

1991
PORTH

PROPOSED W.D.A DEVELOPMENT
AT
CLYDACH VALE
RHONDDA

OVE ARUP & PARTNERS
GEOTECHNICAL DESK STUDY
SYNOPSIS

45998

CLYDACH VALE 1.5 HECTARE PLATEAU

GEOTECHNICAL DESK STUDY

SYNOPSIS

A desk study has shown that the 1.5 ha plateau at Clydach Vale Reclamation Site is suitable for light industrial development.

Part of the plateau is located some 100m downhill of the eastern end of a landslip. There has been no substantial movement of this part of the landslip since at least the nineteenth century and the reclamation works will increase the overall stability by the construction of a fill slope at the toe. Geomorphological studies suggest that any foreseeable future movements will be shallow and remote from the development plateau. Some maintenance of the hillside drainage works may be required.

Several mine entries have been appropriately treated and mineworkings present no significant risk to development.

45998

Client

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Report Serial No: 86/1175

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INTRODUCTION

Rhondda Borough Council are currently reclaiming derelict land at Clydach Vale; the Consultant for the Scheme is Mid Glamorgan County Council Land Reclamation Unit. Part of this project will create a 1.5 ha plateau, which may be designated for industrial development.

Ove Arup and Partners are appointed to carry out a geotechnical desk study of the 1.5 ha plateau. This report presents the findings of the desk study, which concentrated on the geology, geomorphology and mining history of the site. It discusses the potential for landslipping to influence the plateau and makes general comments on the suitability of the site for industrial development.

A previous report by Ove Arup and Partners (reference 86/1165, dated July 1986) presented a geotechnical desk study and the results of a trial pitting investigation into the adjacent, 4.12 ha industrial plateau, and made geotechnical recommendations for its development.

2.0

THE SITE

2.1 Location and Topography

The site is at National Grid Reference SS 980928; see Figure 1. It is part of the Clydach Vale Land Reclamation Scheme and comprises a filled plateau of some 1.5 ha, see Figure 2. The reclamation proposals include improvement of the visual appearance of the slope immediately to the south, by construction of a filled batter, occupying a further 3.5 ha maximum.

An artificial lake defines the site to the north and an abandoned railway line defines the southern limit of the filled batter. A newly completed 4.1 ha industrial plateau is adjacent to the eastern boundary and an allotments plateau is being formed to the west.

The original ground beneath the 1.5 ha plateau slopes gently from about 200m AOD in the south to 195m AOD in the north. Filling was in progress during this investigation and the final level will be about 200 m AOD. The proposed fill batter will be on hummocky ground, sloping at an average gradient of 1 in 3 but steepening towards the railway line. Beyond the railway, the ground rises more steeply, towards Mynydd Pwll yr Hebog.

Above the railway line there are several issues, some from old levels into the No.2 Rhondda Coal Seam, which give rise to streams flowing northwards. Two of the larger streams are culverted beneath the railway at the eastern and western end of the site respectively. Elsewhere, culverts have become blocked and water collects and ponds at the uphill edge of the railway.

Below the railway line there is a local hollow with further issues, poor drainage and some peat development. At the time of the investigation some of these issues had been dug out, exposing small stone-lined culverts in poor condition.

During this investigation, colliery spoil was being placed to form the 1.5 ha plateau. The proposed fill batter area was mainly covered with rough grass with reeds along the flow lines where drainage was poor. However, there were some temporary excavations which revealed pockets of ash fill, soft organic clays and peat in some places.

2.2 History

The history of the site has been studied on 1:2500 Ordnance Survey maps dated 1876, 1898, 1920 (County Series), 1948 partial aerial revision, 1962 and 1978 (National Grid Series). The 1876 and 1962 maps are reproduced in Figure 3.

Aerial photographs taken in 1946, 1947, 1954, 1971 and 1985 were also studied. The 1954 and 1985 photographs are included as Figures 6 and 7.

Prior to the opening of Blaenclydach and Cwmclydach collieries nearby in 1863/64, the site was open fields, part of Pwll yr Hebog Farm.

The first edition Ordnance Survey map (1876) shows Cwm Clydach Cottages (later known as Bush Houses) on the site. These were probably built in the 1860's to house colliery workers. A tramway was also present across the site, serving levels on the No.2 Rhondda Seam on the mountainside to the south; see Figure 3.

Pwll yr Hebog Farm was demolished to make way for the railway line, built along the southern site boundary in 1877. The tramway to the No.2 Rhondda Levels was disused by 1898, dismantled by 1920. Apart from these changes, very little took place on the site itself until recently and the typical state of development is shown by the 1962 Ordnance Survey plan, see Figure 3.

Colliery spoil tips progressively encroached towards the eastern and western site boundaries throughout the late 19th and early 20th Centuries. Cambrian Colliery Tip, to the west, began in 1872 and reached its maximum extent by about 1920. It was re-excavated and washed in the 1970's to recover coal, the discard being dumped further up-valley at the site of the abandoned colliery.

Drainage measures were installed by the National Coal Board in the early 1970's, uphill of the Cambrian Colliery Tip. These included cut-off drains at, and uphill of, the No.2 Rhondda Seam and drainage of several old levels. The combined flow was piped around the hillside to discharge clear of the eastern end of the tip site, see Figure 2. The purpose of these measures was to try to ensure that any re-activation of landslipping caused by removal of the tip would take place as only gradual movement. (Report on First Stage Investigation into the Proposals for Washing and Redisposal of Cambrian Colliery Tip 240 prepared for the National Coal Board by Sir William Halcrow and Partners).

2.2 History (Cont'd)

Tipping to the east of the site took place from Blaenclydach Colliery during the period 1904 to 1947. Most of this tip was removed during the formation of the 4.12 ha plateau.

Bush Houses were demolished in about 1970 and the site remained derelict until the present development began. The railway line was closed in 1967 when Cambrian Colliery ceased production.

2.3 Geology

The 1:10560 geological map shows the Llynfi Beds of the Upper Coal Measures beneath the site, which in turn rest on the Middle Coal Measures. The sequence, illustrated in Figures 4 and 5, consists of alternating sandstones and mudstones with coal seams, dipping at about 1 in 18 to the north-east.

The following coal seams occur in the sequence :-

No.2 Rhondda
No.3 Rhondda
Un-named Thin Coal
Hafod
Abergorki
Pentre

Elevations on mine plans show the Abergorki and Pentre Seams to be more than 110m below the final level of the plateau.

The separation of the seams at Cambrian Colliery Shafts, see Figure 5, may be used in conjunction with the known depths of the Pentre and Abergorki Seams to predict the elevations of the remaining seams. On this basis, the Hafod is at least 70m below the plateau, and the un-named thin coal and the No.3 Rhondda Seam probably outcrop across the site, beneath the plateau and fill batter areas respectively, see Figure 4. The No.2 Rhondda Seam outcrops on the mountainside to the south.

A minor fault is shown on mine plans crossing the western end of the site, in the No.3 Rhondda Seam, see Figure 4. It trends north-north-east and the downthrow is some 6m to the west-north-west.

Boulder clay (Glacial Till) overlies the solid geology across most of the site. It is relatively thin in places, mudstone bedrock being exposed in temporary drainage ditches immediately south of the plateau, see Figure 4, but thickens rapidly to the north and east. Landslip deposits occur in the south-west corner of the fill batter. In the adjacent hollow, temporary excavations revealed up to 2.5m of soft organic clays with layers of peat overlying stiff grey boulder clay.

2.4 Geomorphology

The IGS South Wales Coalfield Landslip Survey (1980) records landslip no. RR 45 on the hillside above the disused railway line. The landslip is described as a complex, shallow translational debris slide with slumped sandstone at its head, grading to debris flow downslope. Active shallow failures in the slip debris were noted, particular reference being made to one such failure which occurred in 1976 above the disused railway line at the eastern toe area.

Aerial photograph overlays, see Figures 6 and 7, show the conjectured extent of the landslipping together with the main scars, lobes and drainage lines. The eastern end of the landslip lies uphill of part of the 1.5 ha plateau and encroaches into the south-west corner of the proposed fill batter.

The central part of the landslip contains slumped/rotated blocks of sandstone from the scarp above the No.2 Rhondda Seam; the steep slope below includes several prominent lobes and scars. The eastern end of the landslip appears to be a shallower feature; a rotated block is not apparent, the overall slope angle is slightly lower and lobes are less pronounced.

The scale of movements which have occurred since the nineteenth century have been examined by comparing the Ordnance Survey plans and aerial photographs. The line of the tramway to the No.2 Rhondda Seam levels shown on the 1876 plan has been broken by shallow movements, as illustrated on the overlay to the 1954 aerial photograph. Comparison shows that there has been no significant disturbance or deviation of the line of the branch railway. Shallow debris flows appear likely to have deposited material on the railway line occasionally and would have been dealt with by routine maintenance.

The landslip morphology changed relatively little between 1954 and 1985. At the eastern end, there have been shallow movements associated with drainage lines, including erosion in gullies and backsapping at issues. These shallow movements are on-going and account for several bare scars which are presently visible. The movements in 1976, referred to by IGS, are likely to have been of a similar nature.

2.4 Geomorphology (Cont'd)

Since the early 1970's, gradual movements have occurred in the central part of the landslip. These were noted by the IGS in 1980 who commented that movement had damaged the drainage works installed in the early 1970's by the NCB (ref. Section 2.2). Two backscars associated with these movements can be seen on site and are apparent on the 1985 aerial photographs, see Figure 7. They are some 50m and 80m long respectively. The movements have disturbed the drainage works which may be leaking and exacerbating the instability.

One of these larger areas of instability is relatively close to the south-west corner of the filled batter.

2.5 Abandoned Mining

2.5.1 Workings

Ten coal seams are recorded as having been worked beneath the plateau, at depths exceeding 100m. Total extraction was up to 15m and has been fairly uniform across the area, with no significant tilting towards the valleyside. Mining finished in the area in 1964 and it is unlikely that workings will take place in the future.

The No.3 Rhondda Seam, which outcrops beneath the proposed filled batter, see Figure 4, was extensively worked from Dinas Clydach Colliery between 1863 and 1897. It was worked almost to outcrop at the eastern end of the batter; however, a pillar of coal was left beneath the western end.

No records of workings have been found for the Hafod or thin coal which outcrops under the plateau. These seams could not have been exploited until after 1904 and are considered unworked; see OAP Report 86/1165, Section 2.4.1.

2.5.2 Mine Entries

Relevant mine entries are shown on Figure 4.

Levels 1, 36 and 37 pass beneath the plateau and the filled batter. They are associated with No.3 Rhondda workings of Dinas Clydach Colliery.

Entry number 32 is known as the Gorki Drift and was a slant inclined at 1 in 4, to the Abergorki and Pentre workings of Blaenclydach Colliery. Its line is just to the east of the site.

2.5.2 Mine Entries (Cont'd)

Two shafts, numbers 1 and 28, are located to the west of the filled batter. Number 28 is recorded on mine plans as an air shaft. It lies close to the line of roadways in the No.3 Rhondda Seam and is likely to have been for ventilation of these workings. Number 1 is recorded as an air shaft on the 1876 Ordnance Survey plan but is not shown on mine plans. It lies close to the crop of the No.3 Rhondda Seam, but outside the recorded workings in this seam. This may have been a trial shaft or it may relate to unrecorded workings close to outcrop in the No.3 Rhondda Seam. There is a remote possibility that the shaft descended to illegal workings in the thin coal below the No.3 Rhondda Seam. However, it is extremely unlikely that any such workings would extend beneath the plateau which is located at least 120m from the shaft.

THE DEVELOPMENT

3.0

3.1 Earthworks

The plateau is being constructed by controlled filling, using surplus colliery spoil available within the reclamation scheme. The fill for the batter consists of surplus material from a nearby road construction scheme, including some sandstone rockfill and suitable excavated glacial soils. It is likely that some colliery spoil will also be required to complete the proposed slope.

3.2 Treatment of Mine Entries

Levels 2, 36 and 37, see Figure 4, have been treated by excavation to invert level and backfilling with compacted fill. This treatment extended from the level mouths across the plateau to the toe of the proposed fill batter. Prior to backfilling, rubble drains were laid in the inverts of these excavations to provide drainage from the old workings.

The Gorki Drift, entry number 32, was excavated to a position approximately 12m north-east of the toe of the filled batter. The roof was found to be in a collapsed condition throughout this length and no significant voids were encountered. A substantial mass concrete plug was installed at a depth of 16m below the finished plateau level and the excavation backfilled with compacted suitable fill.

3.3 Proposed Structures

No proposals for structures yet exist. It is understood that light industrial development is being considered.

4.0

DISCUSSION

4.1 Influence of Slope Stability on Development

Part of the 1.5 ha plateau lies downhill of the eastern end of an area of landslipping catalogued as active by the IGS in 1980. Geomorphological studies, together with examination of historical maps and aerial photographs, show that most of the eastern end of the landslip is of shallow character. Apart from some shallow debris slides associated with drainage lines above the disused railway, there has been no obvious movement of this part of the landslip over the last 100 years or so.

The proposed fill batter, together with the attendant drainage measures, see Appendix A, will further improve the overall stability.

Shallow debris slides on the hillside above the railway bench are possible but it is considered extremely unlikely that the debris could reach the plateau which is some 100m further downhill. Small quantities of slipped material may from time to time need to be removed from the railway bench to ensure that the drainage channel remains effective.

Near the south-west corner of the filled batter, gradual movements of the landslip have damaged drains installed at the top of the slope in the early 1970's, see Section 2.2. This unstable zone is not directly uphill of the development plateau and, from the information available, it appears likely that movements will be confined to the hillside above the railway bench. However, there is inevitably some uncertainty over the possible extent of future instability in this area and there is a slight risk that movements could affect the south-west corner of the filled batter and the associated drainage works. In such event, there would be ample time and scope to undertake local remedial drainage works before there was any significant threat to the development plateau. At this stage, it would be prudent to further investigate the damage which has already occurred to the drainage installations uphill and, if necessary, undertake works to ensure that water is not being directed into the unstable area.

4.2 Influence of
Abandoned
Mineworkings on
Site Stability

The plateau lies just outside the crop of the No.3 Rhondda Seam. Three entries to workings in this seam have been treated by Mid Glamorgan County Council. The methods used are considered adequate to have effectively removed any risk of future ground collapse.

A drift entry at the eastern edge of the plateau similarly has been rendered stable, except for a short length near the toe of the filled batter. The untreated section underlies part of the permanent drainage works and would be, anyway, impractical to develop.

The only other seam which is sufficiently shallow to influence the site is an un-named thin coal below the No.3 Rhondda Seam. It is considered extremely unlikely to have been worked beneath the plateau and the risk of ground instability is considered negligible.

4.3 Geotechnical
Recommendations

4.3.1 Batter Construction

Recommendations for drainage and site preparation works were given in our letter to the County Planning Officer dated 20th August 1986. A copy of this letter is included as Appendix A.

4.3.2 Plateau Development

4.3.2.1 General

The following comments are based on observations of the filling operations and on the findings of trial pits at the adjacent 4.12 ha plateau, parts of which were constructed using similar fill materials and methods.

4.3.2.2 Excavations and Formations

Excavations will be within well compacted colliery spoil and should be possible using conventional earth moving plant. They should remain stable and free of groundwater. Excavations deeper than 1.2m should be shored or battered back if they are to be entered.

Formations for roads and floor slabs should be proof rolled and any soft or loose areas dug out and replaced with well compacted granular material. An allowance for 5% of the area to an additional depth of 0.3m should be reserved at this stage. Formations will be susceptible to deterioration on exposure to weather and should be blinded or covered with hardcore as soon as possible.

4.3.2.3 Foundations and Floor Slabs

The following recommendations are typical and the final choice of foundation and floor slab design should take account of the type of structures proposed.

Pad foundations taken to a minimum of 0.75m below finished ground level and using an allowable bearing capacity of 125kN/m² may be used in the well-compacted colliery spoil. Ground bearing floor slabs may be used in these materials, assuming a "normal" formation as defined by Deacon (1975). Attention is drawn to the treatment of soft spots beneath floor slab formations, described in 4.3.2.2.

Alternatively, reinforced raft foundations could be used with an average bearing pressure of 30 kN/m². The raft should incorporate downstand edge beams to 0.6m below finished ground level to protect against frost damage.

4.3.2.4 Design of Roads and Car Parks

A California Bearing Ratio (CBR) of 6% may be assumed for the design of roads and car parks. As described in Section 4.3.2.2, soft spots should be excavated and backfilled with well-compacted granular material, typically to an additional depth of 0.3m.

4.3.2.5 Protection of Buried Concrete

Colliery spoil placed to form the 1.5 ha plateau has a generally similar origin to that used to form parts of the adjacent industrial plateau. Testing of samples from the industrial plateau, see OAP Report 86/1165, showed that no special precautions were required to protect buried concrete from sulphate attack. Similar results would be expected for the 1.5 ha plateau but it would be prudent to check this before development proceeds. Buried concrete should conform as a minimum, to Class 1 of BRE Digest 250 (1981).

4.3.2.6 Combustibility of the Fill

From visual examination the fill may be regarded generally as noncombustible. Occasional pockets of spoil with a significant coal content may present a small hazard or burning if exposed to fire or intense heat, although spontaneous combustion is not likely.

4.3.2.6 Combustibility of the Fill (Cont'd)

No special precautions are considered necessary beneath buildings or hardstandings, unless exposure to high temperatures is anticipated. Elsewhere a careful watch should be kept for pockets of combustible material in future earthworks and landscaping. Where encountered, they should be covered with a minimum of 0.75m of inert subsoil and topsoil.

4.4 Conclusions

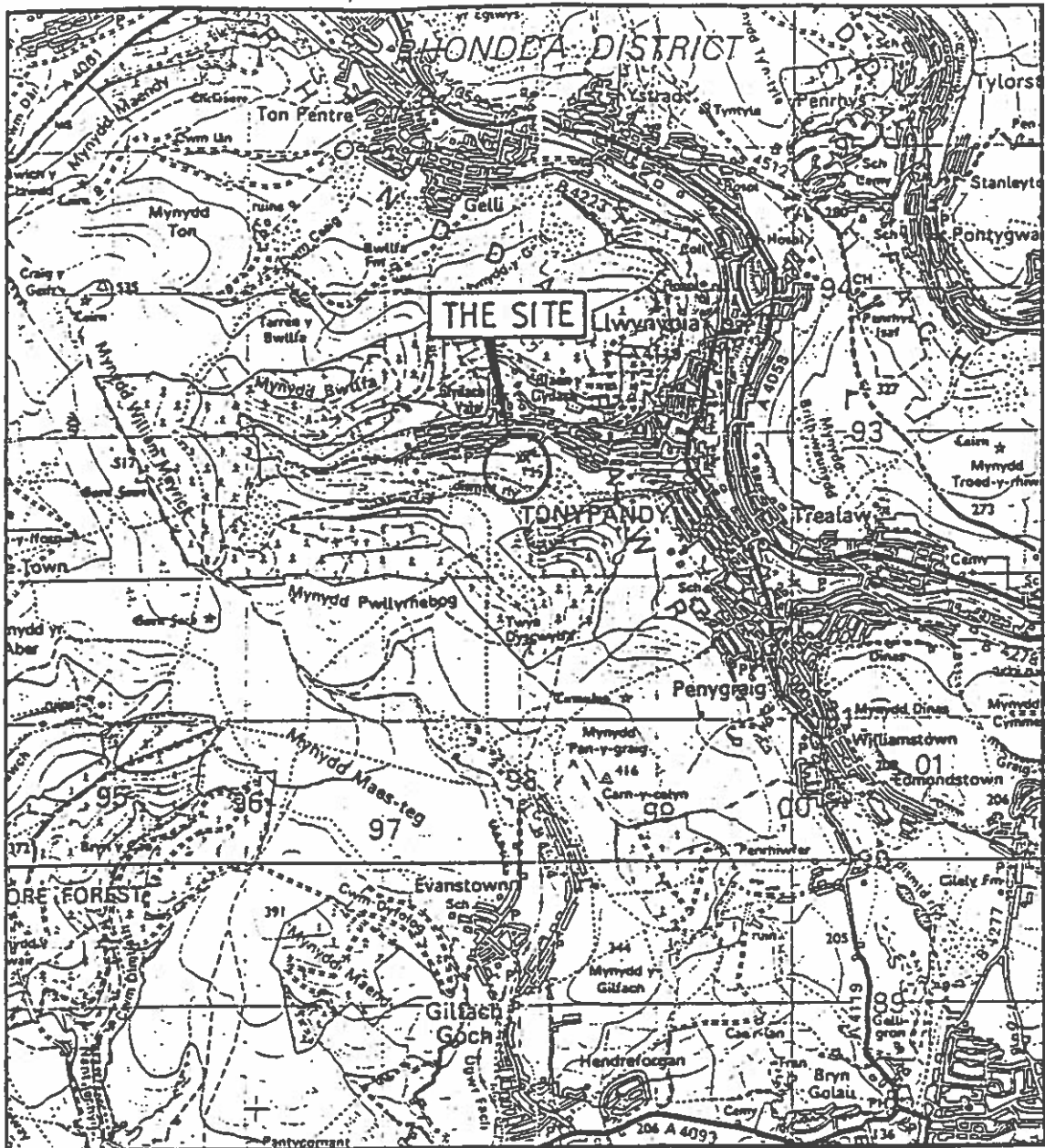
The plateau is composed of well compacted fill. It is suitable for its proposed use as an industrial area and the likely structures may be constructed at, or near, normal costs.

Abandoned mineworkings and entries present a negligible hazard to the plateau.

The hillside some 100m to the south contains part of a landslip complex. Some shallow movements which may occur will be sufficiently remote from the plateau to be of little concern. Small amounts of debris may require periodic removal from the old railway line to ensure that the hillside drainage works remain effective. There is a slight possibility that some drainage works may be required in the future at the south-west corner of the filled batter.

REFERENCES

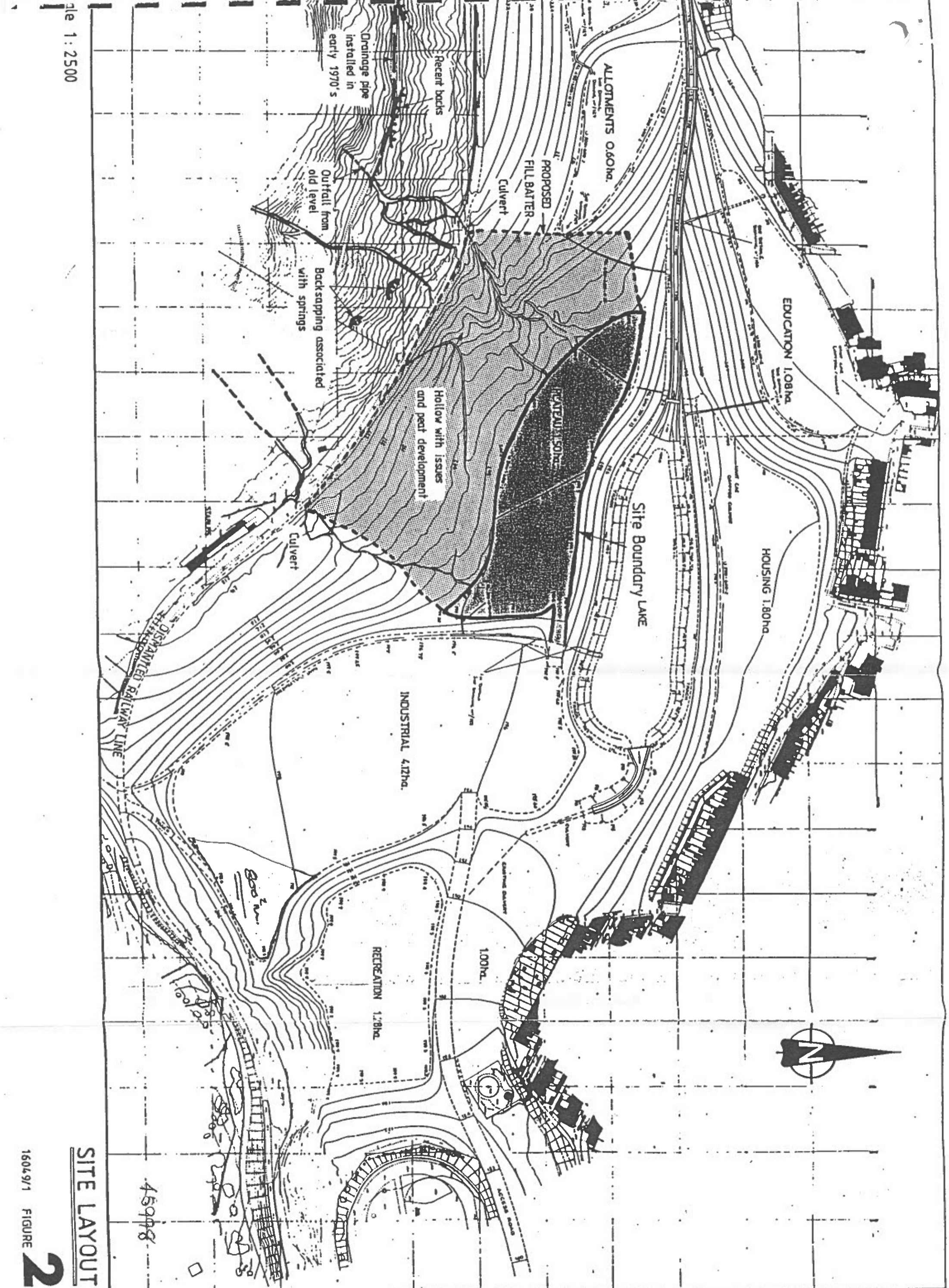
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7. National Coal Board Reports on First and Second Stage Investigations into the proposals for Washing and Redisposal of Cambrian Colliery Tip 240 by Sir William Halcrow and Partners, dated 1971 and 1974.
8. National Coal Board Report on The Investigation into The Security of Blaenclydach Tip 241 by Sir William Halcrow and Partners, dated 1978.



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Scale - 1: 50 000

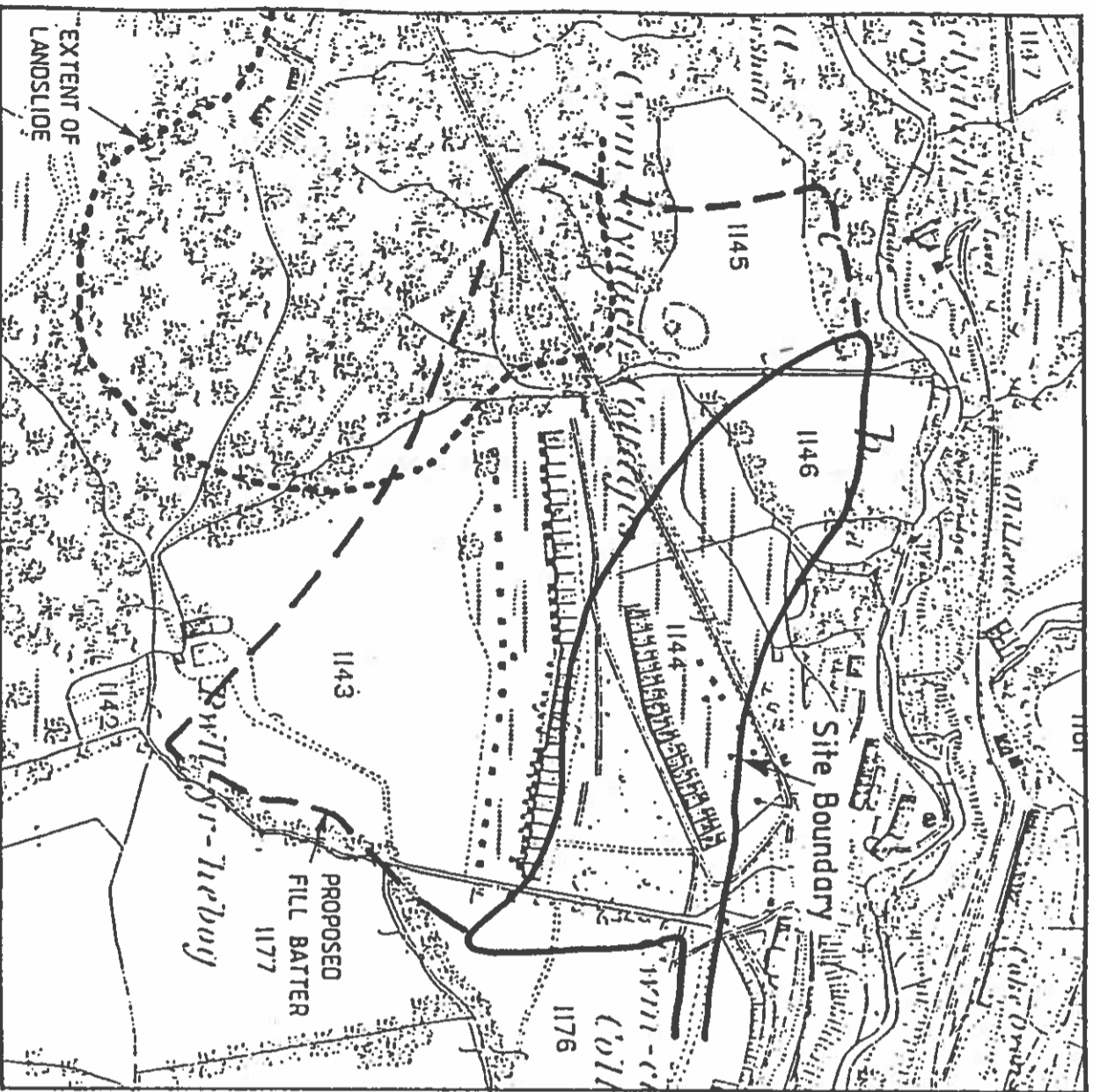
SITE LOCATION



SITE LAYOUT

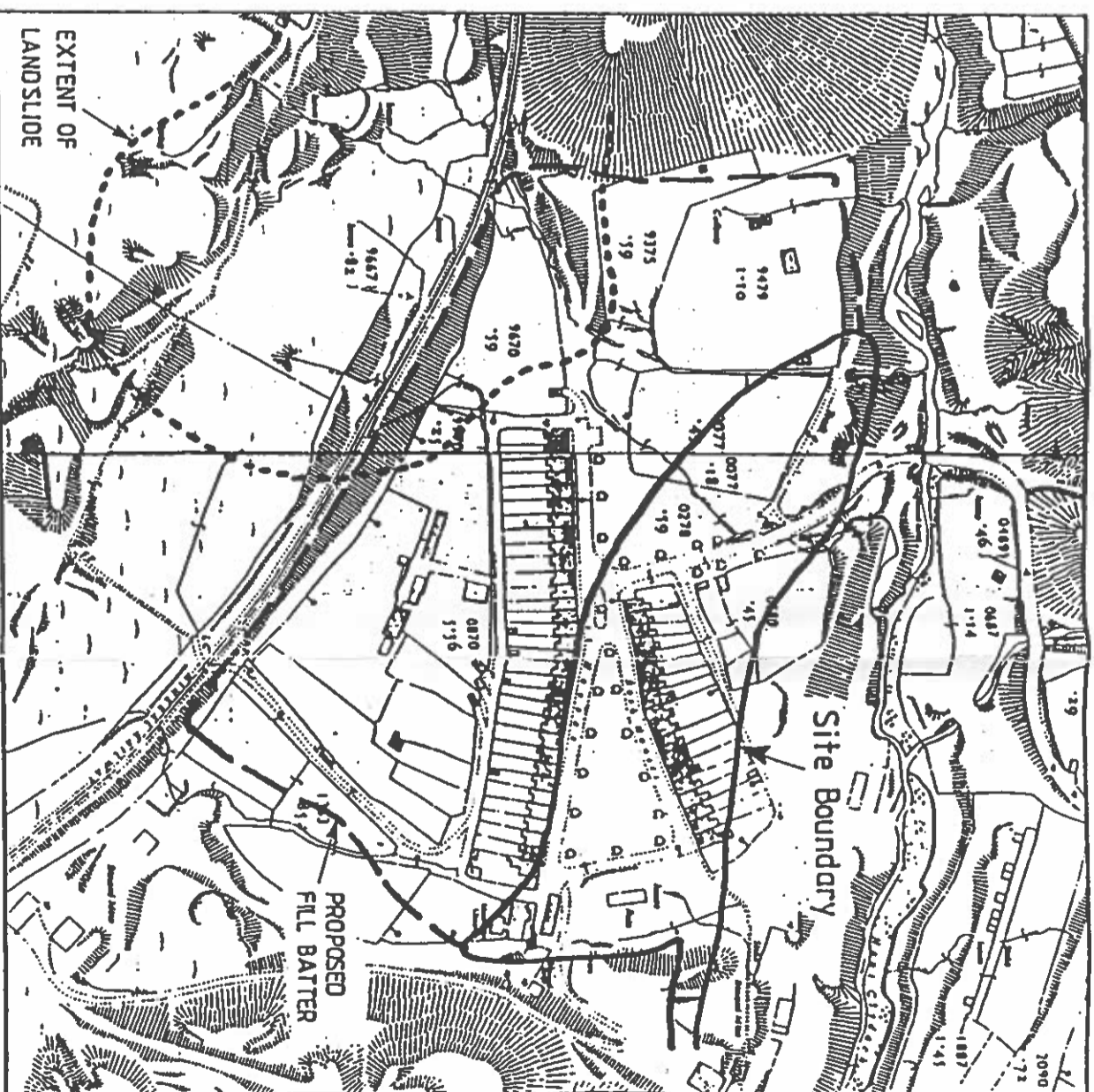
16049/1 FIGURE

2



1876

Scales - 1 : 2500

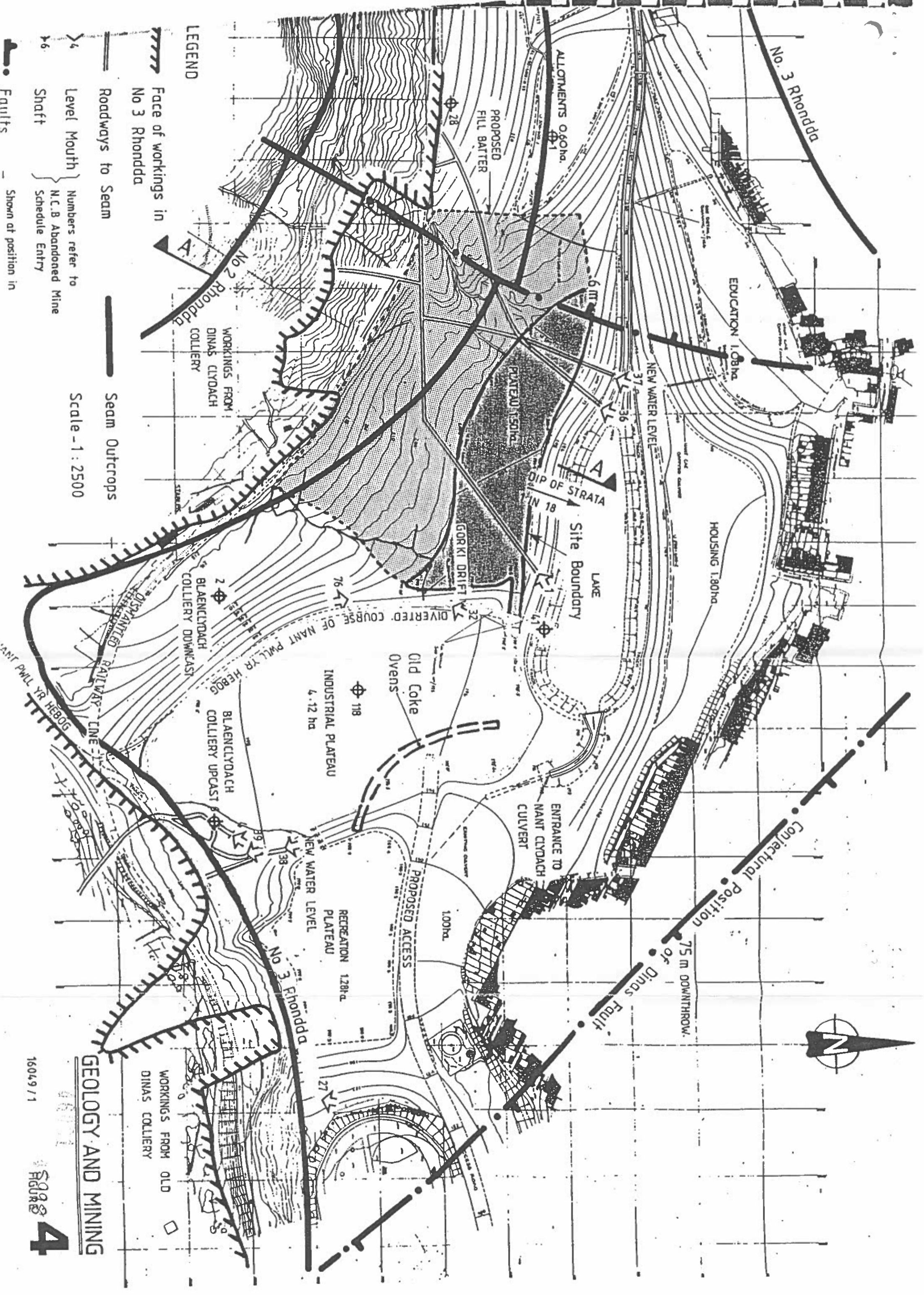


1962

SITE HISTORY

16049/1 FIGURE

3



LEGEND

- Face of workings in No 3 Rhondda
- Roadways to Seam
- Level Mouth
- Shaft
- Faults

Numbers refer to N.C.B. Abandoned Mine Schedule Entry

Scale - 1 : 2500

Seam Outcrops

GEOLOGY AND MINING

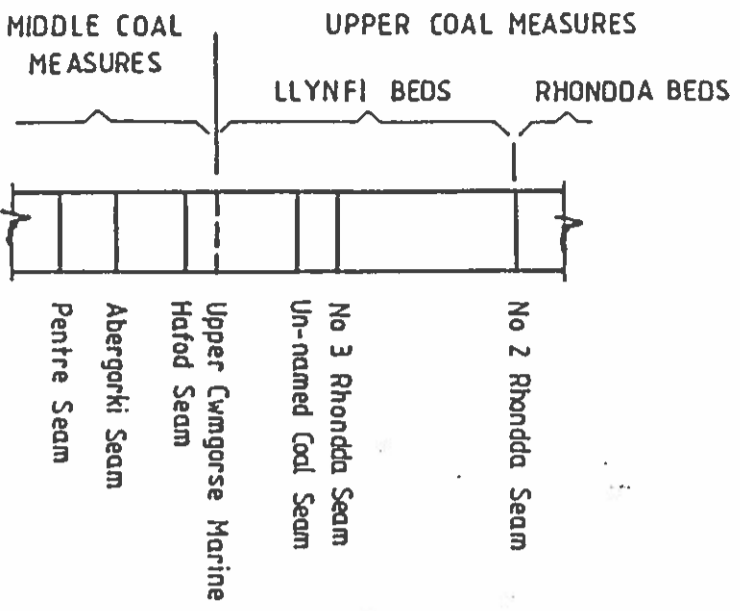
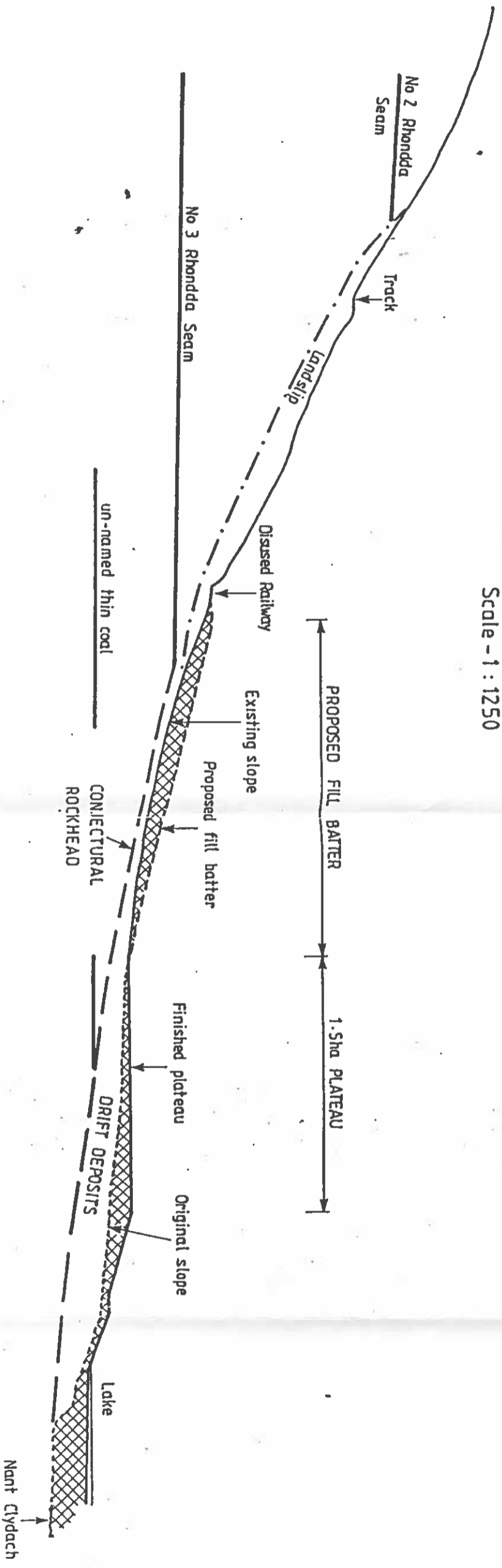
16049/11

FIGURE 4

300
290
280
270
260
250
240
230
220
210
200
190
180

E. A. O. D

Scale - 1 : 1250



GEOLOGICAL SEQUENCE

(NOT TO SCALE)

A ——— A

GEOLOGICAL SECTION

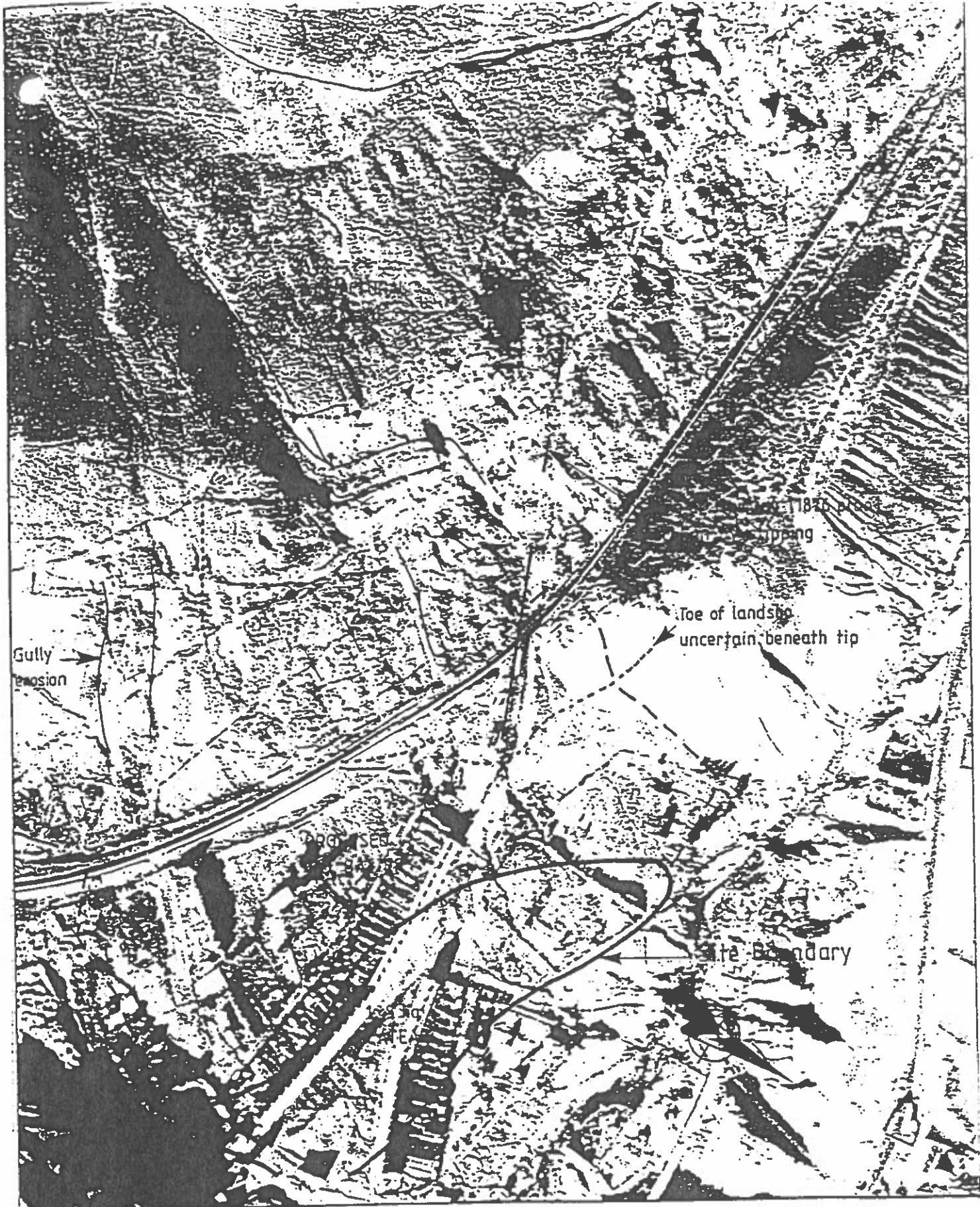
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FIGURE




5

599E

66001



LEGEND

-  Scar
-  Lobe
-  Drainage Line

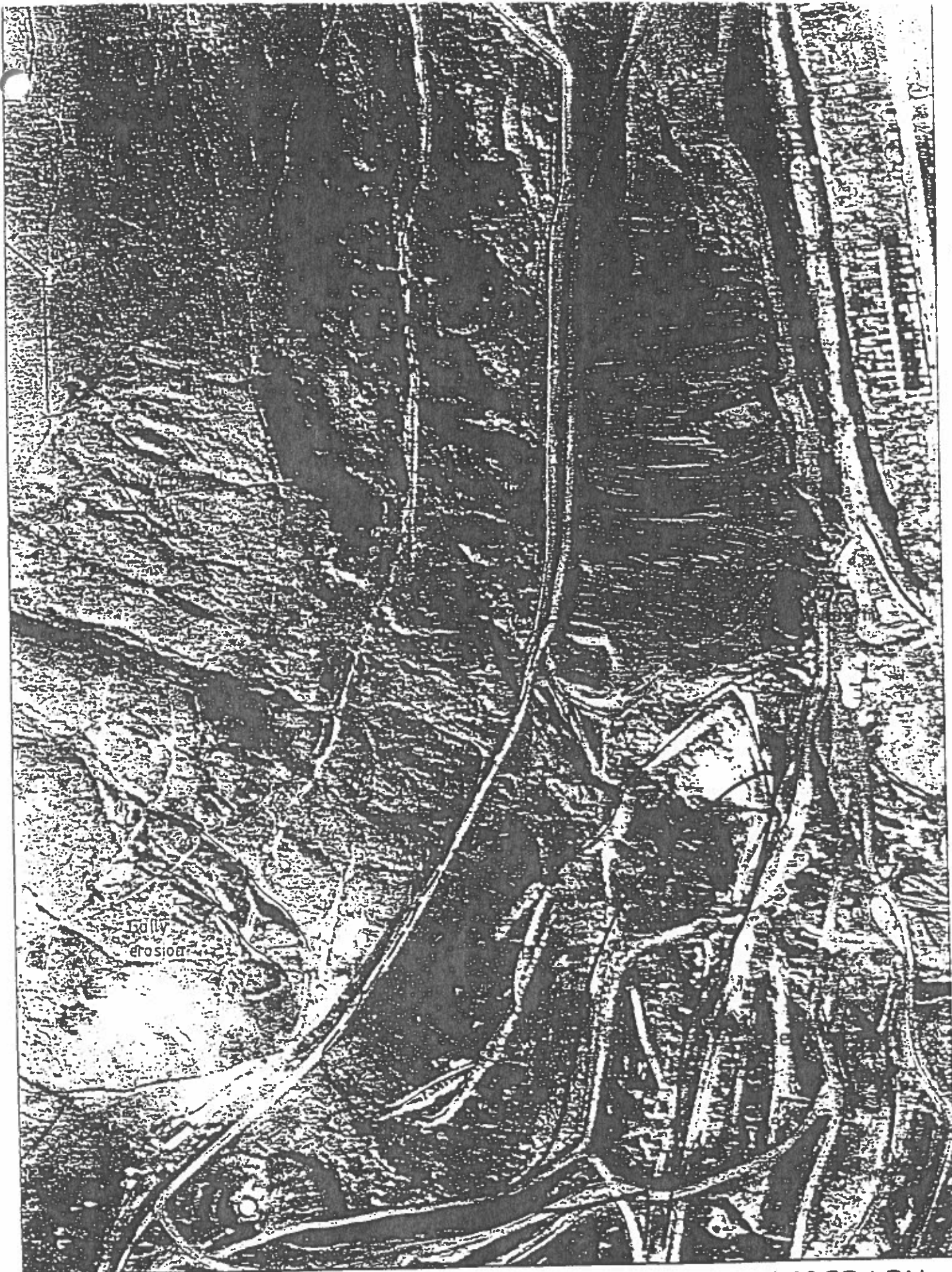
AERIAL PHOTOGRAPH

1954

16049/1

FIGURE

6



LEGEND

-  Scar
-  Drainage Line
-  Lobe

AERIAL PHOTOGRAPH

1985

16049/1

FIGURE

7

APPENDIX A

16049/01/TG/EN

20th August 1986

County Planning Officer
Mid Glamorgan County Council
Planning Department
County Council Offices
Greyfriars Road
CARDIFF, CF1 3LG

For the attention of Mr. A. Christie

Dear Sir,

CLYDACH VALE RECLAMATION SCHEME
Proposed Fill Slope

As promised, here is a brief resume of the points discussed during our site visit on 19th August 1986.

The proposed infilling of the hollow in principle is beneficial in that it would provide some buttressing to the lower part of the hillside. However, appropriate site preparation and drainage measures are critical to ensure that the filled slope remains stable and our comments on these matters are set out on the attached sheet.

Although the comments are given under separate headings, we consider that the most appropriate method of working would be to combine the drainage works, site preparation and filling in one operation. A sketch showing a typical sequence of working is attached.

I hope our ideas will prove helpful, please let us know if you require further assistance.

Yours faithfully,

T. Gordon

Enc.

SUMMARY OF COMMENTS ON INFILLING OF HOLLOW ABOVE THE 1.5 HECTARE PLATEAU

Drainage Works

- a) It is understood that you propose to divert the existing watercourses at the east and west limits of the filling area beyond the area of fill, approximately as shown on the attached sketch plan. We agree with this proposal.
- b) Surface flows on the hillside above the old railway line should be intercepted and conveyed along the railway line in lined channels, leading to the new culverts beneath the railway embankment.
- c) Every effort should be made to locate all springs, culvert outfalls, seepages etc., and these should be chased up-slope as far as is reasonably practical. A collecting blanket of coarse granular material should be provided at each spring source and the flow conveyed away in a rubble drain. We recommend that piped-rubble drains are provided for the main spring flows; several springs and outfalls have been identified already but others may be found during the site preparation works and to some extent it will be necessary to design the drainage network as work proceeds. It may be advantageous to combine seepages which are close together on the slope into a single drain.
- d) The original watercourses beneath the fill slope will still form natural drainage lines and should be backfilled with coarse granular drainage material.
- e) It is important that the rubble drains buried beneath the fill slope do not clog and allow porewater pressure to build up in the overlying fill. Hence the fill to be placed over the rubble drains should either have a grainsize which will preclude washing into the drain or alternatively the drain should be covered by a layer of filter fabric.
- f) The drainage beneath the fill slope should discharge into a toe drain at the edge of the development plateau. This should be designed as a 'carrier drain', either an open channel, lined within the fill, or a piped-rubble drain.

Site Preparation Works

- g) Soft peaty deposits in the hollow and along the drainage lines should be removed.
- h) On the steeper slopes, see sketch sections, the existing ground should be benched to penetrate through the topsoil, typically to a depth of 0.5m.
- j) The tops of the existing small lobes should be removed and the material redistributed to the hollows, to avoid placing a thin layer of fill in some areas.

Fill Material

- k) Any suitable material for general purpose fill will be adequate and should be compacted in layers to your normal specification.

- l) The rock fill/quarry spoil which we examined at the Mid Rhondda Access Road cutting is suitable and could be most advantageously used within the hollow where it would form a permeable blanket over the top of the rubble drains; we understand that some 12,000m³ of this material is available which is clearly insufficient to complete all of the proposed fill slope.

16049/01/TG/EN
20.8.86

Existing lines to remain undisturbed
Coordinates: N 192 14
E 192 47
S 192 50

HOUSING

U400-600-2

NHMT C&E DUFFY CO. CURVE
See drawing N°/221

U300-600-2

N.P. 196 75

TRACK

See detail by sk. /212

LA

TYPICAL ARRANGEMENT
OF RUBBLE

PLATEAU 1.50ha.

CARRIER

Rubble d'égout

NL 300-000

LINED CHANNEL

350 Ø PIPE

LINED CHANNEL

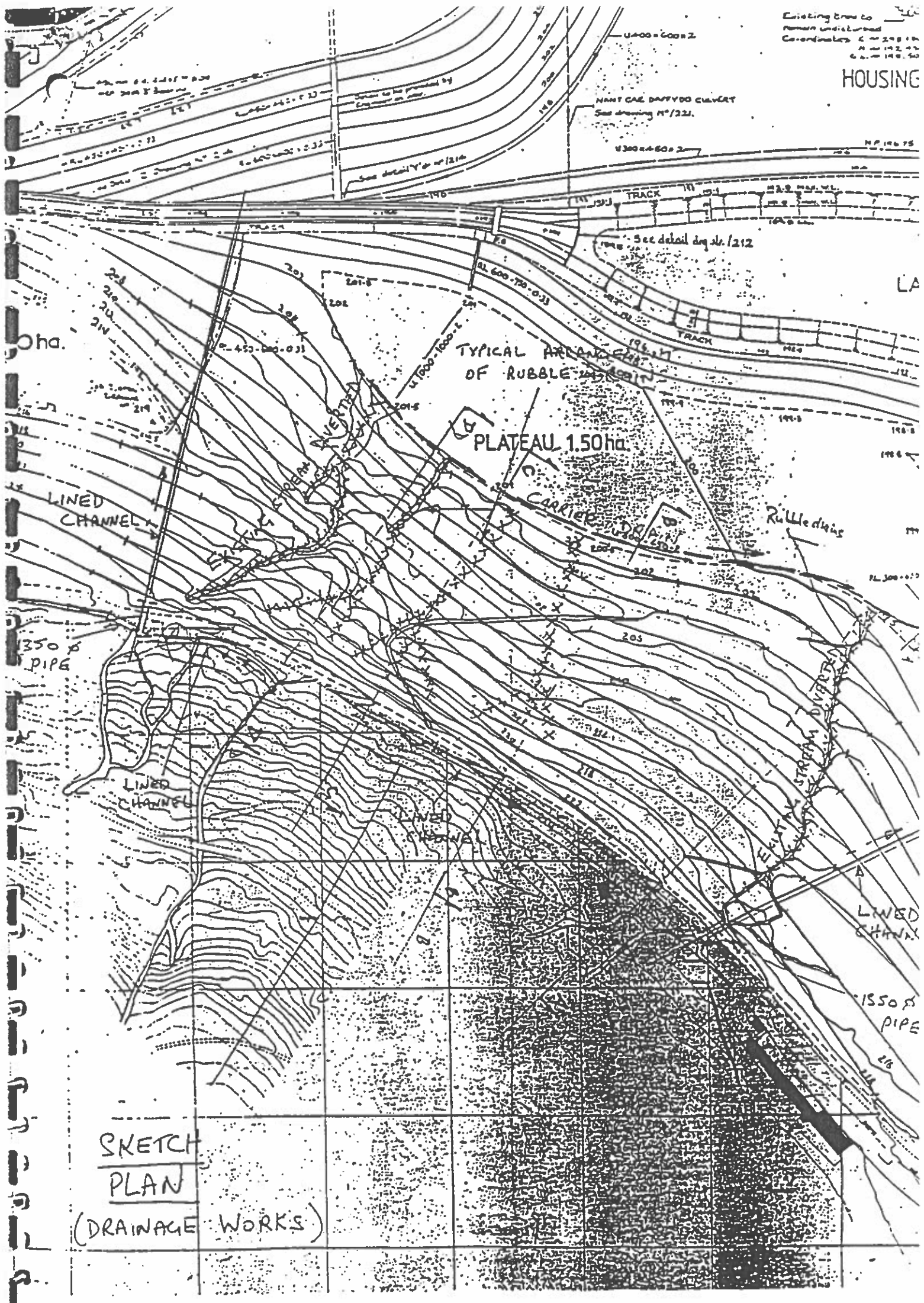
LINED CHANNEL

LINED CHANNEL

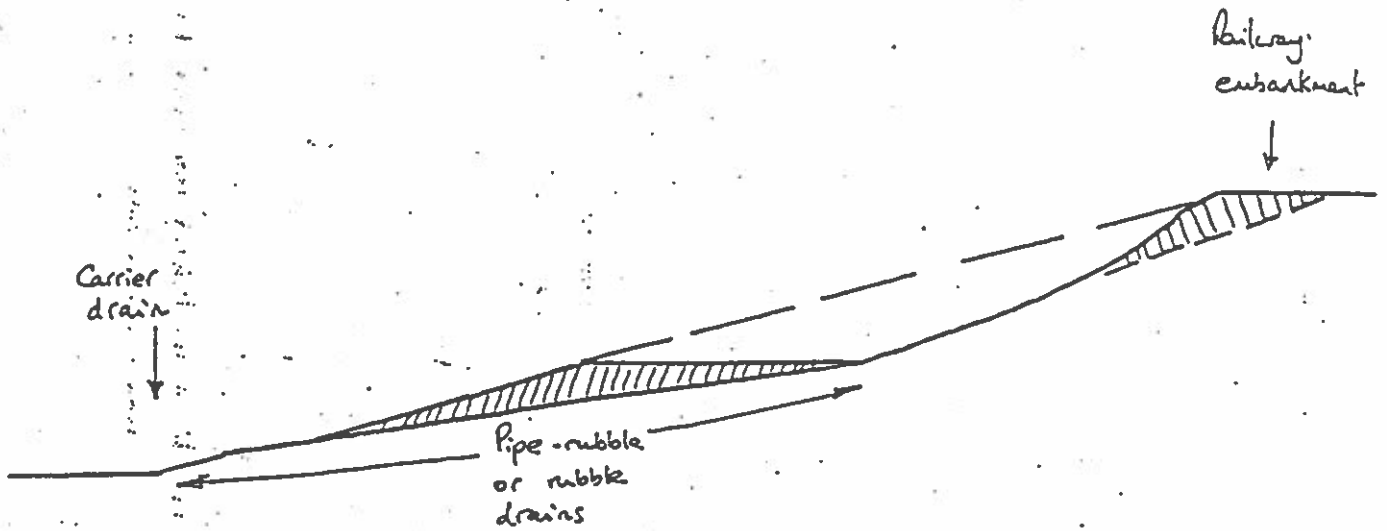
1550 Ø PIPE

SKETCH
PLAN

(DRAINAGE WORKS)

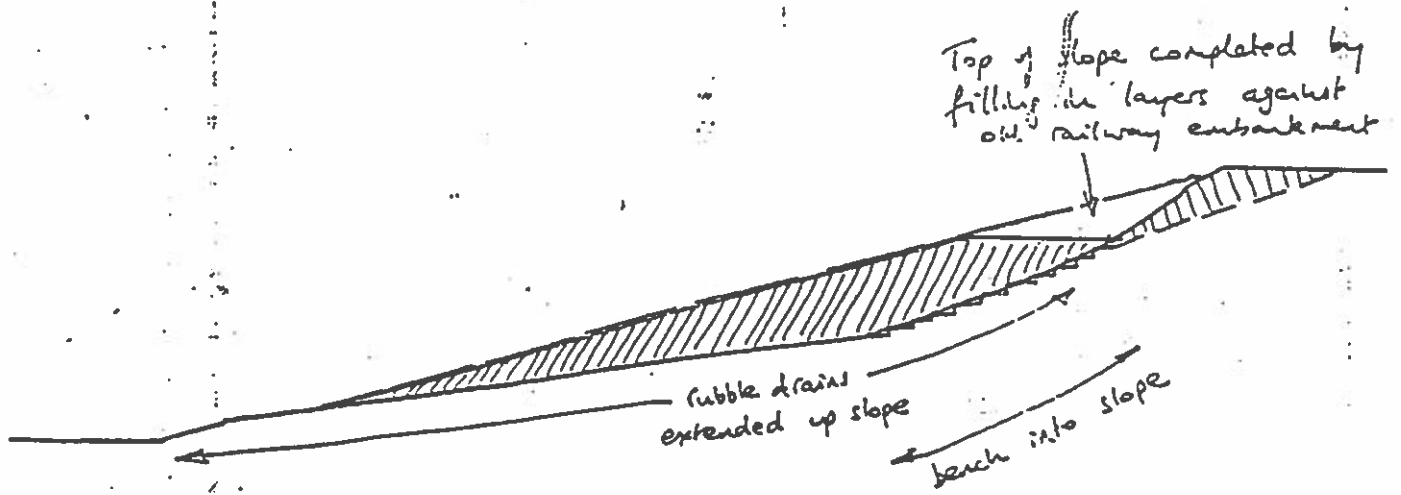


TYPICAL SEQUENCE OF WORKING



STAGE 1

- (i) install pipe rubble drains through lower part of slope to carrier drain at toe; during this work any soft peaty deposits along the drain lines should be removed;
- (ii) place fill on lower part of slope to form working platform to be raised in lifts;



STAGE 2

- (iii) as fill platform is raised, extend drains up-slope bench into hillside and remove soft peaty deposits