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The City of Noamunga
The City of Noamunga

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Prelim engineering

Witton Bluff Protection Strategy

PRELIMINARY ENGINEERING DESIGN

CORPORATION OF THE CITY OF NOARLUNGA

WITTON BLUFF
PROTECTION STRATEGY
PRELIMINARY ENGINEERING DESIGN

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1.0 INTRODUCTION

This is a report on the preliminary design proposals for the protection of Witton Bluff. This prominent headland between Port Noarlunga and Christies Beach south of Adelaide comprises cliffs and steep slopes which are being eroded. In order to protect the hinterland adjacent to the cliffs a rock revetment along the toe together with random fill between it and the cliff is proposed. The section of Witton Bluff to be treated opposite The Esplanade extends between Fenton and Anderson Avenues.

A further report with a detailed engineering design and specification strategy will follow.

2.0 PREVIOUS REPORTS

In 1982 the Corporation of the City of Noarlunga and the Coast Protection Board of the South Australian Department of Environment and Planning undertook a study of possible engineering solutions, totether with effects on adjoining land use.

Two previous reports listed below by Pak-Poy & Kneebone Pty. Ltd., have examined this problem.

1. Witton Bluff Management Strategy - Study Report October, 1982.
2. Witton Bluff Management Strategy - Progress Report on two Protection Alternatives, August, 1983.

The first report in October, 1982 studied the present condition of the bluff, the causes of its degradation and offered some thirteen possible alternative plans to alleviate the situation. The thirteen alternatives are derived from two basic options which were considered in detail in a Management Strategy Report dated August, 1983. One of these basic options comprises the construction of a rock revetment along the toe of a fill slope against the cliff faces.

3.0 PROTECTION STRATEGY

3.1 ROCK REVETMENT

The preliminary engineering design of the proposed rock revetment culminates a study of similar structures, the recently completed O'Sullivan's Beach Breakwater for a marina, and the proposed breakwater at Stony Point. The purpose of this rock revetment is to protect the toe of the fill slope from marine erosion. A structure comprising three zones is proposed, an inner core enveloped by two protective layers of heavy duty rock to act as armour.

The rock revetment is a gravity structure and therefore relies on its weight for stability. In addition the size and packing of rocks to reinforce each rock layer is important in withstanding wave action.

The height and width of the structure related to the sea bed level and depth of water, follow the guidelines of the United States Army Engineers breakwater design charts.

At Bluff Point the revetment has been widened from 4 to 8 metres for extra erosion protection where it will be the most severe, see Drawings 1 and 2. The proposed revetment will be about 6 metres in height with the top at about R.L. 6 metres. As the revetment is within the tide range a seaward slope of 1 on 2 has been chosen to dissipate wave energy as quickly as possible.

It is essential that the outer armouring layers consist of a strong, fresh, non-friable, stable rocktype. The core material should be free draining and may be a crushed rock aggregate derived from similar materials to the armouring rocks.

Designs making use of a low cost quarry rubble including fines which may not be free draining, and incorporating a protective geofabric were considered. However this solution was rejected because of the construction difficulties within the tide range using a

geofabric and materials incorporating a high fines content.

Construction of the proposed rock revetment could be by end tipping from trucks off the existing revetment.

The proposed rock revetment will extend from the existing revetment past Bluff Point to join up with a natural rock ledge about 120 metres south of the promontory. As this ledge is about 1 metre higher than the design level of the top of the revetment it is planned to raise the revetment at this location. This will provide convenient access and merge with a natural feature of the cliff.

3.2 FILL

It is understood that the fill material to be placed against the cliff face will be a low cost random fill which is available at the time. It is assumed that this material will contain a high fines content. The in situ density and therefore the shear strength of this material when placed, will depend on its degree of compaction and moisture content.

Field supervision during construction by experienced personnel with regular field tests on the degree of compaction is essential. If the random fill has a particularly high fines content which may allow pore pressures to build up from surface or groundwater seepage, an inclined layer of free draining material forming a 'chimney' within the random fill may be necessary.

Provided the random fill is compacted to its maximum density at optimum moisture content an overall slope of about 37° is proposed. Two 1 metre wide berms between batter slopes of 1 on $1\frac{1}{4}$ are envisaged. It is understood that Norfolk Pines will be planted along these berms in which case permanent access will be required.

At Bluff Point a strip of the original material forming the bluff will be exposed between the random fill placed in

embayments either side. The exposure will provide access not only to the berms on the random fill slopes but also to inspect the natural formations. It is possible that erosion of the material forming this strip, by natural processes and from man's activities may degrade this strip below the level of the proposed random fill slopes either side. This situation may exist already in parts as a detailed survey along this strip is not available due to access difficulties. In this case it may be necessary to steepen the proposed random fill slope locally to maintain a strip exposure of the natural formations.

The surface of the random fill slopes must be protected from erosion by the elements. We understand that the environmentally attractive solution of planting vegetation is proposed. It will be essential that a hardy plant which will establish itself rapidly is used, so that on completion of construction, the vegetation will be able to protect the slope surface when the next heavy winter rainstorms occur.

It is anticipated that planting by hand may be required. This will be difficult on the proposed 1 on 1½ batters.

We recommend that construction of the random fill will be placed in layers by end tipping from trucks and graded along ramps from the existing revetment to the north and the natural rock ledge to the south. Each layer should be compacted by rolling to achieve a density of at least 93% modified compaction.

3.3 FOUNDATION CONDITIONS

The foundation area for the proposed rock revetment lies between about R.L. 1.4 metres and R.L. -1.1 metres. Almost the entire foundation area lies within the tidal range and is covered by seawater at high tide and exposed at low tide. Views of the foundation area are shown in Plates 1 and 2.

The area at the toe of the cliffs consists of small sandy beaches in each of the embayments either side of Witton Bluff. The sand in the northern embayment is dense while that in the southern embayment is loose.

Offshore from these two embayments and Witton Bluff itself the foundation area comprises irregular outcrops of Blanche Point Marl. The Blanche Point Marl Formation dips at a shallow angle towards the south west. As a result rock ledges rising up to about 1 metre high, extend to the west from the cliff base, see Drawing 1. Other preferentially eroded channels about 0.3 metres deep follow a regional joint direction aligned North/South.

The Blanche Point Marl outcrops are erosion resistant, strong and mainly moderately weathered. These rock outcrops are considered ideal as a foundation for the proposed rock revetment.

4.0 SURFACE DRAINAGE

As part of the protection of Witton Bluff surface run off from the crest of the headland needs to be controlled. This is required to protect the surface calcrete capping as well as prevent run off eroding the surface of the random fill slope.

A concrete spoon drain is proposed about 1.0 metre behind the crest of the cliff and draining from a point near Benny Avenue, both to the north and south, leading into the Esplanade kerb and gutters, see Drawing 1.

As the calcrete capping provides a natural erosion resistant protection to the softer underlying materials, it is essential that the spoon drain is constructed above this calcrete cap leaving the natural protective layer undisturbed. Where the spoon drain is constructed on flat lying areas filling on the high side to provide a fall towards the drain will be necessary. A weatherproof seal on this fill will be required.

PLATES



PLATE 1 View at low tide looking south east from existing revetment. Note the rock ledges of Blanche Point Marl extending from the cliff towards the west.

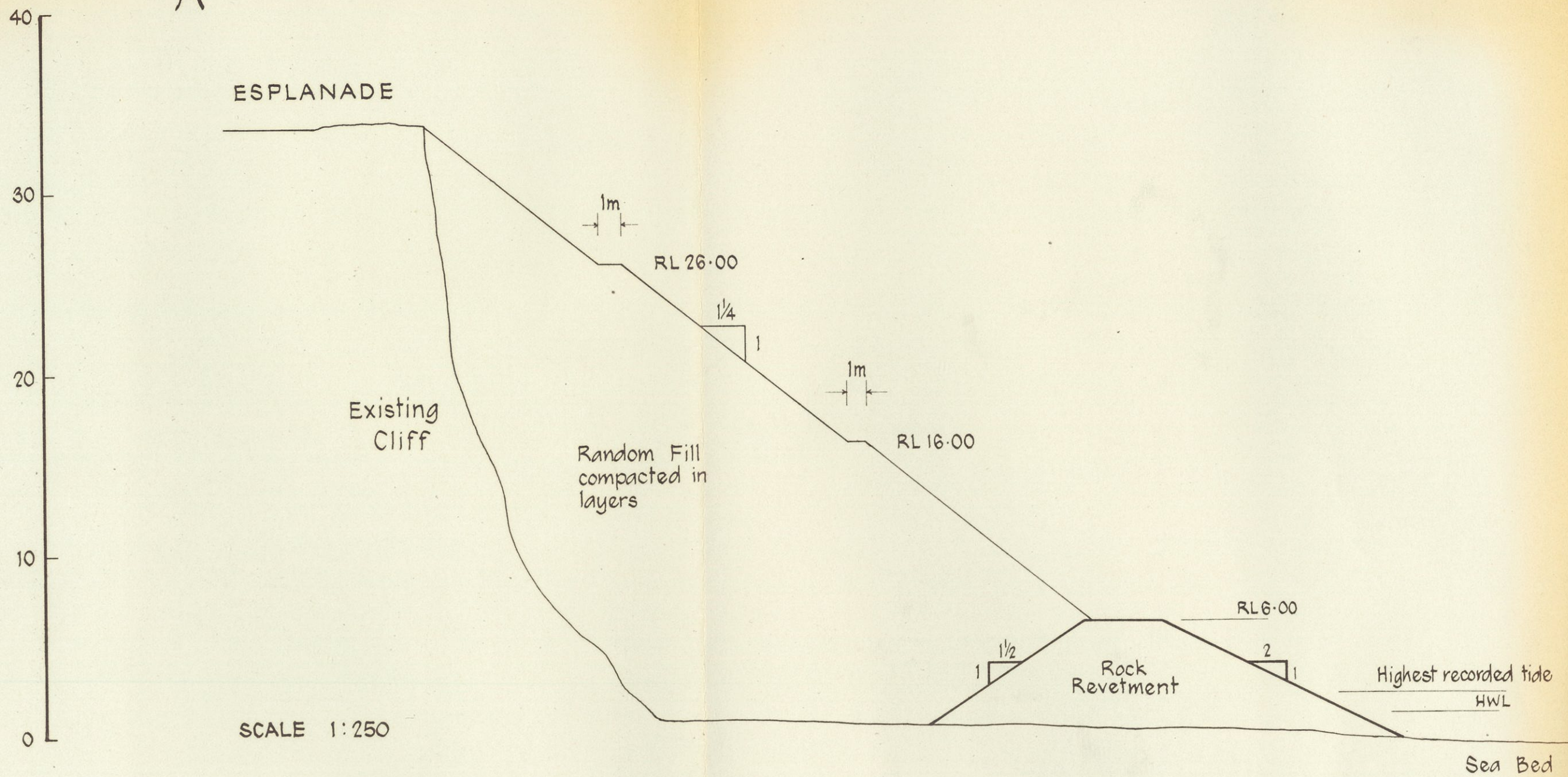


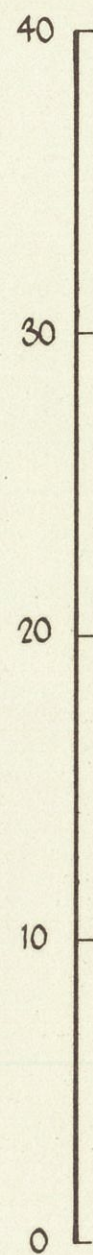
PLATE 2 View of the foundation area at low tide looking to the north west.

DRAWINGS

A

A

LOCATION
PLAN



B

Witton Bluff

SCALE 1:250

Rock Revetment

RL6.00

2
1

Highest r
HWL

B

B

C

Cliff Top

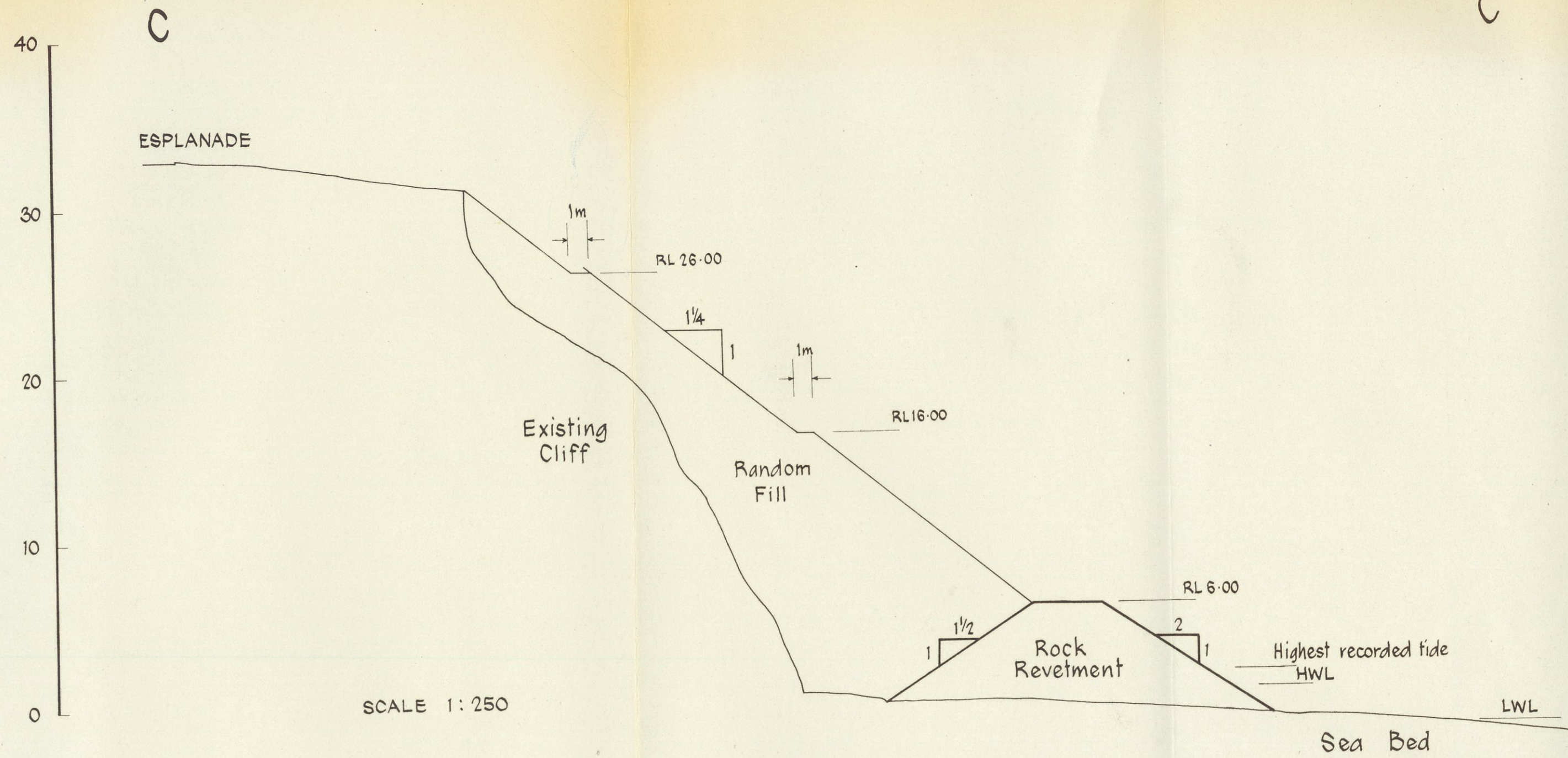
Proposed Rock Revetment
Witton Bluff

A

A

B

C

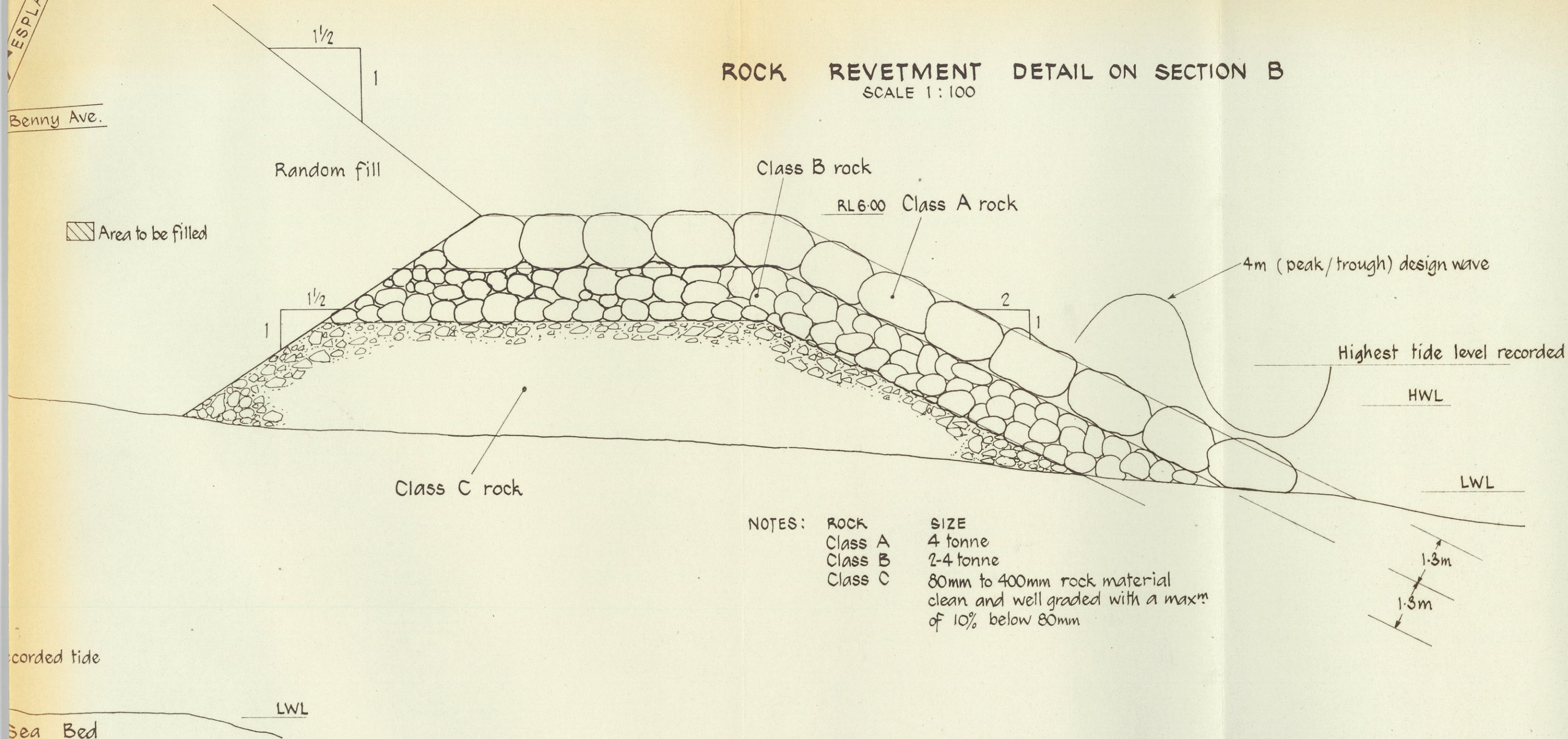


ESPLANADE

Benny Ave.

ROCK REVETMENT DETAIL ON SECTION B

SCALE 1:100



NOTES: ROCK SIZE
Class A 4 tonne
Class B 2-4 tonne
Class C 80mm to 400mm rock material
clean and well graded with a max^m
of 10% below 80mm

recorded tide
Sea Bed
LWL

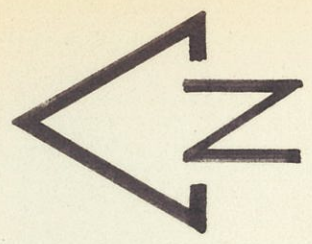
			The Corporation of the City of Noarlunga		SCALE	DE
			WITTON BLUFF		As shown	B.1
			PROPOSED ROCK REVETMENT & RANDOM FILL		APPROVED	DR
			IN SECTIONS		DATE	G.
			PAK-POY & KNEEBONE PTY. LTD.		Nov. 1983	CHE
			CONSULTING ENGINEERS and PLANNERS		DRAWING NUMBER	
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FENTON AVE

ESPLANADE

SPOON DRAIN



ROCK LEDGE

A

ROCK LEDGE

CK REVETMENT

ROCK LEDGE

B

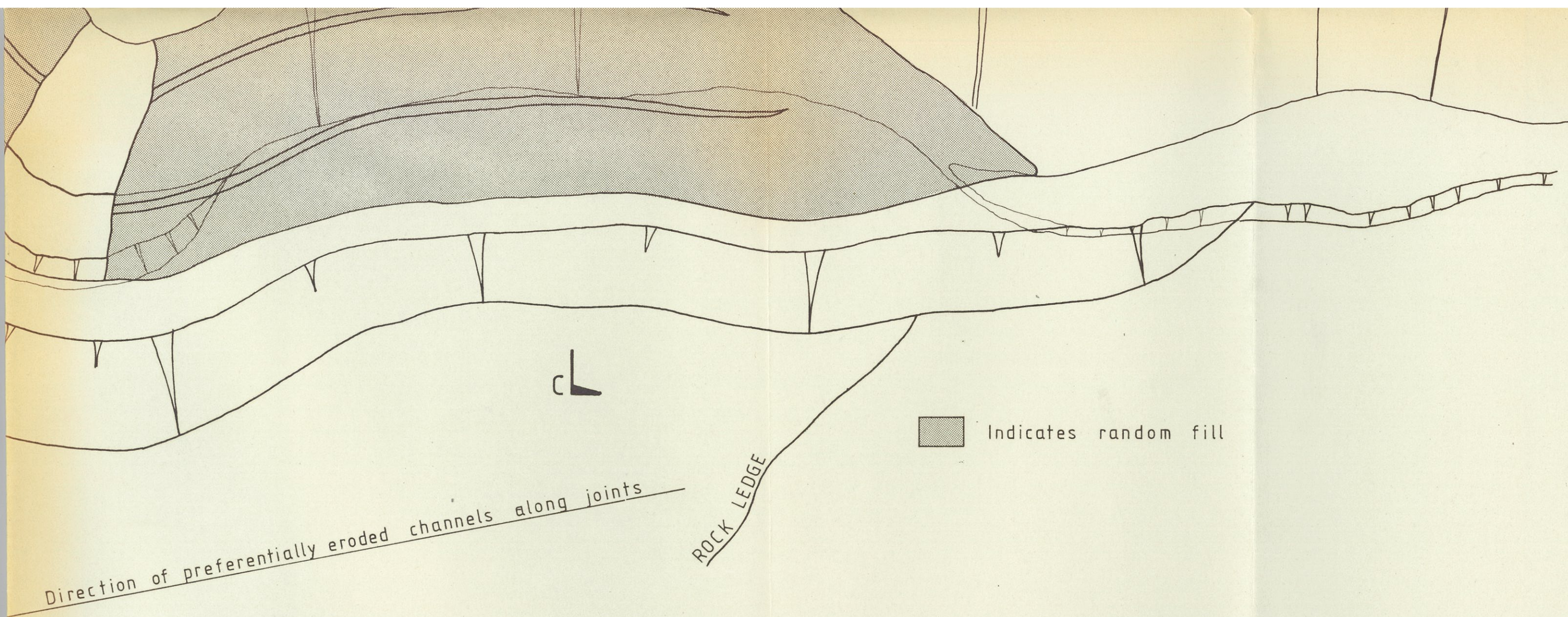
BENNY AVE

ANDERSON AVE

C ESPLANADE


B





NOTE

1. Extremities of fill shown are approximate only
2. This drawing is based on Drg F.O.49 supplied by The Corporation of the City of Noarlunga
3. For Sections A, B, C refer Drg 83A 7926-2

<div>  PAK-POY & KNEEBONE PTY. LTD. CONSULTING ENGINEERS and PLANNERS </div>			THE CORPORATION OF THE CITY OF NOARLUNGA		SCALE 1:500	DESIGN B.W.1
			PLAN OF WITTON BLUFF PROTECTION STRATEGY		APPROVED	DRAW J.F.
					DATE Nov 1983	CHECK
					DRAWING NUMBER 83A 7926-1	