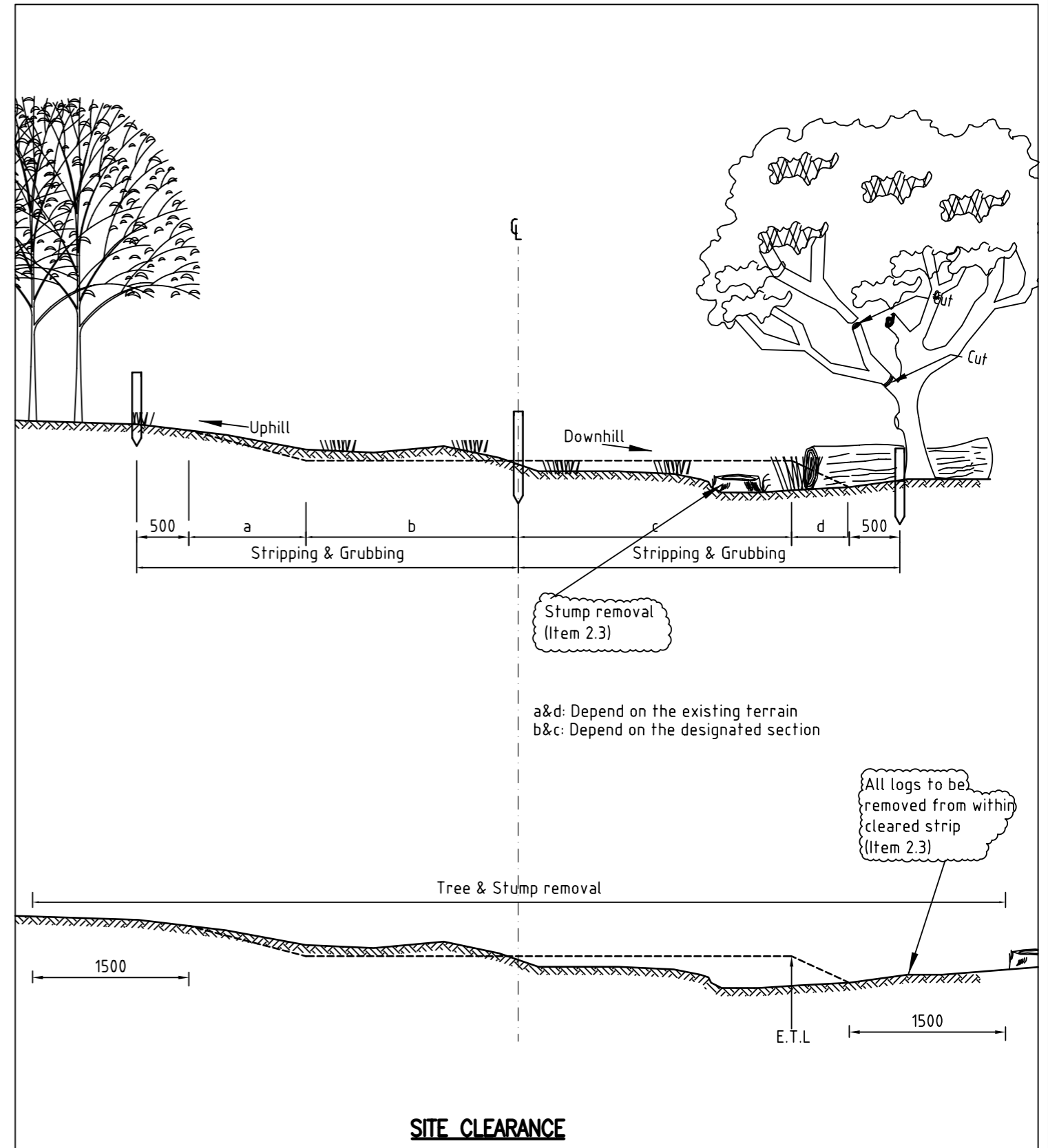
CAR 003

**SECTION A-8**





**SETTING OUT**




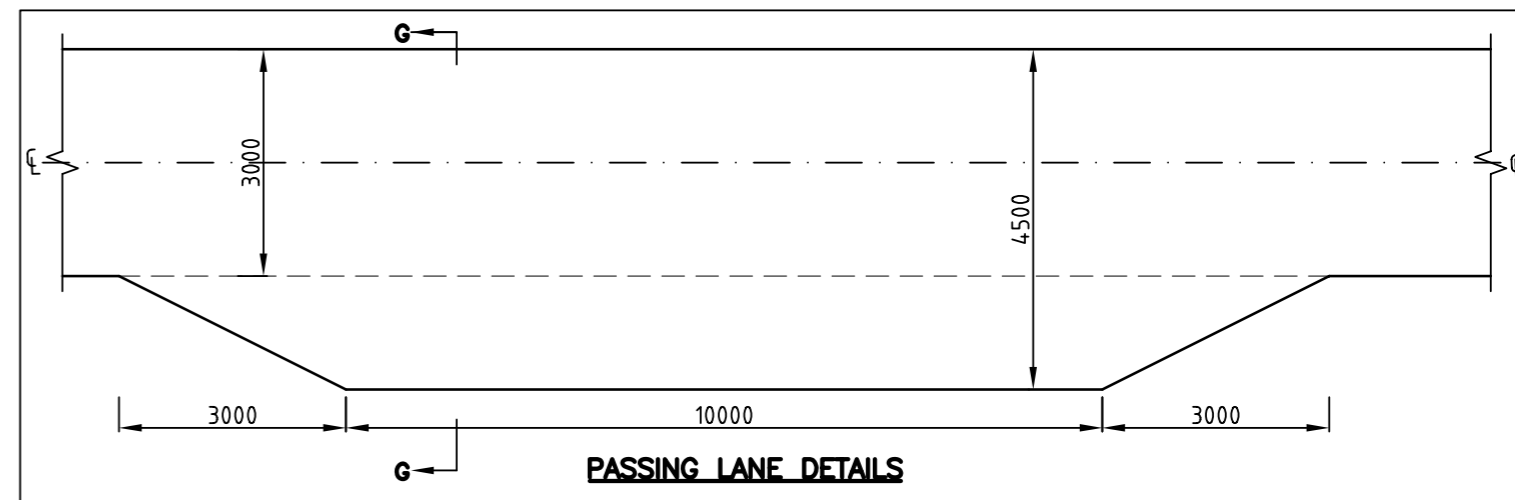
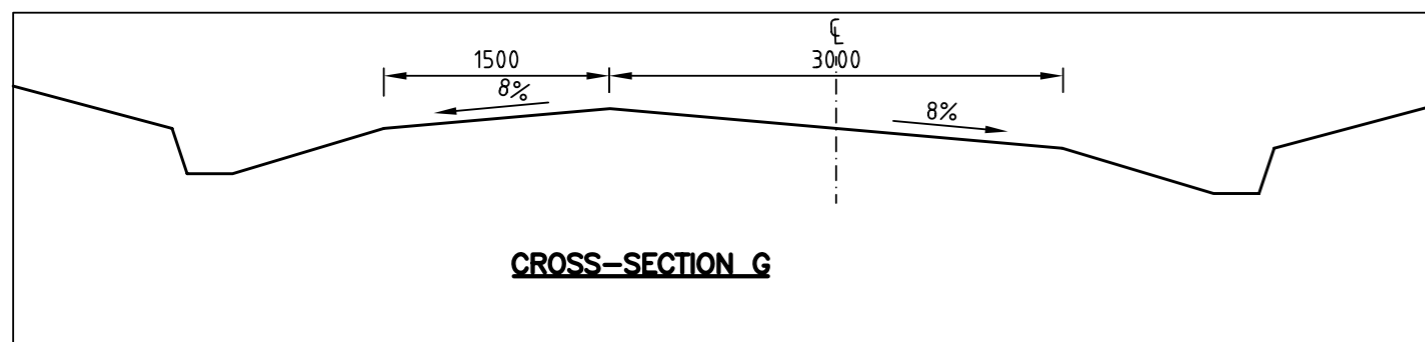
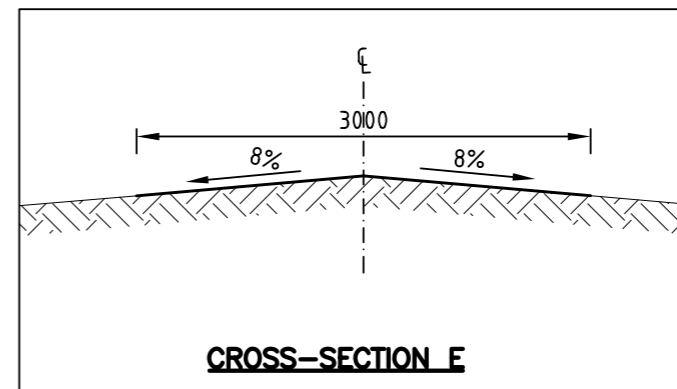
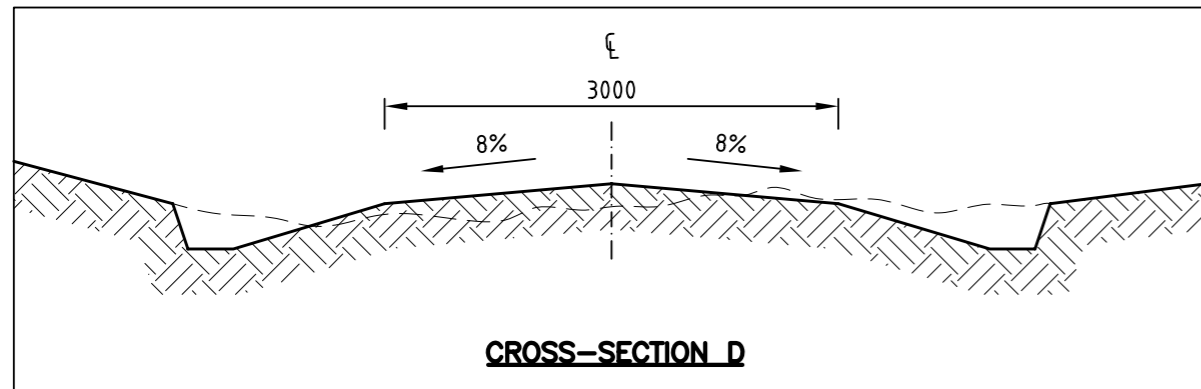
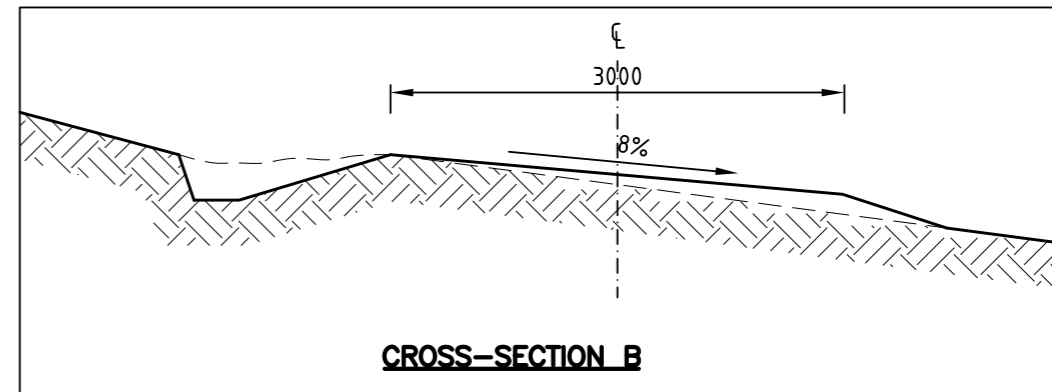
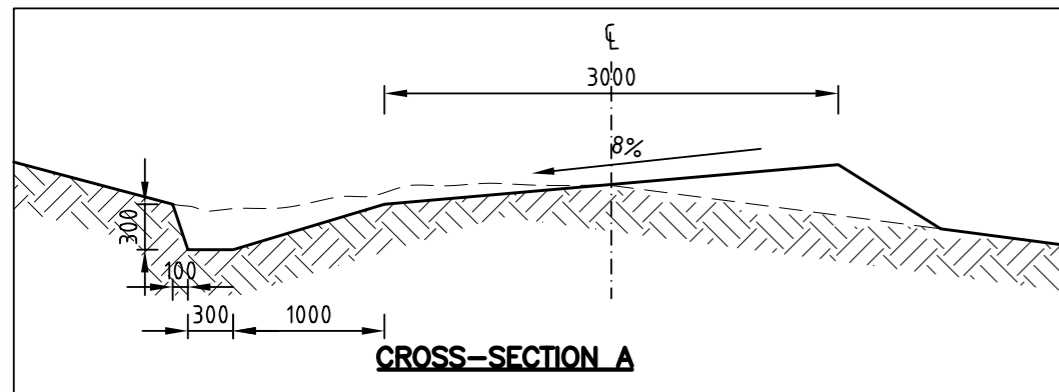
**SITE CLEARANCE**

**Notes on Design and Construction**

1. Site clearance is usually an activity undertaken by community members.
2. When site clearance is a community based activity it must be undertaken in a timely manner so as not to impact on the subsequent contractor based activities. This is the responsibility of the Client/Engineer not the Contractor.
3. Contractors are always responsible for 'setting out'. This is an activity that must be undertaken before community members can clear the footpath/track corridor

4. When site clearance is a contractor activity it should be indicated on strip maps
5. The width of the cleared strip depends on footpath width and existing ground slopes. See drwg no. RA003 for details
6. Specifications, method of work and method of measurement and bill item descriptions for the following bill items are included at the back of this manual; items 2.1, 2.2 & 2.3

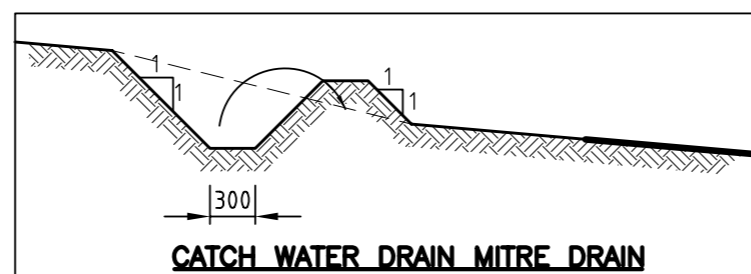
 <p>THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT</p> <p>P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425</p>	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scale:
	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm
	Title: <b>SETTING OUT AND SITE CLEARANCE WORKS</b>		Date: Sept '06
	Project No.	Sheet:	Drawing No. <b>CAR 001</b>
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign Chkd



- NOTES:**
1. Passing lanes to be placed maximum 500mm intervals and located at points where there is poor sight distances.
  2. Locations of passing lanes shall be fixed on site by the engineer.
  3. Payment for provision of passing lanes shall be covered by item 3.2

Invert Gradient		1	2	3	4	5	6	7	8	9	10
Invert Material	Sand	30	21	17	15	13	12	11	10	10	9
	Clay	40	28	23	20	18	16	15	14	13	12
	Gravel	50	35	29	25	22	20	19	18	17	16

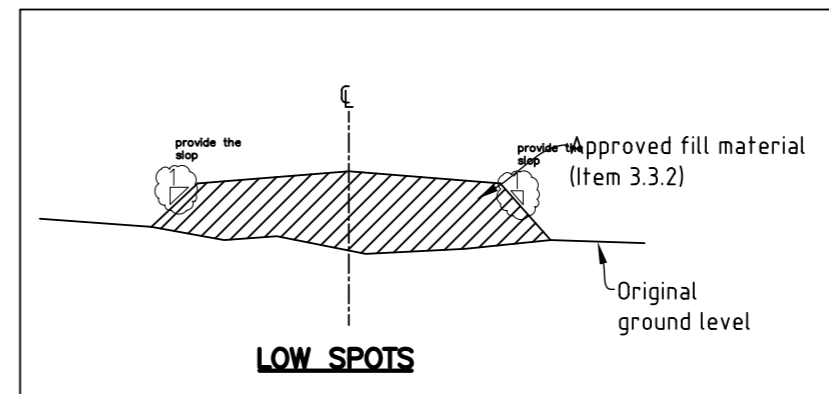
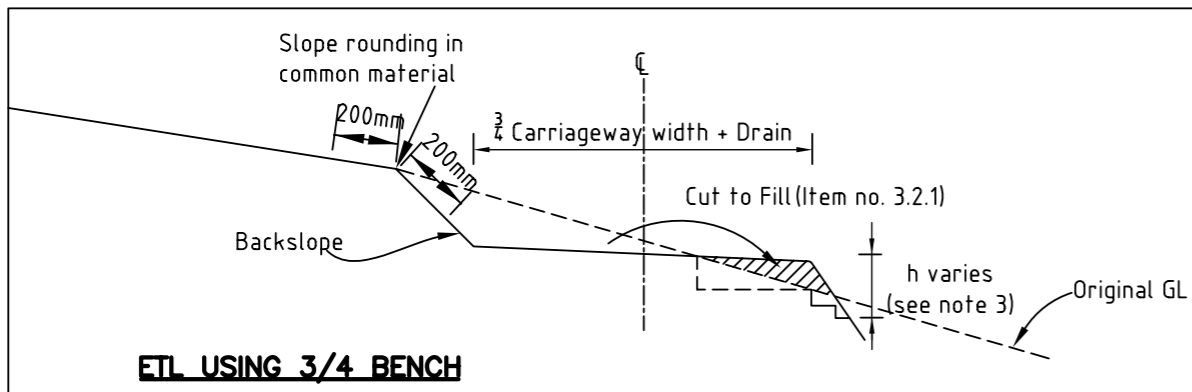
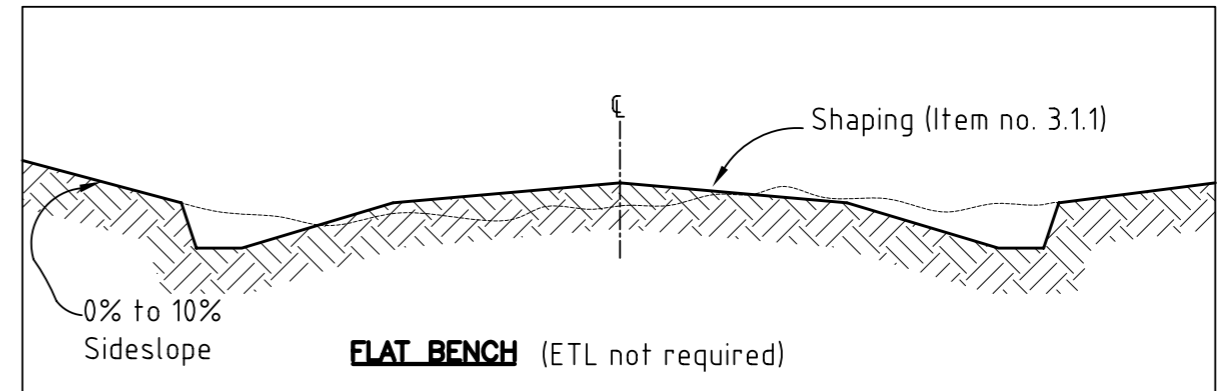
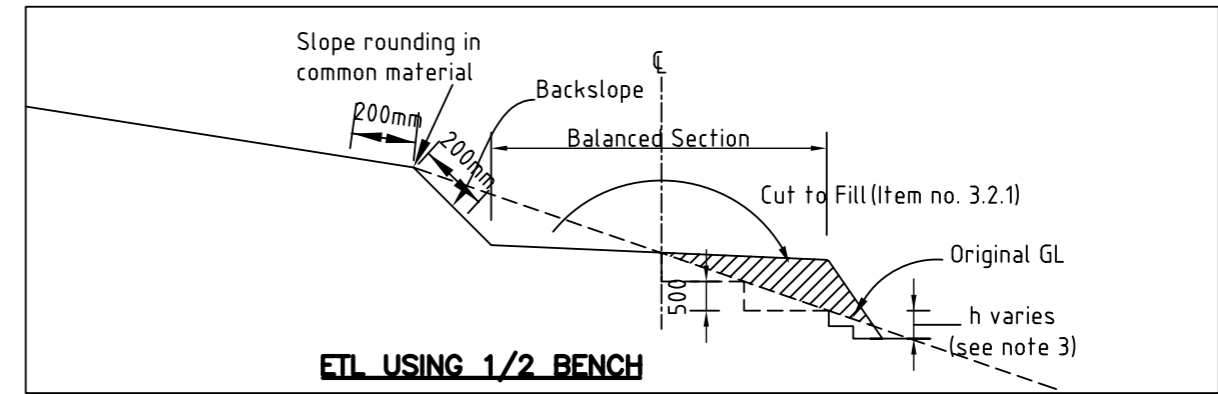
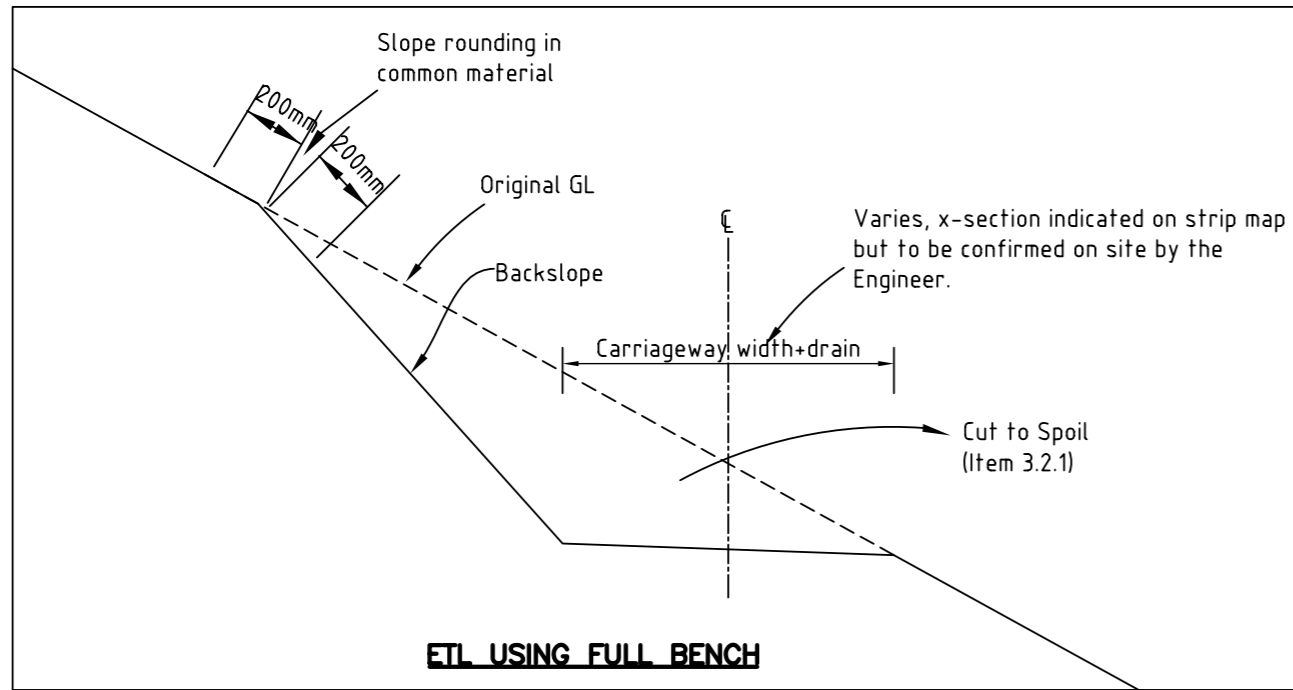
**MITRE DRAIN SPACING**



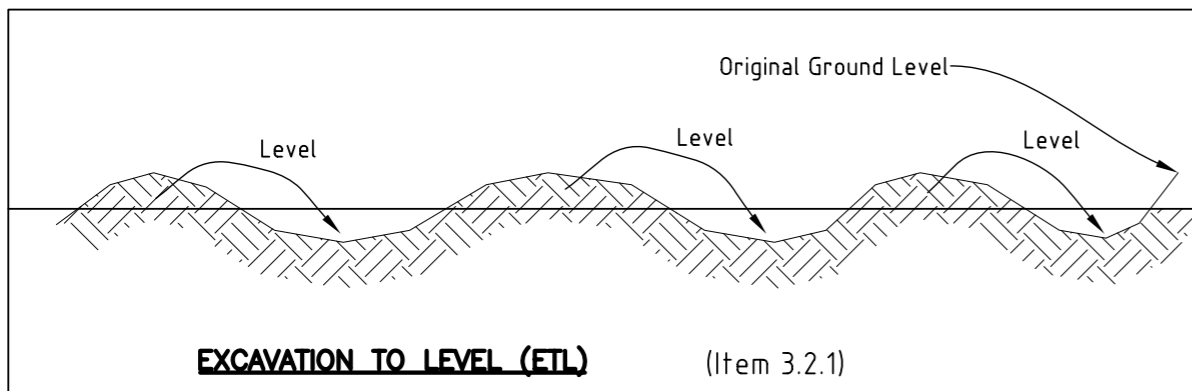
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Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Project No.		Date: Sept '06	
Sheet: <b>STANDARD CROSS SECTIONS</b>		Drawing No. <b>CAR 002</b>	
Drawn by: JAK	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd





- NOTES:**
1. Under usual conditions 1/2 bench is used i.e cut = fill.
  2. Strip maps indicate variations to this standard.
  3. Where h > 500mm benching is required.
  4. Standard not requiring specifications etc.
  5. items covered 3.1,3.2.1,3.3.1



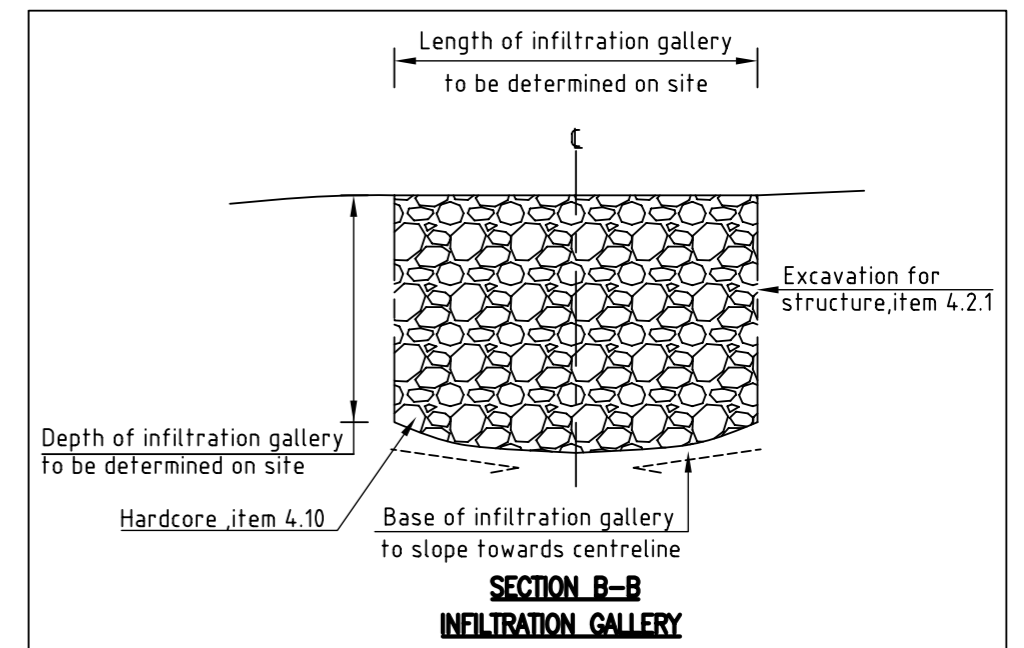
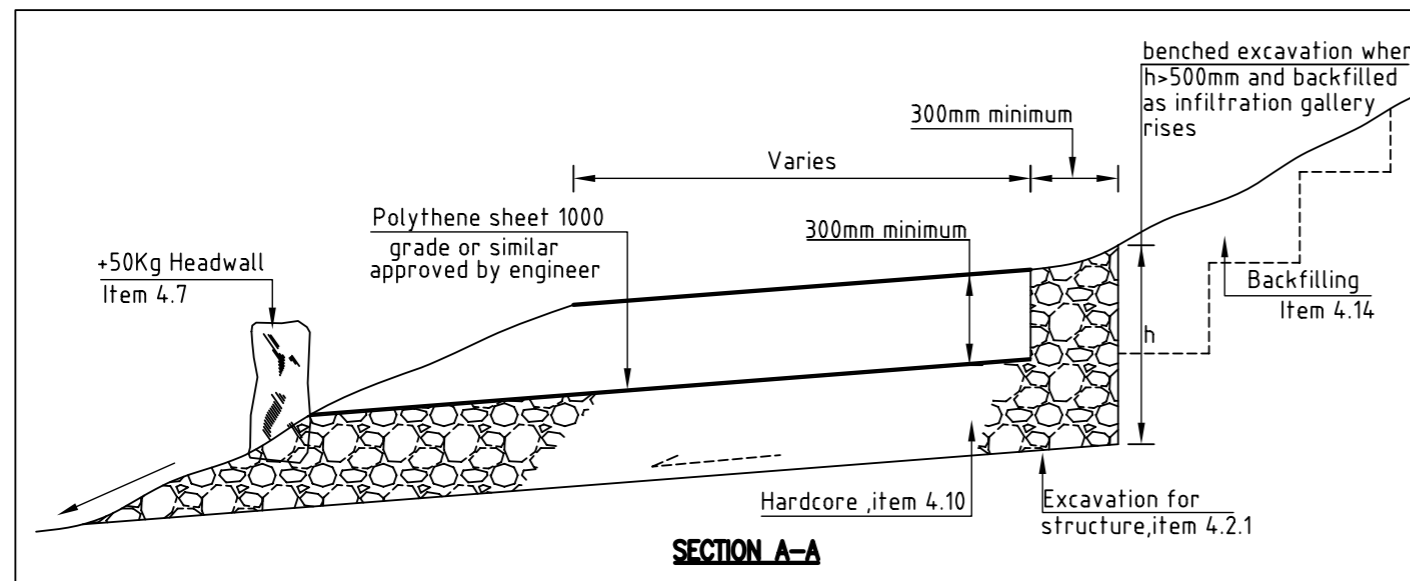
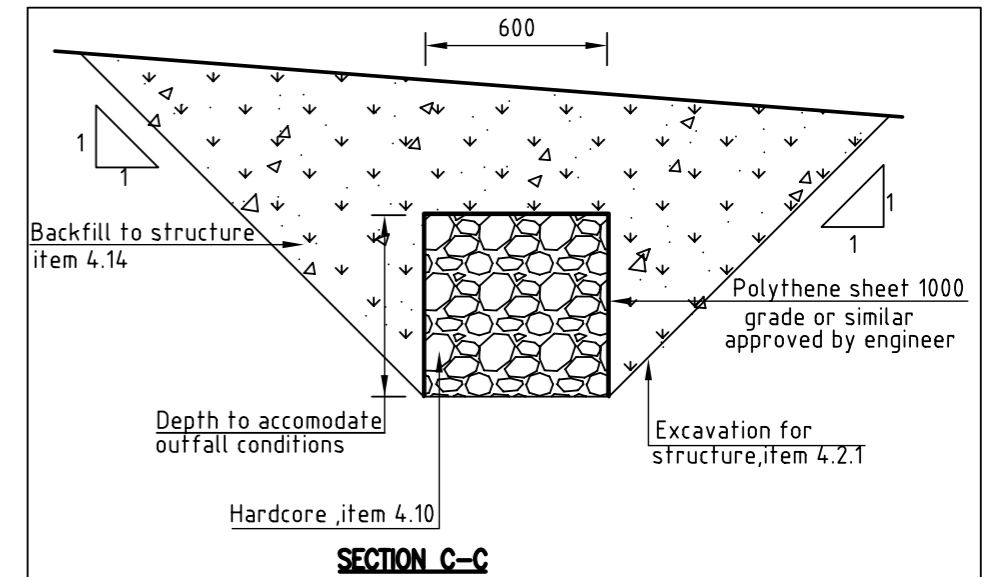
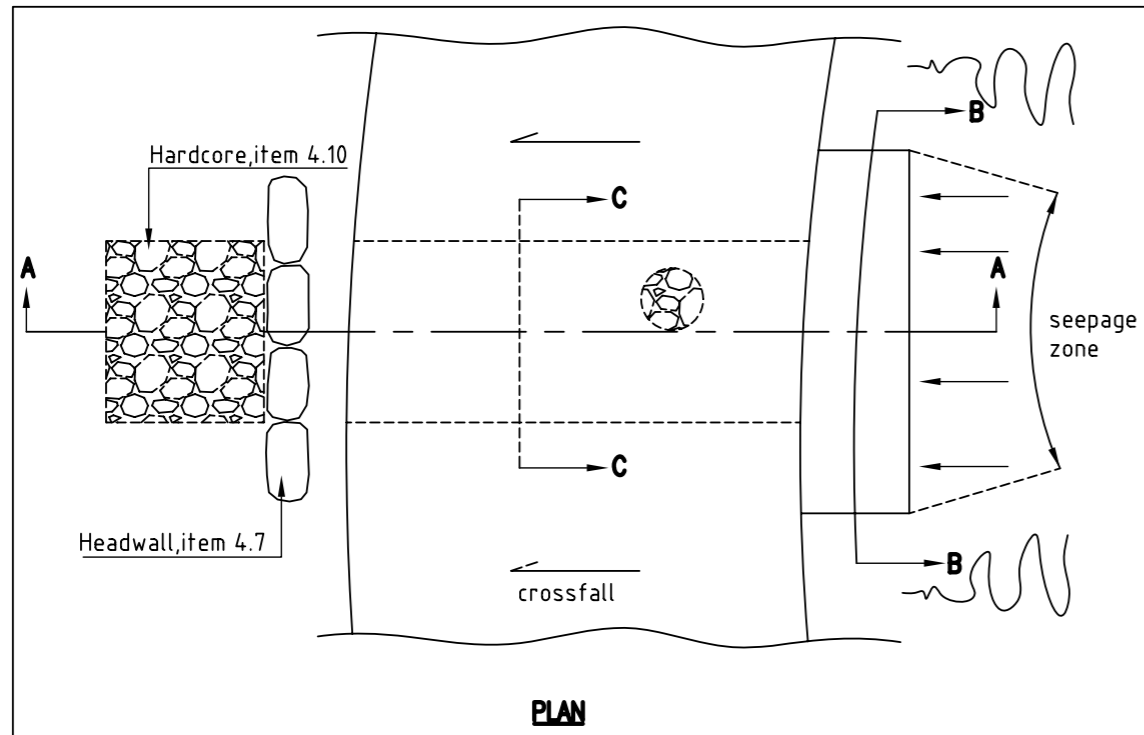
 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX: 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scales:		
	Title: <b>STANDARD CAS MANUAL</b>		<b>EARTHWORKS</b>		Dimension: mm	
	Project No.		Sheet:		Drawing No.	
	Drawn by: JAK	Checked by: JC	Approved by:		<b>CAR 003</b>	
Rev. no	Revision note			Date	Sign	Chkd

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**Section A-9**  
**Community Access Roads, Drainage Structures**


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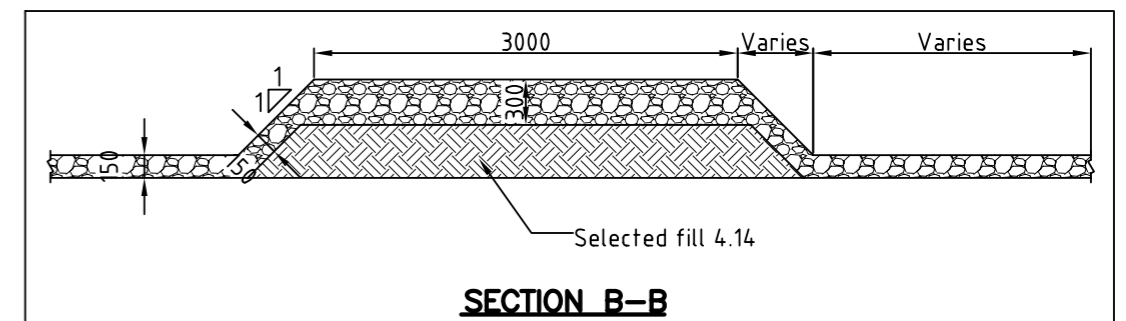
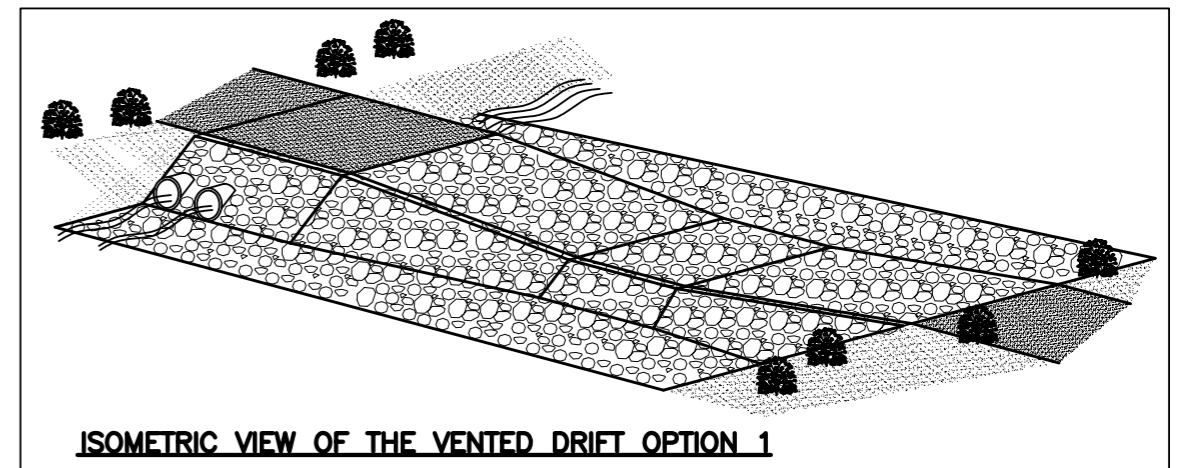
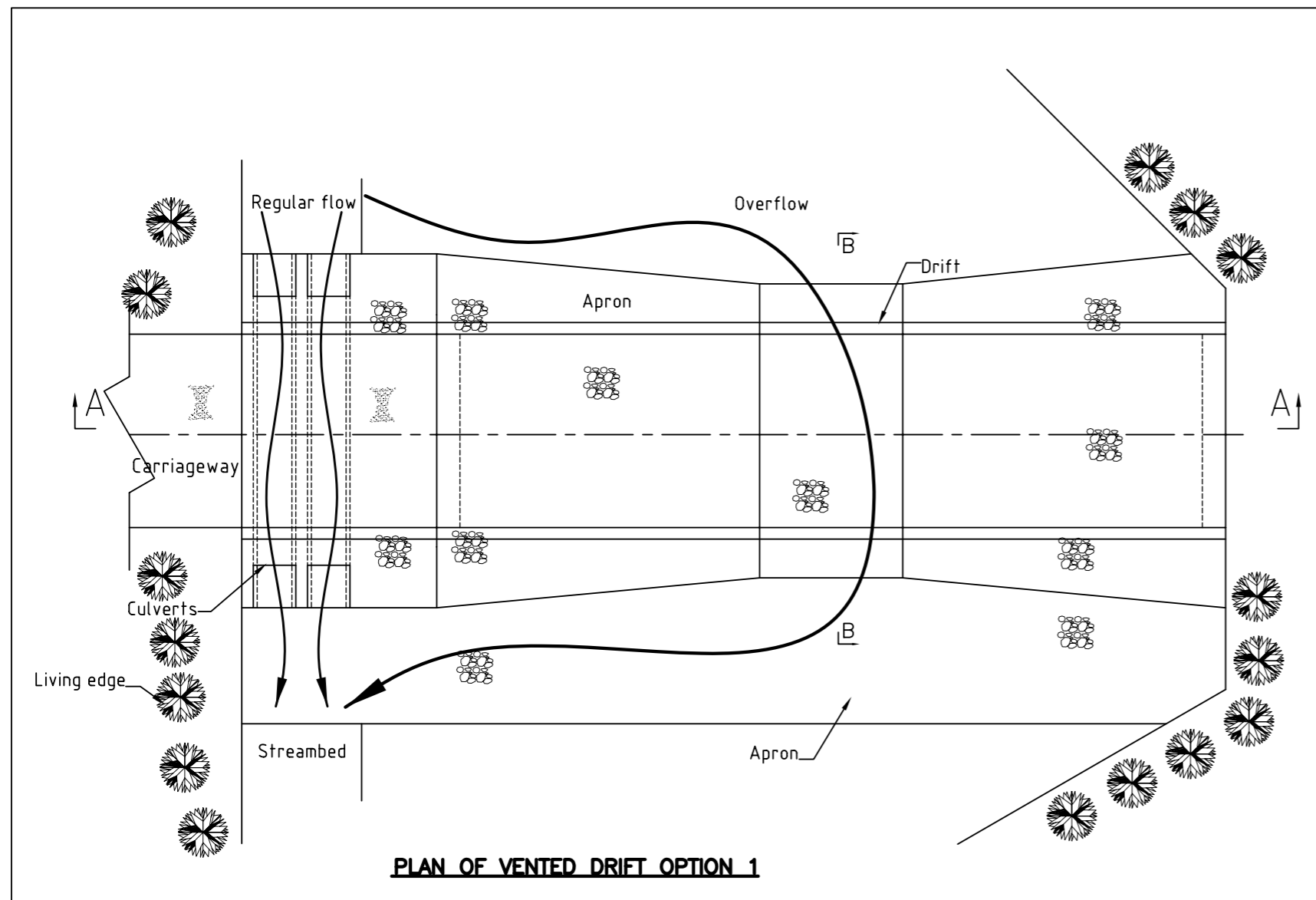
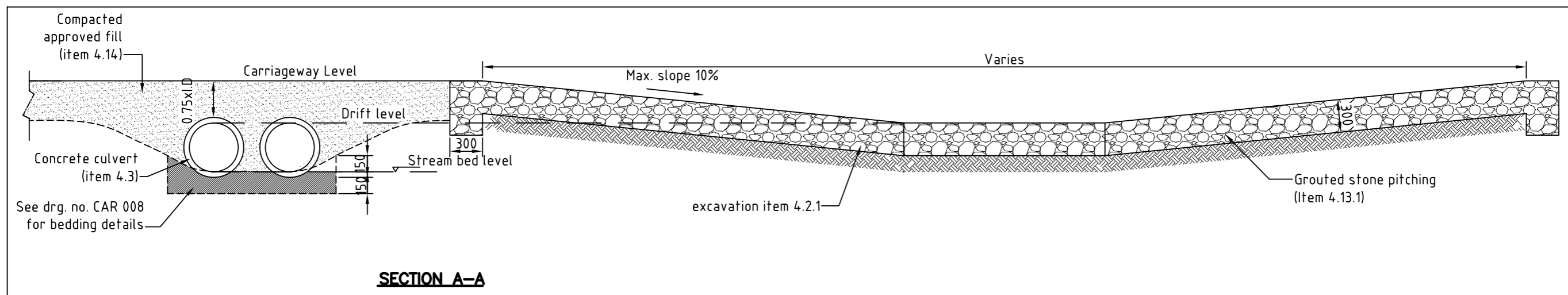
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Cross Drainage Structures; French Drain	CAR 004
Access Roads; Vented Drift Option 1	CAR 005
Access Roads; Vented Drift Option 2	CAR 006
Access Roads; Drift	CAR 007
Access Roads; Culvert Option 1, Concrete Pipe	CAR 008
Access Roads; Culvert Option 2	CAR 009
Access Roads; Culvert Head and Wing Walls in Grouted Stone	CAR 010



**NOTES:**

1. French drain must only be used where inflowing water is relatively free of suspended solids. It should not be used to convey surface water.
2. The length and depth of the infiltration gallery and the geometry of the French drain must be chosen to suit specific site conditions.
3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual: Items 4.2.1, 4.7, 4.10, 4.14

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	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm
	<b>CROSS DRAINAGE STRUCTURES</b>		Date: Sept. '06'
	<b>FRENCH DRAIN</b>		
Project No. _____		Sheet: _____	Drawing No. <b>CAR 004</b>
Drawn by: IOY	Checked by: JC	Approved by: _____	
Rev. no	Revision note	Date	Sign
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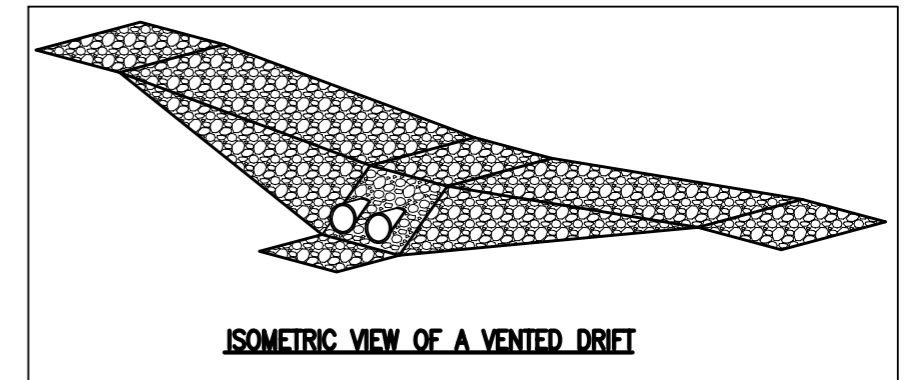
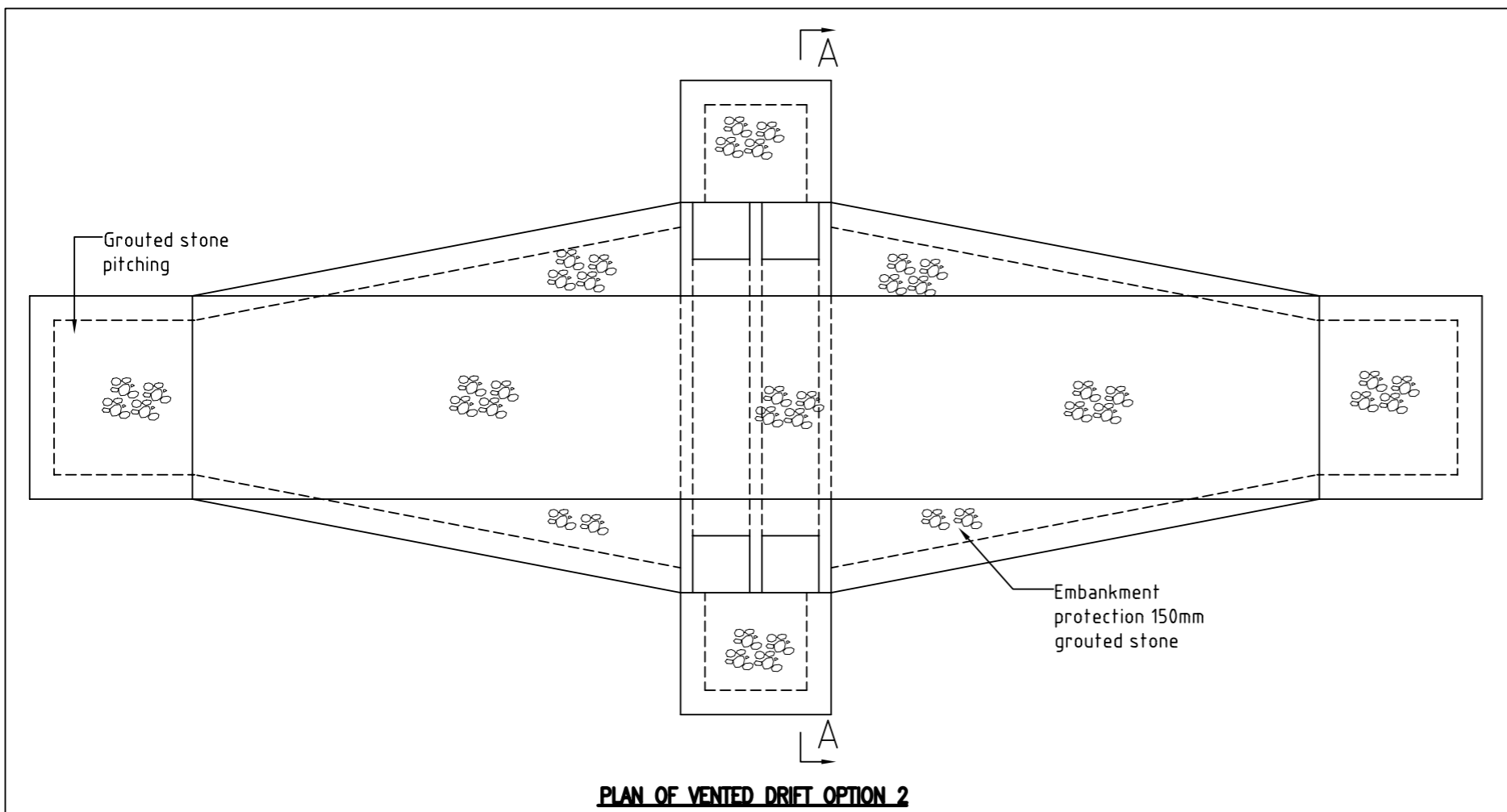
**NOTES:**

1. number and diameter of culverts are dependant on the hydrology of the water course.
2. The geometry of the drift and layout of the culvert(s) is dependant on topography of the site and can be determined after a detailed site investigation
3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual

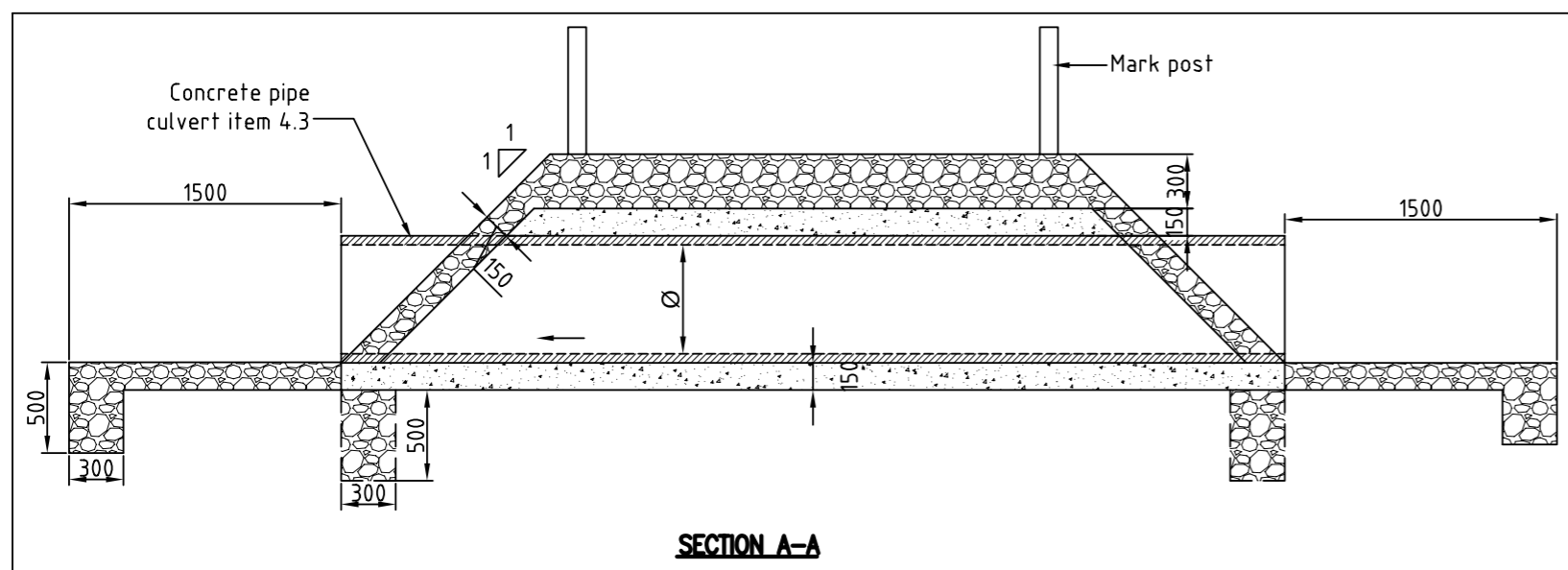
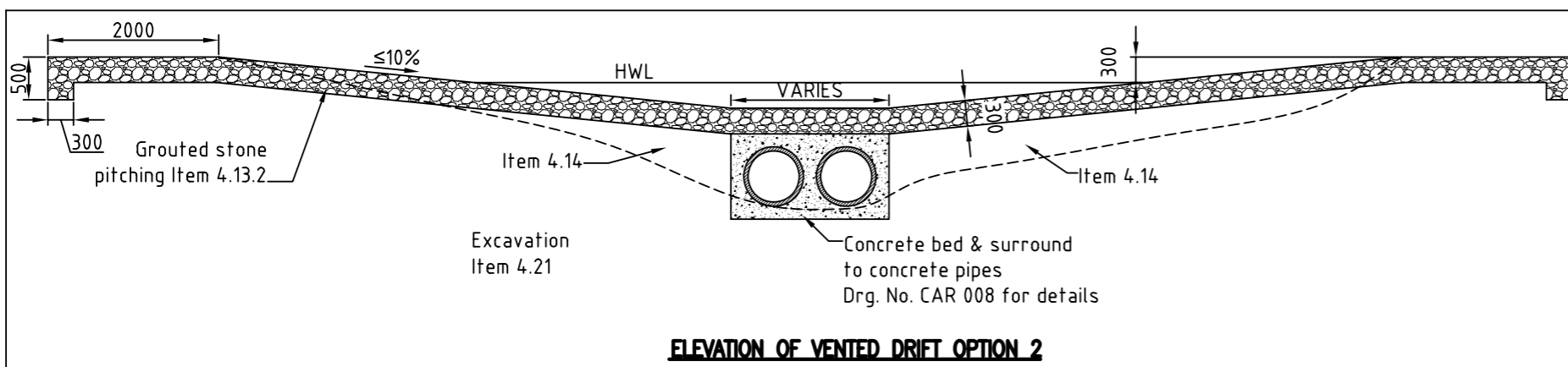



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Project No.	Sheet:	Drawing No. <b>CAR 005</b>	
Drawn by: RL	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
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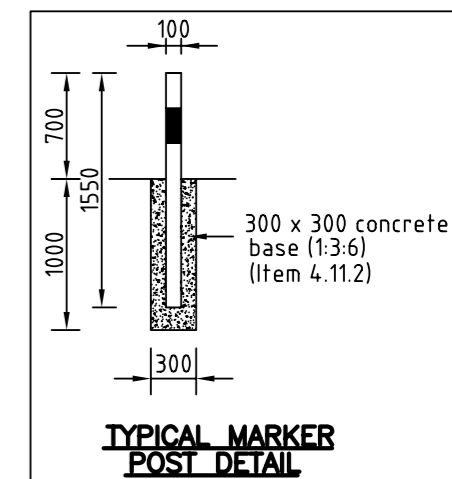
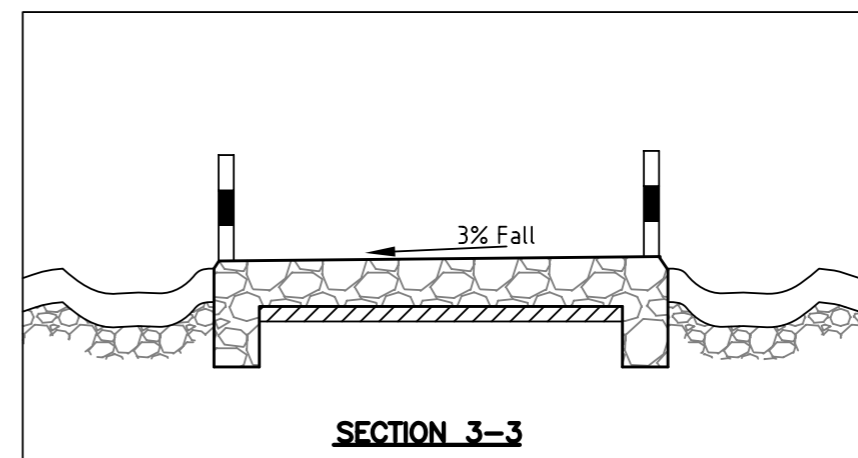
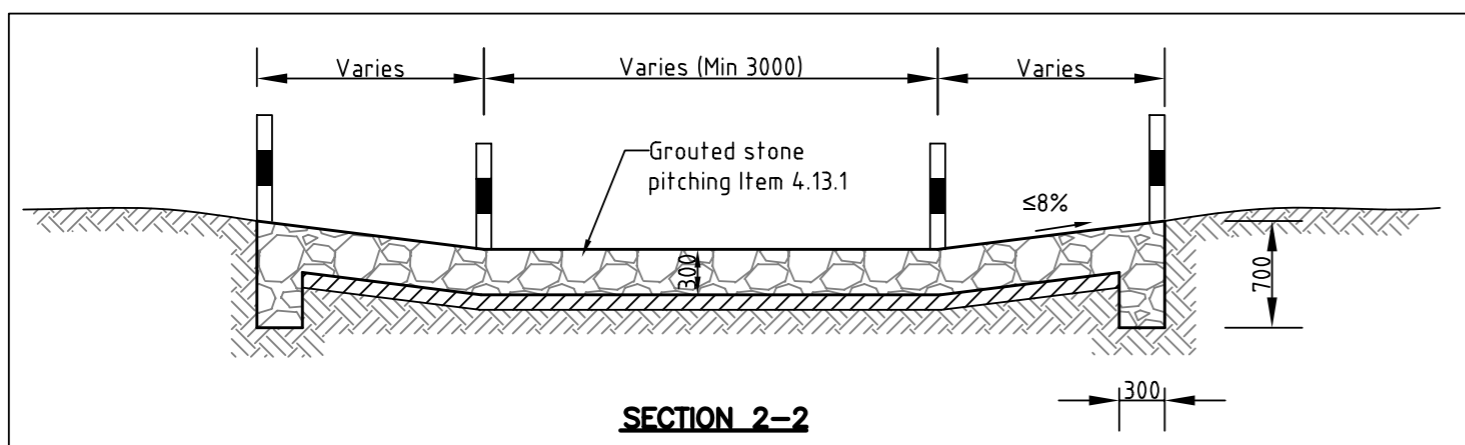
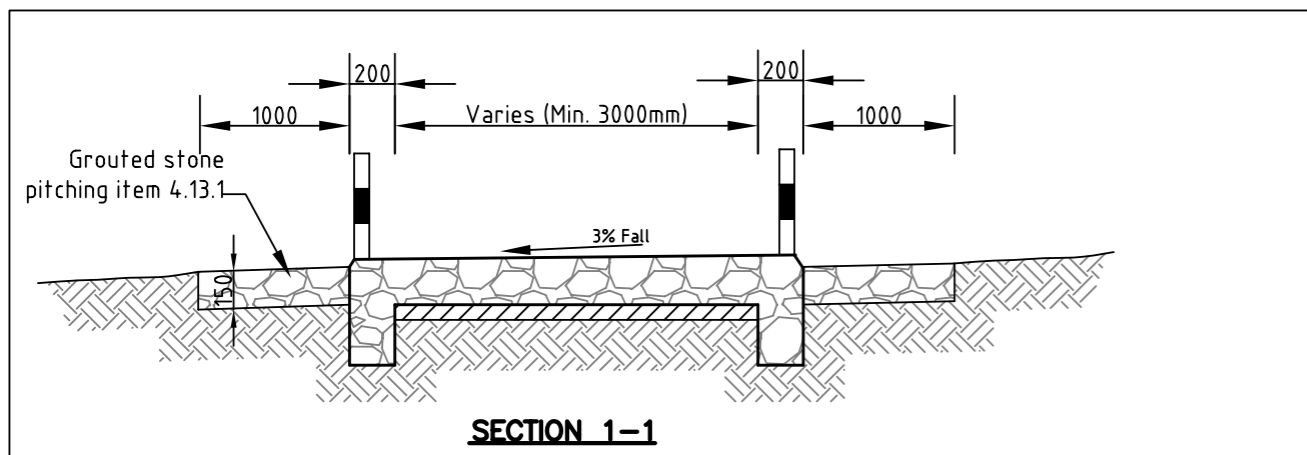
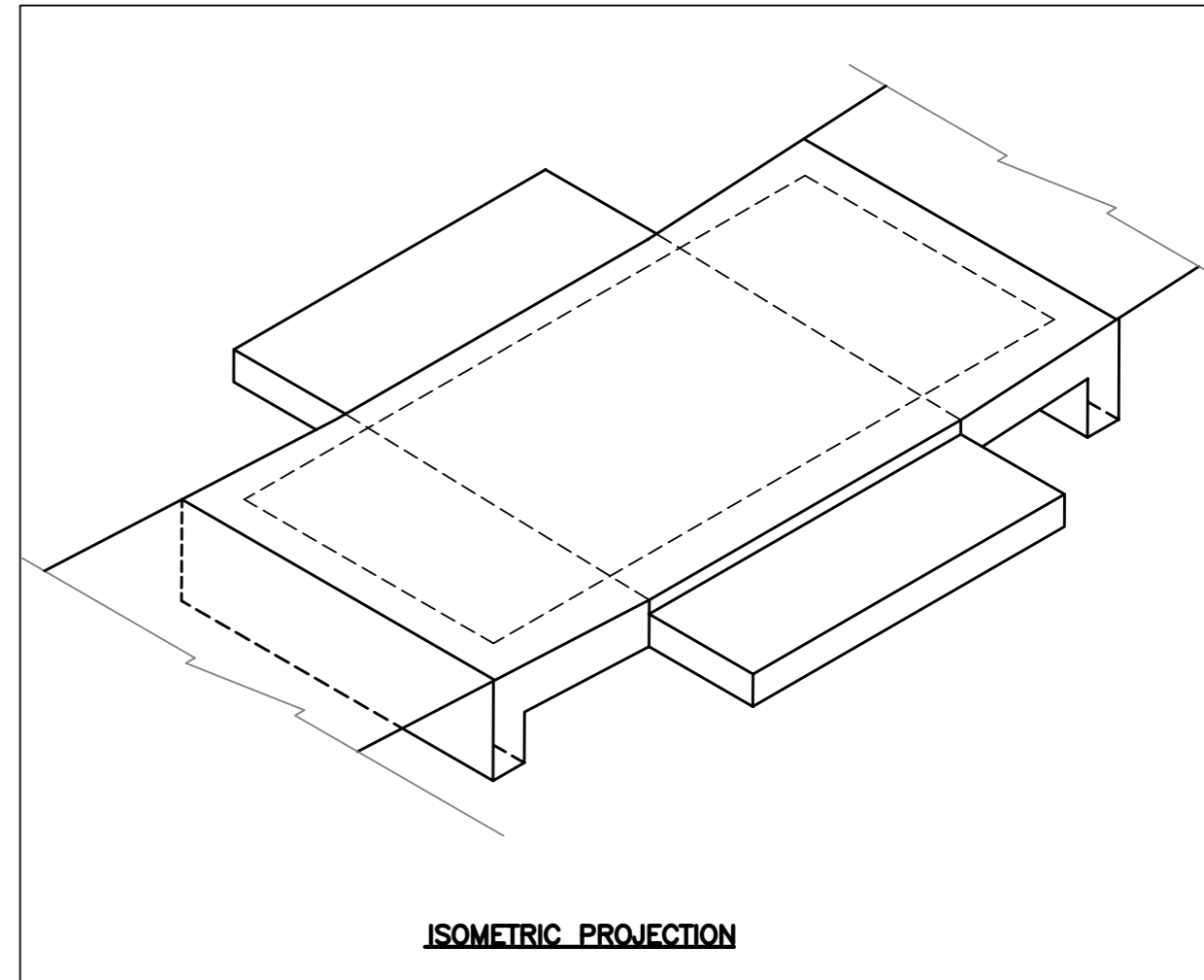
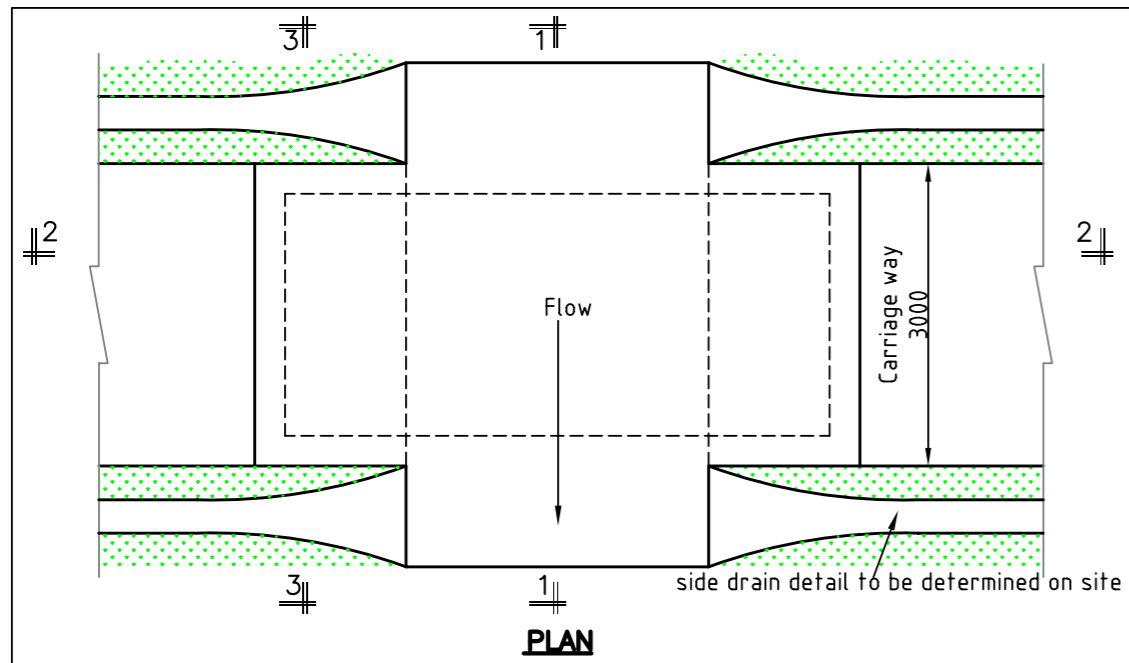





- NOTES:**
1. number and diameter of culverts are dependant on the hydrology of the water course.
  2. The geometry of the drift and layout of the culvert(s) is dependant on topography of the site and can be determined after a detailed site investigation
  3. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual

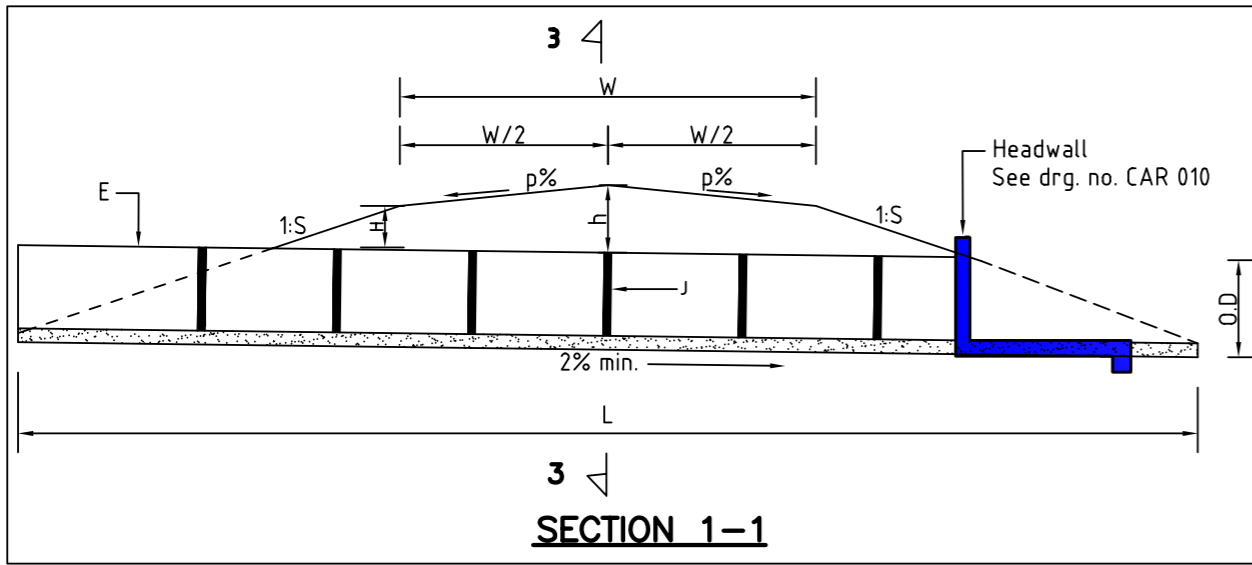


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	Project No.	Sheet:	Drawing No. <b>CAR 006</b>		Date: Sept '06
	Drawn by: RL	Checked by: JC	Approved by:		
Rev. no	Revision note	Date	Sign	Chkd	

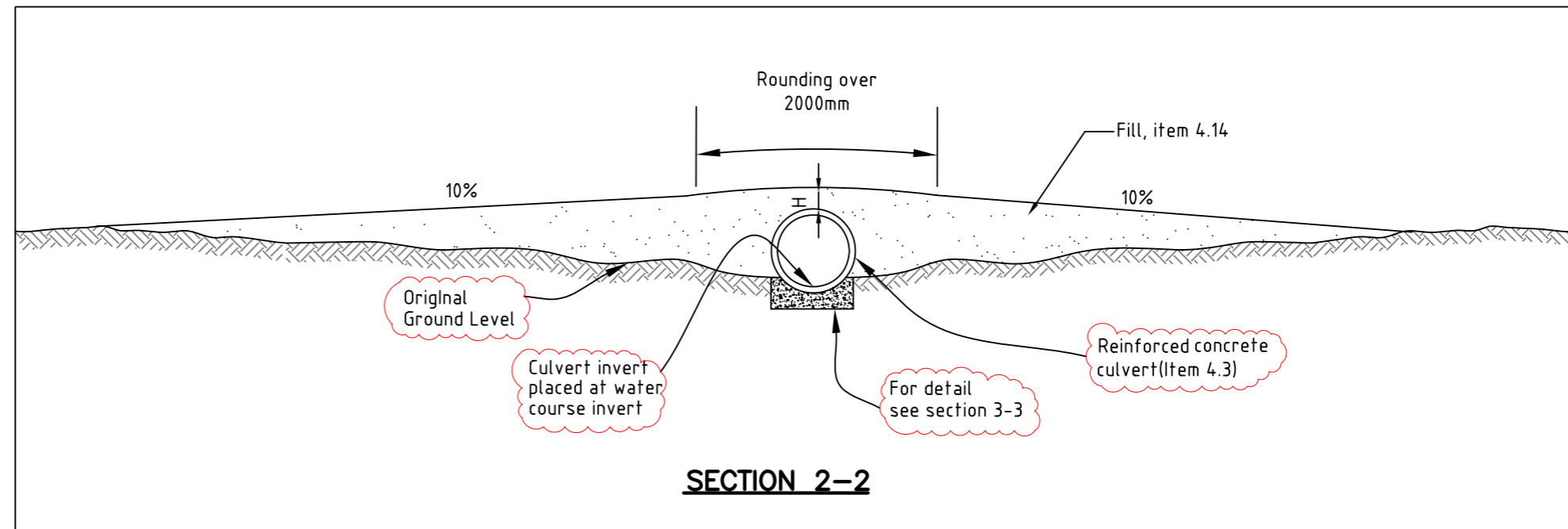
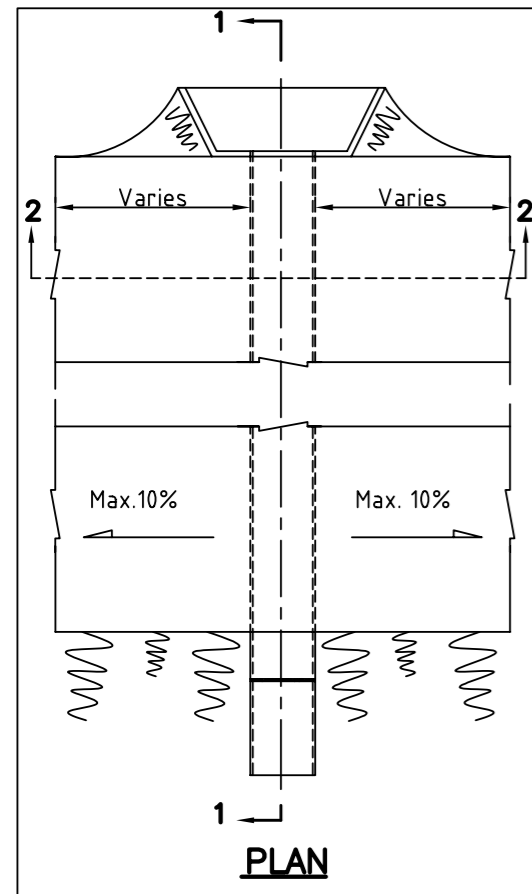
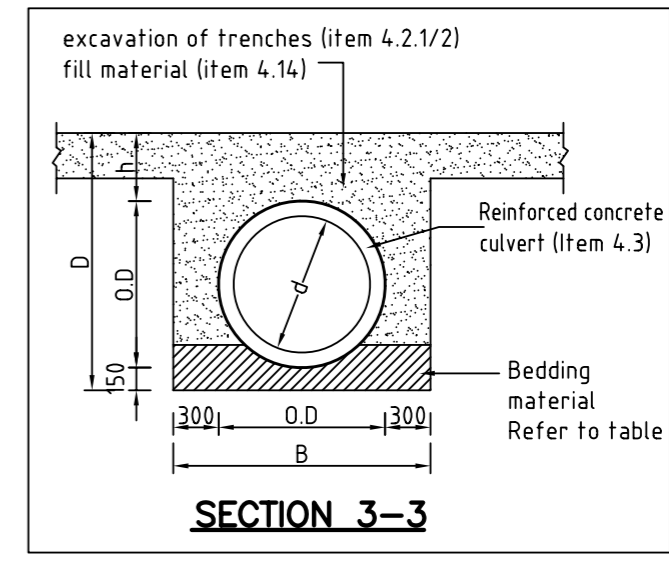


- NOTES:**
1. The geometry of the drift and layout of the culvert(s) is dependant on topography of the site and can be determined after a detailed site investigation
  2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual

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	Project No.	Sheet:	Drawing No.		Date: Sept '06
	Drawn by: JAK	Checked by: JC	Approved by:		<b>CAR 007</b>
Rev. no	Revision note	Date	Sign	Chkd	




E: Extra culvert piece to avoid headwall construction  
 W: Carriageway  
 J: Joint filled with 1:4 mortar  
 H: Minimum fill cover  
 $L = 2s \times (O.D.+h-(Wp/2)) + W$   
 where:  
 L = total length of culvert  
 s = slope of embankment  
 O.D. = outside diameter  
 h = fill above culvert along centreline  
 p = camber (%)  
 t = Headwall thickness



S/N	Culvert Diameter, O.D (mm)	Excavation Width, B (mm)	Excavation Depth, D (mm)	Space between multiple culverts, Min. (mm)	Minimum fill Cover, H (mm)	Bedding Material (mm)
1	450	OD + 600	Varries	150	300	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)
2	600	OD + 600	Varries	300	400	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)
3	900	OD + 600	Varries	450	500	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)
4	1000	OD + 600	Varries	600	600	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)
5	1200	OD + 600	Varries	600	700	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)
6	1500	OD + 600	Varries	600	800	Gravel (item 5.2), Sand (item 4.14) Class lean concrete (item 4.11.1)

**TABLE FOR VARIOUS CULVERT SIZES**

**NOTES:**  
 1. Number and diameter of culverts are dependant on the hydrology of the water course.  
 2. Specifications, method of work, method of measurement and bill item descriptions for the following bill items are included at the back of this manual.



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MINISTRY OF WORKS AND TRANSPORT

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Project: **COMMUNITY ACCESS SUPPORT PROGRAMME**

Title: **STANDARD CAS MANUAL**

**ACCESS ROADS CULVERT OPTION 1 CONCRETE PIPE**

Project No. \_\_\_\_\_ Sheet: \_\_\_\_\_ Drawing No. **CAR 008**

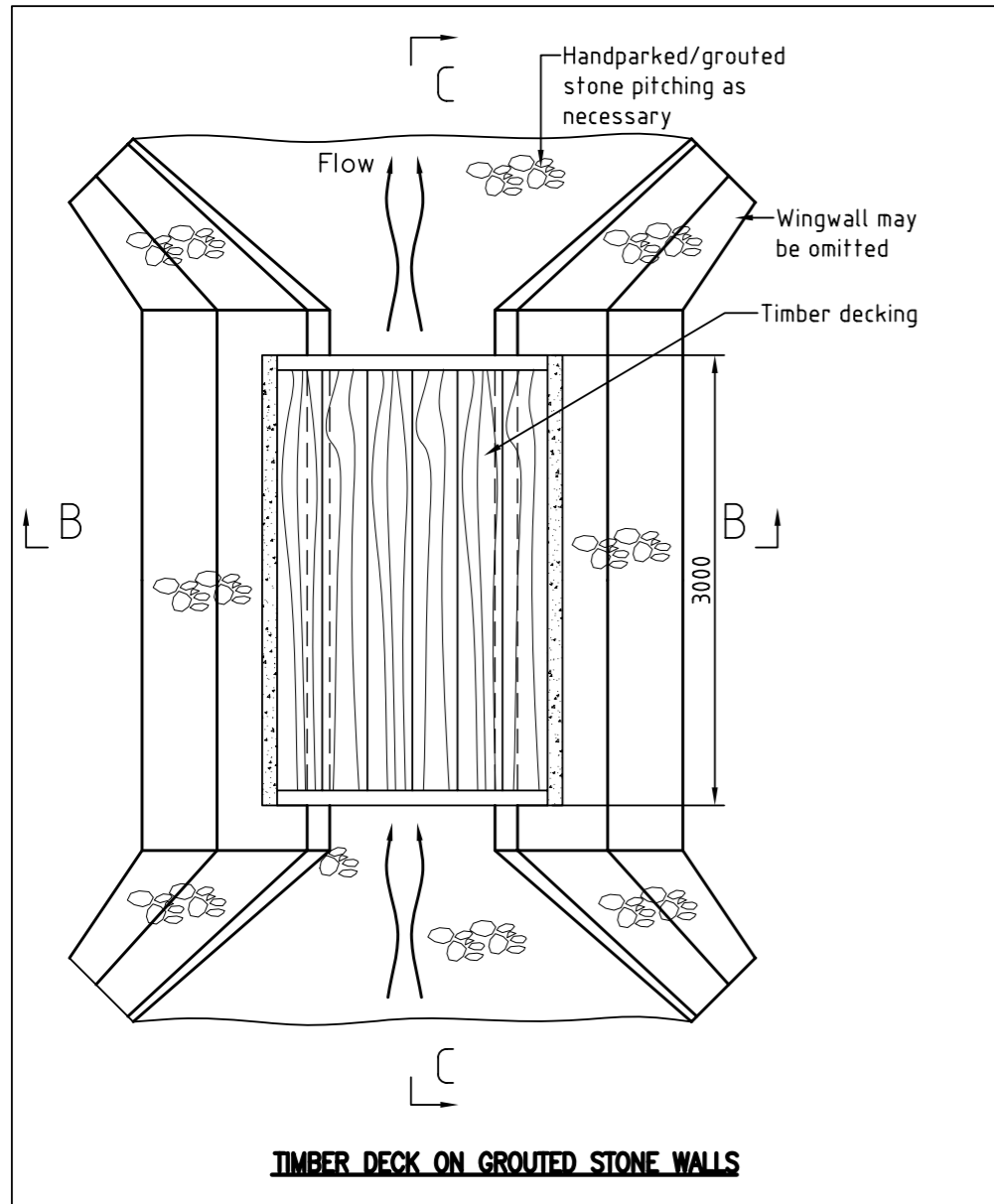
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Scales: \_\_\_\_\_

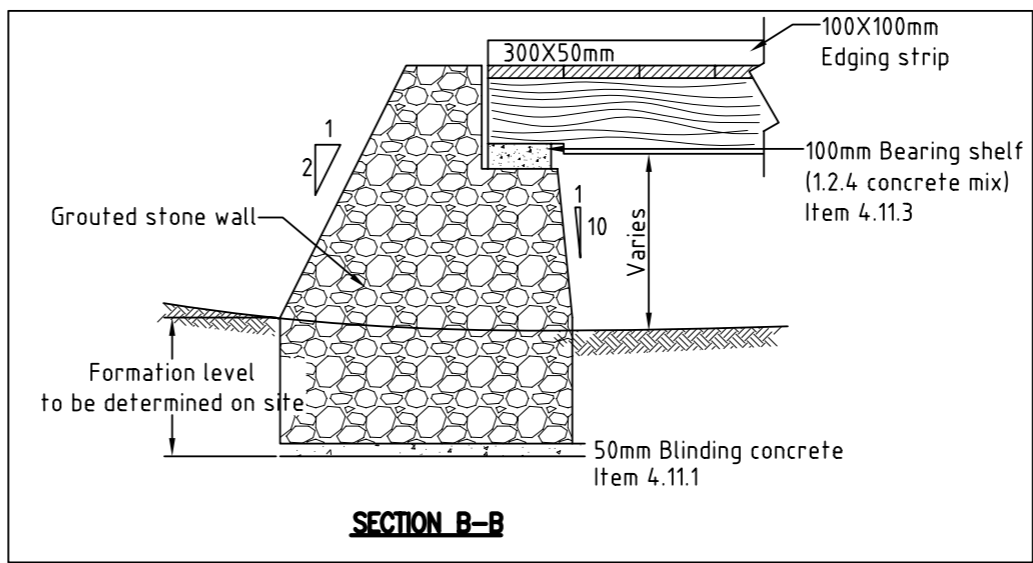
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Date: Sept '06

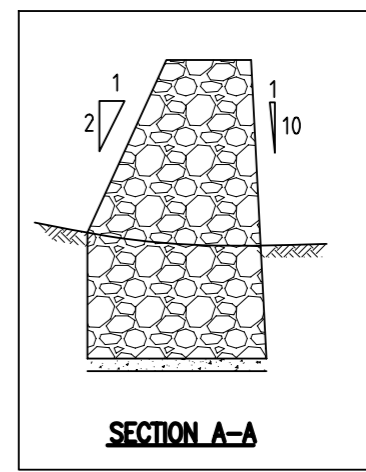
Rev. no	Revision note	Date	Sign	Chkd



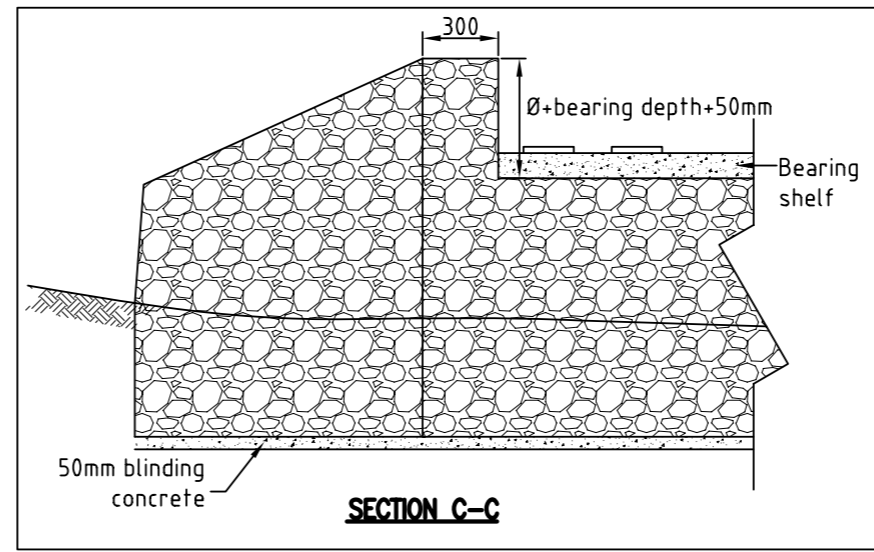
**TIMBER DECK ON GROUTED STONE WALLS**



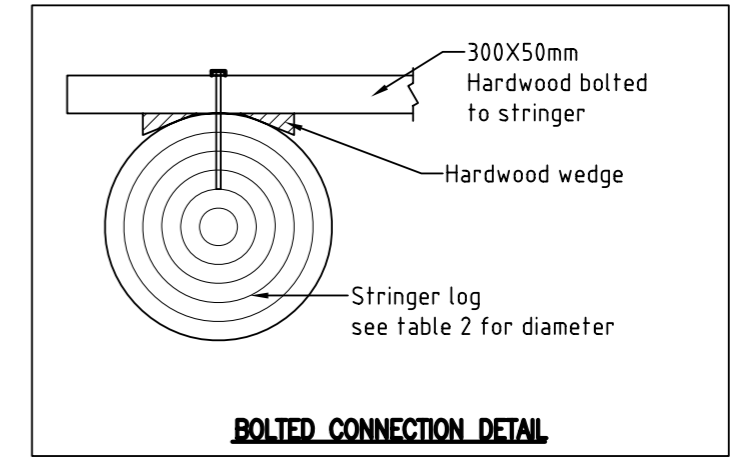
**SECTION B-B**



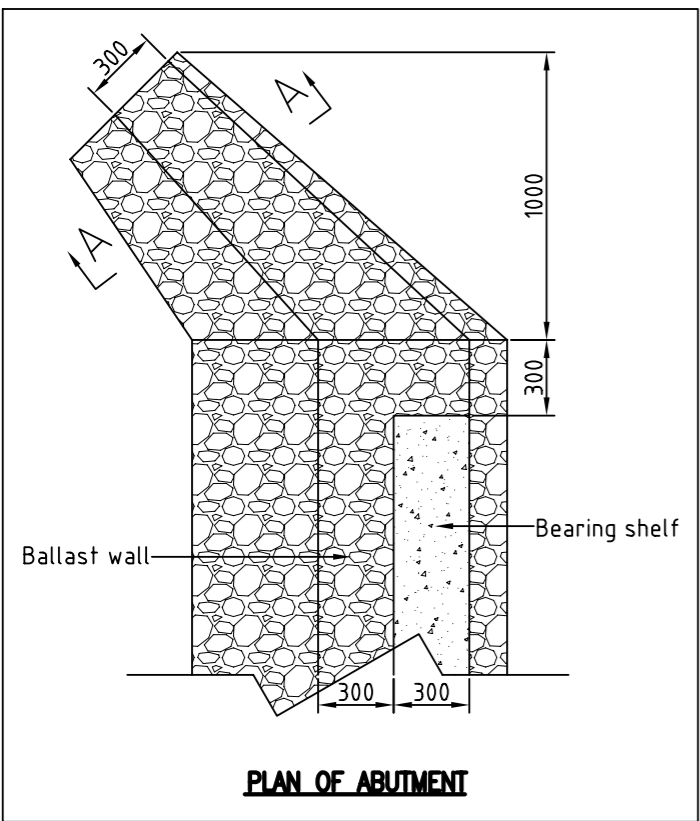
**SECTION A-A**



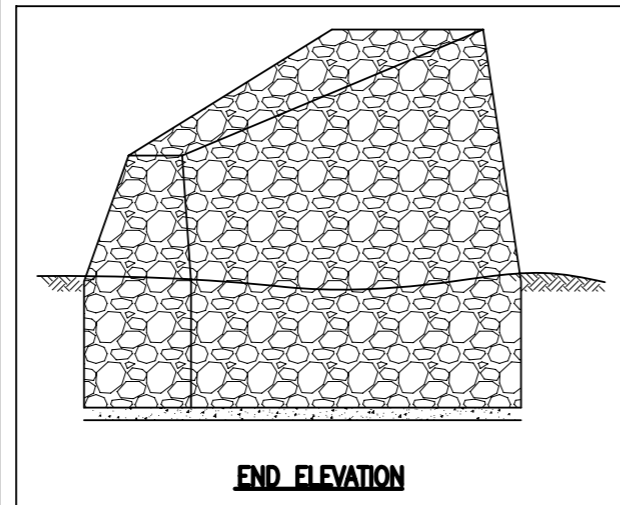
**SECTION C-C**



**BOLTED CONNECTION DETAIL**



**PLAN OF ABUTMENT**



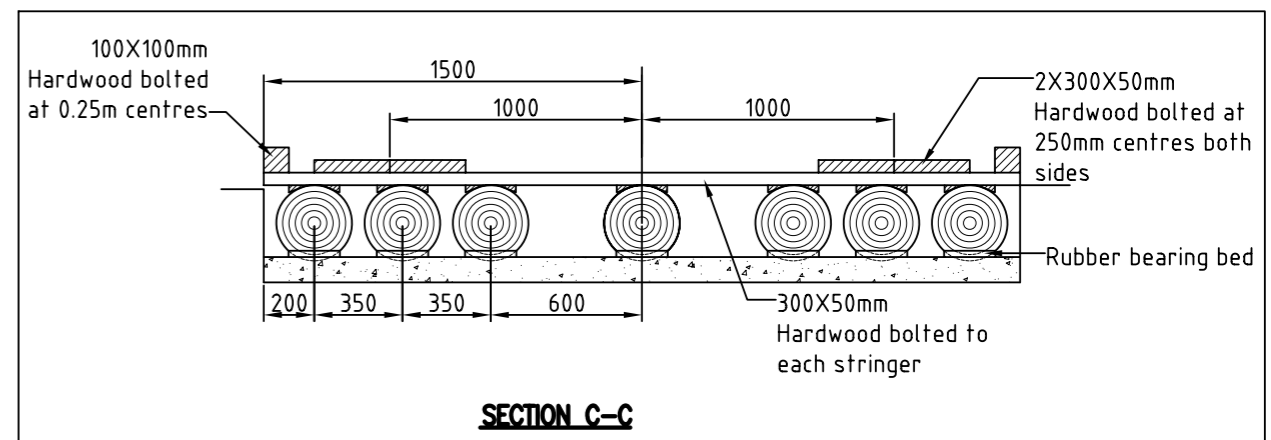
**END ELEVATION**

SAWN TIMBER	ITEM NO.
50 X 300	4.19.5
100 X 100	4.19.3

**TABLE 1**

SPAN	DIAMETER	ITEM NO.
1.0	250	4.18.3
1.5	275	4.18.3
2.0	300	4.18.4
2.5	325	4.18.4

**TABLE 2**

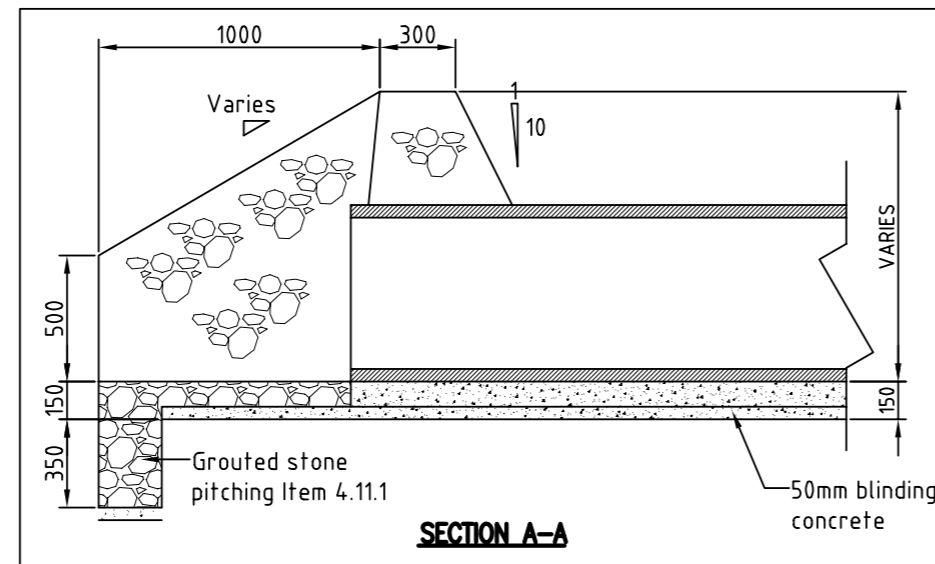
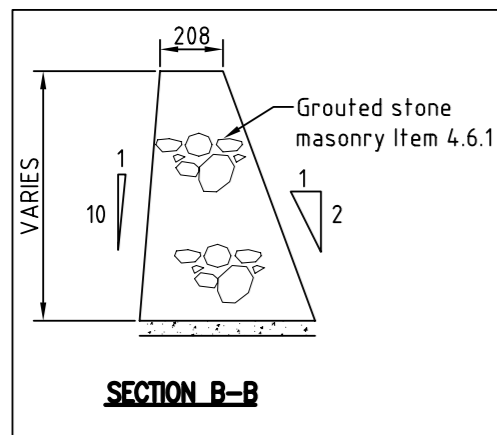
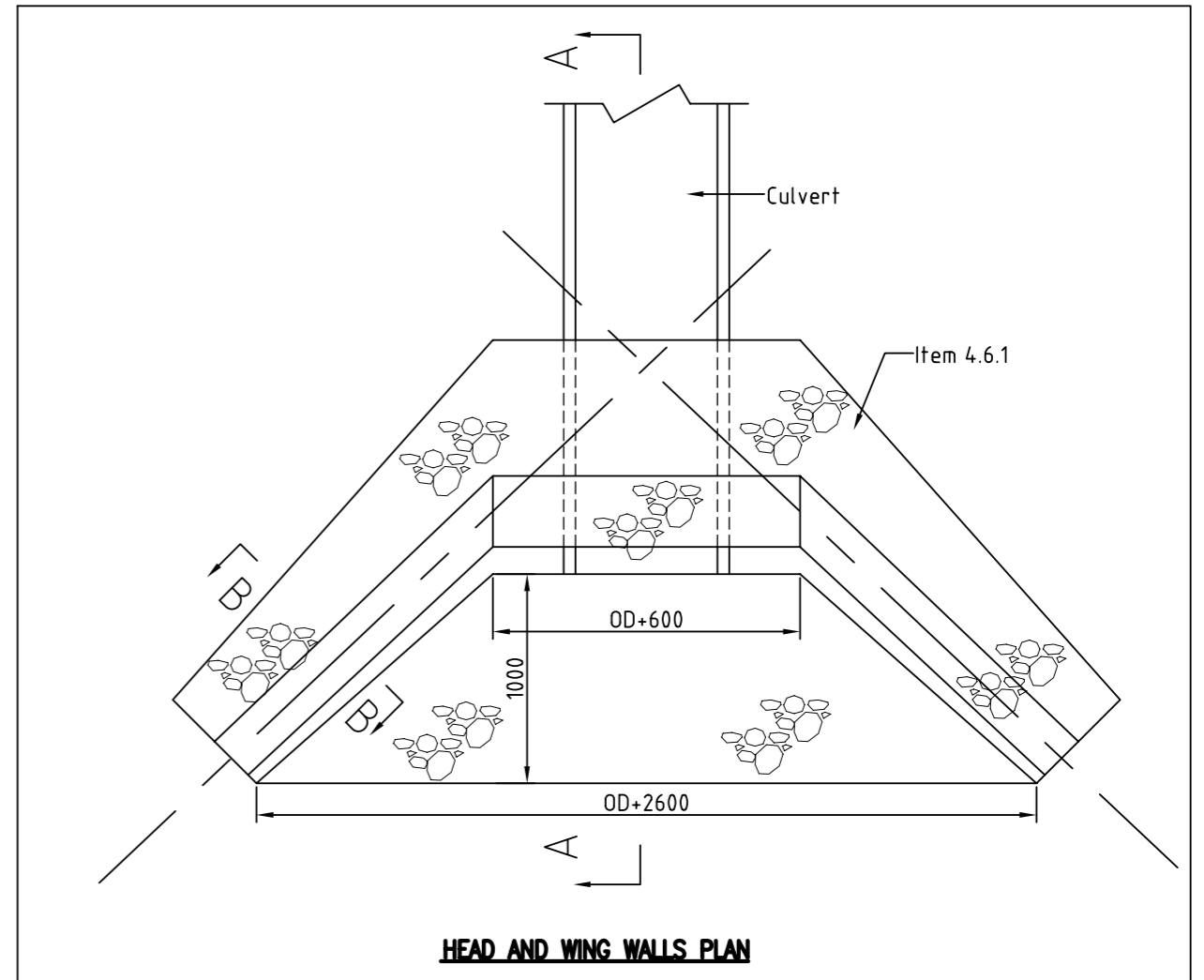
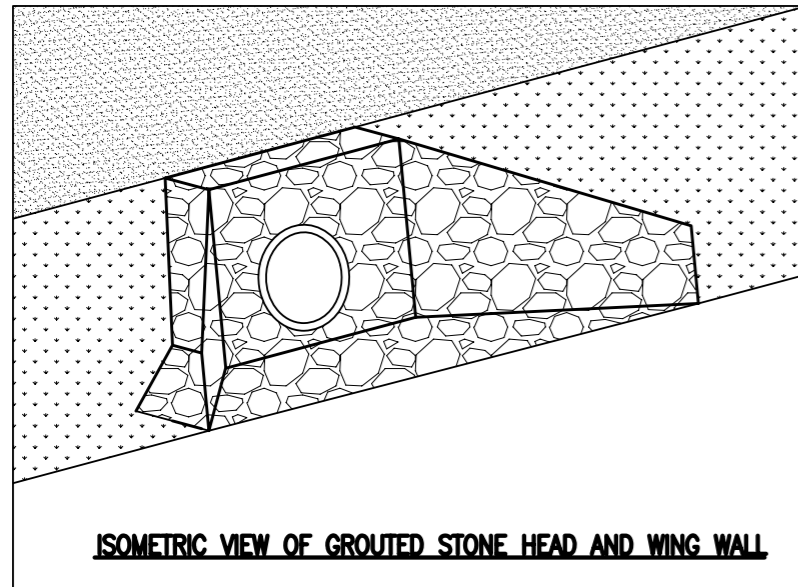



**SECTION C-C**



Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scales:	
Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
		Date: Sept '06	
Project No.		Sheet:	Drawing No. <b>CAR 009</b>
Drawn by: RL	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd





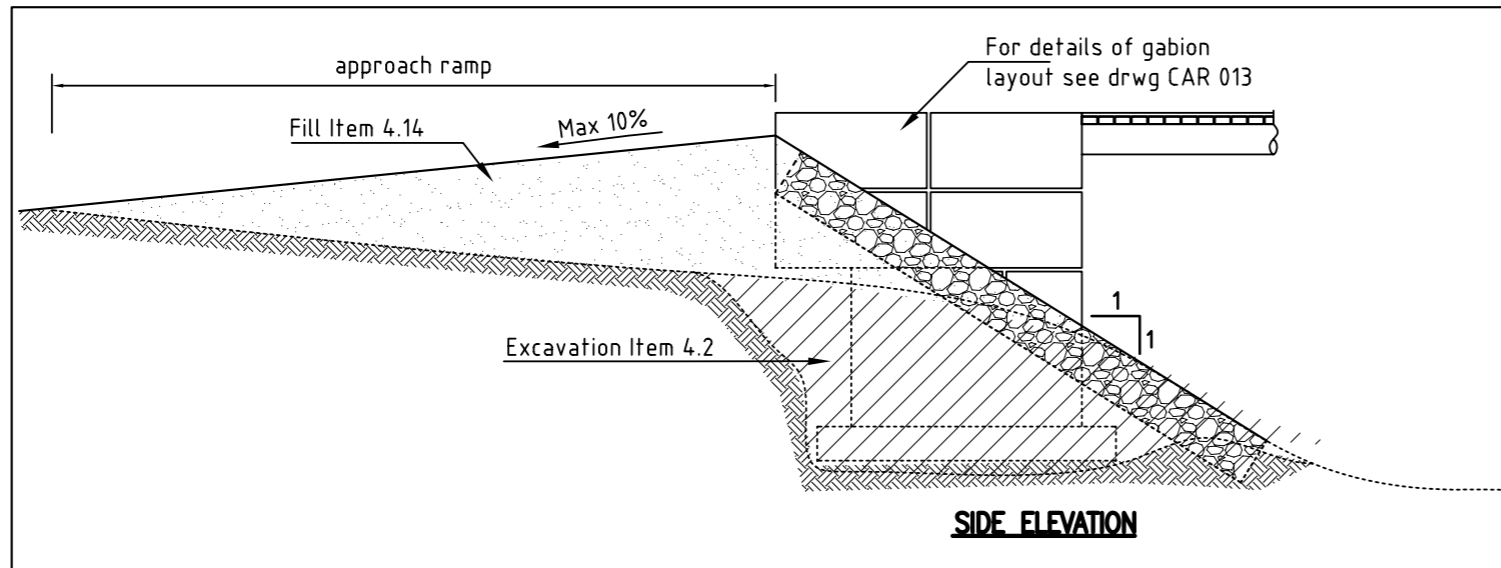
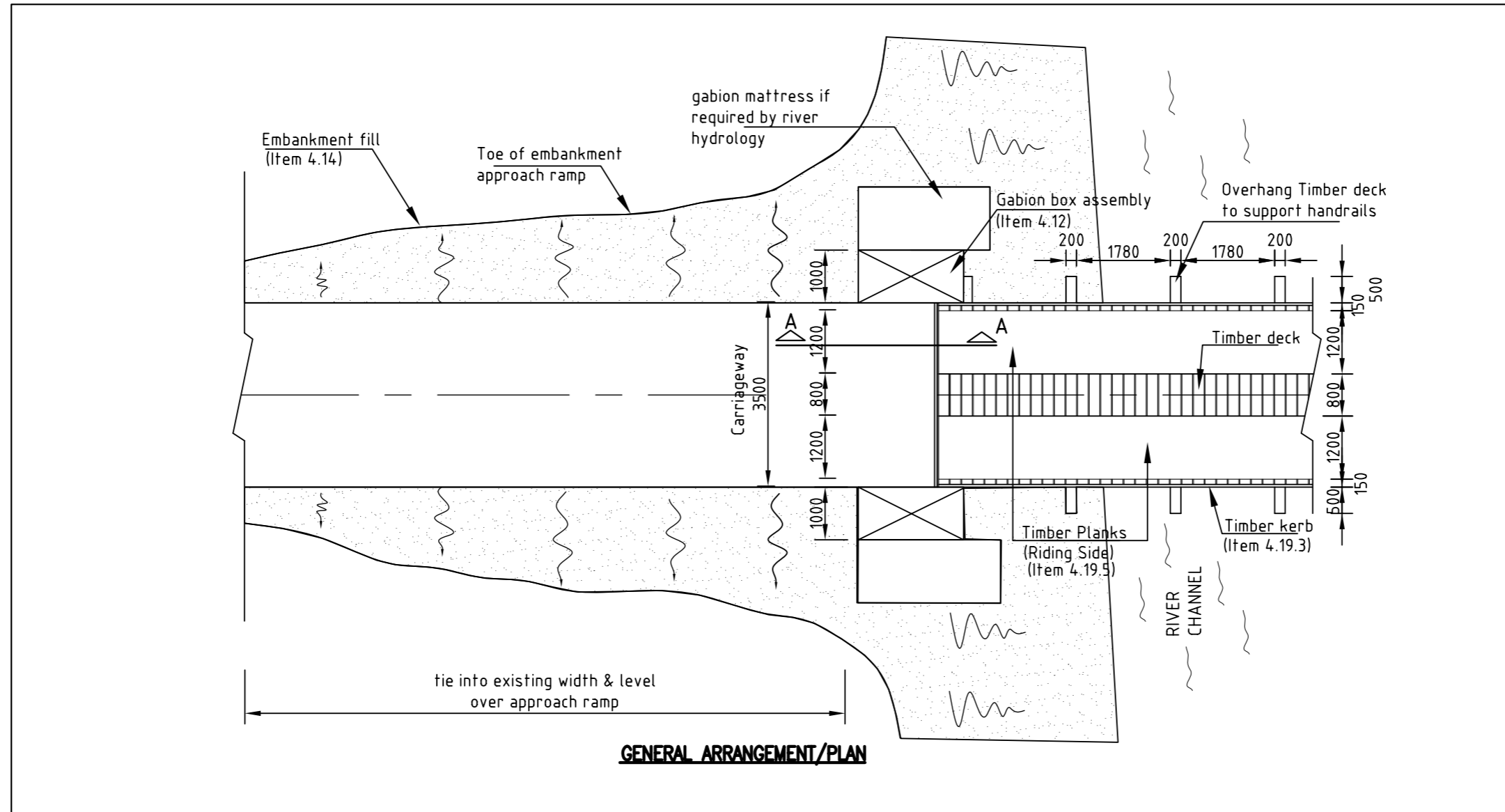
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	Title: <b>STANDARD CAS MANUAL</b>	ACCESS ROADS CULVERT HEAD AND WING WALLS IN GROUTED STONES		Dimension: mm
		Project No.	Sheet:	Drawing No.
	Drawn by: RL	Checked by: JC	Approved by:	Date:
Rev. no	Revision note	Date	Sign	Chkd


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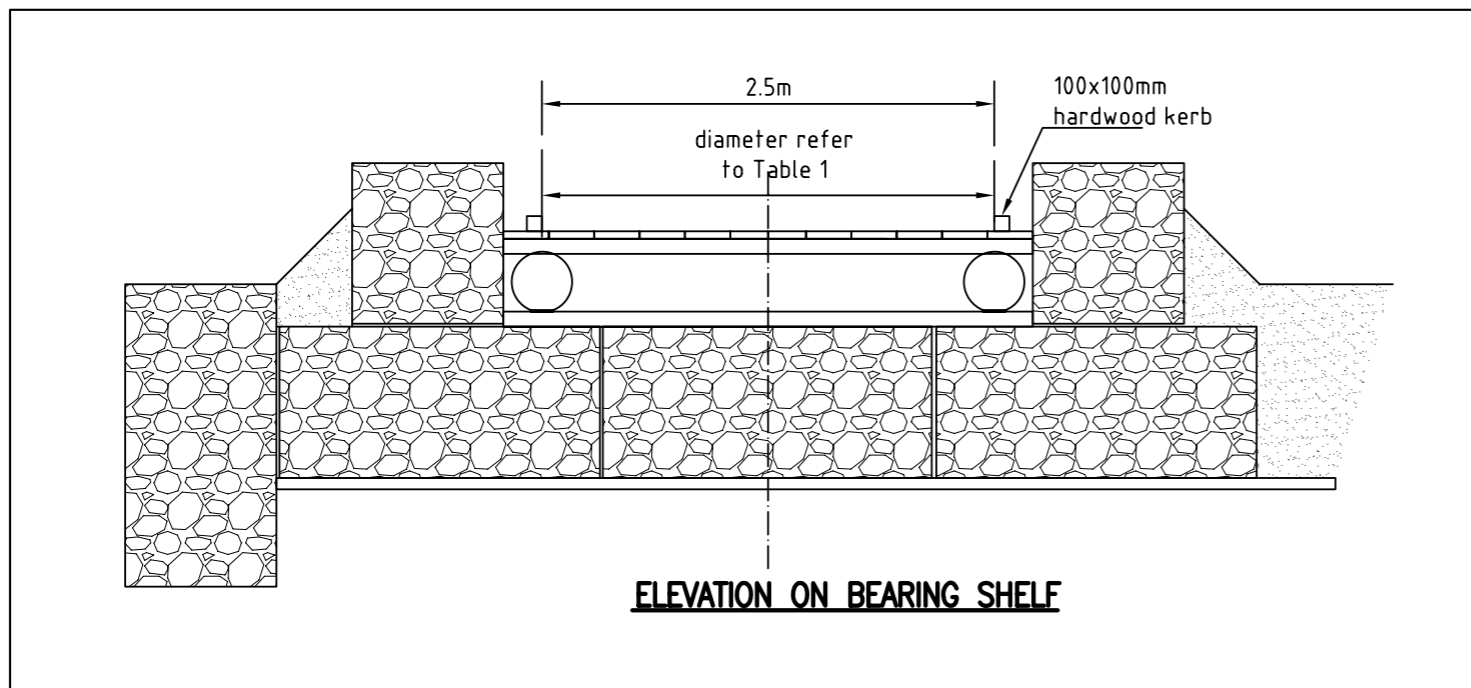
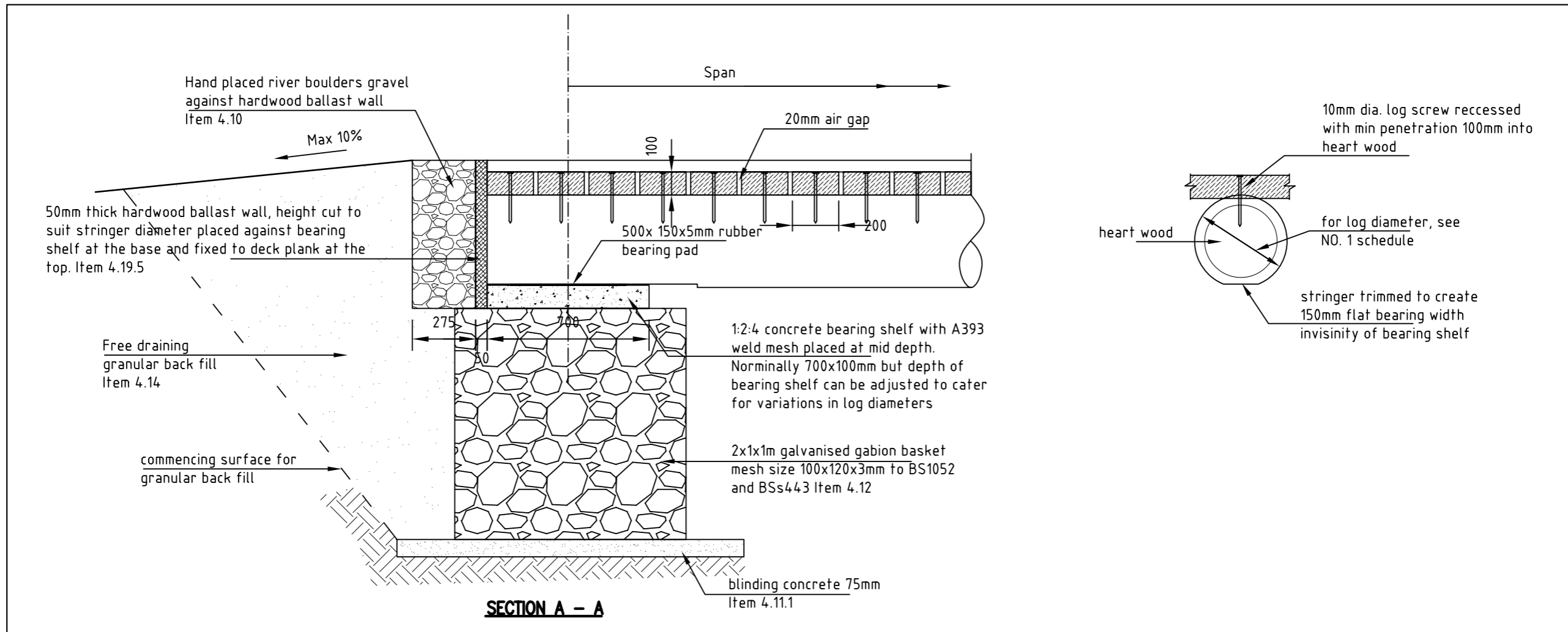
**Section A-10**  
**Community Access Roads, Bridges**

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<b>Drawing Title</b>	<b>Drawing Number</b>
Bridge General Arrangement /Plan & Side Elevation in Gabion Abutment	CAR 011
Bridge Section A-A and Bearing Shelf Elevation	CAR 012
Bridge Section, Bearing Shelf and Abutment Options 1, 2, & 3	CAR 013
Bridge Substructure Construction Sequence (Gabion Abutment)	CAR 014
Steel Bridge Plan & Side Elevation	CAR 015
Steel Bridge Connections	CAR 016




 THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX : 321364, 321425	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>			Scale:		
	Title: <b>STANDARD CAS MANUAL</b>		<b>BRIDGE GENERAL ARRANGEMENT/PLAN &amp; SIDE ELEVATION IN GABION ABUTMENT</b>		Dimension: mm	
	Project No.	Sheet:	Drawing No.		Date: Sept '06	
	Drawn by: ODan	Checked by: JC	Approved by:		CAR 011	
Rev. no	Revision note			Date	Sign	Chkd



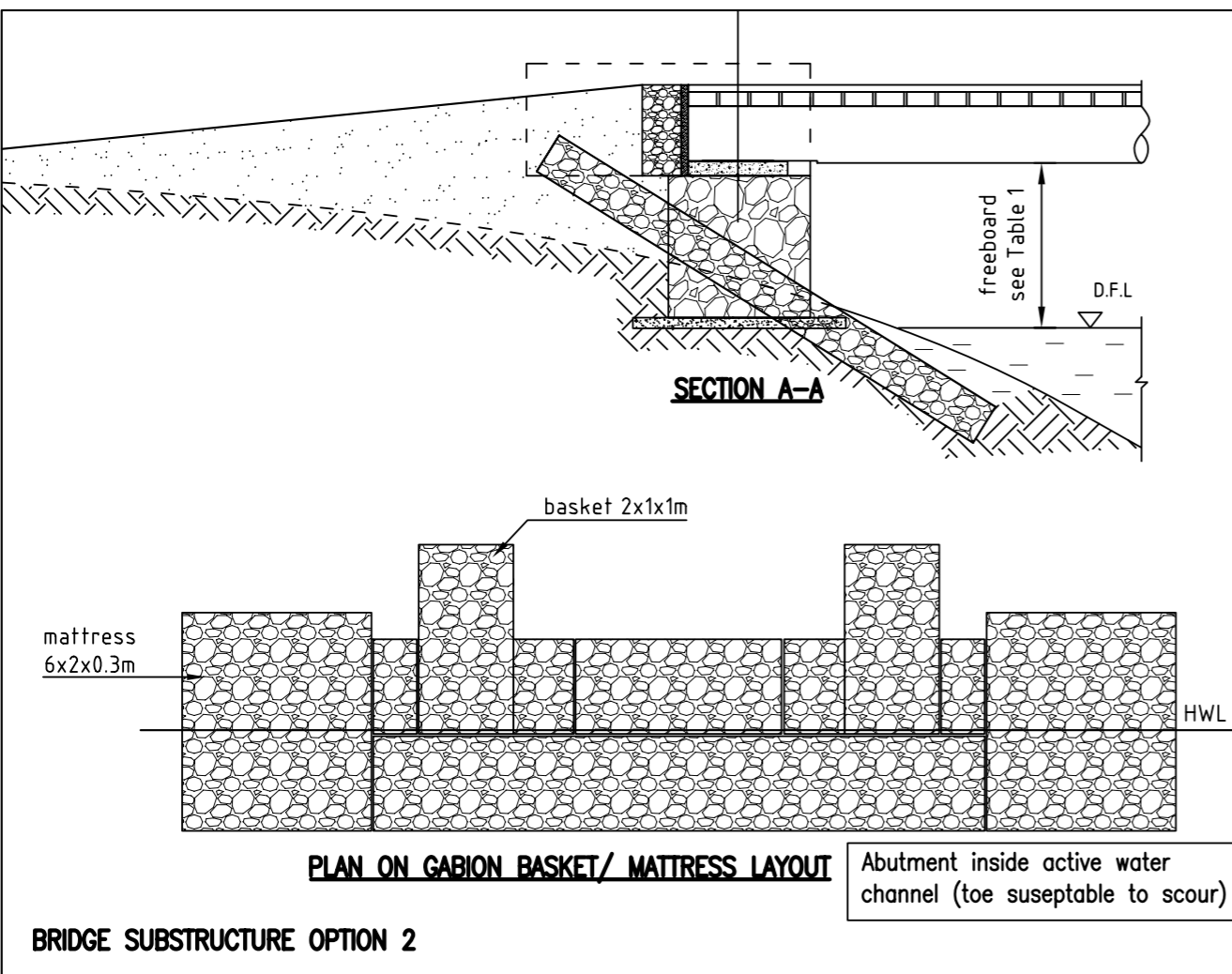
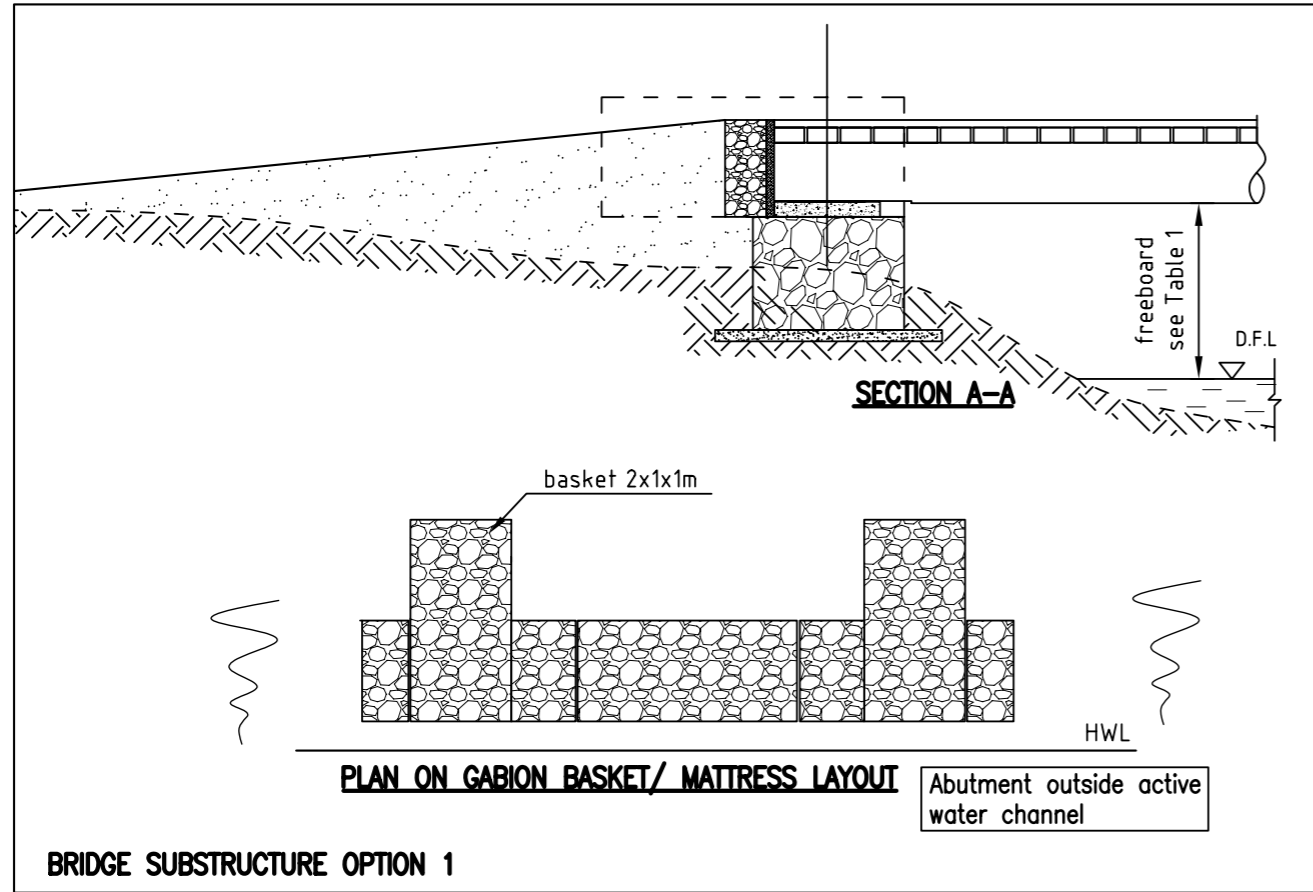
SCHEDULE OF LOG DIAMETER AND SPAN

SPAN m	10 TONNE DESIGN LOAD		20 TONNE DESIGN LOAD			
	NUMBER OF LOGS	DIAMETER	NUMBER OF LOGS	DIAMETER	NUMBER OF LOGS	DIAMETER
4	5	400	7	400	5	450
6	5	450	6	475	5	500
8	5	500	6	525	5	550
10	5	550	5	600		
12	5	600	5	675		

Table 1

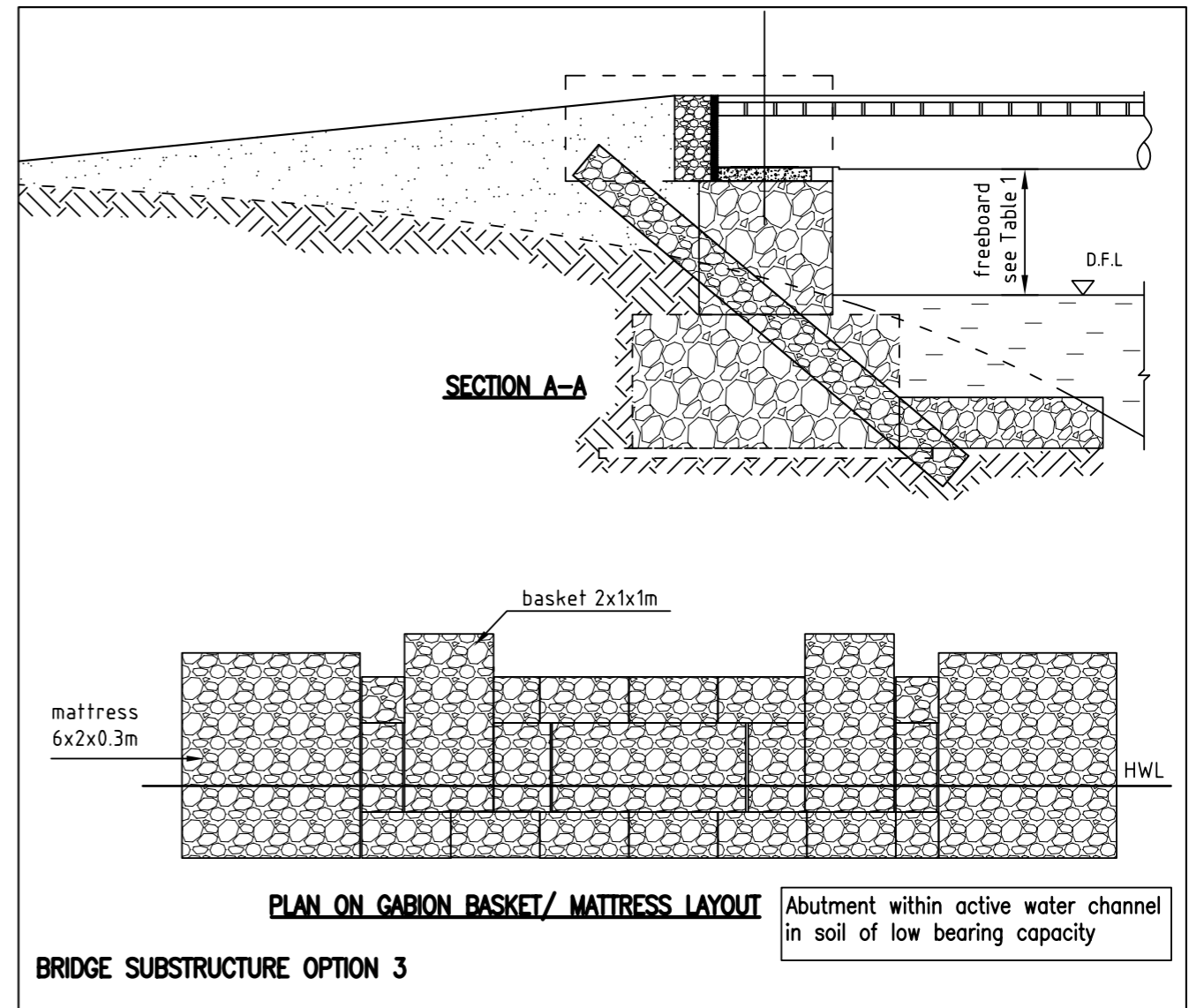
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	Title: <b>STANDARD CAS MANUAL</b>		Title: <b>BRIDGE SECTION A-A AND BEARING SHELF ELEVATION</b>			Dimension: mm
	Project No.		Sheet:		Drawing No. <b>CAR 012</b>	
	Drawn by: ODan	Checked by: JC	Approved by:		Date	Sign
Rev. no	Revision note		Date	Sign	Chkd	




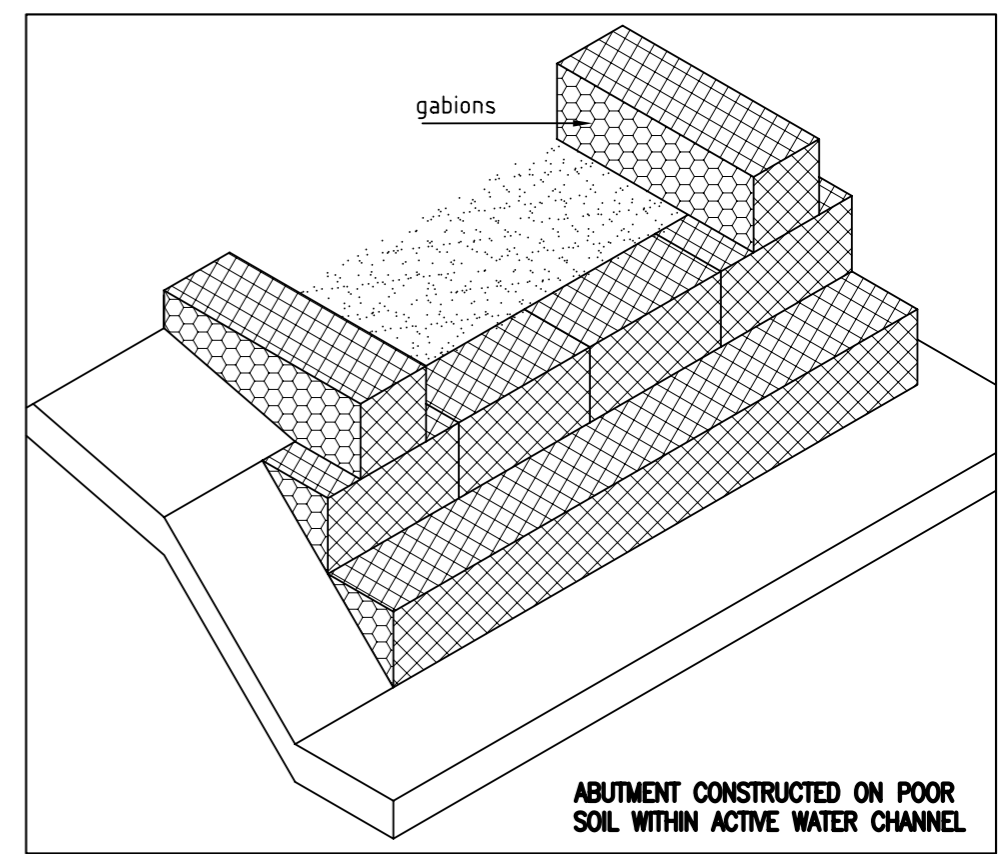
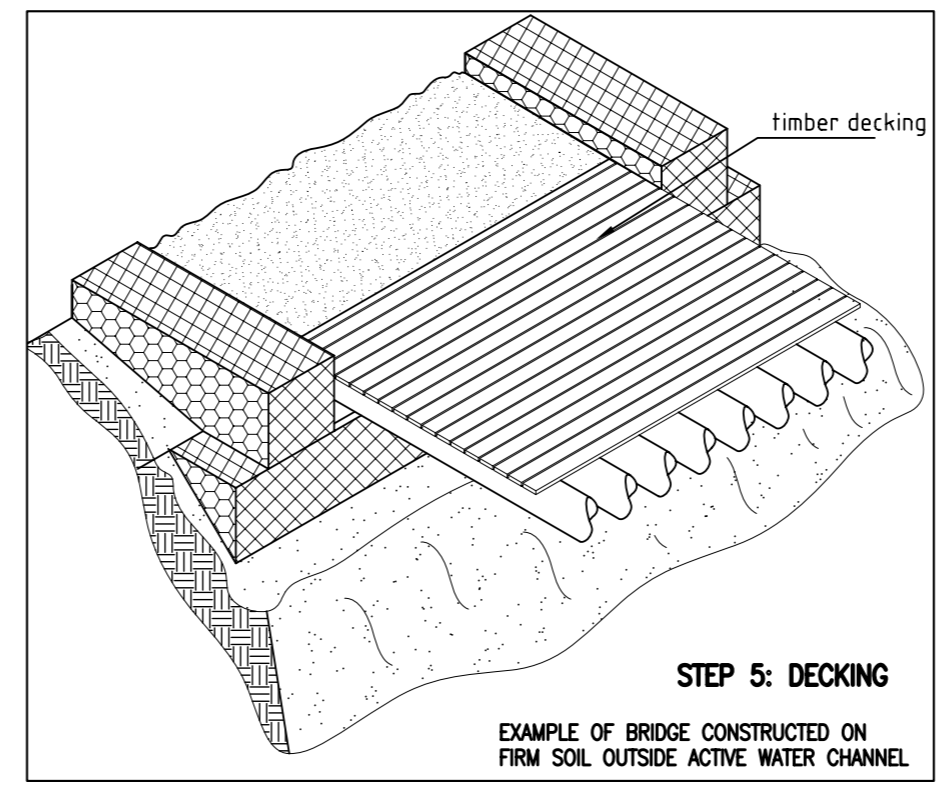
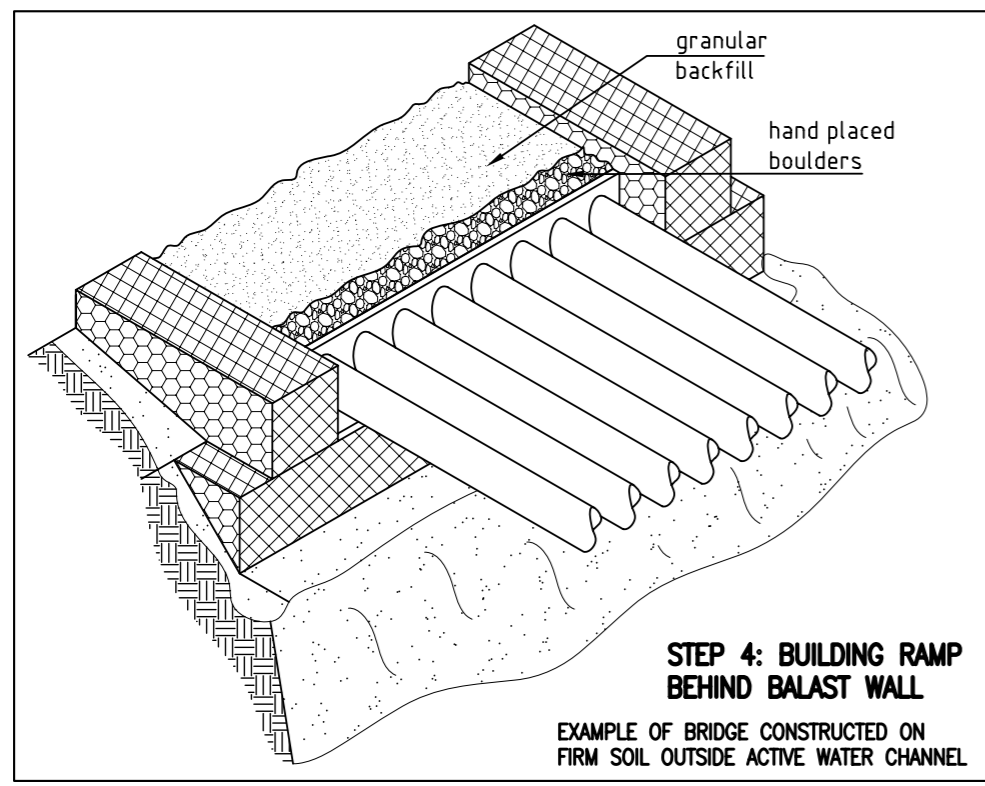
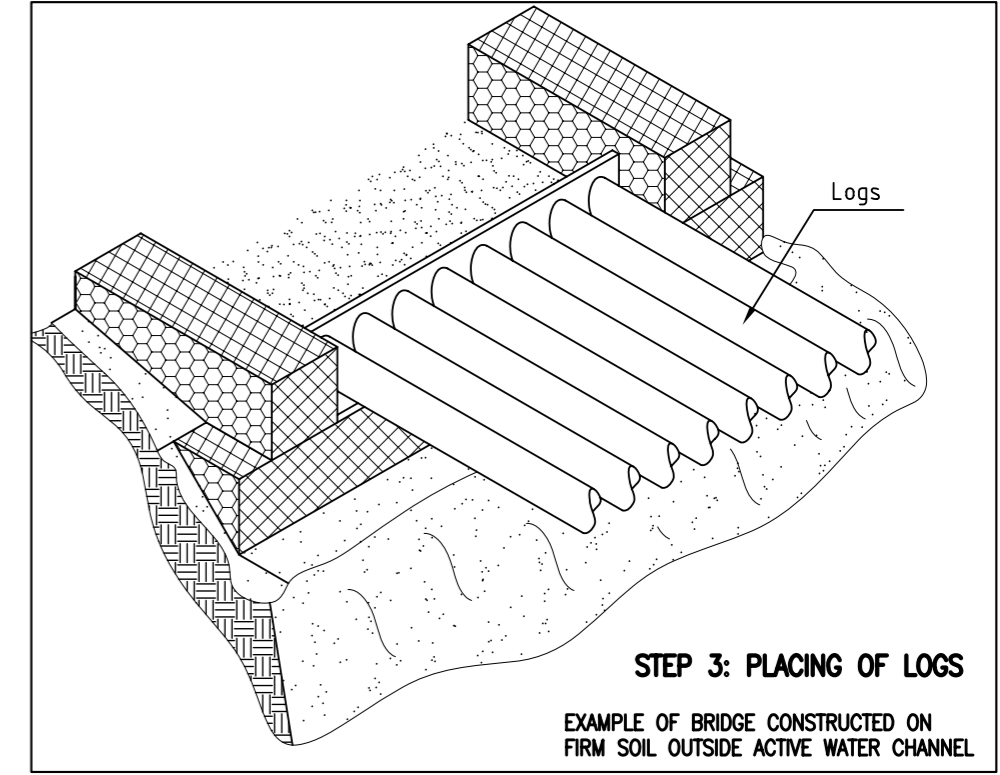
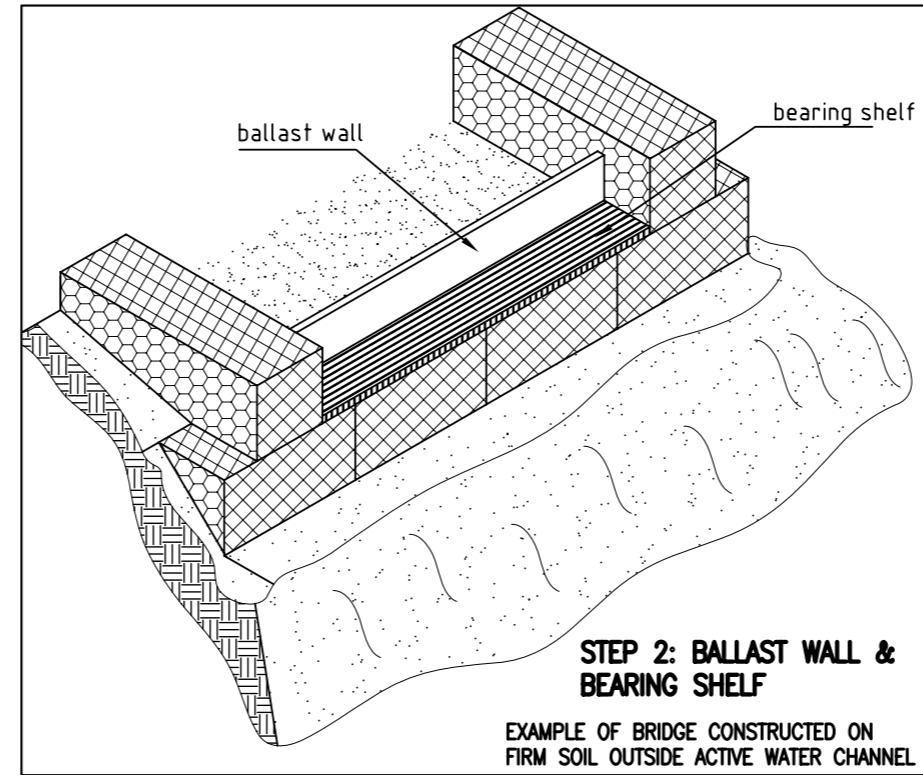
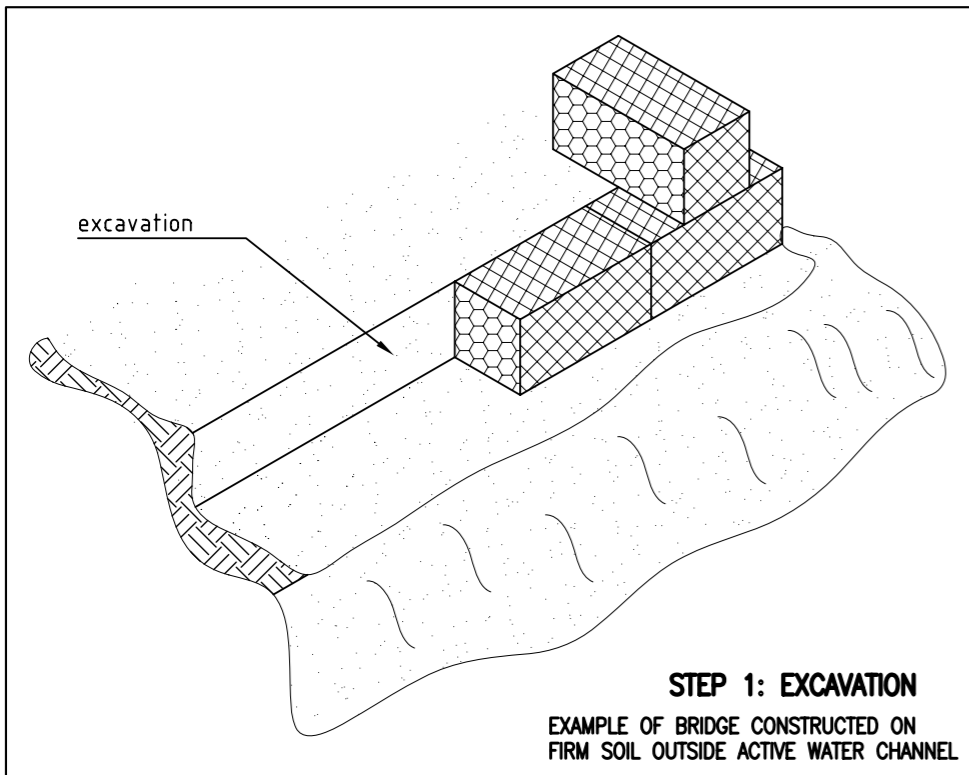


**Table 1**

Freeboard	Discharge (m <sup>3</sup> /sec)
<160	<0.3
450	0.3 - 3.0
600	3.0 - 30.0
900	300 - 300.0
1200	>300

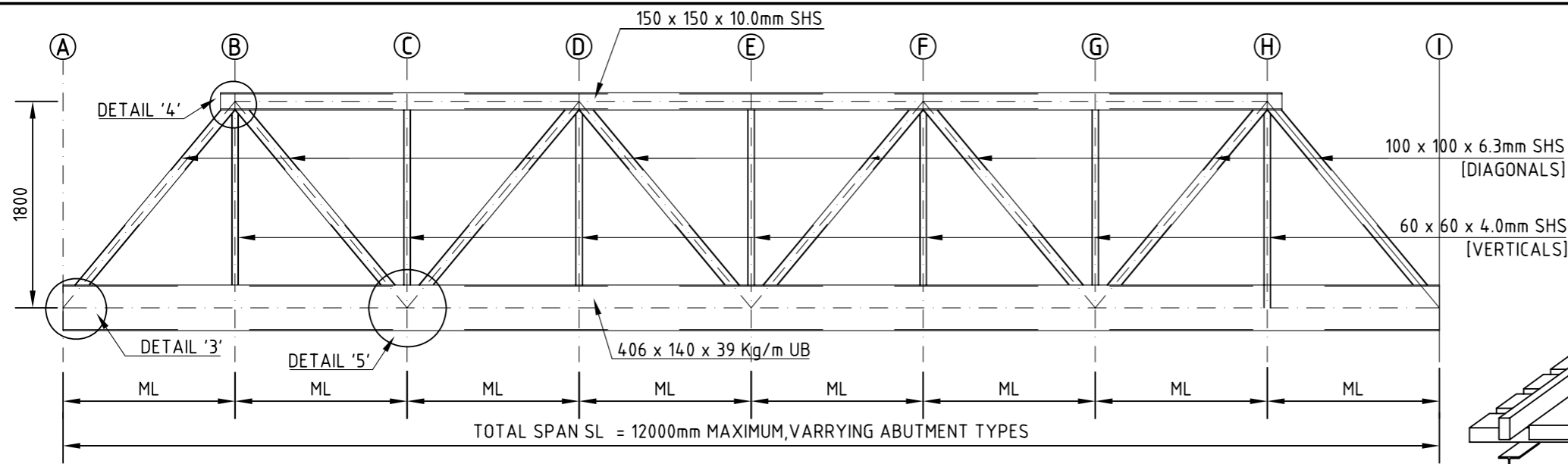


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	Title: <b>STANDARD CAS MANUAL</b>		Title: <b>BRIDGE SECTION, BEARING SHELF AND ABUTMENT OPTIONS 1, 2 &amp; 3</b>		
	Project No.		Sheet:	Drawing No.	
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Rev. no	Revision note	Date	Sign	Chkd	

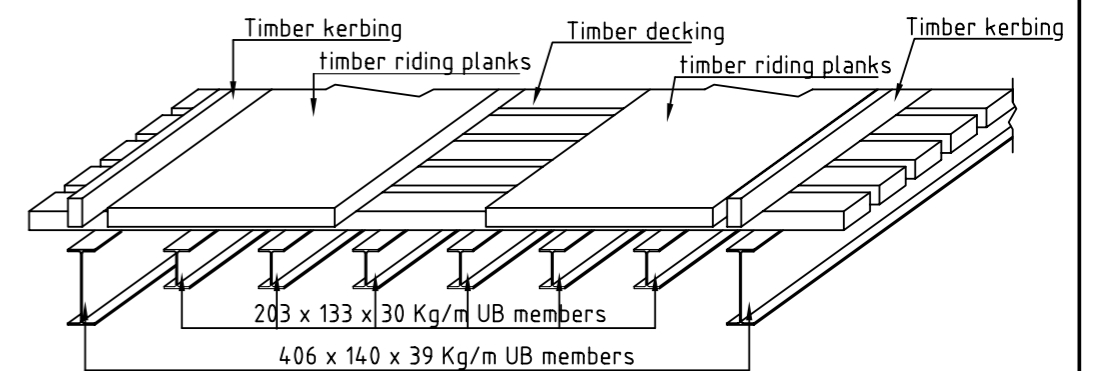


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P.O. Box 10, ENTEBBE, UGANDA  
TELEPHONE: 320101, 320909  
TELEFAX : 321364, 321425

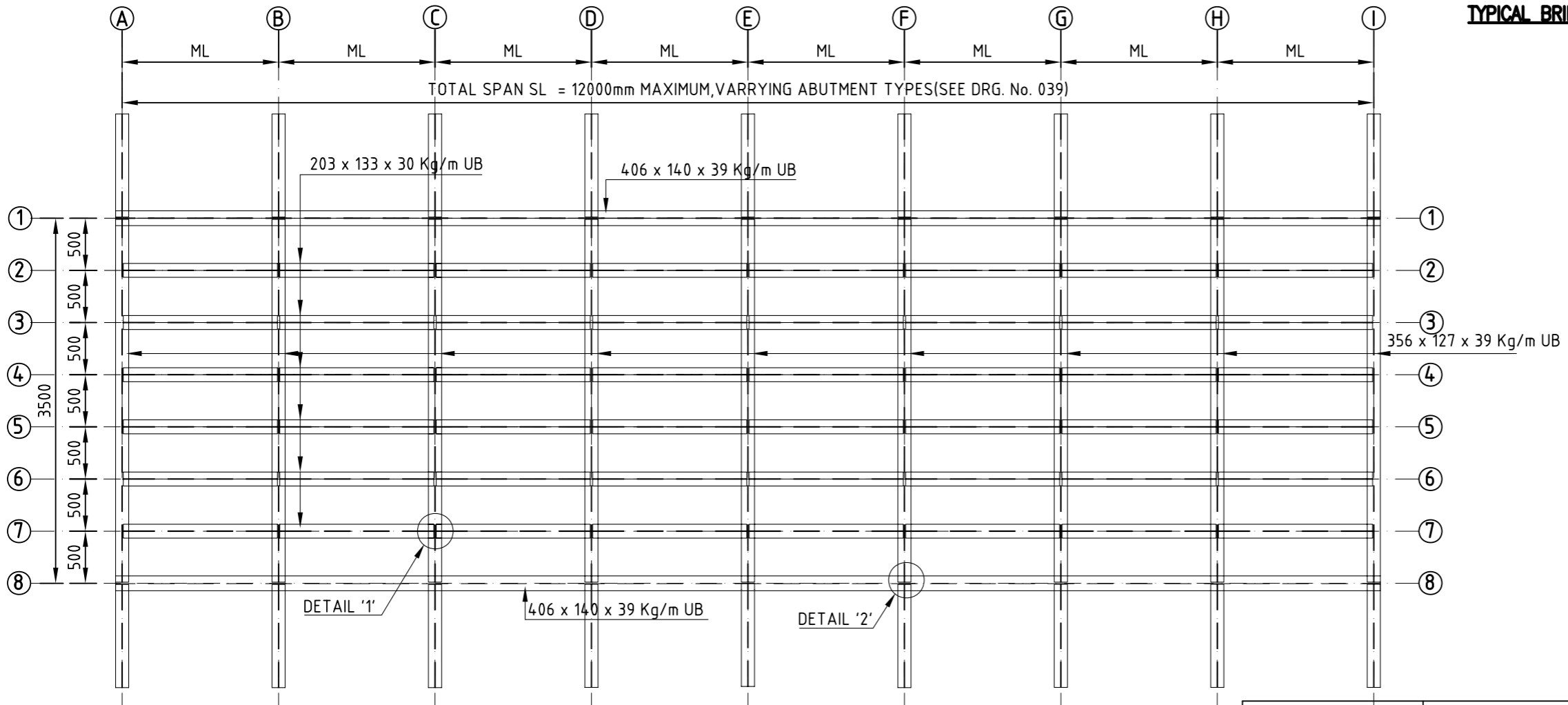
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Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm	
Title: <b>BRIDGE SUBSTRUCTURE CONSTRUCTION SEQUENCE (GABION ABUTMENTS)</b>		Date: Sept '06	
Project No.	Sheet:	Drawing No.	
Drawn by: ODan	Checked by: JC	Approved by:	
		<b>CAR 014</b>	
Rev. no	Revision note	Date	Sign
			Chkd




**TYPICAL BRIDGE TRUSS SIDE ELEVATION**



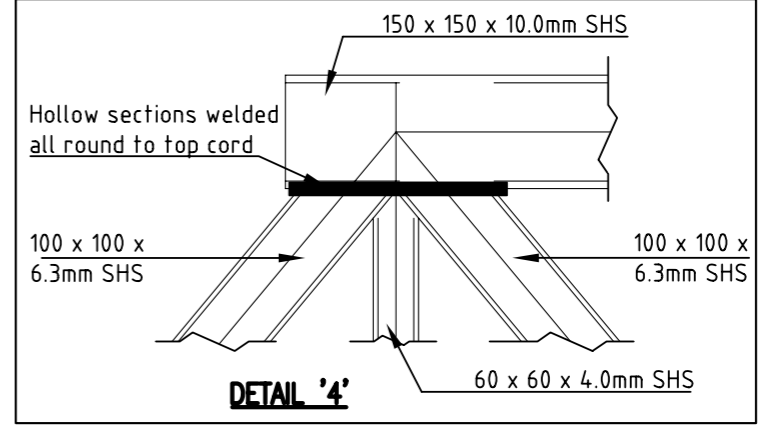
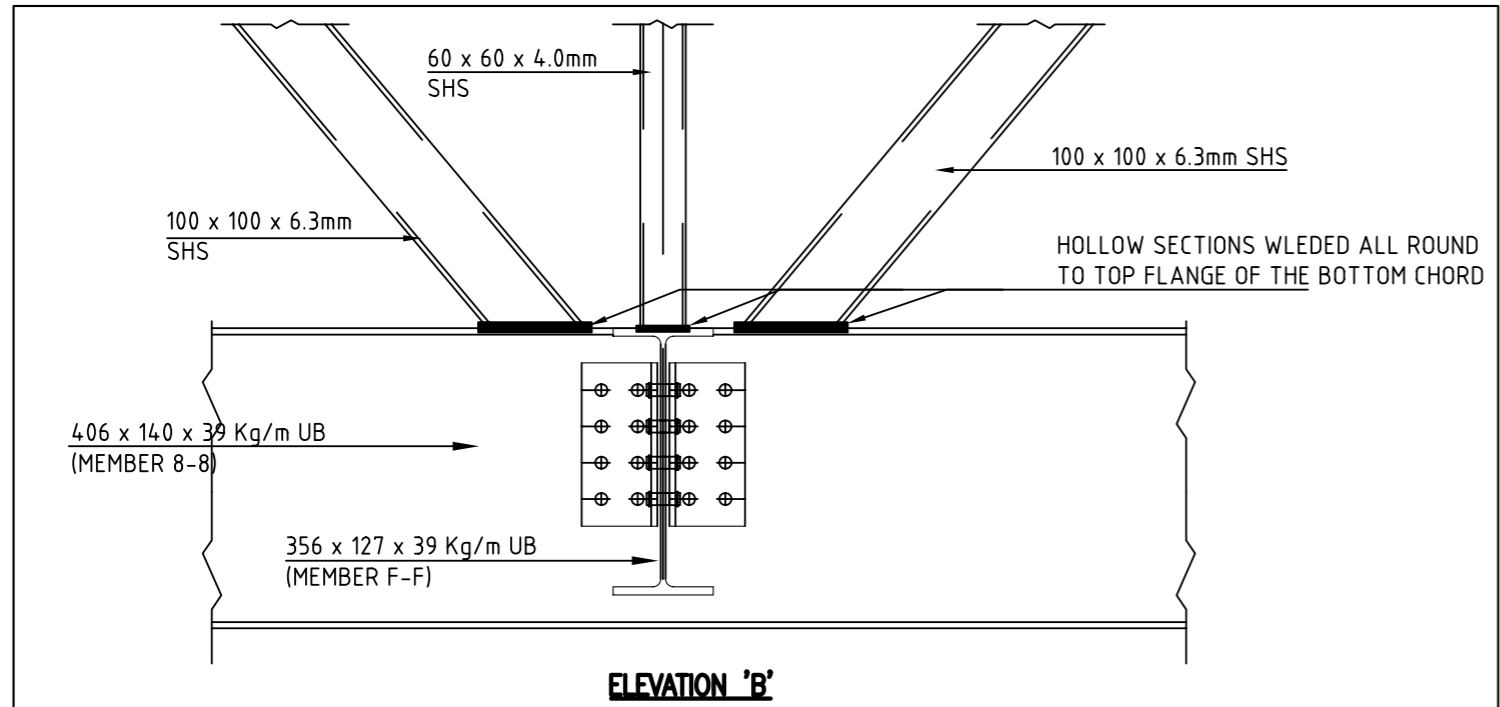
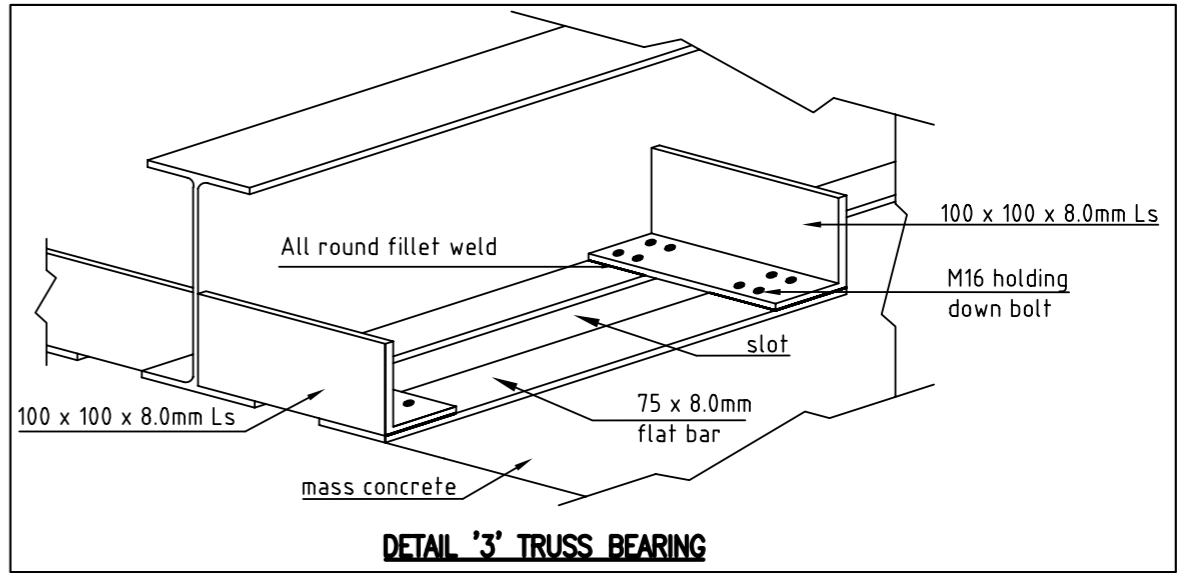
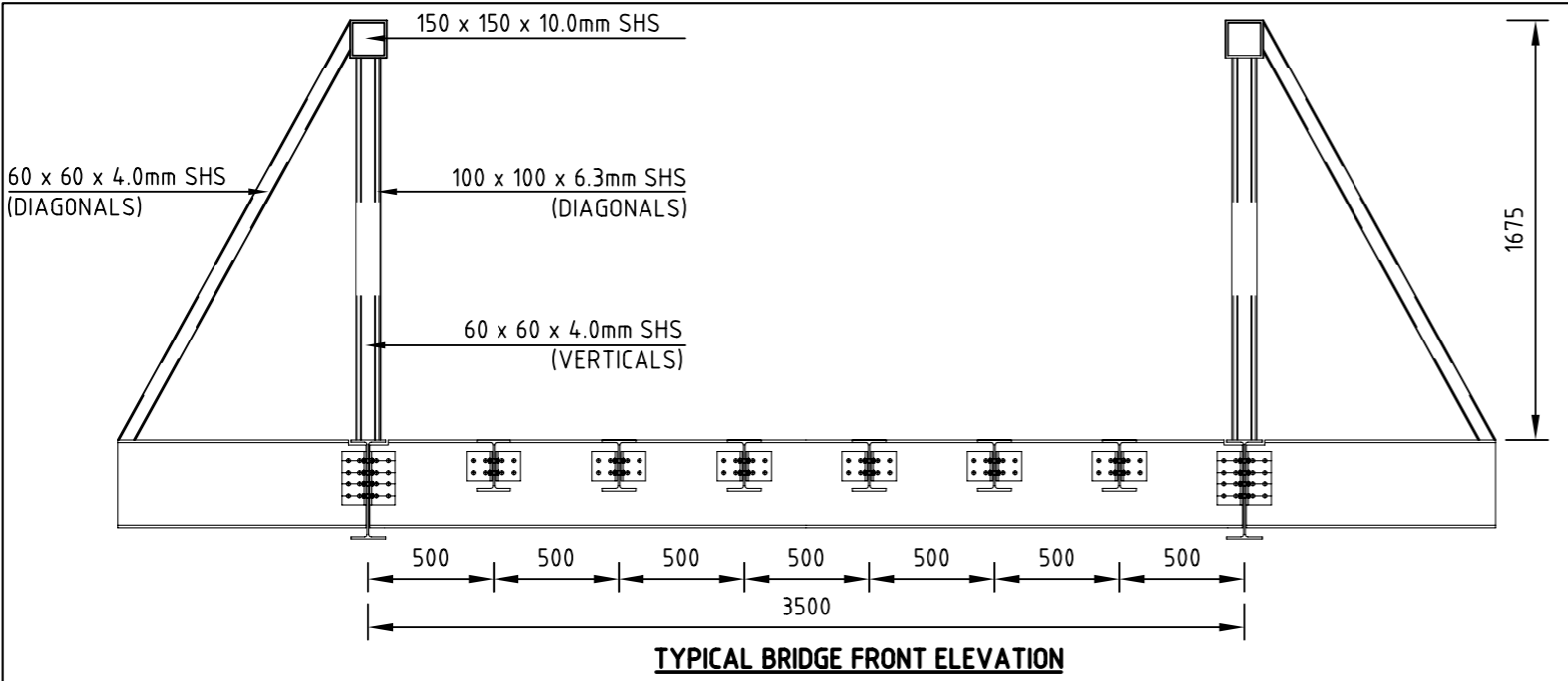
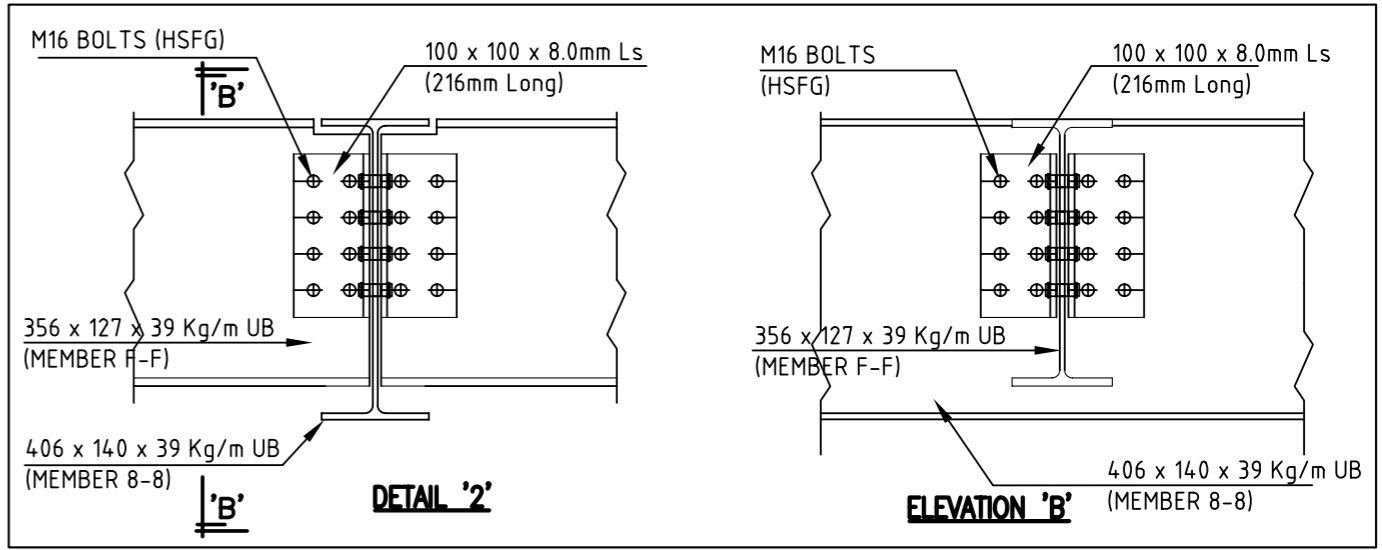
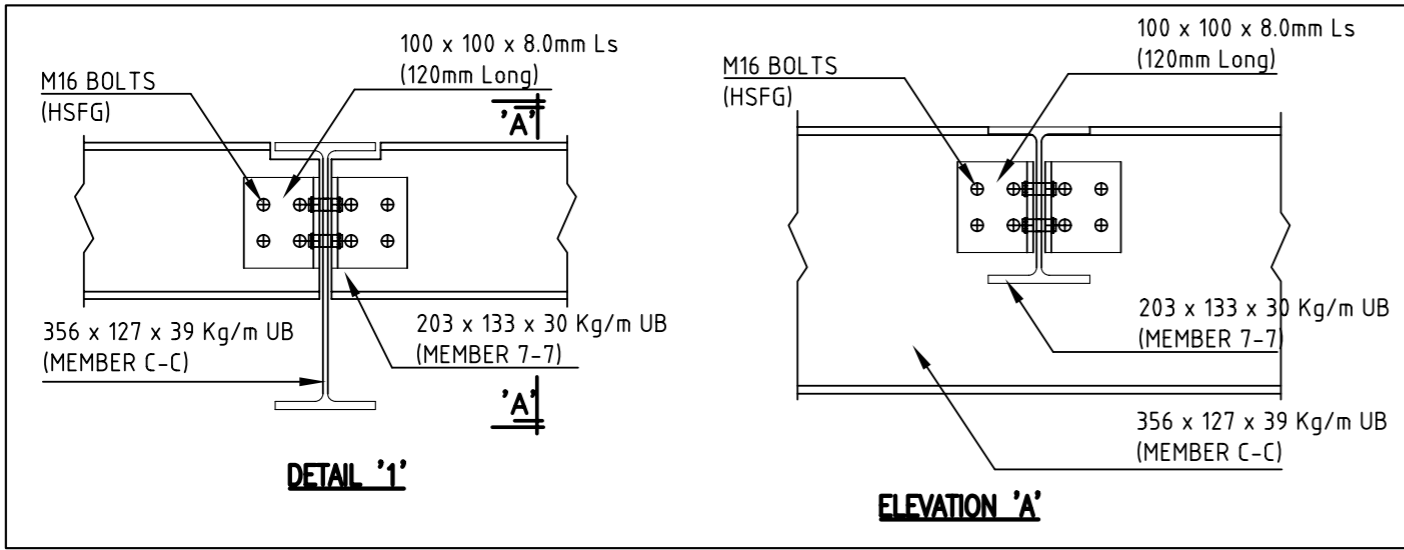
**TYPICAL BRIDGE DECKING ARRANGEMENT**



**TYPICAL STEEL BRIDGE GENERAL ARRANGEMENT PLAN**

 <p>THE REPUBLIC OF UGANDA MINISTRY OF WORKS AND TRANSPORT P.O. Box 10, ENTEBBE, UGANDA TELEPHONE: 320101, 320909 TELEFAX : 321364, 321425</p>	Project: <b>COMMUNITY ACCESS SUPPORT PROGRAMME</b>		Scale:
	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm
	Title: <b>STEEL BRIDGE PLAN AND SIDE ELEVATION</b>		Date: Sept '06
	Project No.	Sheet:	Drawing No. <b>CAR 015</b>
Drawn by: ODan	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign Chkd





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	Title: <b>STANDARD CAS MANUAL</b>		Dimension: mm
	Title: <b>STEEL BRIDGE CONNECTIONS</b>		Date: Sept '06
	Project No.	Sheet:	Drawing No. <b>CAR 016</b>
Drawn by: ODan	Checked by: JC	Approved by:	
Rev. no	Revision note	Date	Sign
			Chkd



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## Section A-11

### Technical Specifications

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**Bill 1 : Site Preparatory Works**

**Bill 2 : Setting Out and Site Clearance Works;Roads**

**Bill 3 : Earthworks**

**Bill 4 : Drainage Works**

**Bill 5 : Gravelling and Completion Works**

**Bill 7 : Footsteps and Ladders**

**BILL 1: SITE PREPARATORY WORKS****ITEM 1.1 Construction of access roads to quarry sites including maintenance throughout the working period****DESCRIPTION:**

- Access roads shall be opened in areas where quarries, approved by the Engineer for materials including surfacing aggregates, selected fill and other materials, are located away from the road to facilitate the ease of movement for haulage equipment from the Site(s) of the Works to the quarry site(s).
- The access roads, their routes and alignment shall be approved by the Engineer.
- Where such access roads cross community owned land/private property, agreement for the access roads shall be obtained from the local authorities/owners by the Contractor and confirmed in writing by the Engineer.
- In the case of supply of required construction material (gravel, hardcore, culverts, etc.) to make the access roads passable, the Rate quoted for this Item by the Contractor shall be full compensation for all activities performed under this Item.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Item consists of the following activities:
  - Setting out (alignment and width)
  - Clearing (bushes, trees, grass)
  - Levelling (fill potholes, remove humps)
  - Opening of the drainage system
  - Maintaining throughout the working period.

**QUALITY CONTROL:**

- Allow for easy and undisturbed hauling.
- No tests required.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
1.1	Construction of access roads to quarry sites including maintenance throughout the working period	Lump Sum	MBC

**Payment:** The Engineer shall effect payment for this Item in proportion to the total value of the Works performed at the time of preparation of the next Payment Certificate and following completion of the access road(s) and upon approval of the works.

**BILL 1: SITE PREPARATORY WORKS****ITEM 1.2 Construction of detours including maintenance throughout the working period****DESCRIPTION:**

- Deviations shall be opened and constructed where traffic cannot be accommodated on the road or road section due to the nature of the Works.
- Deviations are required until the road or road section on which Works are being performed can be reopened for normal traffic.
- Deviations, their standard, length and alignment, shall be approved by the Engineer.
- In the case of supply of required construction material (gravel, hardcore, culverts, etc.) to make the deviations passable, the Rate quoted for this Item by the Contractor shall be full compensation for all activities performed under this Item.
- Traffic signs and traffic control measures for deviations are not part of this Item but are covered under Preliminary and General **Item 6.3**, Traffic Accommodation.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Item consists of the following activities:
  - Setting out (alignment and width);
  - Clearing (bushes, trees, grass);
  - Levelling (fill potholes, remove humps);
  - Maintaining throughout the working period;
  - Drainage system

**QUALITY CONTROL:**

- Allow for easy and undisturbed traffic.
- No tests required.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
1.2	Construction of deviations including their maintenance throughout the working period	Lump Sum	MBC

**Payment:** The Engineer shall effect payment for this Item in proportion to the total value of the Works performed at the time of preparation of the next Payment Certificate and following completion of the deviation(s) and upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, ROADS****ITEM 2.1 (Re) Establishment of road alignment and setting out of road Works****DESCRIPTION:**

- This Item consists of the setting out of the geometric alignment of the centre line of the road at 10 metre intervals by using appropriate methods as described in reference **Volume 4, Manual A, Section E.1**
- Chainage reference pegs shall be placed at 20 metre intervals at both edges of the area to be cleared from bush. Refer **Volume 4, Manual A, Section E.1 and E 2.1**
- This Item also consists of setting out working and material deposit and disposal areas for all activities as described in **Volume 4, Manual A, Sections E and F**
- This Item also consists of setting out of the alignment, dimensions and levels for drainage structures.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- Setting out shall be done using simple measuring aids, including tape measure, ranging rods, line and level, strings and pegs, templates and profile boards.
- The Contractor shall use the Drawings provided by the Employer and the reference points, lines and levels provided by the Engineer to determine the location of the road centreline and measures related to structural works.
- For structural works, profile boards with strings outlining the outer dimensions and reference levels shall be placed.

**QUALITY CONTROL:**

- Centre line pegs set at 10 metre intervals → to be approved by the Engineer
- Chainage reference pegs set and marked at 20 metres intervals on both sides of the road way 1 metre outside the clearing width → to be checked by the Engineer
- Profile boards with outline dimensions and reference levels for structures placed → to be approved by the Engineer

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.1	(Re) Establishment of road alignment and setting out of road Works	Linear Metre (m) → of road length	AWD

**Payment:** The Engineer shall effect payment for this Item in proportion to the total value of the Works performed at the time of preparation of the next Payment Certificate and following completion of the setting out and upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, ROADS****ITEM 2.2 Clear site of all grass, bushes and boulders (up to 1.5m maximum girth) and Grub all roots of grass and bushes including excavation of top soil from road formation****DESCRIPTION:**

- This Item consists of:
  - Bush clearing including grass cutting in accordance with **Volume 4, Manual A, Section E 2.1**
  - Grubbing in accordance with **Volume 4, Manual A, Section E 2.2**
  - Boulder removal (up to 1.5m maximum girth). Refer **Volume 4, Manual A, Section E 2.4**
  - Excavation of topsoil including anthills and other unsuitable materials and depositing in approved locations. Refer **Volume 4, Manual A, Sections E 2.2 and E 2.5**
- The above material shall be deposited well outside the cleared area at locations approved by the Engineer.
- In side-long ground, the above material shall be deposited well outside the cleared area on the lower side (valley side) of the road.
- Neither protected flora nor historical relics shall be damaged. The Engineer shall be informed if these are encountered who will then direct the Contractor as to the appropriate action to be taken.
- Burning of cut grass and shrubs shall only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Item consists of cutting the vegetation, digging out the roots, excavating the topsoil, loading into wheelbarrows all material and other surface litter, hauling and disposing the same away from drains and the cleared area.
- Boulders with a maximum girth of not more than 1.5m can be loaded into wheelbarrows and deposited outside the cleared area. In cases where structures and scour checks are to be constructed using rubble stones, the Contractor is advised to stockpile boulders neatly so that these stones may be available for use.

**QUALITY CONTROL:**

- Cleared areas to be free of organic materials and boulders as specified in **Volume 4, Manual A, Section E 2**. All works to be checked by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.2	Clear site of all grass, bushes and boulders (up to 1.5m maximum girth) and Grub all roots of grass and bushes including excavation of top soil from road formation	Linear Metre (m) → of road length	AWD

**Payment:** The Engineer will effect payment of any cleared road length in the following Payment Certificate upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, ROADS****ITEM 2.2.1 Extra over Item 2.2 for boulders over 1.5m maximum girth****DESCRIPTION:**

- This Item consists of removing boulders over 1.5m maximum girth in accordance with **Volume 4, Manual A, Section E 2.4**
- The boulders or boulder pieces shall be deposited well outside the cleared area at locations approved by the Engineer.
- In side-long ground, the material shall be deposited well outside the cleared area on the lower side (valley side) of the road.
- This Item, paid as Day Work, shall be carried out only upon the explicit and written instruction of the Engineer who will, together with the Contractor, estimate the number of required worker and/or equipment days.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Item may be carried out using any of the following methods:
  - Rolling the boulder to the edge of the roadway
  - Burying the boulder in dug hole (below the subgrade level)
  - Splitting the boulder using fire and water method
  - Splitting the boulder using wedges and feathers
  - Towing/pushing the boulder using labour and/or equipment
  - Blasting the boulder with explosives.
- Care must be taken when using explosives and the relevant rules and regulations strictly adhered to and all unauthorised persons banned from the Site.
- Split boulder pieces can be loaded into wheelbarrows and deposited outside the cleared area. In cases where structures and scour checks are to be constructed using rubble stones, the Contractor is advised to stockpile boulders neatly so that these stones may be available for possible later use.

**QUALITY CONTROL:**

- Cleared areas to be free from boulders as specified in **Volume 4, Manual A, Section E 2** and to be checked by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.2.1	Extra over Item 2.2 for boulders over 1.5m maximum girth.	Day Work	AWD

**Payment:** The Engineer will, firstly, approve this Work to be performed, and secondly, effect payment of any cleared road length in the following Payment Certificate upon completion and approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, ROADS****ITEM 2.3 Cut and remove from site trees (up to 1 m girth), including removal of stumps and roots.****DESCRIPTION:**

- This Item includes the felling of trees **up to 1 m girth** within previously cleared areas including removal of their stumps in accordance with **Volume 4, Manual A, Section E 2.3**
- The girth measurement shall be taken 1 m above the ground.
- The cut material shall be deposited well outside the cleared area at locations approved by the Engineer.
- Burning of felled trees and tree cuttings shall only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- Trees may be cut using handsaw, bow saw, axe or chain saw.
- Care must be taken when felling trees. Unauthorised persons shall not be allowed within the vicinity of the Site.
- Timber from trees can be loaded into wheelbarrows and deposited well outside the cleared area.
- Timber from cut trees may be used for scour checks, setting out pegs and for the construction of water barriers and deviations.

**QUALITY CONTROL:**

- Cleared area to be free from trees as specified in **Volume 4, Manual A, Section E 2.3** and to be checked by Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.3	Cut and remove from site trees (up to 1 m girth), including removal of stumps and roots.	Number (No.) → of trees	MBC

**Payment:** The Engineer will effect payment for the actual number of trees felled and cleared for any cleared road length in the following Payment Certificate upon approval of the works.



**BILL 2: SETTING OUT AND SITE CLEARING WORKS, ROADS****ITEM 2.3.1 Extra over Item 2.3 for trees over 1 metre in girth.****DESCRIPTION:**

- This Item includes the felling of trees **above 1 m girth** within the area previously cleared including removal of their stumps in accordance with **Volume 4, Manual A, Section E 2.3**
- The girth measurement shall be taken 1 m above the ground.
- The cut material shall be deposited well outside the cleared area in locations approved by the Engineer.
- Burning of cut trees and tree cuttings may only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- Trees may be cut using handsaw, axe or chain saw.
- Great care must be taken when felling trees. Unauthorised persons are not allowed to be present within the vicinity of the work site.
- Timber from trees can be loaded into wheelbarrows and deposited outside the cleared area.
- Timber from cut trees may be used for scour checks, setting out pegs and for the construction of water barriers and deviations.

**QUALITY CONTROL:**

- Cleared area to be free from trees as specified in **Volume 4, Manual A, Section E 2.3** and to be checked by Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.3.1	Extra over Item 2.3 for trees over 1 metre in girth.	Number (No.) → of trees	MBC

**Payment:** The Engineer will effect payment for the actual number of trees felled and cleared for any cleared road length in the following Payment Certificate upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, TRACKS AND PATHS****ITEM 2.4 Establishment of footpath/track alignment and setting out of Path Works****DESCRIPTION:****The item consists of:**

- The setting out of the geometric alignment of the centre line of the footpath at 10m intervals and at all changes of gradient on sections where steps are proposed as indicated in the contract drawings.
- Fixing chainage reference pegs at 20m intervals at both edges of the area to be cleared. Refer **Volume 4 manual A, section E.1 and E2.1**
- The setting out working areas and areas for temporary stockpiling and permanent disposal of excavated soils.
- Setting out vertically and horizontally drainage structures, retaining walls, boardwalks and turnpikes etc

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- Setting out shall be done using simple measuring aids, including tape measure, ranging rods, line and level, strings and pegs, templates and profile boards.
- The Contractor shall use the Drawings provided by the Employer and the reference points, lines and levels provided by the Engineer to determine the location of the road centreline and measures related to structural works.
- For structural works, profile boards with strings outlining the outer dimensions and reference levels shall be placed.

**QUALITY CONTROL:**

- Centre line pegs set at 10m intervals → to be approved by the Engineer
- Chainage reference pegs set and marked at 20 m intervals on both sides of the footpath way 1m outside of the clearing width → to be checked by the Engineer
- Profile boards at each change of gradient for sections where steps are to be constructed → to be checked by the Engineer
- Profile boards with outline dimensions and reference levels for structures fixed → to be checked by the Engineer

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.1	Establishment of footpath/track alignment and setting out of road Works	Linear Metre (m) → of footpath length where works are scheduled to be undertaken	AWD

**Payment:** The Engineer shall effect payment for this Item in proportion to the total value of the Works performed at the time of preparation of the next Payment Certificate and following completion of the setting out and upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, TRACKS AND PATHS****ITEM 2.5 Clear site of all grass, bushes and boulders (up to 1.5m maximum girth) and Grub all roots of grass and bushes including excavation of top soil from path formation****DESCRIPTION:**

- This Item consists of:
  - Bush clearing including grass cutting in accordance with **Volume 4, Manual A, Section E 2.1**
  - Grubbing in accordance with **Volume 4, Manual A, Section E 2.2**
  - Boulder removal (up to 1.5m maximum girth). **Refer Volume 4, Manual A, Section E 2.4**
  - Excavation of topsoil including anthills and other unsuitable materials and depositing in approved locations. **Refer Volume 4, Manual A, Sections E 2.2 and E 2.5**
- The above material shall be deposited well outside the cleared area at locations approved by the Engineer.
- In side-long ground, the above material shall be deposited well outside the cleared area on the lower side (valley side) of the road.
- Neither protected flora nor historical relics shall be damaged. The Engineer shall be informed if these are encountered who will then direct the Contractor as to the appropriate action to be taken.
- Burning of cut grass and shrubs shall only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Item consists of cutting the vegetation, digging out the roots, excavating the topsoil, loading into wheelbarrows all material and other surface litter, hauling and disposing the same away from drains and the cleared area.
- Boulders with a maximum girth of not more than 1.5m can be loaded into wheelbarrows and deposited outside the cleared area. In cases where structures and scour checks are to be constructed using rubble stones, the Contractor is advised to stockpile boulders neatly so that these stones may be available for use.

**QUALITY CONTROL:**

- Cleared areas to be free of organic materials and boulders as specified in **Volume 4, Manual A, Section E 2**. All works to be checked by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.5	Clear site of all grass, bushes and boulders (up to 1.5m maximum girth) and Grub all roots of grass and bushes including excavation of top soil from road formation within the corridor specified on the drawings	Linear Metre (m) → of road length	AWD

**Payment:** The Engineer will effect payment of any cleared road length in the following Payment Certificate upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, TRACKS AND PATHS****ITEM 2.6 Cut and remove from site trees (up to 1 m girth), including removal of stumps and roots.****DESCRIPTION:**

- This Item includes the felling of trees **up to 1 m girth** within previously cleared areas including removal of their stumps in accordance with **Volume 4, Manual A, Section E 2.3**
- The girth measurement shall be taken 1 m above the ground.
- The cut material shall be deposited well outside the cleared area at locations approved by the Engineer.
- Burning of felled trees and tree cuttings shall only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- Trees may be cut using handsaw, bow saw, axe or chain saw.
- Care must be taken when felling trees. Unauthorised persons shall not be allowed within the vicinity of the Site.
- Timber from trees can be loaded into wheelbarrows and deposited well outside the cleared area.
- Timber from cut trees may be used for scour checks, setting out pegs and for the construction of water barriers and deviations.

**QUALITY CONTROL:**

- Cleared area to be free from trees as specified in **Volume 4, Manual A, Section E 2.3** and to be checked by Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.6	Cut and remove from site trees (up to 1 m girth), including removal of stumps and roots.	Number (No.) → of trees	MBC

**Payment:** The Engineer will effect payment for the actual number of trees felled and cleared for any cleared road length in the following Payment Certificate upon approval of the works.

**BILL 2: SETTING OUT AND SITE CLEARING WORKS, TRACKS AND PATHS****ITEM 2.6.1 Extra over Item 2.6 for trees over 1 metre in girth.****DESCRIPTION:**

- This Item includes the felling of trees **above 1 m girth** within the area previously cleared including removal of their stumps in accordance with **Volume 4, Manual A, Section E 2.3**
- The girth measurement shall be taken 1 m above the ground.
- The cut material shall be deposited well outside the cleared area in locations approved by the Engineer.
- Burning of cut trees and tree cuttings may only be allowed if explicitly approved by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- Trees may be cut using handsaw, axe or chain saw.
- Great care must be taken when felling trees. Unauthorised persons are not allowed to be present within the vicinity of the work site.
- Timber from trees can be loaded into wheelbarrows and deposited outside the cleared area.
- Timber from cut trees may be used for scour checks, setting out pegs and for the construction of water barriers and deviations.

**QUALITY CONTROL:**

- Cleared area to be free from trees as specified in **Volume 4, Manual A, Section E 2.3** and to be checked by Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
2.6.1	Extra over Item 2.6 for trees over 1 metre in girth.	Number (No.) → of trees	MBC

**Payment:** The Engineer will effect payment for the actual number of trees felled and cleared for any cleared footpath/track

**BILL 3: EARTH WORKS****ITEM 3.1 Rehabilitation of existing road formation****ITEM 3.1.1 Reshaping of existing road formation including watering and compaction****DESCRIPTION:**

- This Item shall be applied when the existing road formation requires reshaping only; not to disturb the already existing formation (not new construction). The Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.3**
- The cross-section(s) and measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section B 2**, as specified in the Drawings for this contract, and as instructed by the Engineer.
- The Works for this Item shall be carried out in combination with **Items 3.1.2 and 3.1.3**
- The longitudinal profile shall have a maximum tolerance of + / - 15 mm when checked with a three-metre straight edge.
- Fill material required for the camber formation shall be taken from the side drains, if suitable and approved by the Engineer. Widening and/or deepening of the side drains may be required to obtain sufficient fill material.
- Compaction shall be carried out with a self propelled or towed roller with approved total weight and dimension. A minimum of six (6) passes for compaction shall be applied or until no further roller imprint on the surface can be recognised. The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.
- The camber of the compacted formation shall have a cross fall of no less than 8% and a maximum tolerance of + / - 1% when checked with a camber board.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works. **Compaction**, however, shall be carried out using approved compaction **equipment**.
- Using **Labour method** for reshaping includes:
  - establishing road formation levels using profile boards or boning rods,
  - establishing profile guides at 10m intervals,
  - reshaping of formation and filling of depressions using approved borrow material from the side drains or if necessary from approved quarries, and spread material from road centre to shoulder break point to required levels and camber cross-fall,
  - watering and compacting the formation with towed or self-propelled roller.
- Using **Equipment method** for reshaping includes:
  - establishing road formation levels using profile boards or boning rods,
  - scarifying of existing formation to a minimum depth of 10cm with grader (towed or self propelled),
  - add extra fill material borrowed from side drains as required using labour,
  - spreading to required levels and camber cross-fall with grader,
  - watering,
  - compacting the formation with towed or self-propelled roller.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for **Item 3.1.2** and consist of:

Test	Method	Frequency	Tolerance
Width of formation (carriageway + shoulders)	Tape	every 100 m	+50 / -20 mm
Camber (cross-fall)	Camber Board	every 50 m	+ / - 1%
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Drain dimensions	Template / Tape	every 100 m	+ / - 25 mm
Mitre drains; numbers, location, dimensions and gradient	Counting, tape, line-level	all	0
Compaction	Counting passes, checking imprint of roller	completed road section	0

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.1.1	Reshaping of existing road formation including watering & ompaction	Linear Metre (m) → of formation	AWD

**Payment:** The Engineer will effect payment of any completed road length in the following Payment Certificate upon approval of the works.



**BILL 3: EARTH WORKS****ITEM 3.1 Rehabilitation of existing road formation****ITEM 3.1.2 Opening of / re-excavation of side, mitre, catch water and other specified drains****DESCRIPTION:**

- This Item shall be applied when the existing road formation requires reshaping only (not new construction). The Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.3**
- The Item includes opening and/or re-excavation of side drains, mitre drains, catch water drains and other specified drains.
- The Works for this Item shall be carried out in combination with **Item 3.1.1** and **3.1.3**
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Sections B 2 and B 4**, as specified in the Drawings for this Contract, and as instructed by the Engineer.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Item consists of the following labour activities:
  - Opening / re-excavation of side drains,
  - Shaping of inner slopes (check both with ditch – slope template),
  - Shaping of back slopes,
  - Opening / re-excavation of mitre drains (additional mitre drains may be required as instructed by the Engineer) to the correct dimensions and gradient,
  - Opening / re-excavation of catch water drains,
  - Opening / re-excavation of other specified drains,
  - All excavation material to be deposited on the lower side of the drains.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for **Item 3.1.1** regarding drain dimensions.
- Visual inspections of all of these Works and their approval by the Engineer are required to ensure full restoration of the drainage system.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.1.2	Opening / re-excavation of side drain, mitre drain and catch water drains.	Linear Metre (m) → of drains	AWD

**Payment:** The Engineer will effect payment of any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.1 Rehabilitation of existing road formation****ITEM 3.1.3 Opening of culverts****DESCRIPTION:**

- This Item shall be applied when the existing road formation requires reshaping only (not new construction). The Works shall be carried out as detailed in **Volume 4, Manual A, Sections E 4.5 and G 4**
- The Item includes opening of blocked or silted culverts including their inlets and outlets.
- The Works for this Item shall be carried out in combination with **Item 3.1.1** and **3.1.2**
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A**, as specified in the Drawings for this Contract, and as instructed by the Engineer.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Item consists of the following labour activities:
  - Opening of blocked culverts including inlets and outlets,
  - All excavation material to be deposited on the lower side of the drains.

**QUALITY CONTROL:**

- Visual inspections of all of these Works and their approval by the Engineer are required to ensure full restoration of the drainage system.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.1.3	Opening of culverts.	Linear Metre (m) → of culverts	AWD

**Payment:** The Engineer will effect payment of any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.2 (Re-) Construction of road formation****ITEM 3.2.1 Excavation to level****DESCRIPTION:**

- This Item shall be applied when the road formation requires full (re-) construction.
- Excavation to level comprises the cutting of material to form a level road bench or platform and placing the excavated material as fill, or in spoil areas approved by the Engineer.
- When using **labour**, the works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.1**
- When using **equipment**, cut and fill shall be balanced to avoid spoil as much as possible.
- In the case where material has to be borrowed this shall only be done from borrow areas approved by the Engineer and included in **Item 3.3.2**
- The Cross-section(s) and measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section E 3.1**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- The terrace shall be horizontal in the cross-sectional direction and the longitudinal profile shall have a maximum tolerance of + / - 15 mm when measured with a three-metre straight edge.
- The compaction of the fill areas shall be carried out with a self propelled or towed roller with approved total weight and dimension. A **minimum** of six (6) passes of compaction shall be applied or until no roller imprint on the surface can be recognised.
- The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work. **Compaction**, however, must be carried out using approved compaction **equipment**.
- Using **Labour method** of (re-) construction includes:
  - cutting and/or filling of slots at 10 m intervals,
  - cutting and filling as guided by the slots to construct a level road terrace or road sub-base,
  - in case of missing material, excavate in approved borrow areas, haul with wheelbarrows and fill; this work included in **Item 3.3.2**
  - watering and compacting the fill layers not exceeding 15 cm loose with towed or self-propelled roller.
- Using **Equipment method** of (re-) construction includes:
  - cut and fill to construct a level road terrace (road sub-base),
  - in case of missing material, excavate in borrow areas, haul and fill,
  - watering and compacting the fill layers not exceeding 15 cm loose with towed or self-propelled roller.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Width of level terrace	Tape	every 100 m	+ / - 50 mm
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Compaction	Counting passes, checking imprint of roller	completed road section	0

**Note:** Excavation of drains, **Item 3.2.2** may only be started **after** the Works covered by this Item have been approved by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.2.1	Excavation to level	Cubic Metre (m <sup>3</sup> ) → of cut to fill	MBC

**Payment:** The Engineer will effect payment of the earthwork quantities completed for any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.2 (Re-) Construction of road formation****ITEM 3.2.2 Excavation of side, mitre, catch water and other specified drains****DESCRIPTION:**

- This Item shall be applied when the road formation requires full (re-)construction. The Works shall be carried out as detailed in **Volume 4, Manual A, Sections E 3.2 and E 3.3**
- The Item includes excavation of side drains, mitre drains, catch-water and other specified drains.
- The material from the side drains shall, where approved suitable by the Engineer, be thrown to the centre of the road and used for the formation of the camber. Where additional material is required to achieve the required camber, and following approval by the Engineer, the side drains may be increased in width and depth to provide this additional material.
- The material from mitre and catch-water drains shall be neatly heaped along the lower side (valley side) of the drains.
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Sections B 2 and B 4**, as specified in the Drawings for this contract, and as instructed by the Engineer.
- This Item shall commence only **after** approval of **Item 3.2.1** (Excavation to level) by the Engineer.

**WORK METHOD:**

- The Contractor shall apply Labour method of work for this Item.
- Excavation of side drains consists of excavating the drain (rectangular profile), sloping from the ditch bottom to the shoulder break point, and back sloping from outer ditch bottom line to the in-situ soil slope. Where approved, the excavation material is thrown to the centre of the road to be used for the formation of the camber.
- Excavation of mitre drains consists of excavating mitre drains at the established locations with the correct outlet direction and gradient. The excavated material is deposited at the lower (valley side) of the drain.
- Excavation of catch-water drains consists of excavating the drains at the established locations with the correct outlet direction and gradient. The excavated material is deposited at the lower (valley side) of the drain.
- The correct size and shape of drains is checked and controlled using templates of their respective size. The gradient of drains is checked using boning rods or line level.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for Item 3.2.3.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.2.2	Excavation of side, mitre, catch water and other specified drains.	Linear Metre (m) → of drains	AWD

**Payment:** The Engineer will effect payment of any completed length of drains in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.2 (Re-) Construction of road formation****ITEM 3.2.3 Form, water and compact road bed****DESCRIPTION:**

- Under this Item the camber is formed using primarily the material excavated from the side drains and deposited in the road centre as outlined under **Item 3.2.2**.
- If using labour method of construction, the Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.2**
- If using equipment method of construction, the formation shall be prepared in layers of loose material not exceeding 15 cm.
- The Cross-section(s) and measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section B 2**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- The longitudinal alignment of the completed formation shall have a maximum tolerance of + / - 15 mm when measured with a three-metre straight edge.
- The compaction shall be carried out with a self propelled or towed roller with approved total weight and dimension. A minimum six (6) passes of compaction shall be applied or unless no more roller imprint on the surface can be recognised. The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.
- The camber of the compacted formation shall have a cross fall of not less than 8%.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a Combination of both** to carry out this Item depending on the degree of difficulty of the Work. **Compaction**, however, must be carried out using approved compaction **equipment**.
- When using **Labour method** of construction, this Item has to be carried out in combination with the side drain excavation (**Item 3.2.2**) and includes:
  - establish material pegs in the road centre; **Volume 4, Manual A, Section E 3.2.1**
  - spread material, water and compact; **Volume 4, Manual A, Section E 3.2.1**
  - spread material from side drain slopes and back slopes and form camber; **Volume 4, Manual A, Section E 3.2.2**
  - water and compact; **Volume 4, Manual A, Section E 3.2.2**
- Using **Equipment method** of construction includes:
  - establish material pegs in the road centre,
  - spread material from side drains in the centre of the road using a grader, water and compact,
  - spread material from side drain slopes and back slopes and form camber using a grader,
  - water and compact.
- Check the camber cross-fall frequently with the camber board.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for **Item 3.2.2** and consist of:

Test	Method	Frequency	Tolerance
Width of formation (carriageway + shoulders)	Tape	every 100 m	+50 / -20 mm
Camber (cross-fall)	Template	every 20 m	+/- 1%
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Drain dimensions	Template / Tape	every 20 m	+ / - 25 mm
Mitre drains; numbers, location, dimensions and gradient	Counting, tape, line-level	all	0
Compaction	Counting passes, checking imprint of roller	completed road section	0

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.2.3	Form, water and compact road bed.	Linear Metre (m) → of formation	AWD

**Payment:** The Engineer will effect payment of any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS**

**ITEM 3.3 Provision of fill materials**

**ITEM 3.3.1 Preparation of borrow pit(s) consisting of clearing from vegetation and removing topsoil**

**DESCRIPTION:**

- The Engineer shall approve quarries and their extent of exploitation.
- The Contractor shall carry out respective negotiations with landowners and communities.
- Before gravel can be excavated, quarry areas and adjacent areas where topsoil will be stockpiled have to be cleared from all vegetation. Topsoil has to be removed and deposited in order to use it again to reinstate the quarry at the end of Work.
- The Item consists of removing vegetation, crops, trees, roots, stumps, boulders, etc., from the gravel excavation area and topsoil (overburden) to deposit areas as shown in the Drawings and/or as directed by the Engineer. Waste material shall be dumped at places approved by the Engineer. Burning of waste material shall only take place upon approval of the Engineer.
- The Item also consists of excavation of topsoil (overburden) including loading, hauling and stockpiling at approved location(s).

**WORK METHOD:**

Refer Volume 4, Manual A, Section E 3.4

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Works for this Item may be carried out consisting of the following activities:
  - remove fences and structures from quarry and topsoil deposit areas,
  - cut grass and bushes,
  - cut trees and remove stumps,
  - grub roots,
  - haul and deposit cut vegetation and debris outside the cleared areas at approved locations,
  - burn deposited material if approved by the Engineer,
  - excavate topsoil layer,
  - load topsoil and haul to approved stockpile locations,
  - stockpile topsoil neatly so that it can be reused for reinstatement of the quarry.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions (cleared quarry area)	Tape	all	+ 200 / - 200 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.3.1	Preparation of quarry site consisting of clearing vegetation and removing topsoil	Square Metre (m <sup>2</sup> ) → of clearing quarry	AWD

**Payment:** The Engineer will effect payment of completed quarry clearing work in the following Payment Certificate upon approval of the works.



**BILL 3: EARTH WORKS****ITEM 3.3 Provision of fill materials****ITEM 3.3.2 Excavation, hauling, placing, watering and compaction of approved fill material in embankments and low spots to create a level road bench****DESCRIPTION:**

- This Item shall be applied where an embankment (fill) has to be constructed to achieve the desired road or formation level. The Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.2**
- The Item includes excavation of fill material from approved borrow areas, loading and hauling, filling in layers not exceeding 15cm loose, watering and compacting.
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section B 2**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- Fill material required for the embankment shall be taken from borrow areas as specified in the contract and approved by the Engineer.
- The compaction shall be carried out with a self propelled or towed roller with approved total weight and dimension. A minimum six (6) passes of compaction shall be applied or unless no more roller imprint on the surface can be recognised. The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works. **Compaction**, however, must be carried out using approved compaction **equipment**.
- Using **Labour method** of construction includes:
  - establish profiles and levels; **Volume 4, Manual A, Section E 3.1.2**
  - excavate and stockpile material in borrow pit,
  - load into wheelbarrow or hauling equipment,
  - haul to site, offload and spread in equal layers of not more than 15cm loose,
  - water and compact using towed or self propelled roller.
- Using **Equipment method** of construction includes:
  - establish profiles and levels,
  - excavate and stockpile material in borrow pit,
  - load onto hauling equipment,
  - haul to site, offload and spread in equal layers of not more than 15cm loose,
  - water and compact using towed or self propelled roller.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions of embankment	Tape, Profiles	every 20 m	+50 / -20 mm
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Compaction	Counting passes, checking imprint of roller	completed road section	0

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.3.2	Excavation, hauling, placing, watering and compaction of approved fill material in embankments and low spots to create a level road bench	Cubic Metre (m <sup>3</sup> ) → of embankment fill	AWD

**Payment:** The Engineer will effect payment of earthwork quantities completed for any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.4 Excavation of Rock****DESCRIPTION:**

- This Item consists of excavating rock and depositing the split rock pieces outside the cleared area.
- Stones from rock excavation may be used for stone masonry or sour checks.
- Any cracked or loose pieces of rock along the edges of the excavated area shall be removed as they may constitute a safety hazard.

**WORK METHOD:****Refer Volume 4, Manual A, Section E 2.4**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Item may be carried out using any of the following methods:
  - excavating soft rock using picks,
  - splitting using fire and water method,
  - splitting using wedges and feathers,
  - ripping using equipment,
  - drilling and blasting with explosives.
- Strict safety regulations must be adhered to when excavating rock.
- Care must be taken when using explosives and the relevant rules and regulations strictly adhered to. All unauthorised persons shall be banned from the Site.
- Split boulder pieces can be loaded into wheelbarrows and deposited outside the cleared area. In cases where structures and scour checks have to be built using rubble stones, the Contractor is advised to stockpile stones neatly for future use at locations approved by the Engineer.

**QUALITY CONTROL:**

- Rock excavation areas and excavation edges to be free from loose stones and splitters.
- Excavated stones removed and deposited at locations approved by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.4	Excavation of rock	Day Work	AWD

**Payment:** The Engineer will firstly, approve this Work to be performed, and secondly, effect payment for the Work in the following Payment Certificate upon completion and approval of the Work.

**BILL 3: EARTH WORKS****ITEM 3.5 Construction of footpath/track formation****ITEM 3.5.1 Excavation to level****DESCRIPTION:**

- This Item shall be applied when the path formation requires full construction.
- Excavation to level comprises the cutting of material to form a level bench or platform and placing the excavated material as fill, or in spoil areas approved by the Engineer.
- When using **labour**, the works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.1**
- In the case where material has to be borrowed this shall only be done from borrow areas approved by the Engineer and included in **Item 3.6.2**
- The Cross-section(s) and measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section E 3.1**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- The terrace shall be horizontal in the cross-sectional direction and the longitudinal profile shall have a maximum tolerance of + / - 15 mm when measured with a three-metre straight edge.
- The compaction of the fill areas shall be carried out where ever possible with a self propelled or towed roller with approved total weight and dimension. A **minimum** of six (6) passes of compaction shall be applied or until no roller imprint on the surface can be recognised. In circumstances where the use of mechanical compaction is not practical, compaction may be undertaken using hand rammers. In such cases material shall be compacted such that under the influence of a rammer weighing 10kg no imprint shall be made on the soil surface.
- The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work. **Compaction**, however, must be carried out using approved compaction **equipment**.
- Using **Labour method** of construction includes:
  - cutting and/or filling of slots at 10 m intervals,
  - cutting and filling as guided by the slots to construct a level road terrace or road sub-base,
  - in case of missing material, excavate in approved borrow areas, haul with wheelbarrows and fill; this work included in **Item 3.6.2**
  - watering and compacting the fill layers not exceeding 15 cm loose with towed or self-propelled roller or hand rammer (10 kg).

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Width of level terrace	Tape	every 100 m	+ / - 50 mm
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Compaction	Counting passes, checking imprint of roller/ 10 kg hand rammer	completed road section	0

**Note:** Excavation of drains, **Item 3.5.2** may only be started **after** the Works covered by this Item have been approved by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.5.1	Excavation to level	Cubic Metre (m <sup>3</sup> ) → of cut to fill	MBC

**Payment:** The Engineer will effect payment of the earthwork quantities completed for any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.5. Construction of track/path formation****ITEM 3.5.2 Excavation of side, mitre, catch water and other specified drains****DESCRIPTION:**

- This Item shall be applied when the track/footpath formation requires full construction. The Works shall be carried out as detailed in **Volume 4, Manual A, Sections E 3.2 and E 3.3**
- The Item includes excavation of side drains, mitre drains, catch-water and other specified drains.
- The material from the side drains shall, where approved suitable by the Engineer, be thrown to the centre of the path and used for the formation of the camber opr within edged steps. Where additional material is required to achieve the required camber, and following approval by the Engineer, the side drains may be increased in width and depth to provide this additional material.
- The material from mitre and catch-water drains shall be neatly heaped along the lower side (valley side) of the drains.
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Sections B 2 and B 4**, as specified in the Drawings for this contract, and as instructed by the Engineer.
- This Item shall commence only **after** approval of **Item 3.5.1** (Excavation to level) by the Engineer.

**WORK METHOD:**

- The Contractor shall apply Labour method of work for this Item.
- Excavation of side drains consists of excavating the drain (rectangular profile), sloping from the ditch bottom to the shoulder break point, and back sloping from outer ditch bottom line to the in-situ soil slope. Where approved, the excavation material is thrown to the centre of the path to be used for the formation of the camber.
- Excavation of mitre drains consists of excavating mitre drains at the established locations with the correct outlet direction and gradient. The excavated material is deposited at the lower (valley side) of the drain.
- Excavation of catch-water drains consists of excavating the drains at the established locations with the correct outlet direction and gradient. The excavated material is deposited at the lower (valley side) of the drain.
- The correct size and shape of drains is checked and controlled using templates of their respective size. The gradient of drains is checked using boning rods or line level.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for Item 3.5.3.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.5.2	Excavation of side, mitre, catch water and other specified drains.	Linear Metre (m) → of drains	AWD

**Payment:** The Engineer will effect payment of any completed length of drains in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.5 Construction of path formation****ITEM 3.5.3 Form, water and compact path bed****DESCRIPTION:**

- Under this Item the camber is formed using primarily the material excavated from the side drains and deposited in the road centre as outlined under **Item 3.5.2**.
- If using labour method of construction, the Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.2**
- If using equipment method of construction, the formation shall be prepared in layers of loose material not exceeding 15 cm.
- The Cross-section(s) and measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section B 2**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- The longitudinal alignment of the completed formation shall have a maximum tolerance of + / - 15 mm when measured with a three-metre straight edge.
- The compaction shall be carried out where ever possible with a self propelled or towed roller with approved total weight and dimension. A minimum six (6) passes of compaction shall be applied or unless no more roller imprint on the surface can be recognised. In circumstances where the use of mechanical compaction is not practical compaction may be undertaken using hand rammers. In such cases material shall be compacted such that under the influence of a rammer weighing 10kg no imprint shall be made on the soil surface.
- The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.
- The camber of the compacted formation shall have a cross fall of not less than 8%.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a Combination of both** to carry out this Item depending on the degree of difficulty of the Work. **Compaction**, however, must be carried out using approved compaction **equipment**.
- When using **Labour method** of construction, this Item has to be carried out in combination with the side drain excavation (**Item 3.5.2**) and includes:
  - establish material pegs in the path centre; **Volume 4, Manual A, Section E 3.2.1**
  - spread material, water and compact; **Volume 4, Manual A, Section E 3.2.1**
  - spread material from side drain slopes and back slopes and form camber; **Volume 4, Manual A, Section E 3.2.2**
  - water and compact; **Volume 4, Manual A, Section E 3.2.2**
- Check the camber cross-fall frequently with the camber board.

**QUALITY CONTROL:**

- Quality control tests for this Item shall be carried out together with the tests required for **Item 3.2.2** and consist of:

Test	Method	Frequency	Tolerance
Width of formation (carriageway + shoulders)	Tape	every 100 m	+50 / -20 mm
Camber (cross-fall)	Template	every 20 m	+/- 1%
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Drain dimensions	Template / Tape	every 20 m	+ / - 25 mm
Mitre drains; numbers, location, dimensions and gradient	Counting, tape, line-level	All	0
Compaction	Counting passes, checking imprint of roller	completed path section	0

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.5.3	Form, water and compact path bed.	Linear Metre (m) → of formation	AWD

**Payment:** The Engineer will effect payment of any completed path length in the following Payment Certificate upon approval of the works.



**BILL 3: EARTH WORKS****ITEM 3.6 Provision of fill materials****ITEM 3.6.1 Preparation of borrow pit(s) consisting of clearing from vegetation and removing topsoil****DESCRIPTION:**

- The Engineer shall approve quarries and their extent of exploitation.
- The Contractor shall carry out respective negotiations with landowners and communities.
- Before gravel/fill can be excavated, quarry areas and adjacent areas where topsoil will be stockpiled have to be cleared from all vegetation. Topsoil has to be removed and deposited in order to use it again to reinstate the quarry at the end of Work.
- The Item consists of removing vegetation, crops, trees, roots, stumps, boulders, etc., from the gravel/fill excavation area and topsoil (overburden) to deposit areas as shown in the Drawings and/or as directed by the Engineer. Waste material shall be dumped at places approved by the Engineer. Burning of waste material shall only take place upon approval of the Engineer.
- The Item also consists of excavation of topsoil (overburden) including loading, hauling and stockpiling at approved location(s).

**WORK METHOD:****Refer Volume 4, Manual A, Section E 3.4**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Works for this Item may be carried out consisting of the following activities:
  - remove fences and structures from quarry and topsoil deposit areas,
  - cut grass and bushes,
  - cut trees and remove stumps,
  - grub roots,
  - haul and deposit cut vegetation and debris outside the cleared areas at approved locations,
  - burn deposited material if approved by the Engineer,
  - excavate topsoil layer,
  - load topsoil and haul to approved stockpile locations,
  - stockpile topsoil neatly so that it can be reused for reinstatement of the quarry.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions (cleared quarry area)	Tape	all	+ 200 / - 200 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.6.1	Preparation of quarry site consisting of clearing vegetation and removing topsoil	Square Metre (m <sup>2</sup> ) → of clearing quarry	<b>AWD</b>

**Payment:** The Engineer will effect payment of completed quarry clearing work in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS****ITEM 3.6 Provision of fill materials****ITEM 3.6.2 Excavation, hauling, placing, watering and compaction of approved fill material in embankments and low spots to create a level path bench****DESCRIPTION:**

- This Item shall be applied where an embankment (fill) has to be constructed to achieve the desired road or formation level. The Works shall be carried out as detailed in **Volume 4, Manual A, Section E 3.1.2**
- The Item includes excavation of fill material from approved borrow areas, loading and hauling, filling in layers not exceeding 15cm loose, watering and compacting.
- The measurements to be applied shall be in accordance with the design standards of **Volume 4, Manual A, Section B 2**, as specified in the Drawings for this Contract, and as instructed by the Engineer.
- Fill material required for the embankment shall be taken from borrow areas as specified in the contract and approved by the Engineer.
- The compaction shall be carried out where ever possible with a self propelled or towed roller with approved total weight and dimension. A minimum six (6) passes of compaction shall be applied or unless no more roller imprint on the surface can be recognised. In circumstances where the use of mechanical compaction is not practical compaction may be undertaken using hand rammers. In such cases material shall be compacted such that under the influence of a rammer weighing 10kg no imprint shall be made on the soil surface.
- The fill layers to be compacted shall not exceed 15cm loose and the soil shall be watered before compaction takes place.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works. **Compaction**, however, must be carried out using approved compaction **equipment**.
- Using **Labour method** of construction includes:
  - establish profiles and levels; **Volume 4, Manual A, Section E 3.1.2**
  - excavate and stockpile material in borrow pit,
  - load into wheelbarrow or hauling equipment,
  - haul to site, offload and spread in equal layers of not more than 15cm loose,
  - water and compact using towed or self propelled roller.
- Using **Equipment method** of construction includes:
  - establish profiles and levels,
  - excavate and stockpile material in borrow pit,
  - load onto hauling equipment,
  - haul to site, offload and spread in equal layers of not more than 15cm loose,
  - water and compact using towed or self propelled roller.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions of embankment	Tape, Profiles	every 20 m	+50 / -20 mm
Longitudinal profile	Three-metre straight edge or by surveying instrument	every 20 m	+ / - 15 mm
Compaction	Counting passes, checking imprint of roller	completed road section	0

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.6.2	Excavation, hauling, placing, watering and compaction of approved fill material in embankments and low spots to create a level road bench	Cubic Metre (m <sup>3</sup> ) → of embankment fill	AWD

**Payment:** The Engineer will effect payment of earthwork quantities completed for any completed road length in the following Payment Certificate upon approval of the works.

**BILL 3: EARTH WORKS**

**ITEM 3.7 Excavation of Rock**

**DESCRIPTION:**

- This Item consists of excavating rock and depositing the split rock pieces outside the cleared area.
- Stones from rock excavation may be used for stone masonry or sour checks.
- Any cracked or loose pieces of rock along the edges of the excavated area shall be removed as they may constitute a safety hazard.

**WORK METHOD:**

Refer Volume 4, Manual A, Section E 2.4

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Item may be carried out using any of the following methods:
  - excavating soft rock using picks,
  - splitting using fire and water method,
  - splitting using wedges and feathers,
  - ripping using equipment,
  - drilling and blasting with explosives.
- Strict safety regulations must be adhered to when excavating rock.
- Care must be taken when using explosives and the relevant rules and regulations strictly adhered to. All unauthorised persons shall be banned from the Site.
- Split boulder pieces can be loaded into wheelbarrows and deposited outside the cleared area. In cases where structures and scour checks have to be built using rubble stones, the Contractor is advised to stockpile stones neatly for future use at locations approved by the Engineer.

**QUALITY CONTROL:**

- Rock excavation areas and excavation edges to be free from loose stones and splitters.
- Excavated stones removed and deposited at locations approved by the Engineer.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
3.7	Excavation of rock	Day Work	AWD

**Payment:** The Engineer will firstly, approve this Work to be performed, and secondly, effect payment for the Work in the following Payment Certificate upon completion and approval of the Work.

**BILL 4: DRAINAGE WORKS****ITEM 4.1 Provide and install scour checks****ITEM 4.1.1 Using stones for Community Access Roads****ITEM 4.1.2 Using sticks for Community Access Roads****ITEM 4.1.3 Using stones for paths and tracks****ITEM 4.1.4 Using sticks for paths and tracks****DESCRIPTION:**

- Where longitudinal drain gradients exceed 4%, water flows at a speed that can cause erosion. Scour checks are small dams or steps in the drain, which reduce the velocity of the water flow.
- The Works shall be carried out as detailed in contract drawings
- Scour checks are built using either stones or sticks, as instructed by the Engineer.
- Intervals at which scour checks are constructed depends on the gradient of the drain:

Gradient of Road/Path	4% or less	5%	6%	7%	8%	9%	10%	>10%
Scour Check Spacing	not required	20m	15m	10m	7.5m	6m	5m	4m

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- Constructing scours checks using stones** consists of:
  - collect stones of adequate size and haul to site,
  - stones to be of minimum 20 kg weight,
  - excavate foundation trench and apron bottom,
  - place stones, backfill and compact with hand rammer or sledgehammer. Use scour check template for correct shape;
- Constructing scours checks using sticks** consists of:
  - cut sticks of adequate size and timber quality and haul to site,
  - sticks to have minimum diameter of 5 cm and minimum 40 cm length,
  - excavate apron bottom,
  - ram sticks into the ground using a sledgehammer. Use scour check template for correct shape;

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Spacing of scour checks	Tape	all	+ / - 20 cm
Shape	Template	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.1.1	Provide and install scour checks using stones	Number (No.)→ of checks	AWD
4.1.2	Provide and install scour checks using sticks		
4.1.3	Provide and install scour checks using stones		
4.1.4	Provide and install scour checks using sticks		

**Payment:** The Engineer will effect payment of the number of scour checks installed in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.2 Excavation of foundation for drainage structures****ITEM 4.2.1 In soil not more than 1m deep****ITEM 4.2.2 In soil more than 1m deep****DESCRIPTION:**

- This Item consists of excavating foundation trenches for culvert head and wing walls, other minor structures, retaining walls and gabion structures.
- The depth and width of excavation shall be carried out as specified in the Drawings and/or as directed by the Engineer.
- The bottoms of excavations shall be hand finished to provide a uniform and smooth footing.
- The excavated material shall be deposited well outside the trench and spoil material shall be deposited as and where directed by the Engineer. Excavated material may, where suitable, be utilised for backfill as approved by the Engineer.
- Suitable and effective drainage shall be provided for foundation trenches to prevent ingress of water into excavations and to keep the trenches dry.
- No foundation work shall be paid before the excavation dimensions, depth and finishing has been approved by the Engineer.**
- The Contractor shall take all necessary precautions to safeguard the stability and safety of the excavations.

**WORK METHOD:****(FC)**

- The Contractor may choose Labour, Equipment or a combination of both to carry out this Item depending on the degree of difficulty of the Work.
- The Work for this Item may be carried out consisting of the following activities:
  - set out trench width and length ,
  - excavate using labour or equipment and deposit material well outside the trench,
  - in case of spoil, haul material to approved dumping locations,
  - hand finish excavation to the required level(s) and dimensions,
  - provide drainage for trench(s) if required to keep them dry.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ / - 50 mm
Trench bottom; level(s), uniformity	Line level, Straight edge and spirit level	all	+ / - 10 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.2.1	Excavation of foundation for drainage structures: In soil not more than 1m deep	Cubic Metre (m <sup>3</sup> )→ of excavation	AWD
4.2.2	In soil more than 1m deep		

**Payment:** The Engineer will effect payment of completed foundation excavation in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.3 Supply and install concrete culvert pipe rings****ITEM 4.3.1 600 mm diameter****ITEM 4.3.2 900 mm diameter****ITEM 4.3.3 1200 mm diameter****ITEM 4.3.4 450mm diameter****DESCRIPTION:**

- The culvert is a cross drain built under the road and its function is to lead water from the upper to the lower side of the road.
- This Item consists of supplying the concrete pipe rings, excavating the trench including inlet and outlet, laying and joining the rings, backfilling the trench and, if required, constructing a ramp over the culvert.
- Culvert **head and wing walls and aprons are not included in this Item** but are covered in **Items 4.6 and 4.7**.
- The Works shall be carried out as detailed in the contract drawings
- The pipe rings shall be of plain concrete with ogee joints of concrete Class 20, at least 28 days cured and, where possible, manufactured on site. If the pipe rings are not manufactured on site the supplier must be approved by the Engineer.
- The culvert gradient including the outlet shall be minimum 2%.
- Sealing of joints shall be done with mortar 1 : 4
- Backfilling shall be done with approved material and compacting in layers not exceeding 15 cm loose.
- Ramps shall be shaped to achieve a minimum overflow of 3/4 of the pipe diameter.
- The disposal of surplus material shall be done at locations approved by the Engineer.
- On high traffic roads, excavation of trench(s) and lying of pipe rings shall be carried out in stages to allow vehicles to pass. Installation work shall wherever possible start from the outlet side. Adequate traffic signs shall be provided.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Work for this Item may be carried out consisting of the following activities:
  - supply plain concrete culvert pipe rings,
  - excavate trench including Inlet and outlet with minimum 2% gradient → establish levels,
  - shape culvert bed,
  - place pipe rings and join them,
  - build head, wing walls and aprons (Items 4.6 and 4.7) → as specified in Drawings,*
  - backfill and compact in layers not exceeding 15 cm loose,
  - shape ramp over culvert.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Culvert ring quality	Visual	randomly	
Culvert length	Tape	all	+ / - 10 mm
Inlet level	Line level, Boning rods	all	+ / - 10 mm
Gradient	Line level, Boning rods	all	+ / - 1%
Sealed Joints	Visual	all	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.3.1	Supply and install concrete culvert pipe rings 600 mm diameter	Linear Metre (m)→ of culvert pipe	AWD
4.3.2	900 mm diameter		
4.3.3	1200 mm diameter		
4.3.4	450mm diameter		

**Payment:** The Engineer will effect payment of completed culvert lines in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.5 Demolish existing structures and cart away debris****DESCRIPTION:**

- This Item consists of demolishing existing structures or parts of structures as directed by the Engineer, and carting away the debris.
- Stones or concrete blocks of good quality from demolished structures may be re-used for new structure works.
- The debris shall be dumped at a place approved by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- This Item consists of:
  - demolishing the existing structure or structure parts, either using labour or equipment,
  - separating of good quality stones or concrete blocks from debris to be re-used for other structure works,
  - loading of debris and hauling to approved dumping locations.

**QUALITY CONTROL:**

- Demolishing work and dumping as instructed.
- Where the structure is to be replaced with a new structure, the equivalent volume of excavation performed in this Item shall be taken into account when determining the unit rates for **Items 4.3** and/or **4.4**.
- Where the demolished structure is not to be replaced, the equivalent volume of excavation performed in this Item shall be filled in accordance with **Item 3.3**.

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.5	Demolishing of existing structures and cart away debris	Lump Sum	MBC

**Payment:** The Engineer will effect payment of demolished structures or structure parts as a Lump Sum in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.6 Provide material and build cement bound masonry work in****ITEM 4.6.1 Stones****ITEM 4.6.2 Concrete blocks****ITEM 4.6.3 Dressed Stone****DESCRIPTION:**

- This Item consists of providing all the required material, including cement, sand, stones or concrete blocks, and building cement bound masonry walls and aprons as specified in the Drawings and directed by the Engineer.
- The workmanship shall be in accordance with the contract drawings
- The mortar mix shall be of 1:4;
- Joints do not require pointing but must be trowled off flush with the surface.
- The joints shall be between 10 and 40 mm thick and bonding shall allow a minimum overlap of 1/4 stone length.
- The shape of the dressed block shall be such that all angles on elevation, side and end plan shall be nominally 90 degrees, and its dimensions and weight are as detailed on the drawings.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The work for this Item may be carried out consisting of the following activities:
  - supply sand and cement,
  - collect stones of minimum 20kg weight and of good quality, dressed stones shall be of a quality as stated above or concrete blocks as required by the Drawings or as directed by the Engineer,
  - mix mortar of mix 1:4 ,
  - build masonry walls or aprons as per the Drawings and/or as directed by the Engineer,
  - protect completed work from direct sunshine for at least 14 days and keep wall crowns and aprons wet for at least 7 days.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ / - 10 mm
Levels	Line level, Straight edge and spirit level	all	+ / - 10 mm
Mortared joints to be fully filled	Visual	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.6.1	Provide material and build cement bound masonry work in:	Cubic Metre (m <sup>3</sup> ) → of masonry work	MAP/AWD
4.6.2	Stones		
4.6.3	Concrete blocks		
	Dressed stones		

**Payment:** The Engineer will effect payment of completed masonry work of any completed structure in the following Payment Certificate upon approval of the works.



**BILL 4: DRAINAGE WORKS****ITEM 4.7 Provide stones and build dry stone masonry walls****DESCRIPTION:**

- This Item consists of providing good quality stones and building dry stone masonry walls as specified in the Drawings and directed by the Engineer.
- The workmanship for all structures shall be in accordance with the contract drawings
- The workmanship for retaining walls shall be in accordance with the Drawings and as directed by the Engineer.
- The Bonding shall allow a minimum overlap of 1/4 stone length. The biggest stones shall be in the bottom layers of the wall.
- Where necessary stones shall be dressed to provide the top and the bottom face with parallel sides
- The top layer shall be bonded with 1:4 cement sand mortar.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Work for this Item may be carried out consisting of the following activities:
  - collect stones of minimum 20kg weight and of good quality as required by the Drawings or as directed by the Engineer,
  - build masonry as per the Drawings and/or as directed by the Engineer,
  - backfill in layers whenever one course of stones has been placed,
  - if instructed provide the wall with a cement mortar crown,
  - protect cement crown from direct sunshine for 14 days and keep crown wet for 7 days.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ / - 50 mm
Levels	Line level, Straight edge and spirit level	all	+ / - 20 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.7	Provide stones and build dry stone masonry walls	Cubic Metre (m <sup>3</sup> )→ of masonry work	MAP/AWD

**Payment:** The Engineer will effect payment of completed masonry work of any completed structure in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.10 Provide, place and compact hardcore foundation layer for structures****DESCRIPTION:**

- Hardcore beds required for structure work shall be as specified in the Drawings and as directed by the Engineer.
- The Item includes supplying approved hardcore material, placing and compacting.
- The longer dimension of the hardcore stones shall not be less than 20 cm and the smaller dimension not less than 10 cm
- The stones shall be placed upright and packed as close as possible. Voids shall be filled with smaller stones
- The hardcore layer shall be compacted using a hand operated vibrating roller. Where this is not practical the hardcore shall be well rammed with hand rammers.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item. However, compaction shall be carried out using a vibrating pedestrian roller.
- The Work for this Item may be carried out consisting of the following activities:
  - supply hard core stones,
  - place the stones upright and wedge them with smaller stones,
  - compact with pedestrian vibrating roller → fill additional voids with more smaller stones,
  - ensure a uniform and level surface is achieved.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions and level	Tape, line level and straight edge	all	+ / - 20 mm
Compaction	Visual	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.10	Provide, place and compact hardcore foundation layer for structures	Cubic Metre (m <sup>3</sup> )→ of hardcore compacted	MAP/AWD

**Payment:** The Engineer will effect payment of compacted hard core layer(s) in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS**

**ITEM 4.11 Provide, cast and cure concrete in class:**

**ITEM 4.11.1 Class Lean (1:4:8)**

**ITEM 4.11.2 Class 15 (1:3:6)**

**ITEM 4.11.3 Class 20 (1:2:4)**

**DESCRIPTION:**

- This Item consist of providing concrete materials, mixing, placing, compacting and curing concrete for structural work as specified in the Drawings and as directed by the Engineer.
- Class lean (1:4:8) is concrete used for blinding.
- Class 15 (1:3:6) is mass concrete usually without reinforcement.
- Class 20 (1:2:4) is structural concrete with reinforcement.
- Sand for concrete mixing shall be clean river sand, free from dust, lumps, soft or flaky particles, organic matter.
- Aggregates shall be well graded and free from organic material.
- Water shall be clean and free from oil and shall not contain any impurities that may affect concrete durability.
- The water / cement ratio shall not be more than 0.5.
- Concrete works for small structures shall be carried out to the line and level indicated on the drawings.
- Concrete works for larger structures shall be carried out as specified in the drawings and as directed by the Engineer.
- Cast concrete elements shall be protected from direct sunshine for 14 days.
- Concrete slabs and wall crowns shall be kept wet for 7 days.
- **No concrete shall be cast unless the formwork, reinforcement and hardcore bed have been checked and approved by the Engineer.**

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item. Mixing shall be done using a mechanical mixer and compacting using a vibrating poker.
- The Work for this Item may be carried out consisting of the following activities:
  - supply approved cement, sand and aggregates,
  - mix concrete using labour or mechanical mixer,
  - cast concrete in equal layers not exceeding 30 cm,
  - compact or vibrate concrete,
  - protect concrete form direct sunshine for 14 days and
  - keep slabs and wall crowns wet for 7 days.
  -

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Workability and mix of concrete	Slump test	As directed by Engineer	+ / - 25 mm of the required slump
Quality of cast concrete	Visual	all	No honey comb
Dimensions (completed concrete work)	Tape	all	+ 20mm / - 10mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement

	Provide, cast and cure concrete in class:	Cubic Metre (m <sup>3</sup> ) → of cast concrete	MAP/AWD
4.11.1	Class lean (1:4:8)		
4.11.2	Class 15 (1:3:6)		
4.11.3	Class 20 (1:2:4)		

**Payment:** The Engineer will effect payment of cast concrete for any completed structure following removal of all formwork in the following Payment Certificate and upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.12 Provide gabion baskets/mattresses and stones, place and fill baskets****ITEM 4.12.1 Provide gabion baskets and stones, place and fill baskets****ITEM 4.12.2 Provide gabion mattresses and stones, place and fill mattresses****DESCRIPTION:**

- Gabions are weld/wire mesh boxes filled with stones and may be used as components of structures, as retaining walls and for erosion protection.
- This Item includes supplying the gabion baskets, placing and filling the baskets with stones as specified in the contract drawings and as directed by the Engineer.
- Gabion baskets are supplied in different sizes. The correct size to be used shall be specified in the Drawings and/or as directed by the Engineer.
- Gabion baskets shall be tied together with 3 mm galvanised wire securing all edges at 15 cm intervals.
- Filling shall be done with stones of similar size and shape as used for dry stone masonry. The stones have to be packed as if constructing a dry stone masonry wall ensuring adequate bonding.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Work for this Item may be carried out consisting of the following activities:
  - supply gabion baskets of the specified size,
  - collect stones of size and shape which allows dry stone masonry,
  - place the gabion baskets in the excavated foundation trench (**Item 4.2**),
  - assemble the gabion baskets;
  - fill gabion baskets with dry stone masonry,
  - close gabion and secure lid → continue with next gabion course,
  - back fill gabions after each course (**Item 4.14**).

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions and level	Tape	all	+ 100mm / - 50mm
Workmanship; placing, tying, filling	Visual	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.12.1	Provide gabion baskets and stones, place and fill baskets, 2 x 1 x 1m	Cubic Metre (m <sup>3</sup> ) → of placed and filled gabion	AWD
4.12.2	Provide gabion mattresses and stones, place and fill baskets, 6 x 2 x 0.3m	Cubic Metre (m <sup>3</sup> ) → of placed and filled gabion	AWD

**Payment:** The Engineer will effect payment of completed gabion work in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.13 Provide material and build grouted stone pitching,****ITEM 4.13.1 Grouted stone pitching, 150 mm thickness****ITEM 4.13.2 Grouted stone pitching, 300mm thickness****DESCRIPTION:**

- Stone pitching is required to protect soil surfaces from erosion. This may be in drains, on slopes or riverbanks.
- The Item consists of levelling the area to be covered with stone pitching, collecting stones, laying stones, mortaring the joints and constructing weep holes.
- The area to be covered with stone pitching shall be trimmed to level and/slope indicated on the Drawings and as directed by the Engineer. The prepared surface shall be firm and well compacted.
- Stones shall be placed in full contact with the surface and bedded into mortar (grout) of mixture 1:4 and at a minimum thickness of 150 mm.
- The mortar shall be troweled off flush with the surface of the stones.
- Weep holes shall be provided to stone pitching on slopes at an average frequency of one per square meter unless otherwise directed by the Engineer.
- The surface of the stone pitching shall be protected from direct sunshine and kept moist for 7 days

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Work for this Item may be carried out consisting of the following activities:
  - supply cement and sand for grouting and mix mortar (water / cement ratio = 1.4),
  - collect stones, not smaller than 15cm thickness,
  - trim and level area to be covered and compact where necessary,
  - place stones in mortar and towel surface flush with stones,
  - construct weep holes (use stacks or banana stems of min. 10 cm diameter),
  - cover stone pitching area to protect from direct sunshine and keep moist for 7 days.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ / - 50 mm
Workmanship; placing, grouting	Visual	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.13.1	Provide material and build grouted stone pitching, 150 mm thickness	Square Metre (m <sup>2</sup> ) → of stone pitching	MAP/AWD
4.13.2	Provide material and build grouted stone pitching, 300 mm thickness	Square Metre (m <sup>2</sup> ) → of stone pitching	MAP/AWD

**Payment:** The Engineer will effect payment of completed stone pitching work in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.14 Provide selected material and backfill structures****DESCRIPTION:**

- Backfilling is required for structures including their approaches, retaining walls and wing walls on structures, gabions, etc. Note; backfilling of culvert lines is included in the **Items for reinforced concrete culvert installation, 4.3.**
- The Item consist of excavation, loading and hauling of approved selected material, backfilling, watering and compacting.
- Material for backfilling has to be approved by the Engineer. Where material from the excavation (Item 4.2) meets the Specifications, this may be used as backfill material provided it has been approved by the Engineer.
- The backfill material shall be filled in layers not exceeding 15 cm loose.
- Each layer shall be compacted with hand rammers for backfill of retaining walls and wing walls, gabions, etc., and equipment for approaches to structures. The material to be compacted shall be watered where necessary.
- Backfilling shall not be done until after 14 days from the date when the cement bound masonry of concrete walls were constructed/cast.
- Stone filters behind walls shall be placed as specified in the Drawings and as directed by the Engineer.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- This Item consists of:
  - excavate approved materials and stockpile,
  - load and haul,
  - off load and spread in layers not exceeding 15 cm loose,
  - water if material is too dry until approximate optimum moisture content is reached,
  - compact with hand rammers all fill behind retaining walls,
  - compact with pedestrian vibrating roller all fills on approaches to structures,
  - care to be taken during compaction so as to not damage the structure.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	-
Compaction	Visual	random	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.14	Provide selected material and backfill structures	Cubic Metre (m <sup>3</sup> ) → of fill	MAP/AWD

**Payment:** The Engineer will effect payment of completed backfilling work in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS****ITEM 4.15 Excavate water diversions and/or construct barriers****DESCRIPTION:**

- This Item consists of excavating water diversions for structure works and/or building water barriers using soil or sandbags to keep the water away from the area where the structure will be constructed. The Item also includes all maintenance work that might be necessary during the use of diversions and barriers, and removal of, to the satisfaction of the Engineer, all diversions and barriers on completion of structural construction works.
- The length, depth and width of water diversions shall be excavated as specified in the Drawings and as directed by the Engineer.
- Water barriers consisting of dams reinforced with wooden stacks or made of sandbags shall be erected as specified in the Drawings and as directed by the Engineer.
- The excavated material shall be deposited well outside the excavated canal in order to ensure that it shall not fall back into the canal.
- The Contractor shall take the necessary precautions to safeguard the stability and safety of the excavations and barriers and maintain them at all times.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- The Work for this Item may be carried out consisting of the following activities:
  - set out diversion / barrier widths, lengths and levels,
  - excavate, using labour or equipment and deposit material well outside the canal,
  - fill sandbags with sand / soil and erect barriers. Sand bags shall be well stacked to ensure overlapping from course to course,
  - the sides of canal diversions and barriers may require reinforcement using large sticks rammed well into the ground,
  - maintain the canal diversions and barriers throughout their period of use, e.g. inspect daily, remove debris and silt, protect sides from erosion, replace defective sandbags, etc.
  - removal of all diversions and barriers on completion of structural construction works to the satisfaction of the Engineer.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ / - 100 mm
Canal bottom; level(s), uniformity	Line level, boning rods	all	+ / - 50 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.15	Excavate water diversions and/or construct barriers	Lump Sum	AWD

**Payment:** The Engineer shall effect payment for this Item in proportion to the total value of the Works performed at the time of preparation of the next Payment Certificate.

**BILL 4: DRAINAGE WORKS**

**ITEM 4.16 Clear swamps for structures, 50m upstream from inlet and 100m downstream from outlet of structure over full width of structure including head and wing walls**

**DESCRIPTION:**

- This Item consists of clearing the area adjacent to structures up- and downstream from vegetation and debris to allow for the free flow of water.
- The area to be cleared shall be:
  - 50 m upstream and as wide as the structure including its wing walls, and
  - 100 m downstream and as wide as the structure including its wing walls, and
  - as specified in the Drawings and directed by the Engineer.
- The cut vegetation and debris shall be deposited well outside the cleared area at an approved location. Burning may be allowed upon approval by the Engineer.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- The Work for this Item may be carried out consisting of the following activities:
  - clear specified area from all vegetation and debris,
  - haul and deposit cut vegetation and debris well outside the cleared area at approved locations,
  - burn deposited material only on approval by the Engineer.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions	Tape	all	+ 500 / - 500 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.16	Clear swamps for structures, 50m upstream from inlet and 100m downstream from outlet of structure over full width of structure including head and wing walls	Lump Sum	AWD

**Payment:** The Engineer will effect payment of completed swamp clearing work in the following Payment Certificate upon approval of the works.

**BILL 4: DRAINAGE WORKS**

**ITEM 4.17 Other drainage erosion protection works as directed by the Engineer (Provisional Item)**

**DESCRIPTION:**

- This Item may consist of any other drainage protection works not covered in the previous drainage Items.
- Such work will be specified in the Drawings and directed by the Engineer

**WORK METHOD:**

- The Contractor shall apply the appropriate work method to this Item
- The Work for this Item may be carried out consisting of the following activities:
  - .....
  - .....
  - .....

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.17	Other drainage erosion protection works as directed by the Engineer		

**Payment:** The Engineer will effect payment of .....



**BILL 4: DRAINAGE WORKS****ITEM 4.18 Provide materials and construct wooden culvert, bridge and handrails using logs**

<b>ITEM 4.18.1</b>	<b>50 - 100 mm dia</b>
<b>ITEM 4.18.2</b>	<b>101 - 200 mm dia</b>
<b>ITEM 4.18.3</b>	<b>201 - 300 mm dia</b>
<b>ITEM 4.18.4</b>	<b>301- 400mm dia</b>
<b>ITEM 4.18.5</b>	<b>401 - 500 mm dia</b>
<b>ITEM 4.18.6</b>	<b>501 - 600 mm dia</b>
<b>ITEM 4.18.7</b>	<b>601 - 675mm dia</b>

**DESCRIPTION:**

- This item covers all logs used for drainage works (culverts and bridges), retaining walls or hand rails for bridges
- The item consists of supplying treated, seasoned and peeled logs of the specified diameter (measured after peeling at the smallest diameter) and length and quality to site, cutting (when necessary), placing and fixing, including fixing materials in accordance with the details indicated on the drawings
- Logs shall be of eucalyptus grandis species (any changes to this must receive written approval from the Engineer)
- For all logs of all diameters specified in the drawings with a length less than 5m must be treated as specified below.
- For all logs that by necessity must be cut on site, the exposed surfaces shall be well coated with a recognised commercial preservative. Approval of any preservative to be used at the site shall be approved in advance of its use.
- Treatment of logs must be of either of the following methods:
  - Pressure impregnation using either a) Creosote at a rate of 150kg/m<sup>3</sup> or b) copper chrome arsenite at a rate of 10 kg/m<sup>3</sup>
  - Hot and Cold tank treatment. Logs are to be immersed in creosote for 1 hour at 85-90C then allowed to cool to ambient temperature before they are removed from the tank.
  - Be purchased from an approved supplier (e.g. National Forestry Authority). Approval to use the supplier is conditional on the presentation and subsequent acceptance of the Engineer of a certificate from the supplier, outlining and guaranteeing the treatment process. The Engineer's approval may be withdrawn at any time if in the opinion of the Engineer the treatment of delivered logs fails to meet with the agreed standards.
- Logs shall have a moisture content of less than 20% when fixed.

**WORK METHOD:**

- The Contractor shall submit to the Engineer either
  - his intended supplier of treated logs for the Engineer's consent
  - Provide the Engineer with his method statement for treating logs including security arrangements if the logs are to be treated outside a commercial property.
- The Contractor shall apply Labour method of work for this item
- As far as possible logs should be cut to the size and shape indicated on the drawings prior to treatment
- Logs are then transported to site and fixed in the manner indicated in the drawings
- Fixings are notched, bolted or screwed. The latter two methods require pre drilling. Nailing is not permitted unless with the specific approval of the Engineer

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
treatment	Random check on log and random inspection at treatment site	Each delivery	zero
Moisture content	Visual inspection	daily	zero
Line and level	Spirit level, straight edge, tape	daily	+/- 20mm
diameter	tape	Each delivery	+20 (no negative tolerance)
workmanship	Visual Inspection	daily	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.18.1	Supply, place and fix treated timber logs 50 -100 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.2	Supply, place and fix treated timber logs 101- 200 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.3	Supply, place and fix treated timber logs 201 – 300 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.4	Supply, place and fix treated timber logs 301 – 400 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.5	Supply, place and fix treated timber logs 401 – 500 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.6	Supply, place and fix treated timber logs 501 – 600 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>
4.18.7	Supply, place and fix treated timber logs 601 – 675 mm	<b>Linear Metre</b> (m) of logs	<b>AWD</b>

**Payment:** The Engineer will effect payment of payment of satisfactory completed structure in the following Payment Certificate upon acceptance of the works

**BILL 4: DRAINAGE WORKS****ITEM 4.19 Supply and fix rough sawn hardwood for the construction of bridge superstructure, bridge deck hand rails, culvert superstructure****ITEM 4.19.1 50mm x 100mm CSA****ITEM 4.19.2 75mm x 100mm CSA****ITEM 4.19.3 100mm x 100mm CSA****ITEM 4.19.4 100mm x 200mm CSA****ITEM 4.19.5 50mm x 300mm CSA****DESCRIPTION:**

- This item covers all structures where sawn hardwood is used for superstructure works on culverts, boardwalks, and bridges.
- The item consists of supplying the specified cross section and quality of sawn, well seasoned hardwood to site, cutting, placing and fixing the timber, including the fixing materials, in accordance with the details indicated on the drawings.
- The timber shall be heartwood and well seasoned (moisture content less than 18%) heavy hardwood (density greater than 600 kg/m<sup>3</sup> at moisture content of 18%) e.g. Mahogany or Mvule (Iroko) species.
- The use of fresh or semi-seasoned timber requires the written consent of the Engineer.
- The timber shall be essentially free of knots, fissures and other defects.

**WORK METHOD:**

- The contractor shall use Labour method for this item
- The Contractor shall submit to the Engineer his intended supplier for sawn hardwood for the Engineer's consent prior to placing any order with the supplier.
- If the Contractor wishes to change supplier subsequent to the Engineer's consent this may be done but only with the Engineer's consent to do so.
- Timber shall be sawn as necessary and fixed as detailed on the drawings. Nailing timber may be done only with the consent of the engineer.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Imperfections (knots, fissures etc)	visual	Each delivery	zero
Heart wood/sap wood	visual	Each delivery	zero
Moisture content	Visual	Each delivery	2%
Cross section	tape	Each delivery	+/- 5mm
Straightness	Straight edge	daily	50mm over 3m
Workmanship	visual	daily	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
4.19.1	Supply place and fix 50 x 100mm section	Linear Metre	AWD

		(m) of timber	
4.19.2	Supply place and fix 75 x 100mm section	Linear Metre (m) of timber	AWD
4.19.3	Supply place and fix 100 x 100mm section	Linear Metre (m) of timber	AWD
4.19.4	Supply place and fix 100 x 200mm section	Linear Metre (m) of timber	AWD
4.19.5	Supply place and fix 50 x 300mm section	Linear Metre (m) of timber	AWD
4.19.6	Supply, place and fix 50 x 150 mm section	Linear Metre (m) of timber	AWD

**Payment:** The Engineer will effect payment for each satisfactorily completed structure in the following Payment Certificate upon approval of the works

**BILL 5: GRAVELLING AND COMPLETION WORKS**  
**ITEM 5.1 Preparation of quarry site(s) consisting of clearing vegetation and removing topsoil**

**DESCRIPTION:**

- The Engineer shall approve quarries and their extent of exploitation. The quarries shall be allocated to the Contractor prior to commencement of the Works. The Contractor shall carry out respective negotiations with landowners and communities.
- Before gravel can be excavated, quarry areas and the adjacent areas where topsoil will be stockpiled have to be cleared from all vegetation, fences and structures. Topsoil has to be removed and deposited in order to use it again to reinstate the quarry at the end of construction work.
- The Item consists of removing all vegetation, crops, trees, roots, stumps, boulders, fences and structures from the gravel excavation area and top soil (overburden) deposited in areas as shown in the Drawings and as directed by the Engineer. Waste material shall be dumped at places approved by the Engineer. The Engineer may allow burning of waste material upon approval.
- The Item also consists of excavation of topsoil (overburden) including loading, hauling and stockpiling at the approved locations.
- Final restoration of the quarry site(s) is covered in **Item 5.3**.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works.
- The Work for this Item may be carried out consisting of the following activities:
  - remove fences and structures from quarry and topsoil deposit areas,
  - cut grass and bushes,
  - cut trees and remove stumps,
  - grub roots,
  - remove and stockpile boulders,
  - haul and deposit cut vegetation and debris well outside the cleared area at approved locations,
  - burn deposited material only when approved by the Engineer,
  - excavate topsoil layer,
  - load topsoil and haul to approved stockpile location,
  - stockpile topsoil neatly so that it can be reused for reinstatement of the quarry.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions (cleared quarry area)	Tape	all	+ / - 200 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
5.1	Preparation of quarry site consisting of clearing from vegetation and removing topsoil	Square Metre (m <sup>2</sup> ) → of clearing quarry	<b>AWD</b>

**Payment:** The Engineer will effect payment of completed quarry clearing work in the following Payment Certificate upon approval of the works.

**BILL 5: GRAVELLING AND COMPLETION WORKS**  
**ITEM 5.2 Excavate gravel, remove boulders, stockpile, load, haul, offload, spread, water and compact**

**DESCRIPTION:**

- The Item includes all operations required to win gravel and to lay the gravel road surface layer. In particular the Item consists of excavation, stockpiling, loading, hauling, off loading, spreading, watering and compacting.
- The gravel shall be excavated from quarries approved by the Engineer. It is the Contractors obligation to inform the Engineer in the case that the quality / availability of the gravel changes during the course of excavation.
- Excavation and stocking of gravel shall be carried out as specified in **Volume 4, Manual A, Section F 2.5**
- Reshaping of the formation surface may be required before the gravel can be placed. Where required, this activity is covered in **Item 3.1**.
- Where there remains a residual gravel layer from previous gravelling operations, this residual layer shall be scarified to a depth of not less than 10cm in order to provide a bond between the old and new gravel materials. Scarification, where required, with be included in the unit rate for this Item.
- Oversize stones and boulders shall be removed from the excavated gravel and deposited outside the quarry at locations approved by the Engineer. Such stones and boulders may be reused for structural works.
- Off loading shall be done by tipping or throwing the material uniformly into spreading boxes set out with pegs and strings as specified in **Volume 4, Manual A, Sections F 2.6 and F 2.7**. The compacted thickness of the layer will be as specified in the Drawings and as directed by the Engineer.
- Spreading of the gravel shall be carried using labour method to ensure uniform thickness of the layer and camber cross-fall as specified in **Volume 4, Manual A, Section F 2.7**. Spreading also includes either removing or crushing of all oversize material using sledge hammers.
- Compaction shall be carried out with a self propelled or towed roller with approved total weight and dimension. A minimum six (6) passes of compaction shall be applied or until no roller imprint on the surface can be recognised. The gravel layers to be compacted shall not exceed 20cm loose and the gravel shall be watered before compaction takes place in order to achieve the required moisture content.
- The camber of the compacted formation shall have a cross fall of not less than 8%.

**WORK METHOD:**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Works. **Excluded** are: **spreading** of the gravel layer which shall be done using **labour** only, and **compaction** which shall be done using **equipment**.
- The Work for this Item may be carried out consisting of the following activities:
  - excavate gravel and stockpile ready for loading,
  - remove oversize stones and boulders, haul to locations allocated for depositing,
  - load gravel and haul to the Site,
  - reshape earth road formation by filling ruts and potholes, re-establish camber and shoulder line if defective; refer **Item 3.1**,
  - scarify, to a minimum depth of 10cm, where any residual gravel exists,
  - set out spreading boxes in accordance with required thickness of the gravel layer,
  - offload and spread material uniformly in boxes using labour. Crush oversize stones with sledgehammer. Form camber and check with camber board,
  - water gravel to achieve approximate optimum moisture content,
  - compact with towed or self propelled roller or compactor,
  - check uniformity of layer thickness (20cm loose) and achieved 8% cross-fall → correct immediately where necessary.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Gravel Quality / Approved Source	Visual / Inspection	Daily	None
Scarification	Visual	As required	None
Gravel Surface Width	Tape	every 100 m	+ / - 20 mm
Gravel Surface Thickness	Test holes, Tape	spot checks, average 10 per km	+ / - 5 mm
Gravel Surface Profile	Camber Board	every 50 m	+ / - 1%
Compaction	Roller Imprint	randomly	None

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
5.2	Excavate gravel, remove boulders, stockpile, load, haul, offload, spread, water and compact	<b>Cubic Metre</b> (m <sup>3</sup> )→ of <b>compacted</b> gravel layer in place	<b>AWD</b>

**Payment:** The Engineer will effect payment of any completed section of gravelling work in the following Payment Certificate only after detailed checking and confirmation of the actual quantity of gravel compacted in place and after approval of the works.

**BILL 5: GRAVELLING AND COMPLETION WORKS**

**ITEM 5.3 Restoration of site(s), quarries and borrow pits**

**DESCRIPTION:**

- For environmental reasons quarries and borrow pits shall be restored at the end of the Works; refer **Clause 64** of the Conditions of Contract. The ground shall levelled, topsoil hauled back and uniformly spread over the entire exposed/excavation area.
- Where necessary appropriate protection measures may be taken to avoid erosion of the spread topsoil layer.
- Grass and trees may be replanted as directed by the Engineer.
- Adequate drainage provisions shall be made to protect excavation areas.
- The Work Site(s) shall also be cleared of all debris, remaining materials, stores, equipment, etc. Site camps including all sanitation facilities shall be dismantled and removed and the entire area of the Works restored to its original condition.

**WORK METHOD:**

**Refer Volume 4, Manual A, Sections E 3.1, F 2.8 and H 4**

- The Contractor may choose **Labour, Equipment or a combination of both** to carry out this Item depending on the degree of difficulty of the Work.
- The Work for this Item may be carried out consisting of the following activities:
  - level quarry or borrow pit,
  - loosen deposited top soil,
  - load and haul,
  - spread uniformly,
  - plant grass and trees as directed by the Engineer,
  - carry out erosion control measures as directed by the Engineer,
  - provide adequate provision for drainage of the area,
  - the entire area of the Work Site(s) restored to its/their original condition.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Check	Visual	all	none

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
5.5	Restoration of site(s), quarries and borrow pits	<b>Lump Sum</b>	<b>AWD</b>

**Payment:** The Engineer will effect payment of this lump Sum Item only after all quarries and borrow pits and the Work Site(s) have all been fully restored to the satisfaction of the Engineer and the work has been approved. Following the completion of this Work and its approval, an Environmental Restoration Certificate will be issued to the Contractor.

**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.1 Provide material and construct log edged steps, Drawing No. RA 007****DESCRIPTION:**

- This item consists of the provision of suitable treated, seasoned and peeled eucalyptus logs placing and fixing, including fixing materials, of the logs as indicated in the drawings to form the restraint for compacted soil which together form the step.
- For all logs that by necessity must be cut on site, the exposed surfaces shall be well coated with a recognised commercial preservative. Approval of any preservative to be used at the site shall be approved in advance of its use.
- Treatment of logs must be of either of the following methods:
  1. Pressure impregnation using either a) Creosote at a rate of 150kg/m<sup>3</sup> or b) copper chrome arsenite at a rate of 10 kg/m<sup>3</sup>
  2. Hot and Cold tank treatment. Logs are to be immersed in creosote for 1 hour at 85-90C then allowed to cool to ambient temperature before they are removed from the tank.
- Logs shall be purchased from an approved supplier (e.g. National Forestry Authority). Approval to use the supplier is conditional on the presentation and subsequent acceptance of the Engineer of a certificate from the supplier outlining and guaranteeing the treatment process. The Engineer's approval may be withdrawn at any time if in the opinion of the Engineer the treatment of delivered logs fails to meet with the agreed standards
- Filling within the retained area is not included in this item.

**WORK METHOD:**

- The Contractor shall submit to the Engineer either
  - a) his intended supplier of treated logs for the Engineer's consent
  - b) Provide the Engineer with his method statement for treating logs including security arrangements if the logs are to be treated outside a commercial property.
- The Contractor shall apply Labour method of work for this item
- As far as possible logs should be cut to the size and shape indicated on the drawings prior to treatment
- Logs are then transported to site and fixed in the manner indicated in the drawings.
- The fixing of steps takes place after path formation but before the cutting of any drains
- Fixings are notched, bolted or screwed. The later two methods require pre-drilling. Nailing is not permitted unless with the specific approval of the Engineer
- Backfilling of the step is covered by item 7.5

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
treatment	Random check on log and random inspection at treatment site	Each delivery	zero
Line and level	Spirit level, straight edge, tape	daily	+/- 20mm
diameter	tape	Each delivery	+20 (no negative tolerance)
workmanship	Visual Inspection	daily	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.1	Provide material, place and fix log edged steps	Linear Metre (m) Total length of log used to construct the step	AWD

**Payment:** The Engineer will effect payment of the log edged steps satisfactorily constructed in the following Payment Certificate upon approval of the works.



**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.2 Provide material and construct dry stone edges steps, Drawing No. RA 006****DESCRIPTION:**

- This item consists of providing appropriately dimensioned boulders, clean sharp sand and ordinary portland cement and constructing dry stone edged steps to the line and level detailed in the drawings.
- The boulder should approximately 300mm high and 150mm wide. Partial dressing may be necessary to achieve these dimensions and/or the foundation depth adjusted to suit boulder irregularities
- The ratio of cement to water shall be 1 to 3.
- Filling within the retained area is not included in the item

**WORK METHOD:**

- The Contractor shall apply Labour method of work for this item
- A boulder source shall be identified and selected boulders transported to site
- Boulders shall be dressed where necessary to conform with the dimensions listed above
- The fixing of steps takes place after path formation but before the cutting of any drains
- Foundation shall be dug as far as possible to accommodate boulder irregularities.
- Sand cement mortar is then paced in the trench floor and boulders carefully placed such that the top lip is 200mm above the excavation to level surface.
- Mortar is then added around the boulder to the level indicated on the drawings
- Backfilling of the step is covered by item 7.5

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions/shape of boulder	visual	all	+ / - 50 mm
Line/level	Line level, Straight edge and spirit level	all	+ / - 10 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.2	Provide materials and construct dry stone edged steps	Linear Metre (m) Horizontal distance around outer edge of the retained step	AWD

**Payment:** The Engineer will effect payment of all satisfactorily completed steps in the following Payment Certificate upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.3 Provide material and construct grouted stone steps; Drawing No. RA 005****DESCRIPTION:**

- This item consists of providing suitably shaped pebbles and boulders of a suitable quality stone, with cement and cleans sharp sand and with them the construction of grouted stone steps to the line and level indicated on the drawings including the excavation of the foundation.
- The geometry of the step shall comply with that indicated in the drawings
- When necessary the Contractor may need to create a key in out cropping stone. This rock breaking activity shall be included in this item but is limited to 0.1 m3 per step

**WORK METHOD:**

- The Contractor shall apply Labour method for this item of work
- The stone source shall be identified and the stones transported to the site.
- The fixing of steps takes place after path formation but before the cutting of any drains
- The foundation shall be dug to the line and level indicated on the drawings and mortar placed on the bed of the excavation.
- Stones shall then be laid in a manner which results in maximum density of stone and minimum use of mortar. The joints shall be between 10 and 40mm thick and bonding shall allow an overlap of ¼ stone length
- The grouted steps shall be protected from direct sunlight for 14 days and the horizontal step surface shall be kept moist of 7 days
- Backfilling of the step is covered by item 7.5

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Line and level	Tape/visual	Each step	=/- 10mm
workmanship	visual	Each step	
Stone quality	visual	Each delivery	
mortar	visual	random	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.3	Provide materials and construct grouted stone steps	Cubic Metre (m3)→ of grouted stone	AWD

**Payment:** The Engineer will effect payment of of all satisfactorily completed steps in the following Payment Certificate upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.4 Provide material and construct dressed stone edged steps;  
Drawing No. RA 004****DESCRIPTION:**

- This item consists of providing appropriately manually shaped stone blocks, clean sharp sand and ordinary Portland cement which together are used to construct a dressed stone edged footstep and detailed on the drawings
- Excavation for the foundation of the stone block is included in the item.
- The ratio of cement to sand shall be 1 to 4.
- The shape of the dressed block shall be such that all angles on elevation, side and end plan shall be nominally 90 degrees, and its dimensions and weight are as detailed on the drawings.
- The filling within the retained area is not included in this item.

**WORK METHOD:**

- The Contractor shall use Labour method for this item
- The Contractor shall provide a sample of dressed stone s/he intends to use in advance of placing an order with a supplier and the Engineer shall give his consent on a suitable sample.
- Changes in supplier require the Engineer's content for the new supplier.
- The fixing of steps takes place after path formation but before the cutting of any drains
- The foundation shall be dug to the line and level indicated on the drawings and mortar placed on the bed of the excavation.
- Stones shall then be laid in a manner limits joint thickness to between 10 and 40mm and bonding shall allow an overlap of ¼ stone length
- The grouted steps shall be protected from direct sunlight for 14 days and the horizontal step surface shall be kept moist of 7 days.
- Backfilling of the step is covered by item 7.5

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Line and level	Tape/visual	Each step	=/- 10mm
workmanship	visual	Each step	
Stone quality	visual	Each delivery	
mortar	visual	random	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.4	Provide materials and construct dressed stone edged steps	Linear Metre (m) Horizontal distance around outer edge of the retained step	AWD

**Payment:** The Engineer will effect payment of all satisfactorily completed steps in the following Payment Certificate upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.5 Provide place and compact selected material within step Drwgs RA 004, 006 & 007****DESCRIPTION:**

- Log, dressed stone and dry stone edged steps require material to be placed and compacted within the restrained sides. This item covers work associated with this activity.
- The item covers provision, placing and compacting selected material within the step edges
- Material shall be placed, within the restrained sides of the step and when necessary watered such that the material is acceptably close to OMC and compacted with a hand rammer such that the top surface is flush with the horizontal surface of the step.

**WORK METHOD:**

- The Contractor shall apply **Labour** method of work for this Item.
- Material shall be borrowed, either from the side drain excavation, side borrow or from a location agreed and approved by the Engineer.
- The material shall be compacted with hand rammer at OMC until such time as there is no imprint on the surface of the material from the 10 kg hand rammer.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Compaction	Hand rammer imprint	Each step	zero
Levels	Line level, Straight edge and spirit level	all	+ / - 10 mm

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.5	Provide place and compact selected material within step	Cubic Metre (m <sup>3</sup> ) → of compacted fill material	AWD

**Payment:** The Engineer will effect payment of completed masonry work of any completed structure in the following Payment Certificate upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS**

**ITEM 7.6 Supply and fix rough sawn hardwood for the construction of Ladders (This is item is identical to item of 4.19)**

**Item 7.6.1 50 x 150mm CSA**

**Item 7.6.2 75 x 100mm CSA**

**DESCRIPTION:**

- This is the main structural member in ladders.
- The item consists of supplying the specified cross section and quality of sawn, well seasoned hardwood to site, cutting, placing and fixing the timber, including the fixing materials, in accordance with the details indicated on the drawings.
- The timber shall be heartwood and well seasoned (moisture content less than 18%) heavy hardwood (density greater than 600 kg/m<sup>3</sup> at moisture content of 18%) e.g. Mahogany or Mvule (Iroko) species.
- The use of fresh or semi-seasoned timber requires the written consent of the Engineer.
- The timber shall be essentially free of knots, fissures and other defects

**WORK METHOD:**

- The contractor shall use Labour method for this item
- The Contractor shall submit to the Engineer his intended supplier for sawn hardwood for the Engineer's consent prior to placing any order with the supplier.
- If the Contractor wishes to change supplier subsequent to the Engineer's consent this may be done but only with the Engineer's consent to do so.
- Timber shall be sawn as necessary and fixed as detailed on the drawings. Nailing timber may be done only with the consent of the engineer.

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Imperfections (knots, fissures etc)	visual	Each delivery	zero
Heart wood/sap wood	visual	Each delivery	zero
Moisture content	Visual	Each delivery	2%
Cross section	tape	Each delivery	+/- 5mm
Straightness	Straight edge	daily	50mm over 3m
Workmanship	visual	daily	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.6	Supply, place and fix timber planks 50 x 150mm CSA	Linear Metre (m) of timber	AWD

**Payment:** The Engineer will effect payment of the satisfactorily completed ladder construction in the following Payment Certificate upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS**

**ITEM 7.7 Supply and install fixings for ladder treads and splice plates for ladder stringers**

**ITEM 7.7.1 Supply and fix 65 x 65 x 6 x 140mm angle brackets**

**ITEM 7.7.2 Supply and fix 12 x 100mm diameter bolts**

**ITEM 7.7.3 Supply and fix 12mm x 200 mm diameter bolts**

**ITEM 7.7.4 Supply and fix 150 x 550 x 6mm mild steel splice plate**

**DESCRIPTION:**

- The item includes all necessary fixing components required for fixing treads to ladder strings and splicing ladder stringers
- The item includes cutting and drilling of angle members (item 7.7.1) as indicated on the contract drawings and fixing the brackets using bolts (item 7.7.2) complete with washers and nuts.
- The item includes cutting and drilling of splice plates to accommodate the angle of repose of the ladder and fixing using bolts (item 7.7.2/3)

**WORK METHOD:**

- The contractor shall accurately assess the quantity of fixings required and the exact angle of repose of the ladder before placing an order for supply.
- The ladder shall be fabricated before erection and then placed in holding down fixings and intermediate supports as necessary all of which shall be cast at least 14 days previously

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
dimensions	tape	Random	
workmanship	visual	Daily	

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.7.1	Supply and fix 65 x 65 x 6 x 140mm angle brackets	Number (no.) of brackets	MAP/AWD
7.7.2	Supply and fixing 12 x 100mm bolts	Number (No.) of bolts	MAP/AWD
7.7.3	Supply and fix 12 x 200mm bolts	Number (No.) of bolts	MAP/AWD
7.7.4	Supply and fix 550 x 150 x 6mm MS plate	Number (No.) of plates	MAP/AWD

**Payment:** The Engineer will effect payment of each satisfactorily completed ladder structure in the following Payment Certificate and upon approval of the works.

**BILL 7: FOOTSTEPS AND LADDERS****ITEM 7.8 Supply and Fix End and Intermediate Supports for Ladders****Item 7.8.1 Provide and Fix Support at Base of Ladder Option 1, Double stringer****Item 7.8.2 Provide and Fix Support at Base of Ladder Option 2, Single Stringer****Item 7.8.3 Provide and Fix Support at Top of Ladder Option 1, Double Stringer****Item 7.8.4 Provide and Fix Support at Top of Ladder, Option 2, Single Stringer****Item 7.8.5 Provide and Fix intermediate Support for Ladder Option 1, Double Stringer****Item 7.8.6 Provide and Fix Intermediate Support for Ladder, Option 2, Single Stringer****DESCRIPTION:**

- Ladders require solid fixing points at the base, the top and if necessary at intermediate points (see drwgs No. RA008, 009 and 010).
- The item includes
  - the supply of all steel fixings, (brackets, bolts, washers, plates
  - excavation for the foundation,
  - fitting of holding down bolts and plates, including where necessary welding
  - supplying and fixing channel section steel members (including cross bracing), where detailed
  - Supply and placing 1:2:4 mix concrete to the foundation.
- The unit of measurement is number of supports, where the support is defined as fittings and fixings associated with both left and right hand stringers.

**WORK METHOD:**

- The contractor shall accurately assess the quantity of materials required for the fixings and the exact angle of repose of the ladder before placing an order for supply.
- Ladder holding and fixing brackets shall be prefabricated, cut and welded

**QUALITY CONTROL:**

Test	Method	Frequency	Tolerance
Dimensions and level	Tape	all	+ 100mm / - 50mm
Workmanship; placing, tying, filling	Visual	all	-

**MEASUREMENT AND PAYMENT:**

Pay Item No.	Description	Unit of Measurement	Method of Measurement
7.8.1	Provide and fix support at base of ladder, option 1, double stringer	Number (no.) of supports	MAP/AWD
7.8.2	Provide and fix support at base of ladder, option 1, double stringer	Number (no.) of supports	MAP/AWD
7.8.3	Provide and fix support at top of ladder, option 1, double stringer	Number (no.) of supports	MAP/AWD
7.8.4	Provide and fix support at top of ladder, option 2, single stringer	Number (no.) of supports	MAP/AWD

7.8.5	Provide and fix intermediate support, option 1, double stringer	Number (no.) of supports	MAP/AWD
7.8.6	Provide and fix intermediate support, Option 2, single stringer	Number (no.) of supports	MAP/AWD

**Payment:** The Engineer will effect payment of each satisfactorily completed ladder structure in the following Payment Certificate and upon approval of the works.