
Project:	Kyleakin Berthing Dolphin Demolition		
Our reference:	358436 AK	Your reference:	
Prepared by:	Michael Kerr	Date:	25/08/2020
Approved by:	Mathew Ross	Checked by:	Mary Cairns
Subject:	Review of Existing Information & Logistics Exercise		

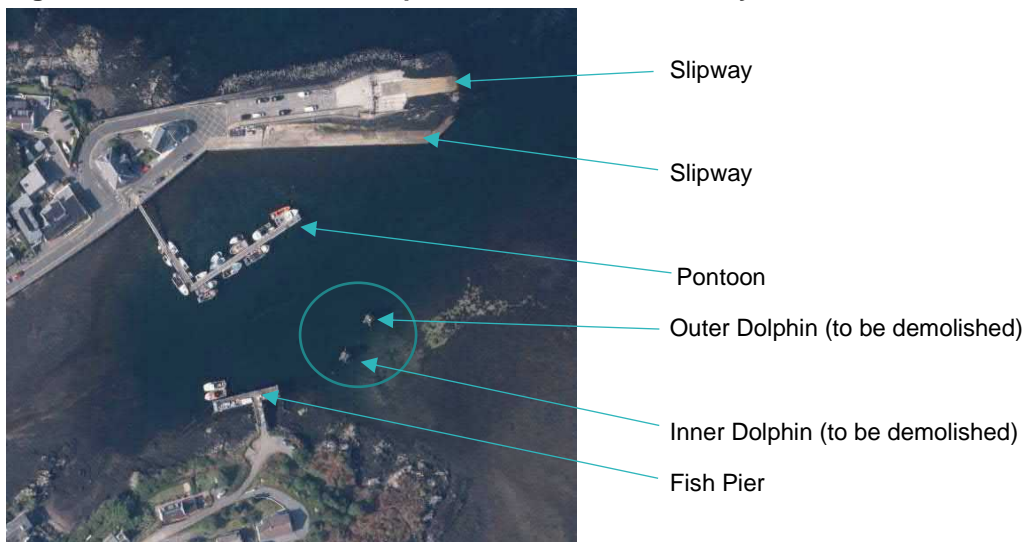
1 Introduction

Mott MacDonald (MML) has undertaken a review of available information and explored options for the demolition of two (2 No.) berthing dolphins owned by Caledonian Maritime Assets Limited (CMAL) within the harbour area at Kyleakin, Isle of Skye.

This document provides an overview of the existing information, quantifies the materials to be removed and determines viable options to demolish the berthing dolphins. It includes a review of suitable plant and equipment that will be used to facilitate the demolition works, alongside an outline programme and cost estimate. This information will be used to inform the Contract Documents for the project.

The key stakeholders are also detailed in this document, along with a summary of anticipated license requirements for the works based on initial stakeholder engagement.

Figure 1.1: Annotated Aerial Capture of Harbour Area at Kyleakin



Source: OS Maps (2020). License Number 100026791

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2 Existing Information

2.1 General Description

The berthing dolphins are located within the harbour area at Kyleakin, Isle of Skye. The berthing dolphins were built in late 1970's and were used during ferry operations until circa 1995. Figure 1.1 provides an aerial view of the berthing dolphins. Figure 2.1 and Figure 2.2 provide a closer view of the dolphin structures.

CMAL have provided MML with the following information on the berthing dolphins:

- Record drawings from the construction of the berthing dolphins late 1970s / early 1980s;
- Asset survey report from CH2M 2015 visual inspection; and
- Photographs of the structures from CMAL H&S File.

Figure 2.1: Berthing dolphins



Source: CMAL H&S File

Figure 2.2: Outer berthing dolphin (with nav light)



Source: CMAL H&S File

2.2 Stakeholders

The berthing dolphins are owned by CMAL and are located within the Statutory Harbour Authority remit of Highland Council Harbours Authority.

The key stakeholders to be consulted throughout this project are:

- Highland Council Harbour Authority;
- Marine Scotland;
- The Crown Estate;
- Northern Lighthouse Board; and
- Local Harbour Users.

2.3 Tidal Data

The tidal data for the site is provided in Table 2-1, extracted from Admiralty Chart data and levels shown on record drawings (General Arrangement, April 1989). Levels are shown in Chart Datum, which is 2.73m below Ordnance Datum Newlyn.

Table 2-1 Kyleakin Tidal Data

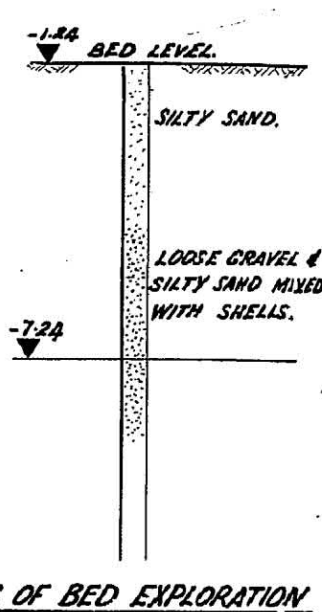
HAT	+5.95*
MHWS	+5.3
MHWN	+3.9
MLWN	+2.1
MLWS	+0.6
LAT	+0.1*

Levels marked with * have been taken from record drawings and converted into Chart Datum

2.4 Ground Investigation Data

There is very limited GI data for the site. Review of record drawing "1985/11/4B, setting out points", indicates the seabed materials are silty sands transitioning into loose gravel and silty sands mixed with shells to at least 7m below Chart Datum, as shown in Figure 2.3. It is not clear from drawing "1985/11/4B" where this log was recorded.

Figure 2.3: Borehole data from record drawing



Source: Crouch and Hogg Drawing No. 1985/11/4B (1978)

Review of the current Admiralty Chart for the area indicates the seabed level around the dolphins is between 1 to 2m below Chart Datum. This aligns with the level shown on record drawings "1985/11/3, Details of Dolphin 2 No", indicating little change in the seabed level during this period. This has been confirmed by discussion with the current Harbour Manager. The drawing also shows that the piles are driven to a minimum of 6m beyond bed level. Therefore, it has been assumed that rock level will be approximately 8m below Chart Datum, which aligns with the limited GI data, and that the piles are toed into rock.

The bed material is assumed to consist of a layer of silty sand, on top of loose gravel/silty sand mixed with shells, on top of rock at approximately 8m below Chart Datum.

3 Berthing Dolphins – Form of Construction

The berthing dolphins are almost identical in construction, with the addition of 1 No. navigation light on the outer dolphin. From review of the Admiralty Chart, it appears that the navigation light is no longer identified, and as such it is assumed that it is no longer in use. This is to be confirmed with the Northern Lighthouse Board.

Each dolphin has 4 No. raking steel cased tubular piles with reinforced concrete cores. The piles are approximately 10 metres in length above seabed level and support a timber deck. The timber deck has a timber cope formed from 4 No. timbers and packers.

There are 4 No. levels of steel bracing, formed from various steel section sizes. 4 No. vertical timber fender boards are connected to the bracing and there were originally 6 No. tyres connected to the timber fenders which acted as a berthing face for vessels. It is unclear how many tyres remain connected to the structure below the waterline.

Miscellaneous items on each dolphin include 1 No. ladder, 1 No. mooring bollard and base plate, connector plates and bolts, handrails on the deck platform and 1 No. navigation light with associated equipment (outer dolphin only).

Table 3-1 provides an overview of the materials for each dolphin. The gross weight of the berthing dolphin is estimated at approximately 25.5 tonnes.

Table 3-1 Materials to be removed

Item	Construction Material	Quantity	Approximate Weight (kg)
Tubular Piles	406mm OD Steel tubular piles with reinforced concrete core, approx. 10m in length above seabed level. Weight to 1m below bed level.	4	16,500
Deck Platform	Timber boards, cope and packers.	1	400
Deck Bracing System	Formed from various sections of steel channel	1	1,100
1 st Bracing System	Formed from various sections of steel channel	1	1,200
2 nd Bracing System	Formed from various sections of steel channel	1	1,200
3 rd Bracing System	Formed from various sections of steel channel	1	1,200
Fenders	Timber fenders and wailing, approx. 8m and 1.2m long.	4 and 3 respectively	2,500
Miscellaneous Items	Steel ladder approx. 7.5m long	1	50
	Mooring bollard	1	100
	Tubular Handrailing	Various Lengths	50
	Steel Connector plates and bolts	Various	500
	Rubber tires	6	600
Navigation Light (Outer Dolphin Only)	Light and associated fixings	1	50

4 Options for Demolition

From review of existing information, consideration of the depth of embedment of the piles and early contractor advice, MML believe it would be extremely difficult to completely remove the piles from their current location and such a requirement would introduce significant risk to the resulting contract. Rather it would prove more efficient and cost effective to cut the piles to an agreed level below the seabed. The reasons for this are:

- The steel wall of each pile is thin (8mm as-built condition). Achieving a secure grip of the steel casing by a traditional pile extractor tool will be difficult. Removal of the concrete core to achieve a grip is likely to damage the steel casing, causing further complications.
- Box clamps can be used to extract piles; however, these are made for square timber or concrete piles of sizes 305mm and 365mm. Fabrication of a bespoke clamp would be required.
- The 5:1 rake of 4No. piles will increase the difficulty of the extraction
- It may be possible to extract the piles using a large excavator with a demolition jaw; however, this method is not guaranteed and the pile may split during extraction.
- It is likely the bond between the pile and the seabed would “give” suddenly resulting in shock loading on the jib; historically this may have been considered acceptable but would now be frowned on, with the possible exception of specialist demolition plant.

Therefore, MML have proposed two options for demolition of the berthing dolphins, both of which involve cutting each pile below bed level. The level to which the piles are required to be removed is to be confirmed, however it is anticipated to be between 1m and 2m below current bed level.

Option A considers the ‘Piece Small’ demolition of the structure i.e. dismantling the larger structure in-situ, removing small, manageable sections for transportation off site for disposal.

Option B considers the ‘Lift Out’ of the complete structure for transportation off site for disposal.

Both options will require use of marine plant and, at this stage, it is assumed no onshore compound will be provided. The Contractor may approach The Highland Council to agree a suitable onshore area for use during the demolition works however this is to be confirmed.

4.1 Option A – ‘Piece Small’ Demolition

The anticipated sequence of works to demolish the dolphins in a ‘Piece Small’ method is described in the following paragraphs, including a high-level review of suitable plant and equipment. This section also includes an estimated programme and associated cost estimate for this option.

4.1.1 Methodology

Step 1 – Mobilise and prepare site

Contractor to mobilise to site and set up plant in the agreed locations.

Step 2 – Strip deck platform

The deck platform and furniture including railings, timber cope beams, bollard, ladder and handhold, navigational light (for outer dolphin only) and all fixings will be removed, leaving only the main components of the fender system, steel and timber bracing structure and raking piles.

Step 3 – Remove fender system

The tyres and fixings, front timber fenders and wailings will be removed.

Step 4 – Remove dolphin bracing system

The dolphin bracing system will be dismantled and removed. Cantilever raking piles to remain in place and Contractor to determine method to maintain stability.

Step 5 – Local seabed excavation

The seabed is to be excavated locally around the raking piles to a minimum depth of 1m (TBC) below bed level. Due to the anticipated silty sand bed material, the 'airlift' method may not be suitable, and the seabed may require to be excavated by divers.

Step 6 – Cut and remove raking piles

Each pile shall be cut to a minimum 1m (TBC) below seabed level and lifted individually.

Step 7 – Reinststate seabed

Upon completion of the demolition works, the seabed shall be reinstated to the original level.

4.1.2 Plant and Equipment

Marine plant will be required to provide access to the dolphins and to provide a lay-down area for storage of materials and equipment, diving equipment and welfare during the demolition works. It is assumed that no landside lay-down area will be provided.

From review of existing information, the minimum available water depth within the channel in front of the dolphin structures 2m below Chart Datum.

The largest lift required for Option A is for 1 No. 11m length reinforced concrete pile, which weighs approximately 4T. At an assumed 10m radius, a 60T crawler crane would be sufficient to lift the maximum anticipated load. *The Kobelco CKE600G may be suitable for lifting the load at 10m radius, with a 27.4m crane boom* <https://www.weldex.co.uk/equipment>. A multi-cat with crane could also lift this anticipated load.

It is assumed 1 No. barge would be used as the crane working area, lay-down area, storage of equipment including dive equipment and welfare. Coastworks CW3¹ or CW6² barges provide sufficient deck area for a crane, lay-down and contractor welfare units, with suitable draught when fully laden to allow working at water depths greater than MLWS, with an allowance for 500mm under-keel clearance.

Use of several barges may be considered, however this would require additional tug support. If this is the Contractor's preferred method, they are to ensure use of the channel can be maintained in line with Highland Harbours requirements.

The dismantled materials are to be placed on a laydown barge during the demolition works, and once works are complete shall be disposed of by the Contractor.

If use of an area of harbour land is granted, dismantled materials can be placed at the agreed location and immediately transported from the harbour by the Contractor. However, at this stage, it is assumed that no landside laydown area will be provided.

The Contractors Working Area is shown on Drawing 358426-MMD-AK-XX-DR-C-1000, included in Appendix A.

¹ From Coastworks website dimensions are as follows: Length (34.3m), Breadth (18.9m) and Moulded Depth (2.74m)

² From Coastworks website dimensions are as follows: Length (55m), Breadth (18m) and Moulded Depth (3.0m)

4.1.3 Programme

An outline programme for Option A is approximately **25 working days**, as indicated in Table 4-1 below. Assuming a 6-day working week, this equals an approximate 4-week programme duration. Weather impact and contingency are to be considered over and above this estimate, overall a total contract period of say 5 to 6 weeks appears appropriate.

Table 4-1 Sequence of Works – Option A

		Estimated Programme for Works		Notes
		Estimated site time (working days)	Accumulated site time (working days)	
1	Mobilisation and prepare site	1	1	Allow 1 day on arrival to site – marine plant only
2	Strip deck platform	2	3	Allow 1 day per dolphin
3	Remove fender system	4	7	Allow 2 days per dolphin – above and below water working required
4	Remove bracing system	4	11	Allow 2 days per dolphin – above and below water working required
5	Prepare the seabed	2	13	Allow 1 day per dolphin – dive team
6	Cut and remove raking piles	10	23	Allow 5 days per dolphin (4 No. piles each dolphin)
7	Reinstate seabed	1	24	Allow 0.5 days per dolphin
8	Demobilisation	1	25	Allow 1 day – marine plant only
	<i>Contingency Allowance</i>	5	30	Allow 5 days

4.1.4 Cost

An outline cost estimate for Option A can be seen in Table 4-2. This is based on similar projects and anticipated costs. The contract cost estimate includes an allowance for contractors' overheads and preliminaries and a further allowance for risk and uncertainty. At this stage, the cost estimate has not been vetted by early Contractor input and variations in prices from historical projects can be expected.

Table 4-2 Demolition cost estimate – Option A

	Out-turn low (-15%)	Cost Estimate	Out-turn high (+30%)
Option A	£215,000	£250,000	£325,000

Additional project costs to cover contract administration, project management and site supervision have been estimated as £15,000 (7.5% of the anticipated contract cost estimate). It is assumed this would be a largely office-based activity with limited attendance on site.

4.2 Option B – Lift out

The anticipated sequence of works to 'Lift Out' the complete dolphin structures is described here, including a high-level review of suitable plant and equipment. This section also includes an estimated programme and associated cost estimate for this option.

4.2.1 Methodology

Step 1 – Mobilise and prepare site

Contractor to mobilise to site.

Step 2 – Strip loose items from the deck platform

Any loose items shall be removed from the deck platform.

Step 3 – Prepare for lift out

Contractor to assess the structures and prepare dolphins to be lifted from the seabed. If considered necessary the contractor may install temporary bracing between the piles.

Step 4 – Local seabed excavation

The seabed is to be excavated locally around the raking piles to a minimum depth of 1m (TBC) below bed level. Due to the anticipated silty sand bed material, the 'airlift' method may not be suitable, and the seabed may require to be excavated by divers.

Step 5 – Cut raking piles and lift dolphin

Each pile shall be cut to a minimum 1m (TBC) below seabed level. Once cut, the complete berthing dolphin structure is to be lifted from the seabed, positioned on the barge and transported off-site for disposal.

Step 6 – Reinststate seabed

Upon completion of the demolition works, the seabed shall be reinstated to the original level.

4.2.2 Plant and Equipment

As with Option A, Option B will require marine plant to provide access to the dolphins and to provide lay-down area for storage of the removed dolphin materials, contractor's equipment and welfare during demolition. It is assumed that no landside lay-down area will be provided.

From review of existing information, the minimum available water depth within the channel in front of the dolphin structures is 2m below Chart Datum.

If placed horizontally on the deck of a barge, stored side by side, the area required for 2 No. dolphins is approximately 12m x 15m.

The largest lift required for Option B is for 1 No. complete dolphin structure, which weighs approximately 25T. At an assumed 10m radius, a 90T crawler crane would be sufficient to lift the maximum anticipated load. *The Kobelco CK900G may be suitable for lifting the load at 10m radius, with a 30.5m crane boom*
<https://www.kobelcocm-global.com/products/cranes/europe/pdf/CKE900G-2spec.pdf>

Again, it is assumed 1 No. barge would be used as the crane working area, lay-down area for dolphins and storage of equipment including dive equipment and welfare. Coastworks CW3³ barge provides sufficient deck area for a crane, lay-down area and contractor welfare units, with suitable draught when fully laden to allow working at water depths greater than MLWS, with an allowance for 500mm under-keel clearance.

Use of a separate lay down barge may be considered, however this would require additional tug support and would have to be managed to minimise impact on the navigation channel.

The dolphin structures are to be stored on marine plant during the demolition works. Once works are complete, these shall be disposed of by the Contractor. It is assumed that no landside laydown area will be provided.

4.2.3 Programme

An outline programme for Option B is approximately **18 working days**, as indicated in Table 4-3 below. Assuming a 6-day working week, this equals an approximate 3-week programme duration. Weather impact and contingency are to be considered over and above this estimate. Overall a total period of 4 to 5 weeks would appear appropriate.

³ From Coastworks website dimensions are as follows: Length (34.3m), Breadth (18.9m) and Moulded Depth (2.74m)

Table 4-3 Sequence of Works – Option B

		Estimated Programme for Works		Notes
		Estimated site time (working days)	Accumulated site time (working days)	
1	Mobilisation and prepare site	1	1	Allow 1 day on arrival to site – marine plant only
2	Strip deck platform	1	2	Allow 0.5 days per dolphin – loose items only
3	Prepare for lift out	2	4	Allow 1 day per dolphin
4	Prepare the seabed	2	6	Allow 1 day per dolphin – dive team using 'airlift' dredge method or local excavation by divers
5	Cut raking piles and lift structure onto laydown area	10	16	Allow 5 days per dolphin (4 No. piles each dolphin)
6	Reinstate seabed	1	17	Allow 0.5 days per dolphin
7	Demobilisation	1	18	Allow 1 day – marine plant only
	<i>Contingency Allowance</i>	5	23	Allow 5 days

4.2.4 Cost

An outline cost estimate for Option B can be seen in Table 4-4. This is based on similar projects and associated costs. The contract cost estimate includes an allowance for contractors' overheads and preliminaries and a further allowance for risk and uncertainty. At this stage, the cost estimate has not been vetted by early Contractor input and variations in prices from historical projects can be expected.

Table 4-4 Demolition cost estimate - Option B

	Out-turn low (-15%)	Cost Estimate	Out-turn high (+30%)
Option B	£175,000	£205,000	£270,000

Additional project costs to cover contract administration, project management and site supervision have been estimated as £12,000 (7.5% of the anticipated contract cost estimate). It is assumed this would be a largely office-based activity with limited attendance on site.

4.3 Contractors Working Area

4.3.1 Use of Land-Based Area

Agreement is to be made with The Highland Council regarding use of an agreed land-based laydown / materials pick-up area and the associated costs prior to tender. If agreed, the Contractor is to include for these costs in their tender.

For the purpose of this logistics exercise, it is assumed the Contractor will not be allocated a land-based compound/working area and that the Contractor's shall confine all his activities within the working area shown in Figure 4.1 below.

Figure 4.1: Indicative Contractors Working Area

Source: Extract from drawing 358426-MMD-AK-XX-DR-C-1000

4.3.2 Anchorage of Marine Plant

The dolphins are located approximately 60m from the pontoons on the opposite side of the channel. Due to shallow water depths, the proximity of the pontoons and the restrictions on working area required to maintain the operation of the harbour, the Contractor is to avoid use of spread anchors to secure their marine plant. Accordingly, it is anticipated a spud leg or jack-up barge will be utilised.

4.3.3 Location of Berth for Workboat and Crew Access / Egress

To be discussed and agreed with The Highland Council prior to tender.

4.3.4 Area for Contractor's Compound

If The Highland Council are able to provide an onshore area for Contractor's compound, this is to be agreed and costs determined to input into tender documents. From initial discussions, the area at the top of the Old Ferry Slipway may be suitable for this purpose.

4.3.5 Berth for Discharge of Materials for Transportation Off-Site

To be discussed and agreed with The Highland Council prior to tender. From initial discussions and review of available water depths, The Railway Pier at Kyle Harbour may be suitable for this purpose.

5 Stakeholder and Licensing Requirements

5.1 Permits

The Statutory Harbour Authority, Highland Council Harbour Authority, will confirm any requirements for works license, permit to work and/or permit to dive during the project programme.

It is anticipated the Contractor will be required to attend daily briefings with the Harbour Master and to obtain daily dive permits when necessary.

5.2 Licensing Requirements

5.2.1 Scottish Natural Heritage

From an initial review of the Scottish Natural Heritage interactive map and the Scottish Government environment map (<https://map.environment.gov.scot/sewebmap/>):

- Loch Alsh is a Special Area of Conservation (Scotland), however the harbour area and works area are not,
- Loch Alsh is a Marine Protected Area, however the harbour area and works area are not,
- The berthing dolphins are within the Highland Council Marine Planning Zone (Zone 7),
- The berthing dolphins are within the Wester Ross Biosphere Reserve (Scotland).

The Wester Ross Biosphere Reserve team have confirmed to MML that there are no statutory obligations to adhere to for the demolition works, and that best practice should be followed.

5.2.2 Crown Estates

A Crown Estates licence should be sought for the demolition works, detailing the proposed demolition programme and providing notification that the dolphins have been fully removed. This action is currently with CMAL.

5.2.3 Marine Licence

Initial engagement with Marine Scotland indicates a Marine Construction license is required for the project. The timeline for processing a marine construction license is 14 weeks and MML are drafting the application in line with the methods described in this document.

6 Conclusions

Both options require the use of marine plant to complete the demolition works and store plant, equipment and materials. Option A has a longer programme of marine works, consequently resulting in larger cost and impact on the local community in terms of noise caused by the works when compared to Option B. The contract cost for Option A is in the region of **£250k** and the anticipated duration of marine works is **5-6 weeks** allowing for weather downtime.

The programme of marine works for Option B is slightly shorter, as the dolphins will be transported from site to be fully demolished. The contract cost for Option B is in the region of **£205k** and the anticipated duration of marine works is **4-5 weeks** allowing for weather downtime.

The demolition contract will be let under an NEC4 contract. MML are preparing the tender package in accordance with the requirements of NEC4 and Client specific requirements. The tender package will include Pre-Construction Information, Site Information, Contract Data and Scope.

A. Contractor's Working Area Drawing



- Notes
1. This drawing shall be read in conjunction with the Scope.
 2. The Project Manager shall be notified immediately of any discrepancy encountered on site.
 3. All dimensions are in millimetres (mm) unless noted otherwise.
 4. The drawing shall not be scaled. FOLLOW WRITTEN DIMENSIONS ONLY.
 5. Levels are in metres relative to Chart Datum (CD) unless noted otherwise.
 6. At Kyleakin, Chart Datum is 2.73m below local Ordnance Datum.
 7. Details of existing structures and services have been taken from available record drawings and may not be complete in every detail. Details shall be confirmed by the Contractor.
 8. Access to the harbour shall be maintained at all times. Harbour Operations shall not be disrupted by the Contractor.
 9. The Contractor shall ensure the temporary and permanent stability of all parts of the Works at all times.
 10. The Contractor shall be responsible for maintaining the seabed free of debris and obstructions outwith the working areas.
 11. The Contractor shall be responsible for determining the tidal conditions affecting the Works and planning their activities accordingly. The Site Information presents tidal conditions anticipated at Kyleakin. Actual water levels can vary substantially due to meteorological conditions and other effects.
 12. Contractor to clearly mark their agreed working area at all times.

Key to symbols

Contractors Working Area

Reference drawings

358436-MMD-AK-DR-C-1001 Demolition Requirements

Record Drawings
 1985/11/4B Kyleakin Moorings - Setting Out Details (Crouch and Hogg, 1978)
 1985/11/11 Kyleakin Moorings - Setting Out Details (Crouch and Hogg, 1978)

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	25.08.20	RM	For Client Comment	MC	MR


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Title

**Kyleakin Berthing Dolphin Demolition
 General Arrangement and
 Working Area**

Designed	L Anderson	LA	Eng check	S Hillier	SH
Drawn	R Macrae	RM	Coordination	S Hillier	SH
Dwg check	M Kerr	MK	Approved	M Ross	MR
Scale at A1	Status	Rev	Security		
1:250	PRE	P1	STD		

Drawing Number
358436-MMD-AK-XX-DR-C-1000

