OPW

Skellig Michael Lower and Upper Lighthouses

Scheme Report for Energy and Water Strategy

273170-00

Issue 2 | 7 December 2020

Job number 273170-00

Ove Arup & Partners Ireland Ltd

Arup
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

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Document verification

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Job title		Skellig Michael Lower and Upper Lighthouses		**Job number** 273170-00
Document title		Scheme Report for Energy and Water Strategy		**File reference**
Document ref		273170-00		
Revision	**Date**	**Filename**		
Issue 1	24 Jun 2020	**Description**	Issued to OPW	
			Prepared by	Checked by	Approved by
		Name	Rosie Creedon	John Burgess	Edith Blennerhassett
		Signature			
Issue 2	7 Dec 2020	**Filename**	27130-00_2020_11_27_Skellig Michael Scheme Report_ Issue 2.docx		
		Description	Updated to include for Upper Lighthouse and Input from Irish Lights		
			Prepared by	Checked by	Approved by
		Name	John Smyth	John Burgess	Edith Blennerhassett
		Signature	PP 		PP 
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document verification with document	✓

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Appendices

1 Introduction

Arup was commissioned by the OPW to investigate appropriate energy and water solutions, including mechanical and electrical (M&E) services systems for the refurbishment of the Lower and Upper Lighthouses on the island of Skellig Michael. The lighthouses will provide accommodation for 16 OPW employees or authorised visitors for an occupied season of April to October (7 months). Skellig Michael is home to an early medieval monastic site and is a world heritage site. The island of Skellig Michael is also a bird sanctuary. Therefore, both historical and environmental constraints on the site must be considered with every potential solution.

The island has no connection to the mainland electrical grids or gas network. The M&E systems must be capable of operating entirely off-grid. Energy supplies for the lighthouse are selected with sustainability, robustness, resilience and maintainability in mind. The solutions developed are in line with Ireland's Climate Action goals, whilst also minimising impact on wildlife. In line with the targets for a net-zero carbon lighthouse, 100% of the energy supply is to be provided from renewable resources, and waste is to be collected for return to the mainland. Organic waste is composted on site locally with the residue transported back to the mainland at the start of each season.

Refer to Appendices for record of minutes of meetings (appendix A), historical report (appendix B) and consent application drawings and photographs for lower lighthouse (appendix C & D), and upper lighthouse briefing guide and survey drawings (appendix E).

2 Energy Demand

The energy demand profiles of the building and the occupants has been estimated for system sizing. Typical energy use patterns for households were utilised for a daily profile to be generated for 3 scenarios: for the occupied coldest (April) and warmest (July) month as well as the coldest (January) month of the unoccupied season.

Space heating requirements were calculated using heating degree days (HDD) with an internal space temperature setpoint of:

Table 1 Space Temperature Setpoint

Season	*Months*	*Temperature (°C)*
Occupied Season	April-October	19
Unoccupied Season	November-March	13

During the unoccupied winter season, the lighthouse needs heat to maintain the fabric of the building. Without the space heating measures, mould, damp and other factors will degrade the building fabric which would lead to additional maintenance works.

Appliances and equipment to be included in the building are listed in the following sections and assessed for their expected energy requirement throughout the day. Key electrical plant and equipment include dehumidifiers (for the drying room), fridge, freezer, laptop/phone/tools charging, PCs, lighting, washing machine, and the heat-pumps. Key gas fired appliances include cookers and hot water heaters for the 2 kitchens and 1 kitchenette (upper lighthouse).

Natural ventilation will be used throughout both lighthouses to provide suitable ventilation to occupants. During the winter, when the windows are shuttered up, the building will need to limit infiltration of fresh air. The renovated building will undergo air pressure tests (positive and negative) to identify points where the building envelope is leaking. A suggested target of achieving less than $5m^3/s/m^2$ of building envelope at 50Pa pressure difference is given for guidance. Given that this is an old building the final performance of the building envelope may be difficult to improve to very low levels.

Energy demand profiles are shown for both lighthouses in the workbook presentation in section 10 below.

3 Energy Supply

Given the major operation in removal of fuel oil from Skellig Michael, Arup has proposed an energy generation strategy that adopts a 3 stage approach to meeting the demands of future planned use and occupation of the lighthouses by the OPW:

1. Solar PV and battery storage, maximised to avoid the need for stages 2 and 3.
2. Wind and battery storage, and
3. Bio-diesel generator (as a last resort) with fuel storage in a bunded tank that would be protected from rain and sea spray ingress.

The lighthouses' energy supply system is organised into a micro grid with provision for multiple renewable energy sources including PV, solar thermal, wind and a stand-by generator powered by biodiesel. Although it is the aspiration of the project to only need PV and battery storage to meet the energy demands. Electrical energy will be stored in batteries to capture excess solar (and/or wind) energy for use throughout the day and night.

The existing 24m^2 of PV panels (located on the approach path to the lower lighthouse and facinge southeast) will be replaced with new, more efficient PV technology. The panel area will also be extended by another 20m^2 by extending the length of this row of panels. Also, a steel frame will be incorporated on the roof of the lower lighthouse accommodation block to provide an estimated additional 48m^2 to provide a southwest facing PV array that will extend the period of available solar energy generation. There is a need to maximise the solar generating capacity to provide energy during winter for heating. In this first phase of the project, due consideration should be given to identifying additional areas where PV panels could be mounted should the need arise. A second row of approximately 28m2 could be mounted over the existing PV panel location on the approach path to the lower lighthouse. This would provide a total PV panel area of 120m^2, enough to exceed the estimated energy demand profiles for the lower lighthouse.

The upper lighthouse will have 70m^2 of PV located on the roof and a battery energy storage system located in one of the ancillary structures outside the main building.

Electricity generated will be used to power appliances and heat-pumps for space and water heating requirements.

For a remote area power supply system, security of supply is paramount. Resilience will be built into the new systems by providing a stepped approach to plant sizing and selection, ie. at least 2 circuits, pumps, and ancillary plant so that some service provision remains in place should there be equipment failure until a replacement or repair has been put in place.

Subject to space limitations, battery energy storage capacity will be designed to cover for the longest duration possible within the available space of the plantroom. The electricity storage system will be arranged with several battery strings so should one battery cell fail, the other battery strings will continue to provide power at a reduced capacity.

Monitoring and control of the energy systems will need remote access communications links using a GSM mobile network (Vodafone / Eircell) back to the mainland. The radio communications aerials will be located on the gable wall of the coal shed.

For cooking energy requirements, bottled bio-LPG will be transported to the lighthouse and stored in a marine safe cage at the rear of the lighthouse to serve both kitchens. A reserve of three bottles should be provided for in addition to the active bottle in use. A similar arrangement will be needed for the upper lighthouse with a duty/reserve, 2 bottle arrangement.

4 Heating Systems

Lower Lighthouse

Heating will be provided by 2 air-source heat-pump systems that store thermal energy in 2 large buffer vessels. Each buffer vessel will be fitted with a heat exchanger connected to a roof mounted solar heating array. The roof mounted array will be demountable for storage during the unoccupied season. Safe maintenance access to roof is required.

Each buffer vessel will be provided with a side mounted plate heat exchanger to heat hot water for showers and wash-hand basins (non-potable supply) and kitchen sinks (potable supply).

The heat-pumps will be arranged to serve the building heating system through a pipe network to underfloor heating and wall-mounted low temperature radiators.

The outdoor units for the heat-pumps will be located on the rear wall beneath the external access stairs which will provide additional coverage for protection from the marine environment.

Heating of the internal spaces will set back to a lower operating temperature for the unoccupied months to provide for protection of the fabric against condensation.

Heat will also be provided to the drying room where portable dehumidifying units will work to dry clothes in the drying room on days of inclement wet weather. It is expected that natural ventilation will provide a less energy intensive method of drying clothes with cross-ventilation through openable windows in fair weather conditions.

Upper Lighthouse

Heating will be provided by 2 air-source heat-pump systems that store thermal energy in a large buffer vessel.

The heat-pumps will be arranged to serve the building heating system through a pipe network to underfloor heating and wall-mounted low temperature radiators.

The outdoor units for the heat-pumps will be located on a rear wall with additional coverage for protection from the marine environment.

Heating of the internal spaces will set back to a lower operating temperature for the unoccupied months to provide for protection of the fabric against condensation.

5 Water Supply and Treatment

All water used for domestic purposes will be transported to the island by boat to the one access point where small boats can dock while loading or unloading. It is recommended that a water transfer pipe is installed from the quayside to the lighthouse water storage tanks to enable pumping of the water from the boats. The boats would have to use on-board pumps to transfer the water to the tanks. Manual transfer of water to the transfer vehicle will pose considerable wear and tear to the access pathway between the quayside and the lighthouse.

There is space for storage of up to 80m^3 in 4 tanks – subject to ground bearing capacity checks and transport of the tanks themselves for safe installation.

Estimated water consumption could be as much as 160m^3 per annum, requiring a regular water delivery routine during the summer months.

5.1 Water Supply

Potable water demand is estimated to be 10 l/person/day. Washing water demand is estimated based to be 50 l/person/day. This water will supply showers, wash hand basins, and the washing machine.

Total estimated demand is 60 l/person/day, or 960 l/day for 16 people (undiversified demand).

Maximum storage capacity in 4 tanks at 20m^3 each would be 80m^3. This would cover approximately half of the summer season demand.

All water will be transported to the island by boat or ship. It will need to be pumped from the boat / ship to the storage tanks. On the above water demand estimates, planned deliveries of water need to be regularised across the summer months to refill each of the 4 tanks as they are drawn down and emptied on a rotational basis.

All tanks to be fitted with water level instrumentation to indicate remaining capacity and rate of use. The tanks will be arranged in two pairs with piping arrangements and valving arranged for a duty, standby pump arrangement for each pair of tanks.

The stored water will be pumped to two day-tanks in the upper plantroom to provide a gravity feed supply to the kitchen sinks and hot water heating system. Automated chemical analysis and dosing of all water will be provided for in the upper plantroom through the day-tanks. Duplication of the water treatment systems in the upper plantroom will provide resilience in the event of equipment failure.

Four empty 20 litre bottles will be retained and used to decant water from the storage tanks should the power / pumped systems fail.

Consideration should be given to collecting rainwater in the concrete tank on the roof of the old utility room (north end of lower lighthouse) for use in washing down external pathways and walls.

6 Wastewater Treatment

For the lower lighthouse, 2 toilets (both unisex for male and female use) will be provided on the link bridge between the upper plantroom and the bedroom accommodation. The toilets are waterless and will freely drain to a composting unit located on the ground floor beneath. The waste from the composting tank is to be removed at the beginning of each occupied season having had 6 months to decompose the waste.

Wastewater from the washing machine, showers and wash-hand basins will be piped to a wastewater filter before discharging in the existing latrine.

One composting toilet will be provided at the upper lighthouse.

7 Plant Accommodation

The sketches in the workbook show the proposed mechanical and electrical plant locations. The water treatment systems, heating plant and electrical switchgear, inverters and control system will be located in the upper plantroom directly over the drying room.

Access to the upper plantroom will be through the bathrooms from the main house or by an external stairway which also provides a fire exit from the upper floor. Fire extinguishers will be located in the plant room, bedroom area and the kitchens.

The bio-diesel powered standby generator (if it is ever required) is shown to be located in the old coal store next to the solar PV battery cabinet. In the first phase of the project, there may be a need to used all of the coal shed to house the batteries that will need to store sufficient energy to get through an extended cloudy, wet period in winter.

8 Communications Linked to the Mainland

A communications link to the mainland will provide remote monitoring of the facility. A GSM connection to a mobile network carrier (Vodafone, Eircell) will enable monitoring of the essential systems and operating performance of the plant from the mainland. The aerials to facilitate this comms link will be located on the gable wall of the coal shed.

The upper lighthouse will communicate to the lower lighthouse through walkie-talkies for the people staying there, and through a wifi-system for data transfer from monitoring systems, computer / laptops and handheld devices.

A weather monitoring station on the northern peak (near the monastery) will use similar technology to transfer data to the land-based monitoring systems.

9 Summary

The lower and upper lighthouses refurbishment project will produce near zero carbon accommodation for 16 people for an occupied season of 7 months.

Transport of food, water, materials, consumables and people to the island by boat will see the consumption of fossil fuels by the engines on the boats. While this is outside the scope of this project, it is expected that shipping transport fuels will convert to bio-fuels in the not-too-distant future.

Energy demand has been estimated based on the Irish Meteorological Service weather data available for Valentia and the activity of the inhabitants. The energy supply system proposed to meet these demands includes PV panels, battery storage, wind energy (small units mounted on the building), and a back-up biodiesel generator. Water demand has been estimated at close to 200m^3 per annum, with all water for use in the buildings to be transported from the mainland.

Communication links to the mainland will be needed to provide remote monitoring and control of the energy and water systems.

The proposals outlined in this report are at scheme stage only. These proposals will need further detailed design and coordination with the OPW before going to the market for competitive tenders for the energy and water systems in this unusual project.

10 Project Scheme Design Workbook

The following workbook in Powerpoint presentation (pdf'd) format shows the current status of the energy and water systems proposed for the refurbishment of the lower and upper lighthouses. These sketches, annotated layouts and notes present the context and spatial coordination aspects for the project in a format that assists the reader to understand the challenges and constraints of the location on the island of Skellig Michael.

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Skellig Michael Lighthouses Retrofit

Upper and Lower Lighthouse Refurbishments

Contents

Click on hyper-links to bring you to the section of interest

OPW Brief

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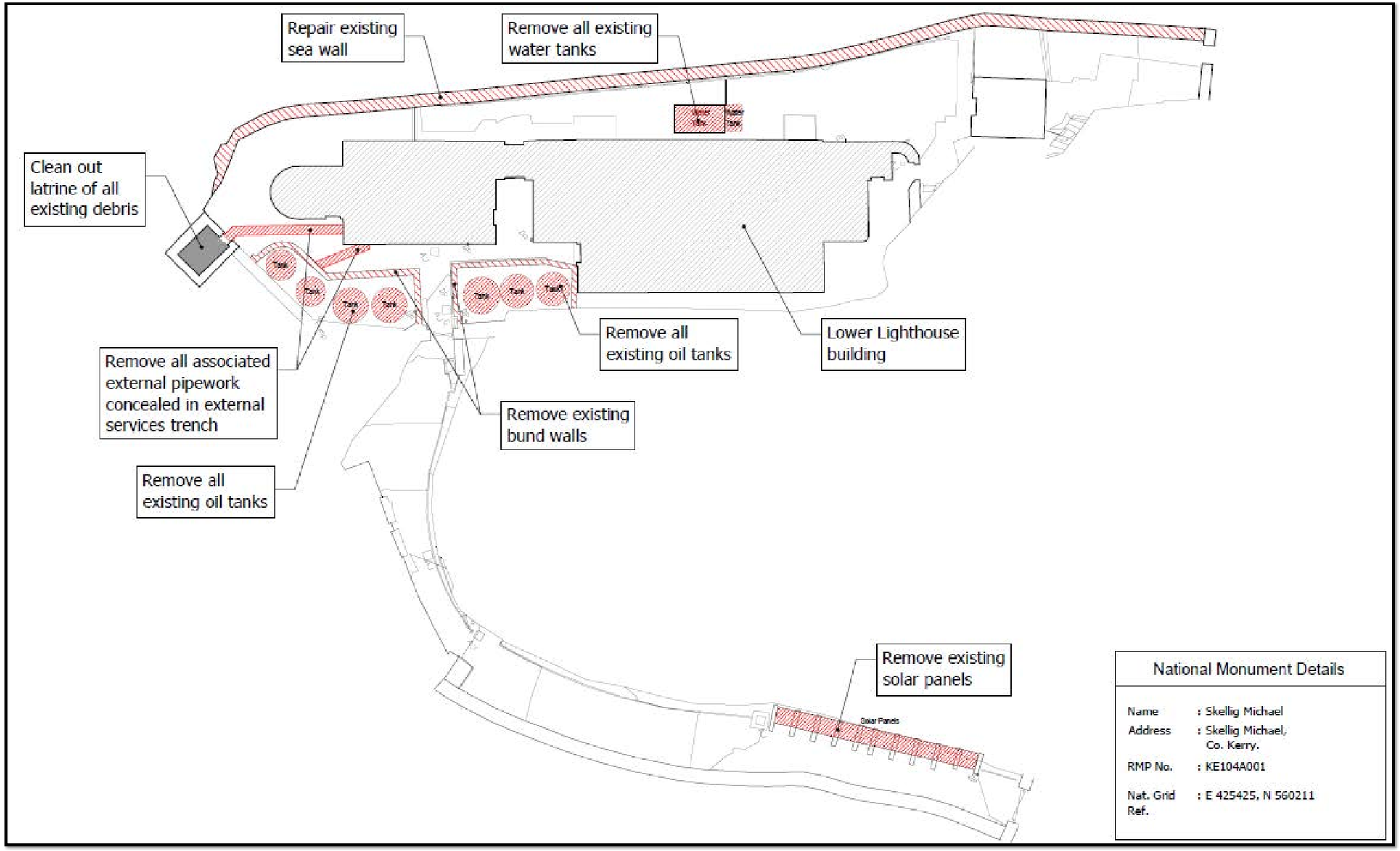
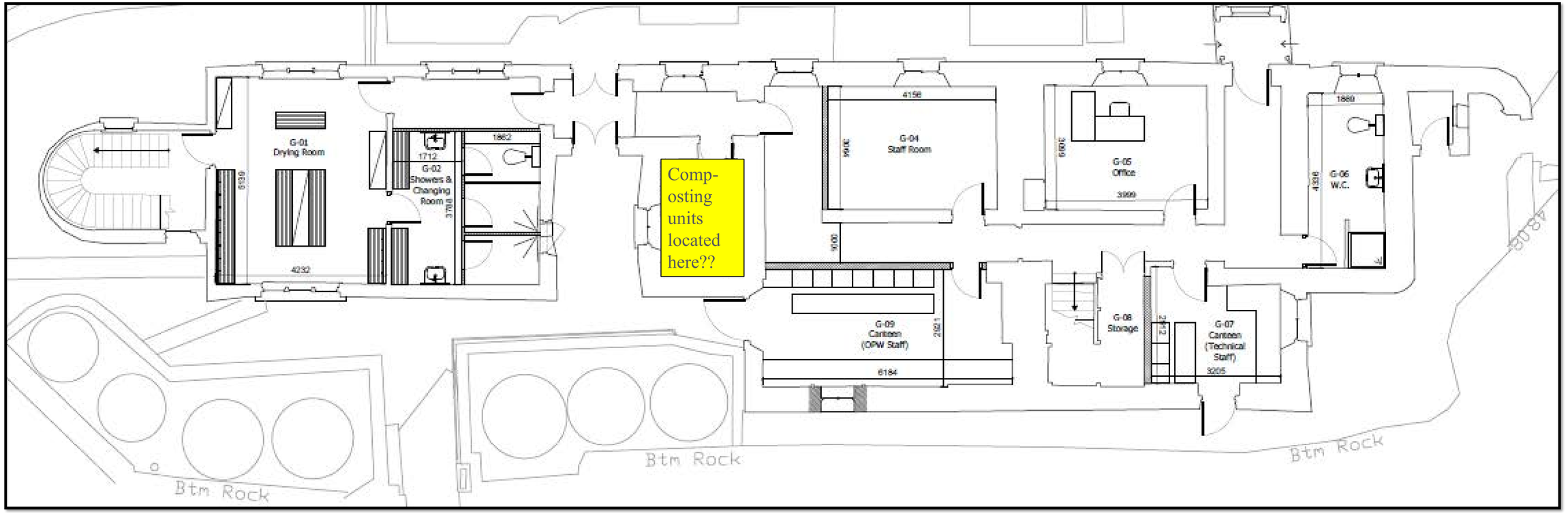
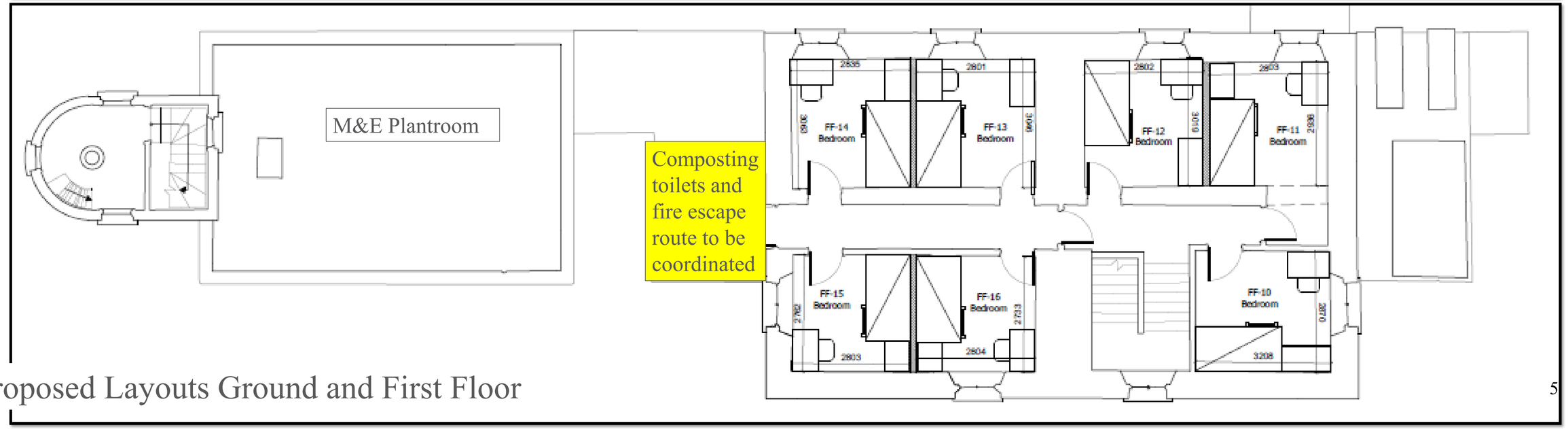
Upgrade of both the upper and lower lighthouse and installation of visitor toilet facilities to provide accommodation and facilities for approximately 16 people, (14 lower, 2 upper). This is an important conservation project for these buildings. Arup has undertaken a desktop study to consider the following items:

- Energy demand for heating, hot water and power for both facilities
- Energy supply using renewable energy and energy storage technologies
- Water storage requirements and provision for drinking and general purposes
- Toilet facilities and waste treatment and management
- Communications links to the mainland to facilitate remote monitoring and control
- Location for these systems and services, illustrated using sketch designs to show where the existing structures will need augmentation to accommodate them



Outline site preparatory work

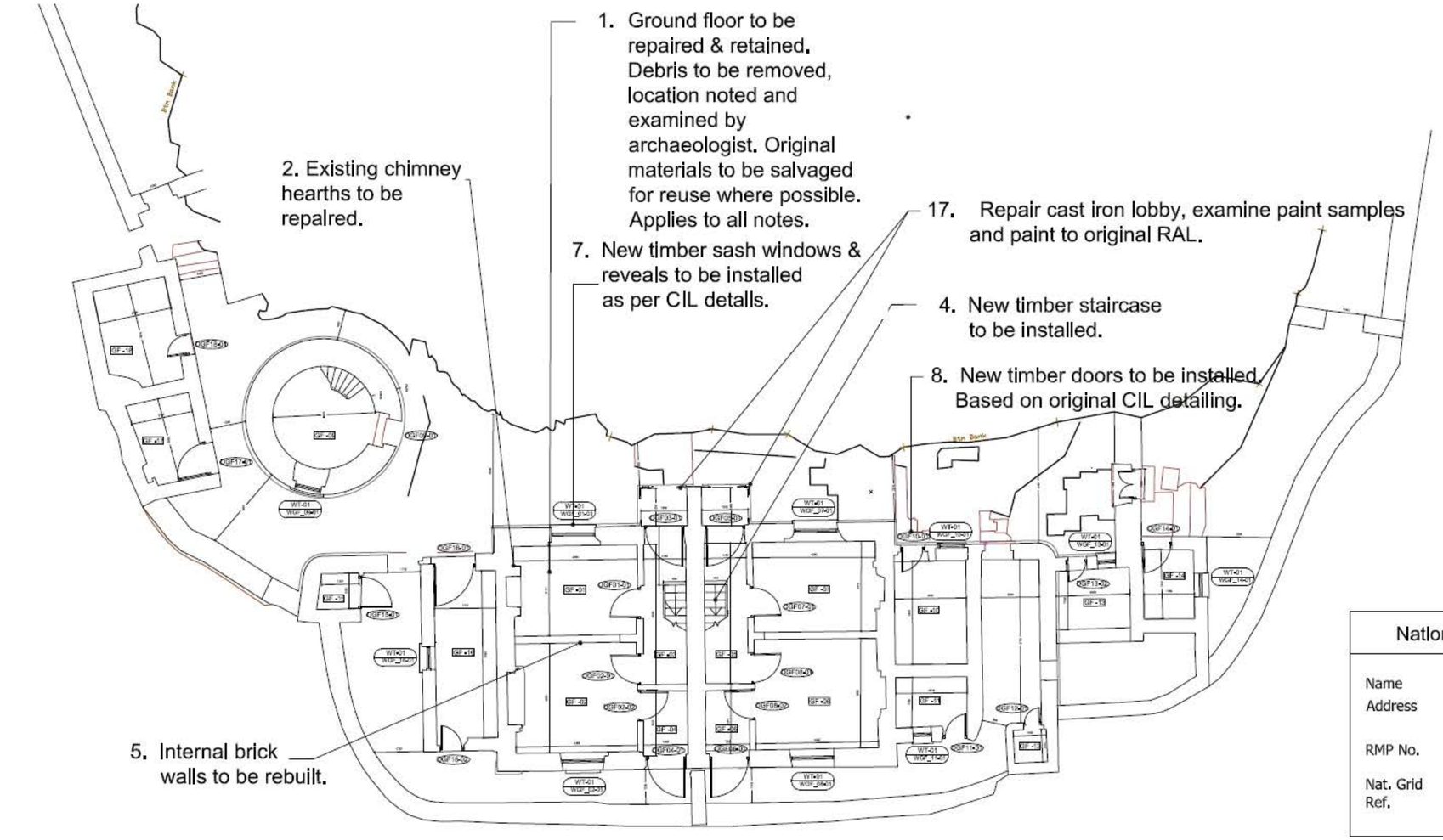




Proposed Layouts Ground and First Floor

Upper Lighthouse Ground floor plan

ARUP

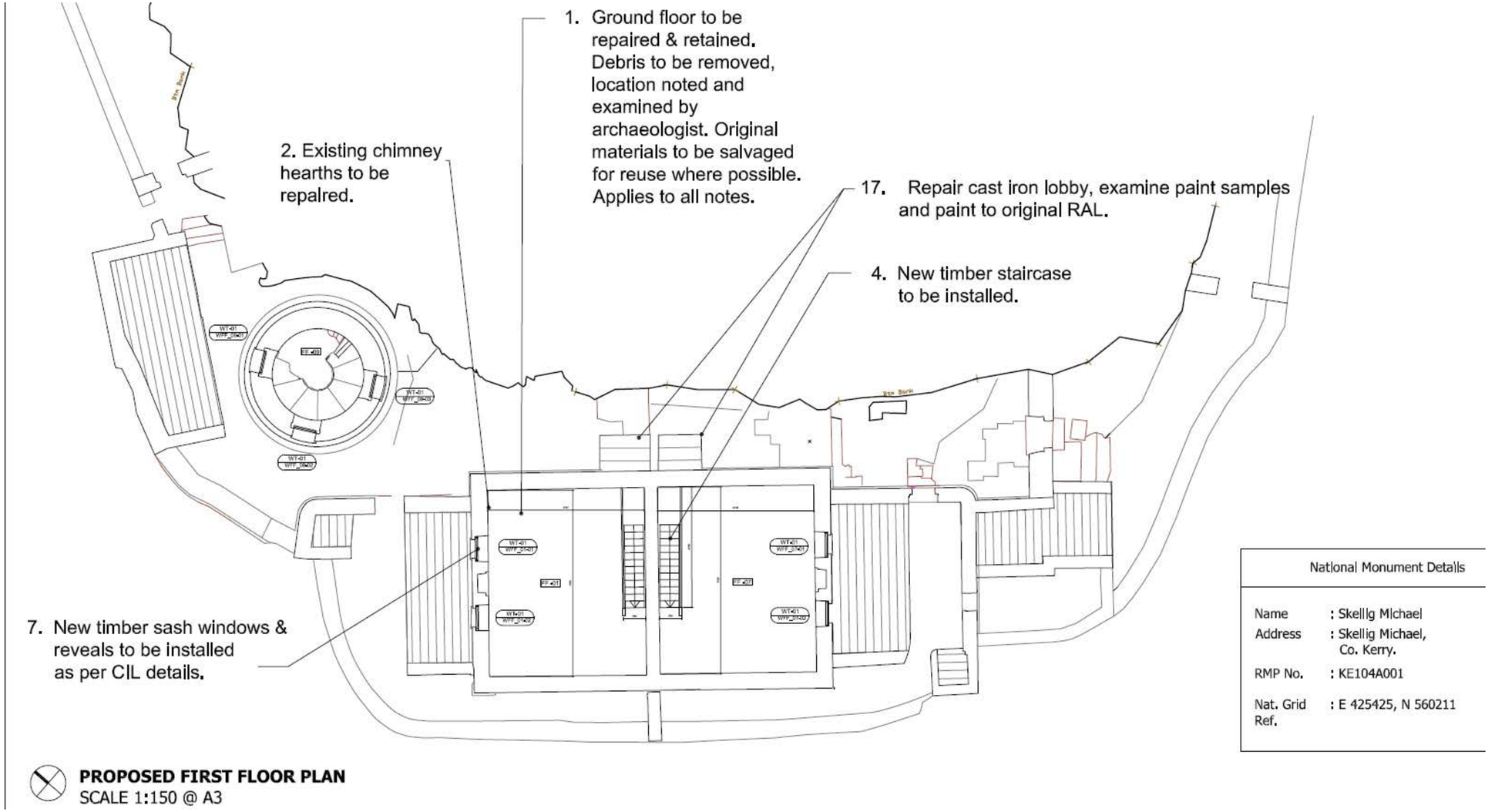


PROPOSED GROUND FLOOR PLAN
SCALE 1:150 @ A3

Natlonal Monument Detalls	
Name	: Skelllg Mlchael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

Upper Lighthouse First floor plan

ARUP



National Monument Details	
Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

Basis for Design

ARUP

Upgrade of lighthouses to provide accommodation and facilities for approximately 16 people

Occupied Season (1st April – 31st October , weather dependant)

- 14 people in Lower Lighthouse – 2 people in Upper Lighthouse.
- Space heating to 19^{O}C, water heating to 50^{O}C with sterilisation routines
- Lighting, power, cooking
- Water, toilets, waste-water

Unoccupied Season (1st November – 31st March)

- Heating and ventilation to limit fabric degradation

Energy Demand

Electrical Loads

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Loads taken into account:

- Heat Pump (for space heating and hot water)
- Dehumidifier
- Fridge
- Microwave
- Laptop/Phone Charging/Comms equipment
- Lighting
- Washing Machine
- *Others to be determined during detailed design for completeness*

Evaluated April, July and December loads to determine the difference in extremes in following slides

Estimated Electrical Loads – April (October)

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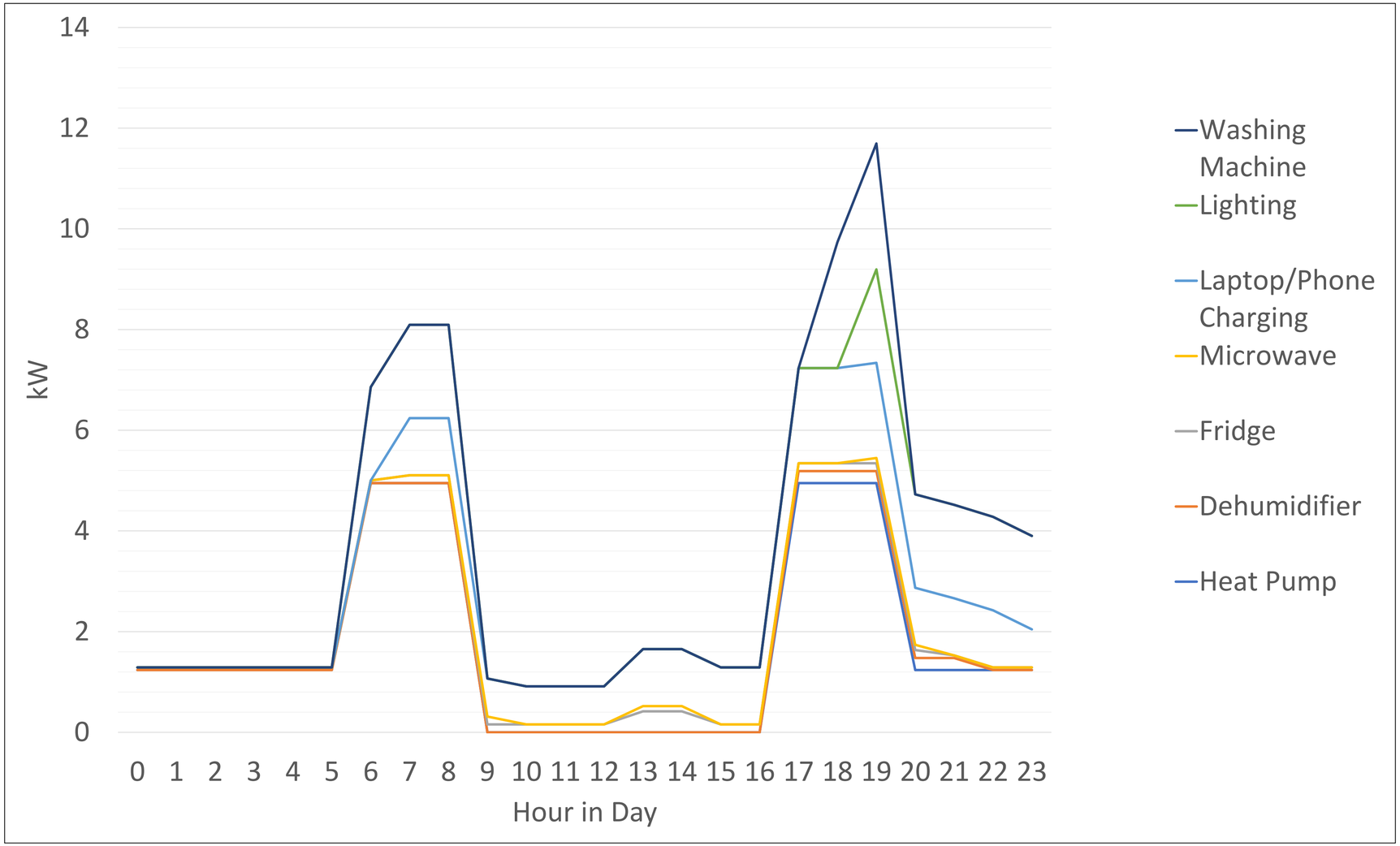
- Graph shows stacked line to represent loads, space between lines is estimated specific load

April Loads

- Load, 84 kWh/day
- Peak Load, 11.7 kW



Estimated Electrical Loads - July

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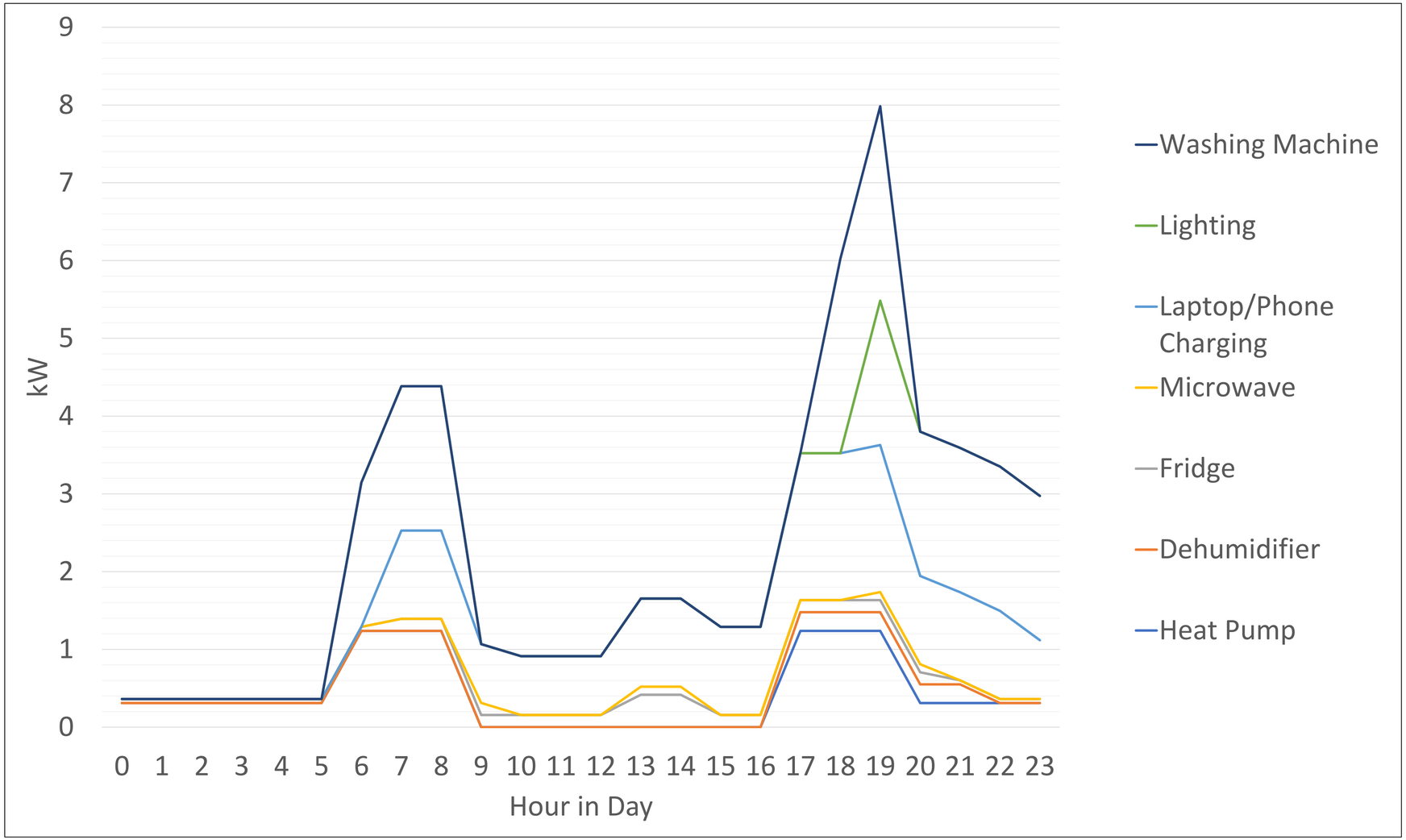
- Graph shows stacked line to represent loads, space between lines is estimated specific load

July Loads

- Load, 53 kWh/day
- Peak Load, 8 kW



Unoccupied Season Loads - December

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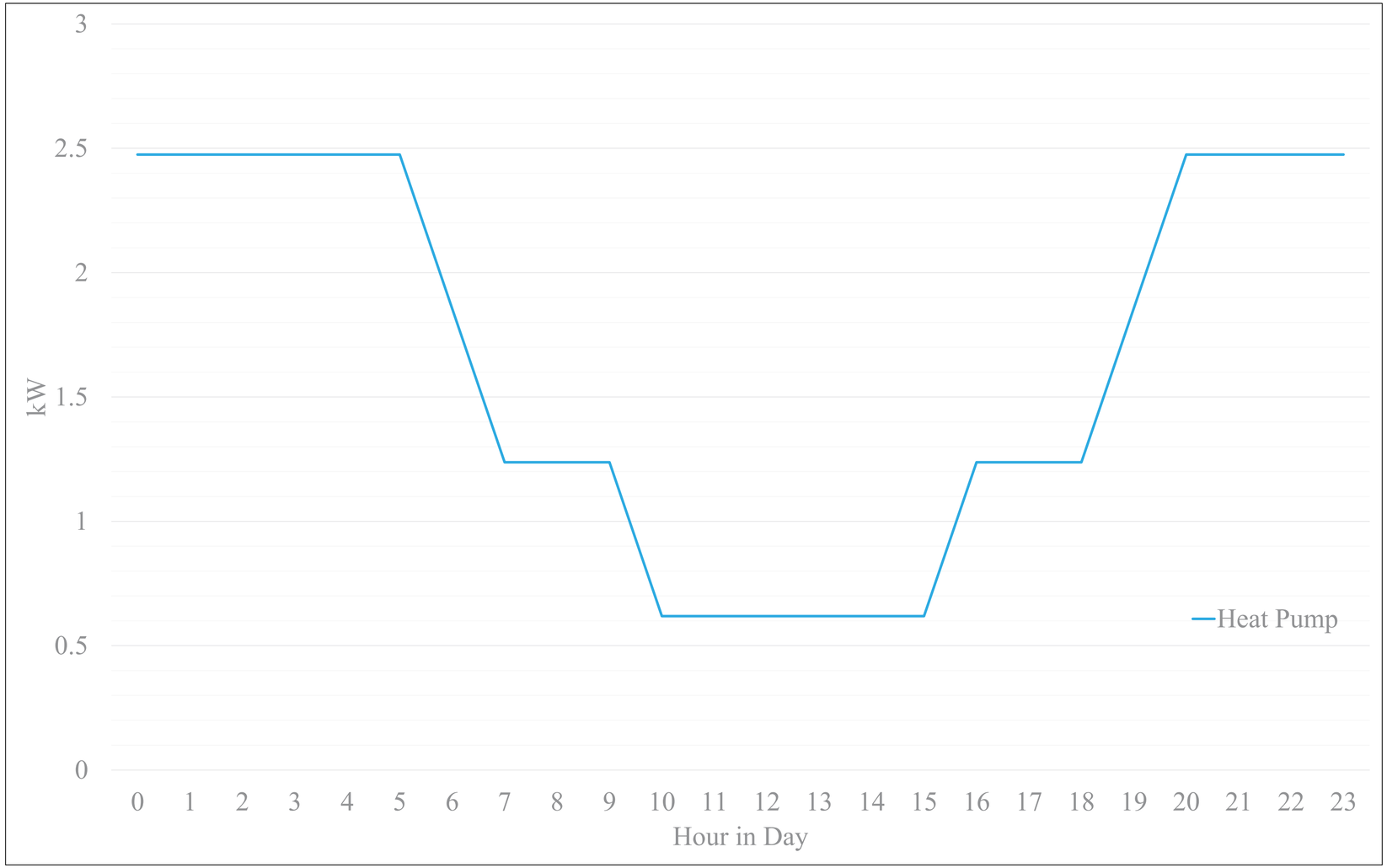
- Total thermal load = **116** kWh/day
- Electrical demand = 45 kWh/day
- Internal temp. 13°C
- Valentia weather data



Heating Loads – based on Valentia weather data

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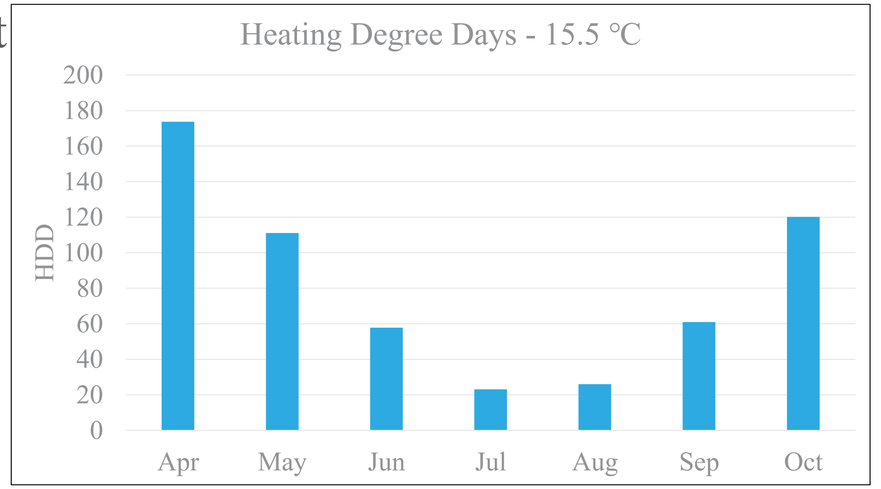
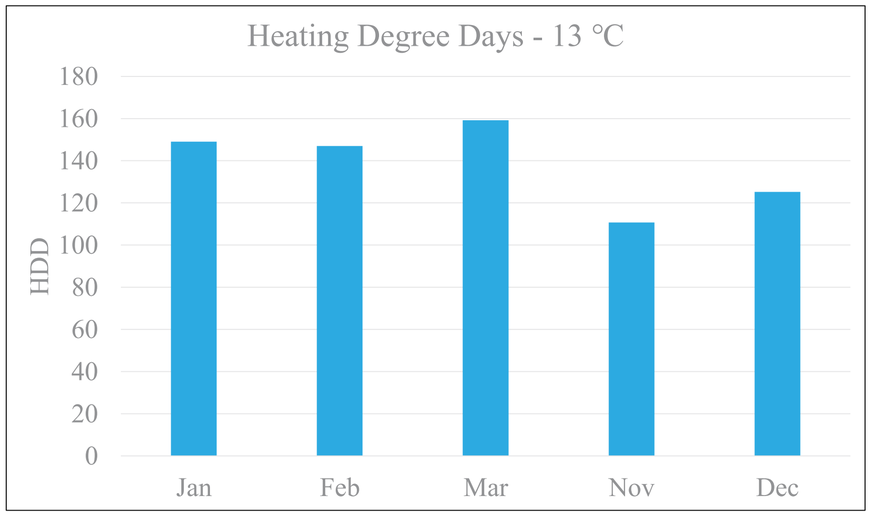
General

- Graphs show the number of Heating Degree Days* per month (average) that outside air temperature is below the baseline outside temperature above which space heating would not be required. The better insulated the building, the better it is at retaining heat, the lower the baseline temperature can be, and the lower the heating demand will be.
- Insulation of the building should be improved for optimum efficiency.



Occupied Season

- Drying room will be main load.
- Average total HDD show a low space heating need from Jun to Sept



Unoccupied Season

- Heating to protect fabric of building from condensation over winter, maintaining a temperature of 13 degrees when power is available from the renewable energy systems.

*Heating Degree Days = (Number of hours at given outside temp * (baseline temp – outside temp) / 24) for all temps below baseline temperature noted in graph title

Heating Loads – Occupied Season, Unoccupied Season

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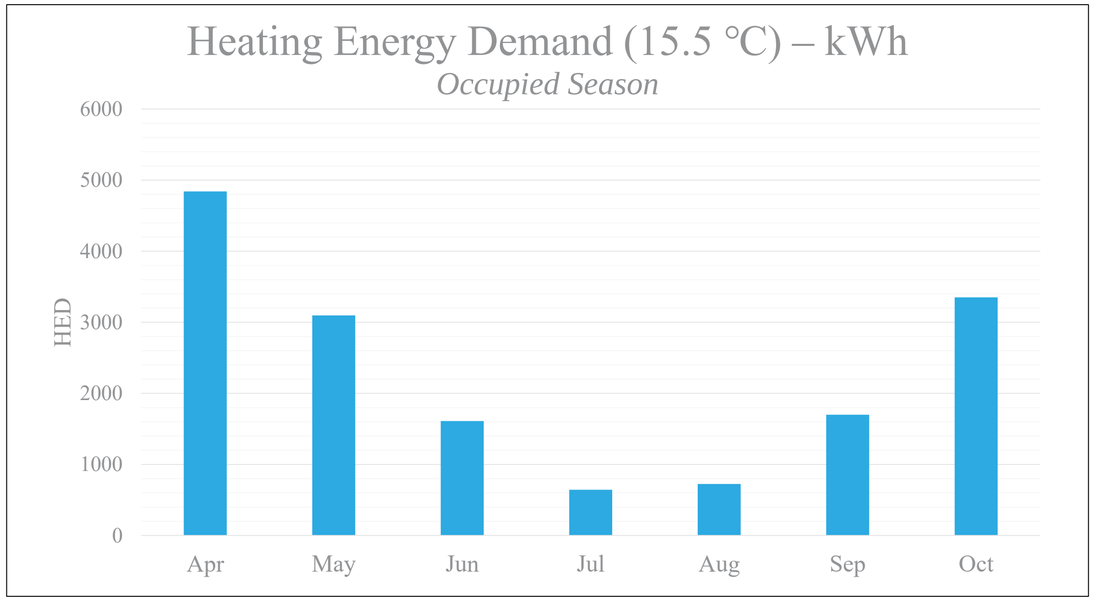
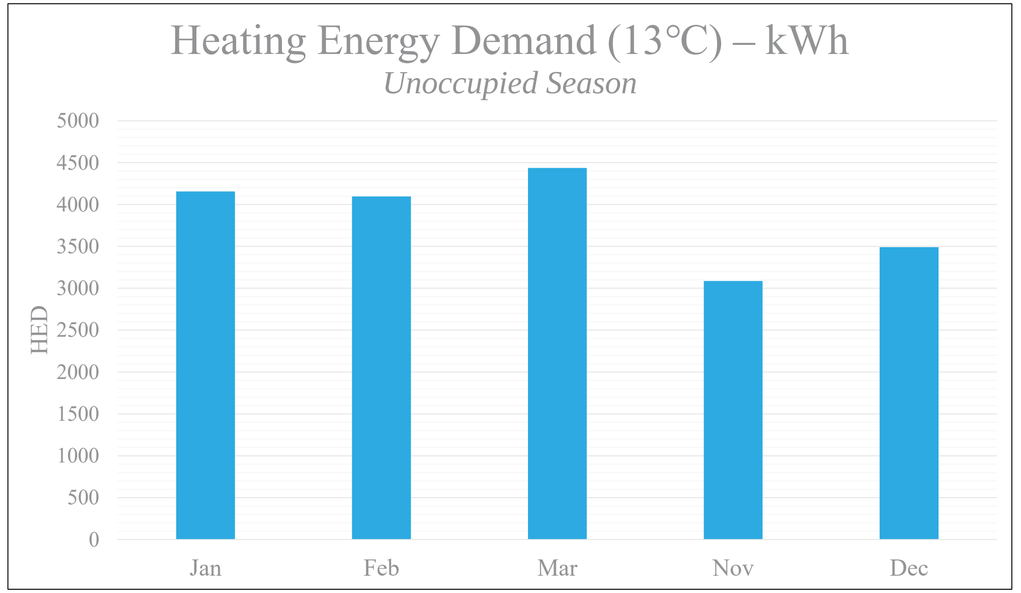
- Calculations are based on assumptions of fabric heat loss and infiltration





Heating Loads – Unoccupied Season

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- Consideration has been given to the use of natural ventilation to maintain the lighthouses during the unoccupied Winter season but difficult to control ingress of moisture laden air that is cold. Better to control the air intake and to use heat of exhaust air to preheat the incoming fresh air (low quantities are need as there are no people in residence during this period).
- While some of the older lighthouses contain more durable, natural materials, there are concerns that the upgraded lighthouse properties may be at increased risk of degradation during an unheated winter season.
- Use of uncontrolled natural ventilation during windy winter weather will increase the air infiltration and the winter season heat demand, which in turn will increase the heat pump size and energy consumption.
- It is recommended that the heating systems are used over the unoccupied season, in addition to mechanical ventilation heat recovery systems (MVHR) to keep the lighthouse building aired and at an appropriate temperature that mitigates against the risk of condensation and deterioration of the internal fabric.

Hot Water Demand – for thermal energy estimation

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- With reference to water demand assessment slide below, hot water demand is approximately 33l/s/person per day. (based on 50 l/s/person with 33% mixing of cold water).
- For 16 people, and 90% diversity, hot water requirement is 475 litres/day
- To heat this water from 10 to 50^{O}C over a 2-hour period, requires a heat input of 11kW thermal
- The dual heat-pumps can heat the hot water, provided it does not provide space heating at the same time
- The hot water heating electrical demand is included in the heat pump demand electrical load predictions
- This takes showers and general wash hand basin use into account.
- Water efficiency strategies are required to reduce water demand. All water for drinking and washing purposes needs to be shipped from the mainland.
- Solar PV panels on the roof of the lighthouse are preferred to solar thermal collectors to minimise maintenance activities.

Kitchen/LPG Consumption

Cooking will be provided for by Liquified Petroleum Gas (LPG), microwave and toaster

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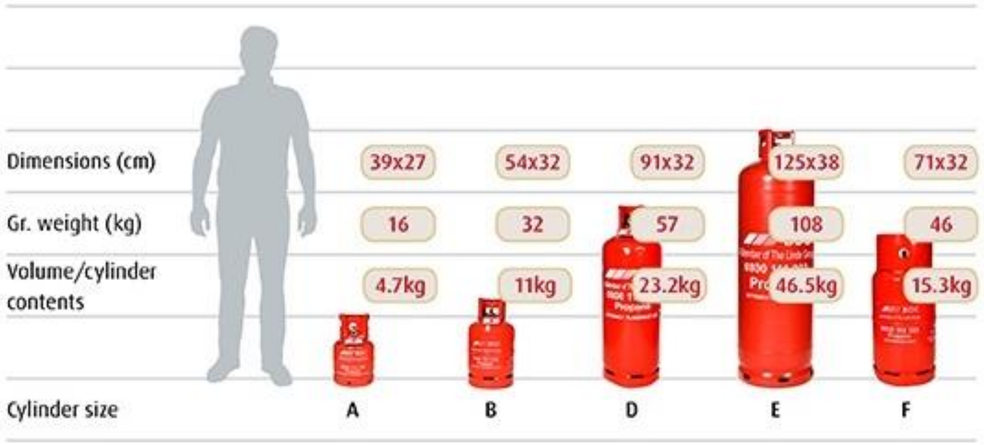
- Cooking – 4 ring gas hob in each of 2 kitchens and one oven
- Stacked bottles x 4 stored in cage - to be constructed behind (or to north wall of) building and piped along alleyway for connection to both kitchens.
- Provide either an electric undersink heater or gas fired water heater for kitchen sink hot water.
- Hot water for tea / coffee will be by heating a kettle on the stove.
- A dishwasher will be provided to minimise need for hot-water use.
- Assuming 0.33kWh/p/day cooking energy and a 46.5kg LPG tank, 1 tank should last 16 people 3 months



Ventilation

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Occupied Summer Season

- Opening windows to provide natural ventilation in all rooms during occupied summer season
- Extract fan to be included in both kitchens and to be blanked off on outside in winter when not in use.
- Air filtration system required in the plant room to prevent equipment damage from salt in the air

Unoccupied Winter Season

- External shutters and windows to be closed to protect the building, reducing infiltration heat loss
- Ventilation will occur naturally through infiltration.
- Refurbished buildings should undertake a building pressure test to find and infill gaps to reduce air infiltration.

Energy Supply

Electricity Supply Strategy

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Photo-voltaic cells will be the key energy producing (renewable) technology to be adopted for the lighthouse.

In addition to a new installation of 44m^2 of PV to be mounted on the approach path to the lower lighthouse, a permanent steel frame will be provided on the roof of the lighthouse for mounting of up to 48m^2 of PV panels. Note that there is also a possibility of an additional 28m^2 of PV panels located as a second row of panels over the existing PV panel location.

- Stage 1: PV and battery storage on approach path and on roof of lighthouse.

Should the energy generation capacity of the PV installation fail to meet the energy demand requirements in winter, stages 2 and 3 will be considered, as follows:

- Stage 2: Small Vertical Axis Wind Turbines (VAWT) on the lower lighthouse roof for winter months
- Stage 3: Biodiesel fuelled stand-by generator, housed in the old coal shed (next to the battery store-room)

Microgrid Overview

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Supply Components

- **Phase 1:**
- Photo-voltaic panels - replacement of existing southeast facing array on approach path to lower lighthouse
- PV Panels on steel platform on flat roof of lighthouse, southwest facing
- Electrical energy storage in batteries to eb located in the coal shed.
- DC to AC inverters
- Supervisory Control And Data Acquisition system (SCADA)
- Communications link to mainland for remote monitoring and control

Electricity Microgrid Overview

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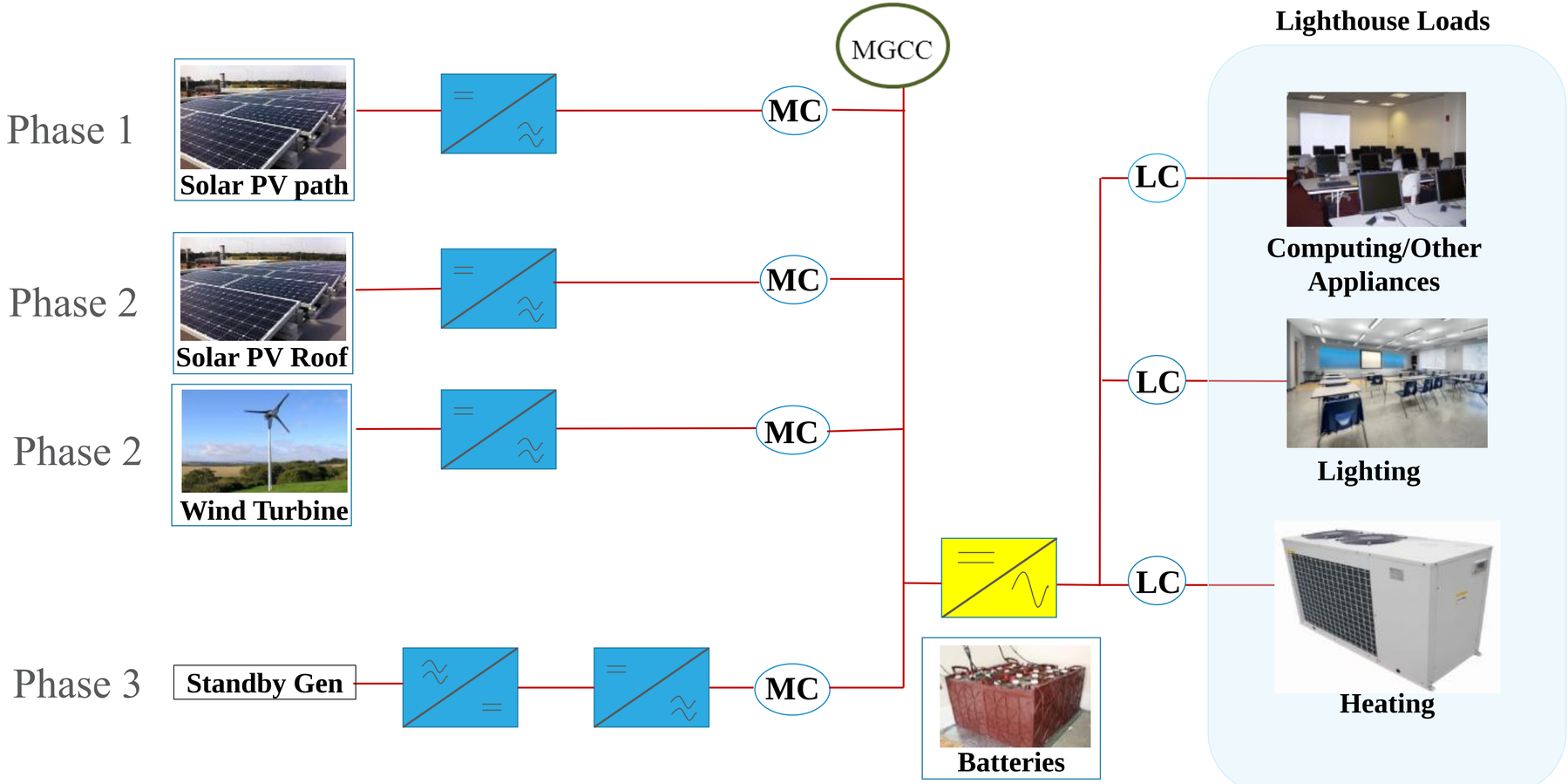
Full installation, all three phases included in schematic.



Phase 1: PV

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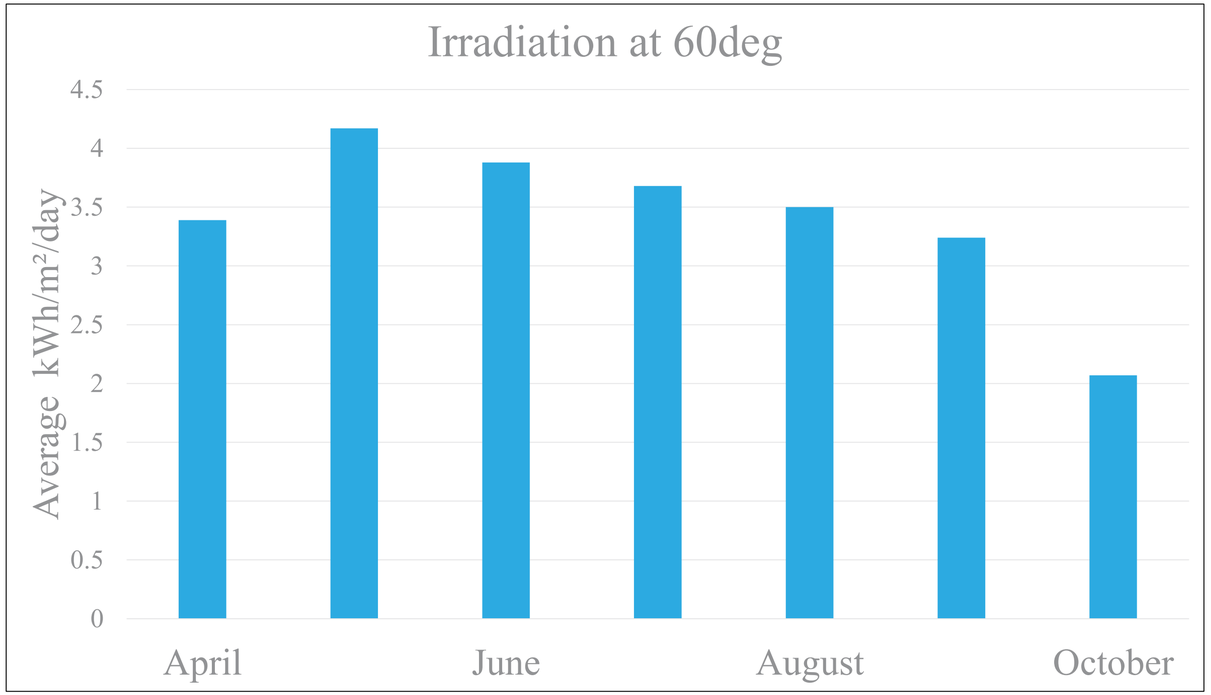
Solar Resource

- Data from nearest weather station; Valentia
- Panels should face south as much as possible

Location (see sketch slide)

- Approach path on rock – 80m^2 facing southeast
- All calculations currently based on this PV array
- Option to consider smaller array on lighthouse roof - facing southwest



Phase 1: PV

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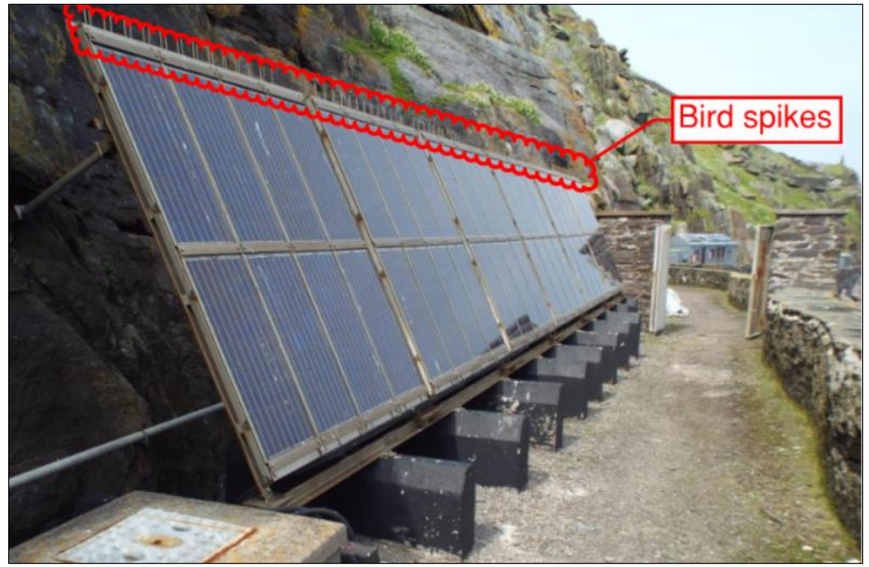
Array size, up to 120 m² based on following conditions

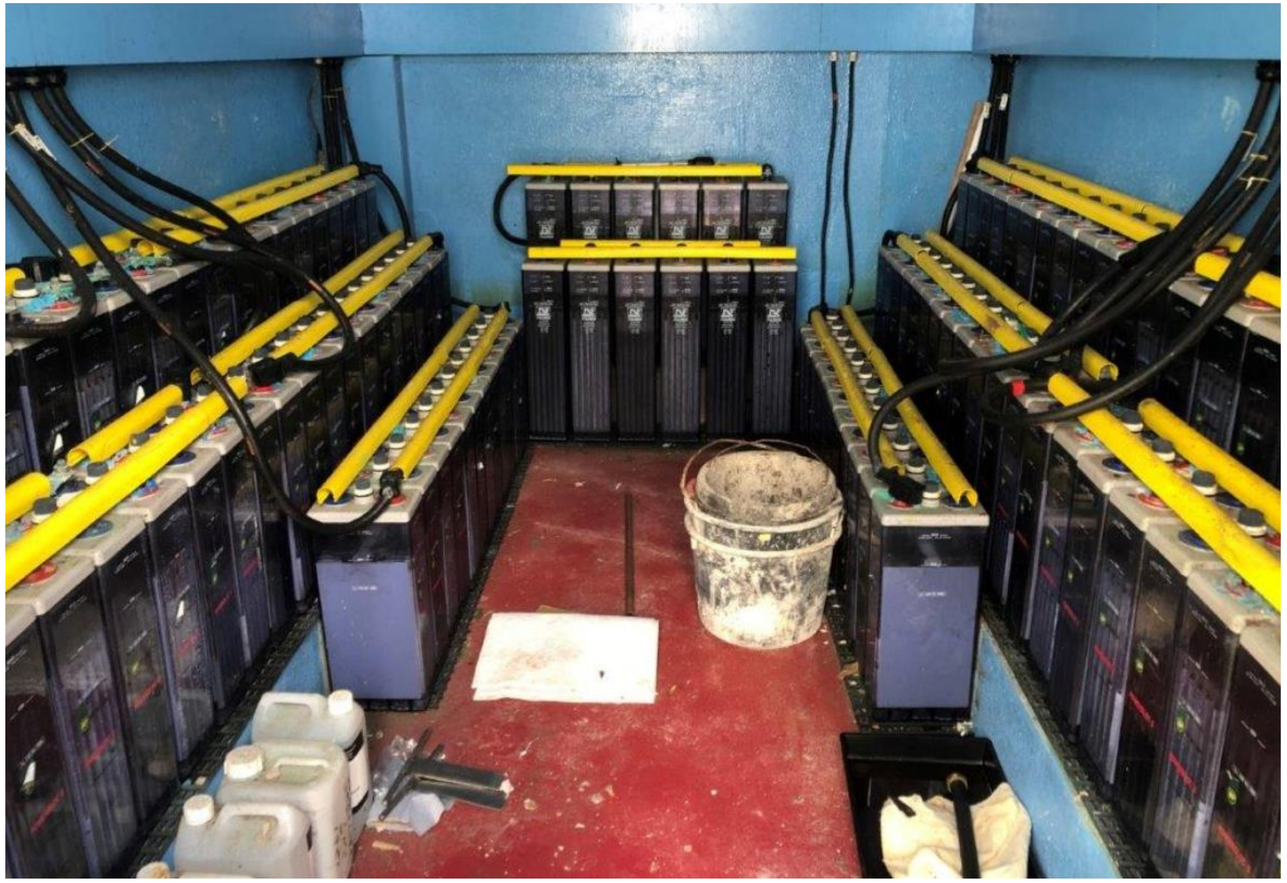
- Replacement of 24m^2 of existing PV panels on path before coal shed
- Extension of this row by 8m to left and 2m to right adding 20m^2
- Making provision for another 14m row on over existing adding 28m^2
- Adding 4 rows of 6m length on roof of bedroom block adding 48m^2
- Tilt angle of ~ 60 degrees (based on existing PV orientation)
- Facing southeast on path and southwest on roof
- Sturdy frame for marine conditions, corrosion resistant, wind forces
- Spikes on top of panels to discourage bird soiling on panels



Stage 1: Battery Storage

ARUP

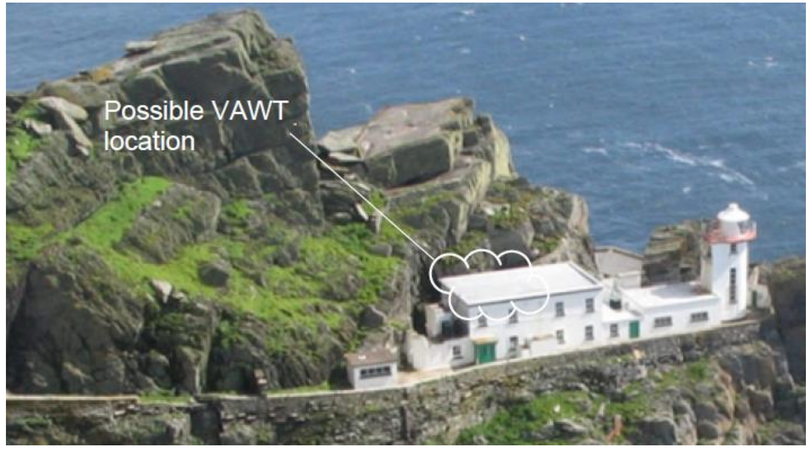
- Battery storage to integrate with solar to store excess energy generated during the day and make it available when needed.
- Size for maximum available storage capacity in the space available up to the equivalent of 1 week of energy demand using December profile, 315kWh.
- Use at least 8 strings of batteries to build in redundancy.



Stage 2: Wind Turbine

ARUP

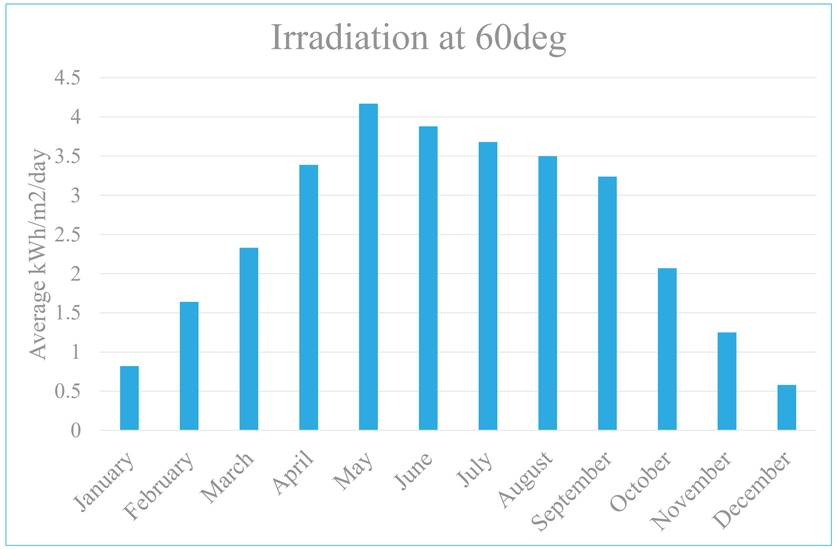
- Must work in marine environment (robust and resistant to corrosion).
- Bird sanctuary : The puffins (nesting from March to July).
- Removable from steel frame on roof – must be easily removable with 2 people without the aid of lifting machinery
- Aeolos-V 3kW pictured is larger scale option
- Primus Windpower (100W) small scale option
- Wind turbines have proven difficult to maintain in an exposed marine environment. If wind turbines are to be seriously considered, they must be small to facilitate easy handling, and have a minimal impact on bird-life and be designed for the marine environment. If this is to proceed, trials on one unit must be undertaken before proceeding with several units.

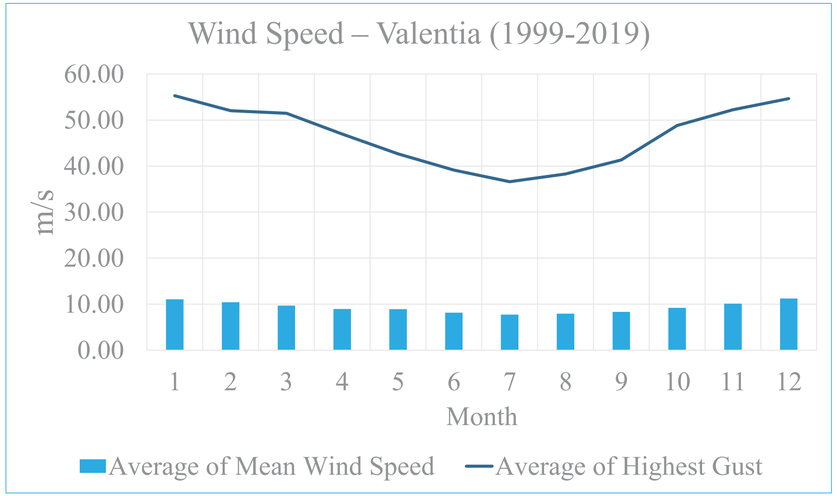


Winter vs Summer supply

ARUP

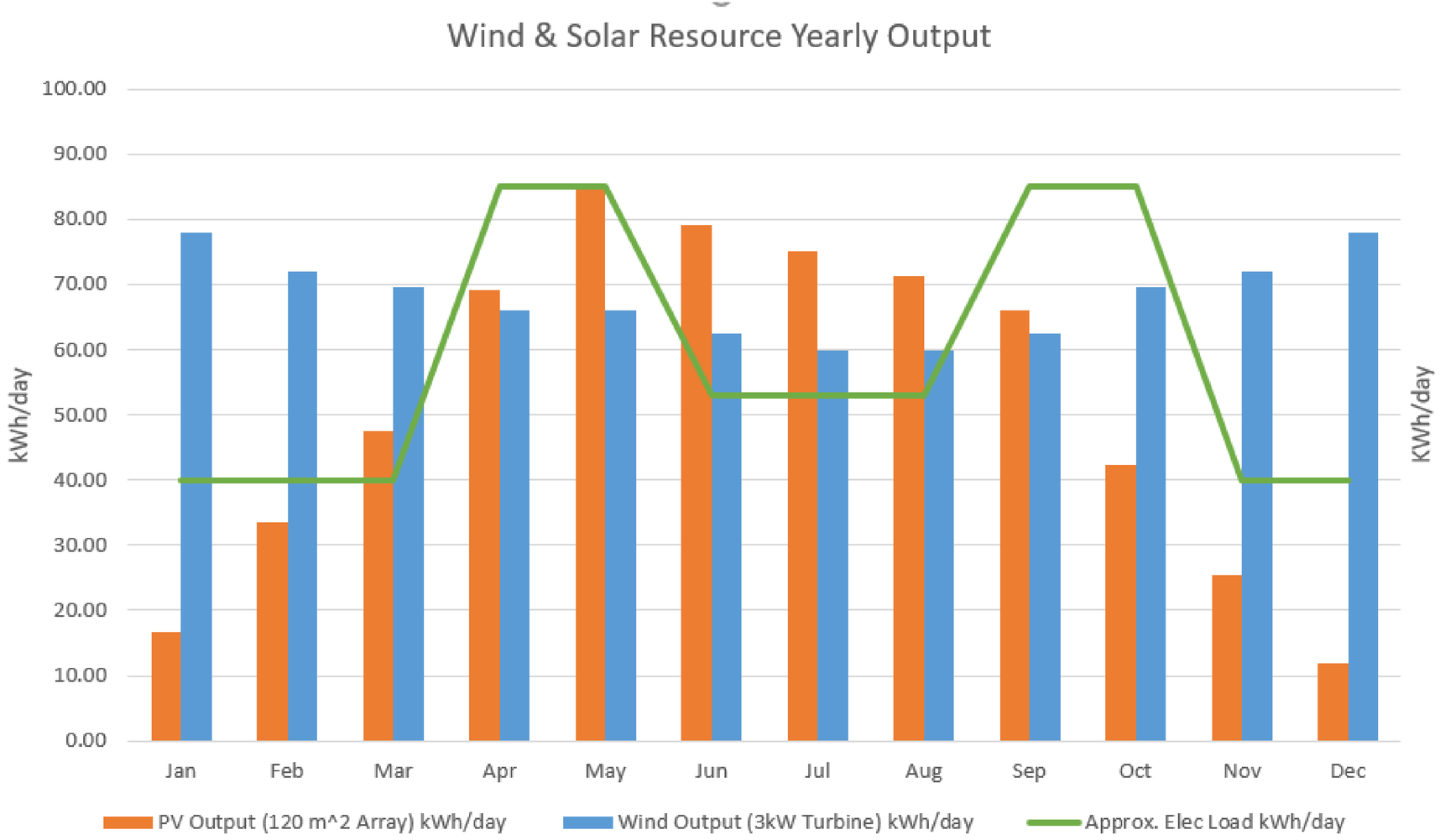
	Advantages	Drawbacks
PV	• Silent • Good availability in occupied season • Renewable • Low Maintenance	• Intermittent – relies on sun • Requires space • Decreased power in winter
Wind Turbine	• Good availability – great potential • Renewable • Space-efficient • Reasonable power all year	• Intermittent – relies on wind • Requires space/height • Visually intrusive • Possible bird strike • High wind speed gusts 200km/h • Increased maintenance needs





Wind and PV Power Generation Annual Profile

ARUP

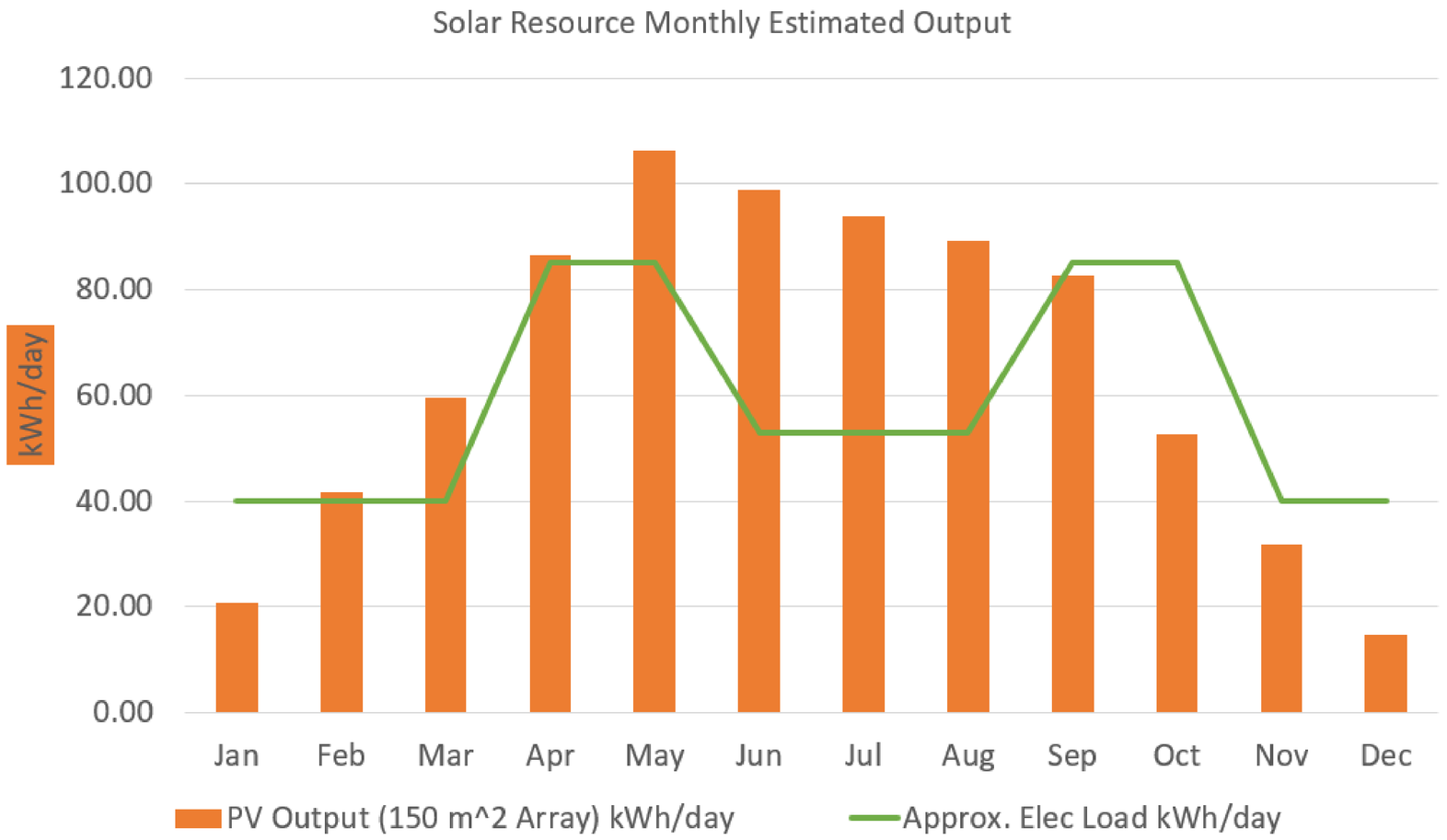


Increasing the PV to 120m^2 leaves a considerable gap to meeting estimated energy demand profile.

Cannot rule out wind energy despite the considerable extra effort in installing and maintaining wind turbines.

Wind and PV Power Generation Annual Profile

ARUP

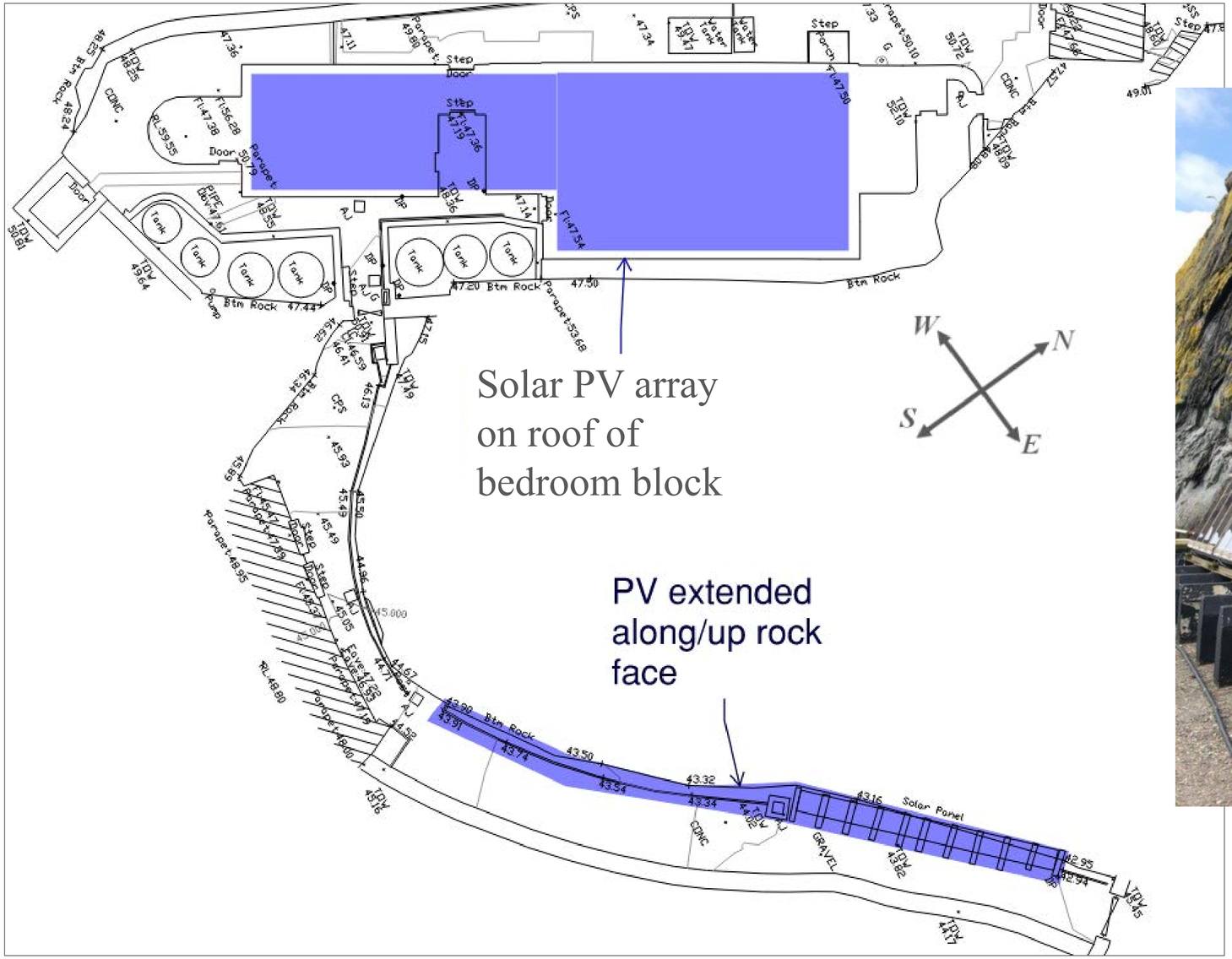


Increasing the PV to 150m^2 reduces the gap to meeting estimated energy demand profile.

To eliminate reliance on wind turbines, the focus during the detailed design stage needs to reduce energy demand by increasing thermal efficiency of the building and the heating systems.

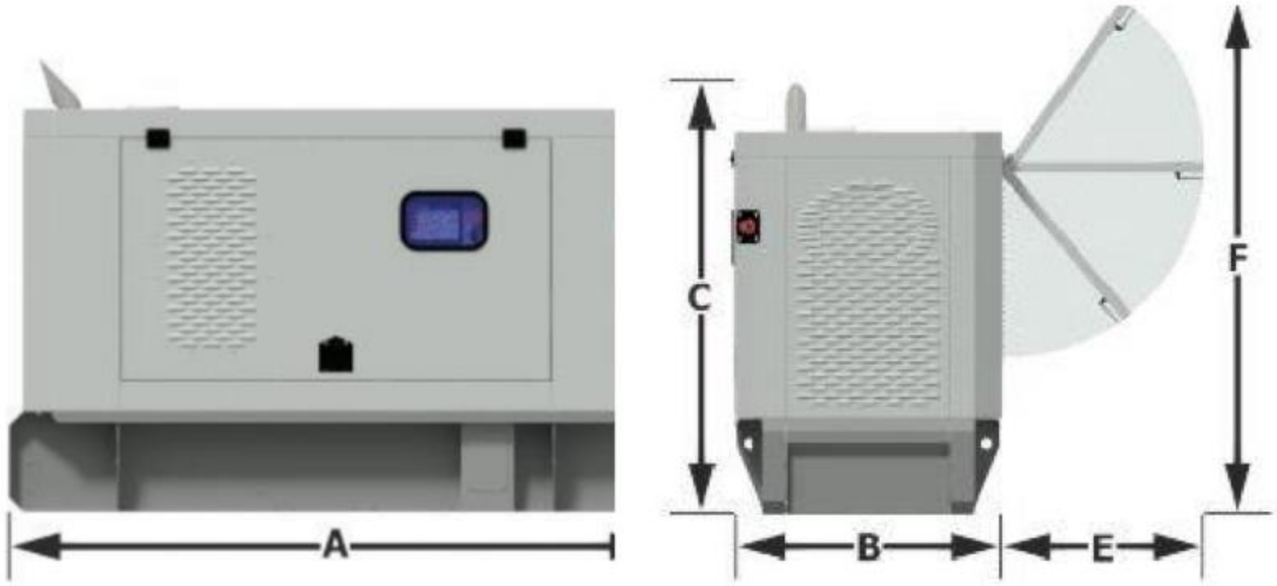
Solar PV Panel Locations

ARUP



Stage 3: Bio-diesel generator – only if PV energy generation is not enough

- Suggested location in old coal store
- Sizing: Peak load + 20% ≈ 14 kW
- Only runs if insufficient energy available
- Powered from bio-diesel
- Biodiesel generator: ***https://jspower.co.uk/wp-content/uploads/2019/01/3d_series_16_32kva_biodiesel_generator_range.pdf***
- Bio-diesel storage tank with sheltered bund. Tank will need to be insulated to avoid gelling (& other cold weather issues): ***https://www.tanks.ie/oil-tanks/bunded-oil-tanks/domestic-oil-tanks.html***



DIMENSIONS* mm	
Length (A)	1,946 mm
Width (B)	720 mm
Height (C)	1,425 mm
Max width projection per side (E)	816 mm
Max Height total (F)	1,775 mm
WEIGHT* Kg	
Wet (with lube oil and coolant)	738 kg

	Generating Set Model		JSPBD16
Power Factor 1	Prime	**kVA**	**16.5**
		kW	*16.5*
	Standby	**kVA**	**17.2**
		kW	*17.2*

Space Heating

ARUP

Only heat source is through a heat pump:

- Low heating water temperatures of 35 to 40^{O}C.
- Underfloor heating to provide best use of low-grade heat.
- Tall wall mounted radiators in bedrooms – careful planning of furniture in rooms required
- Floor build-up to include 100mm insulation, 75mm concrete screed with heating pipes embedded.
- Tiled or hard surface for improved radiant heat dissipation.
- Timber floors upstairs.
- Fan assisted convection radiators for the drying room in addition to underfloor heating.

Air to Water Heat-pump - Space Heating & DHW

ARUP

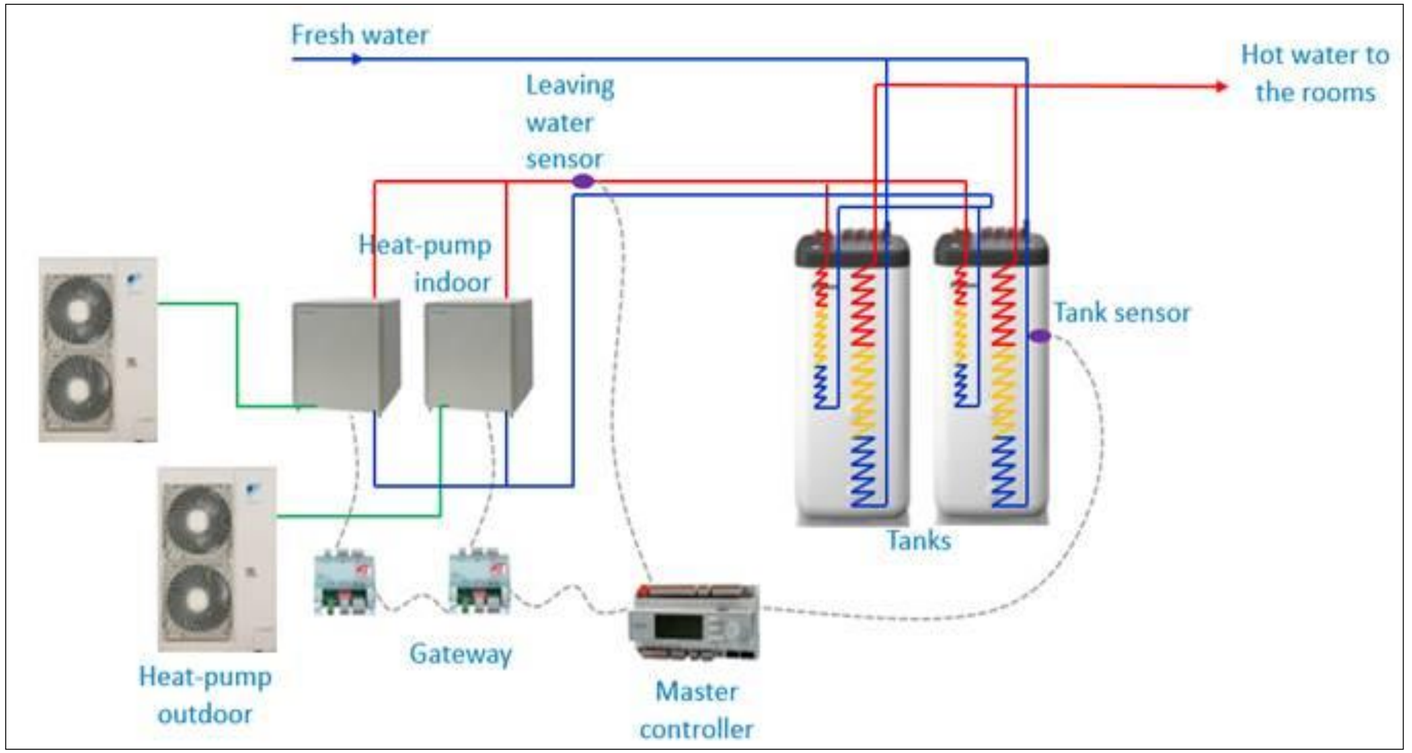
- Air-to-water heat-pump with outdoor unit rated for marine environment
- Assume 2*16 kW heat pumps – single phase supply from micro-grid
- Split system (outdoor and indoor units)
- Indoor units supply warm water to underfloor heating manifolds and air convectors (drying room)
- Indoor units also serve hot water cylinder, operating at a higher supply temp (55^{O}C) but not at same time as for space heating

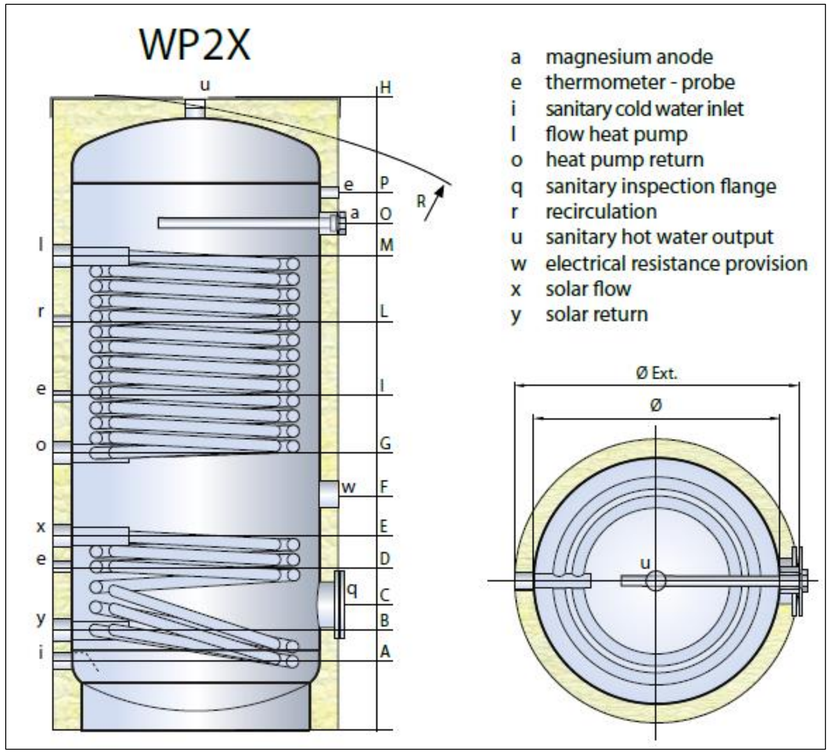
Outdoor Unit

Indoor Unit

Hot Water System Schematic

ARUP





Model	Dimensions (mm)				Exchanger (Sq.m.)		Weight
	Ø	H	Ø Ext **	R *	Lower	Upper	(Kg)
WP2X 00300R	500	1595	600	1720	1,00	2,40	90
WP2X 00400R	650	1395	750	1600	1,20	3,00	107
WP2X 00500R	650	1645	750	1820	1,50	4,20	131
WP2X 00600R	650	1895	750	2050	2,00	5,00	154
WP2X 00800_	790	1750	990	1745	2,00	5,20	179
WP2X 01000_	790	2110	990	2095	3,30	6,00	219
WP2X 01500_	1000	2115	1200	2145	3,60	7,50	305
WP2X 02000_	1100	2435	1300	2465	5,50	8,50	396

Solar Thermal - Considerations

ARUP

- Solar Thermal panels would assist the heat pump in DHW production via a solar coil in the Calorifier
- HW tank sizing – enough for daily load (500 - 1000L)
- 18 m² evacuate tubes (3 times typical home installation)
- Demountable for removal during winter period when vacant
- Additional considerations for maintenance - ease of safe access
- Solar thermal would provide some resilience to electrical system by reducing demand during summer, but….
- Solar thermal produces estimated 4,080 kWh thermal energy for occupied period. Replacing solar thermal (18m^2) with Solar PV would produce estimated 4,000 kWh electrical energy for same period. Combine with DHW heat pump at COP 2.5 = 10,000 kWh with minimal maintenance.

Resolved to maximise energy production using PV and minimise manual interventions.

Solar Thermal Vs Solar PV – Pros & Cons

ARUP

Solar Thermal	Solar PV
More Space & Energy Efficient	Can fit in same areas/locations as solar thermal but has lower energy efficiency
Shorter lifespan & greater maintenance requirement	Long lifespan with minimal maintenance requirements
Lower Capital costs	Higher capital costs
Produce only heat for DHW or limited space heating	Versatile with electricity produced available for multiple use
Provides resilience as secondary source of heated water if electricity should fail	Dependent on microgrid system for distribution and application
Increased DHW storage and tank size requirements	Works well with heat pump system to produce hot water and heating
Winter disassembly and storage of solar thermal tubes is required	Passive, low impact technology that can be permanently integrated

Drying Room Dehumidifier

ARUP

- Small discrete units to be placed in drying room for dehumidifying
- For wet cold days, dehumidifier and heating in tandem to be used in drying room
- For drier days, windows can be operated for cross wind drying through the room
- Suitable for rooms up to 30m² (Drying Room: 22m²)
- 2.3 litres water tank with auto shut-off
- Drying room effectiveness can be improved using optimal clothes hanging set up.

Dimensions	
Depth (mm)	220
Height (mm)	500
Weight (kg)	13.7
Width (mm)	365

Cooking Energy Supply: LPG

ARUP

Storage space

- Cage to be constructed for secure storage behind building in smaller alleyway for connection to both kitchens. Access the LPG bottles from both ends of the alleyway.
- Various LPG tank sizes to meet storage constraints

Cooking requirements & Water heating for consumption

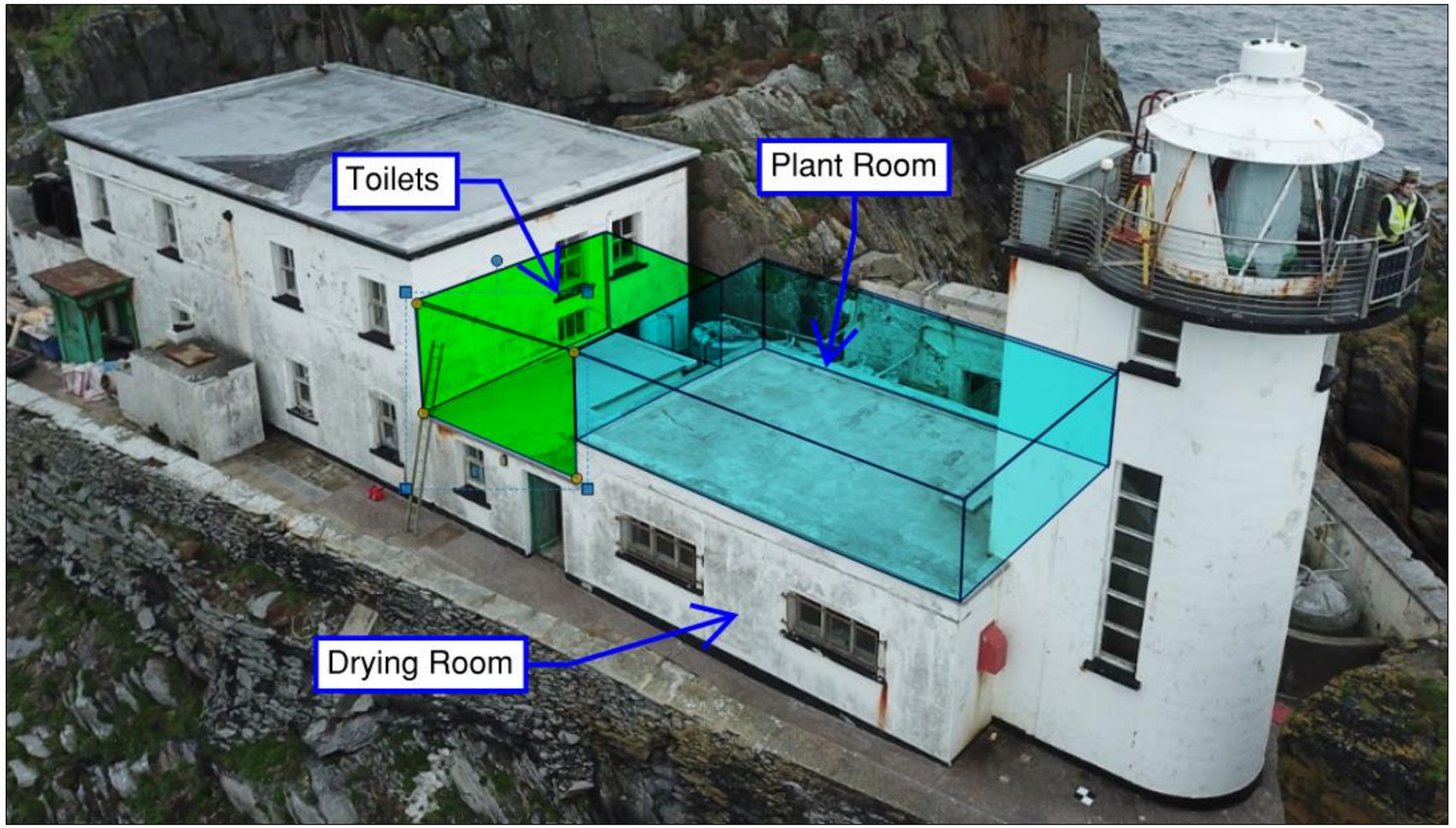
- Bottles per season as per existing usage for workers – estimated 10-15 bottles (11.4kg) per season
- Approx. **4 bottles** to be on site for security of supply

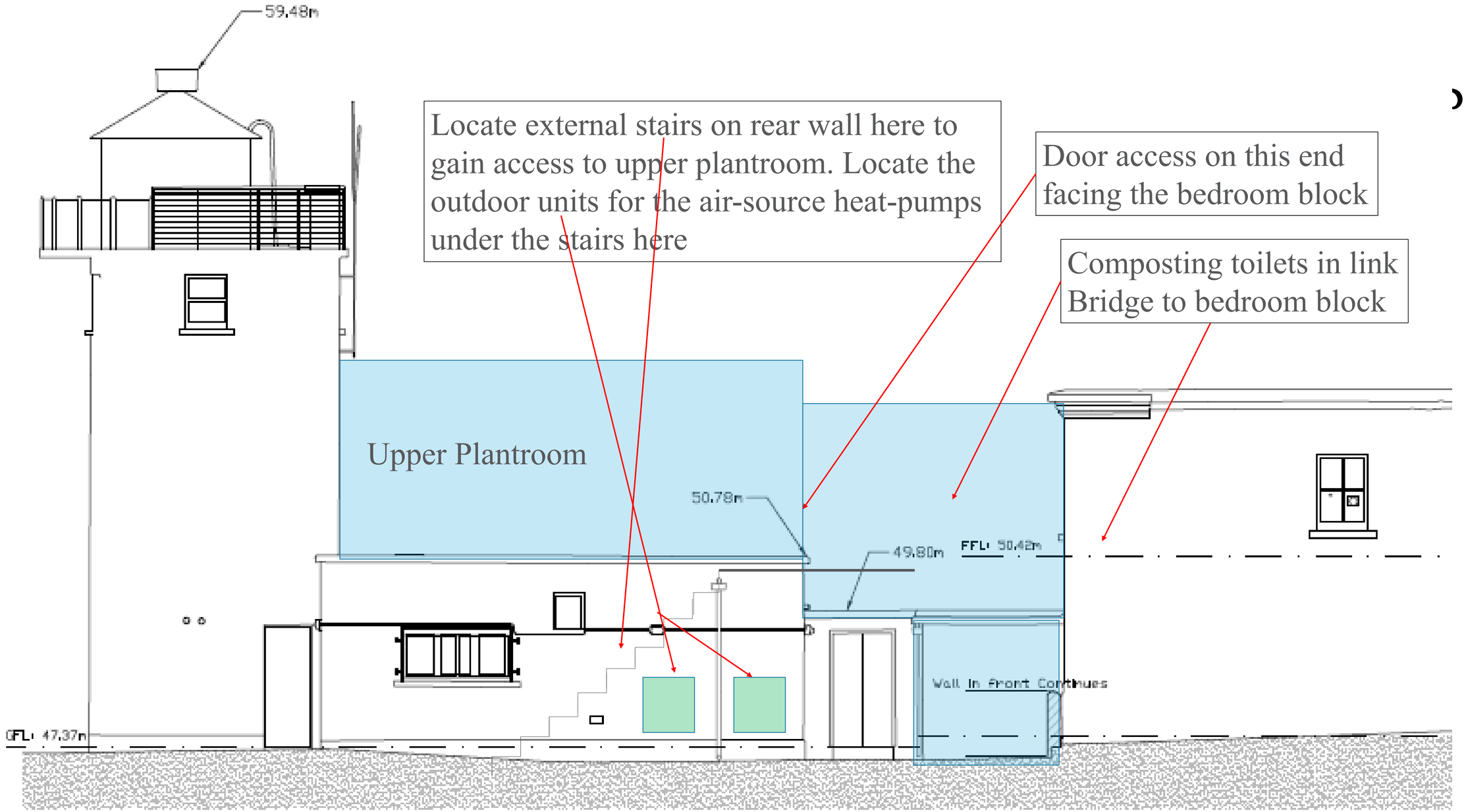
Plant Room Location

ARUP

Upper plant-room requirements:

- Heat pumps
- Hot Water Storage
- Battery storage (in old coal stores)
- SCADA
- Switchboards
- Storage for water treatment chemicals

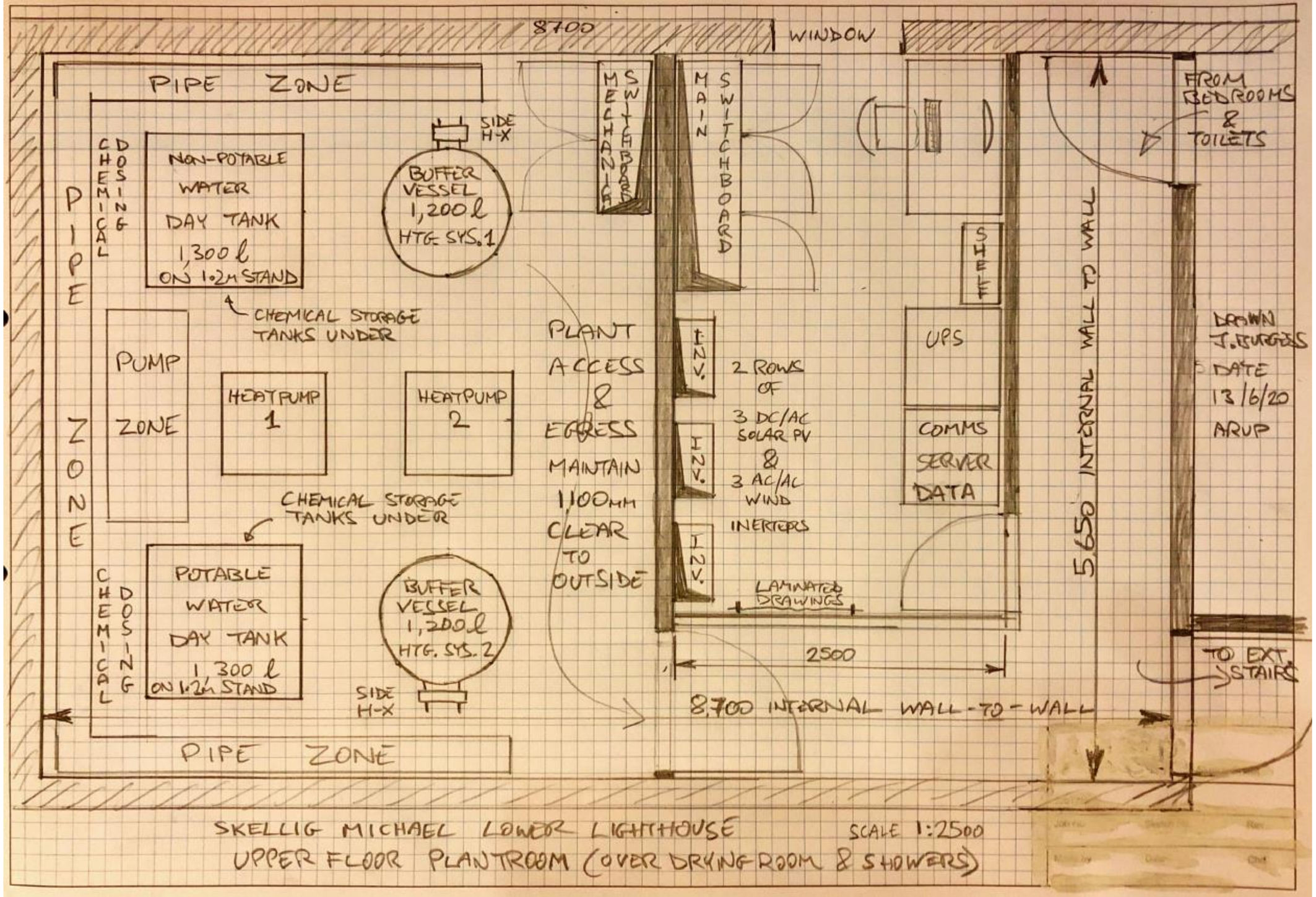




SOUTH ELEVATION

SCALE 1:100 @ A3

Upper Plant Room Layout



December 2020

Locate Standby Generator
and solar photovoltaic battery energy storage
in the old coal stores

Bio-diesel Standby Generator if needed – use space for batteries in first phase to maximise energy storage

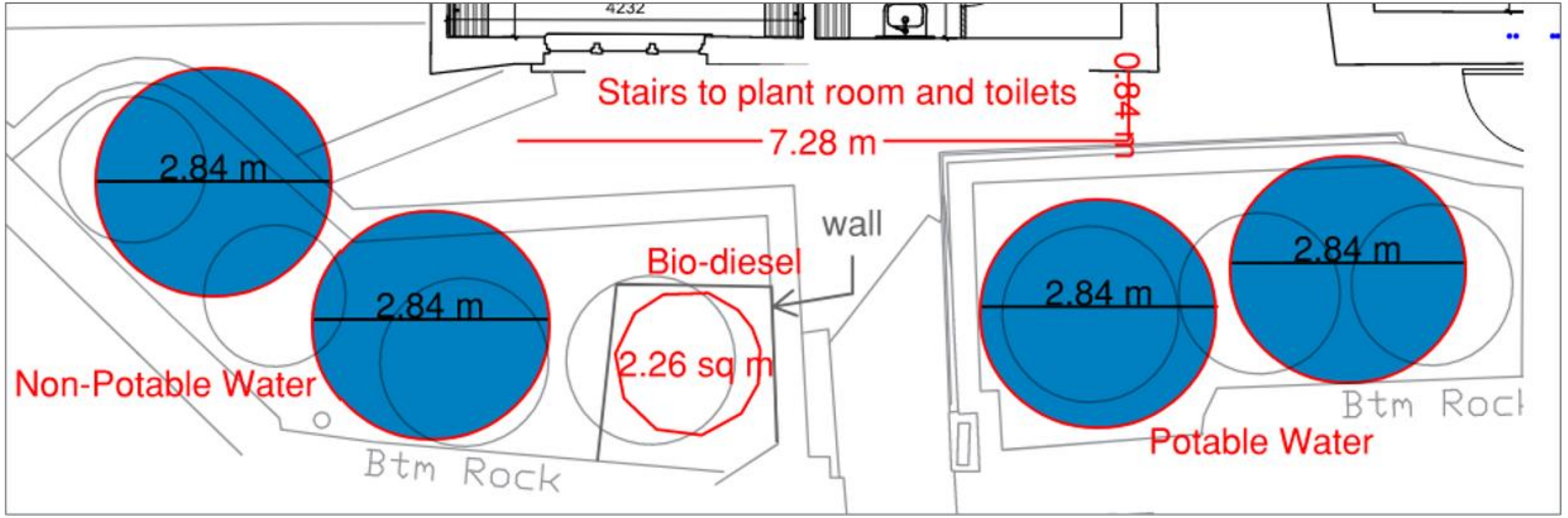
Battery Storage

Water Supply & Storage

Yard Sketch

ARUP

Old diesel tanks being removed – will make space for new water storage tanks



Water Requirements – Water efficient demand

ARUP

Non-Potable Water Requirements

- Allow for 50 l/person/day encompassing:

1. Showering 25 l/p/day- assuming 5 l/min flow for 5-minute shower
2. WHB – 5 l/p/day – assuming 6 hand washes for 20 seconds per day
3. Toilets – 0 l/p/day – assuming compostable toilets
4. Clothes washing: 60 litres of water per wash during an average cycle for a Watersense / A+++ unit shared between 3 people

Potable Water

- Estimated Load = 10 l/p/day.
- Drinking water – 5 l/p/day

Estimated Water Load	Daily	**960**	Litres
	Monthly	**28,800**	Litres

- Kitchen sink & cooking water - 5 l/p/day – (hot water served from either under sink heater or gas from bottled gas for cooking – lowest energy solution to be adopted).

Combined Demand – 60l/person/day, 16 people – 960l/day

Storage capacity availability (TBC) 4*20m^3 tanks = 80 m^3 or 83 days at 960 litres per day. Diversity of use may see this extend to cover half the summer season. Allowance to be made for several deliveries of 20m3 whenever a tank empties to achieve rotation of tanks.

Water Demand Efficiency

ARUP

- Water consumption may be lowered using proven efficiency techniques;
- Largest water demand is showers – can limit water consumption using push button operation function such as in public pools
- Flow regulators and low flow outlets on WHBs and showers should be considered to reduce water usage
- Install A+++ energy and water efficient washing machine to be used once per day based on clothes washing needs.

Contingency in case of Reduced Water Supply

ARUP

- Monitoring of tank water levels recorded against time to plan timely delivery of water by boat or ship
- Store spare empty 20 litre drums for transfer of water from storage tanks as a back to pumping system
- Baby wipes/hand sanitizer to be used instead of water at times of low water reserves
- Rainman low-flow showers for washing
- Rainwater harvesting for non-potable external uses only

Water Sources – Water Delivery

ARUP

- Transporting water on the island expected to be difficult due to wear and tear on path arising from frequent ferrying of water on caterpillar-drawn trailer
- Size of tankers to be used to deliver water and their manoeuvrability on narrow path is problematic
- Shipping of water using pumped pipeline from boats at the drop off-quay preferred solution
- Irish Lights ship, the Grainuaile, anchored at the lighthouse could be considered if only to ease the burden on local smaller vessels
- 80m3 of water stored at lower lighthouse and 40 litres carried to the upper lighthouse daily (as needed)
- Delivered water to be used for all drinking, cooking, and washing
- Harvested or recycled water to be used for external purposes only

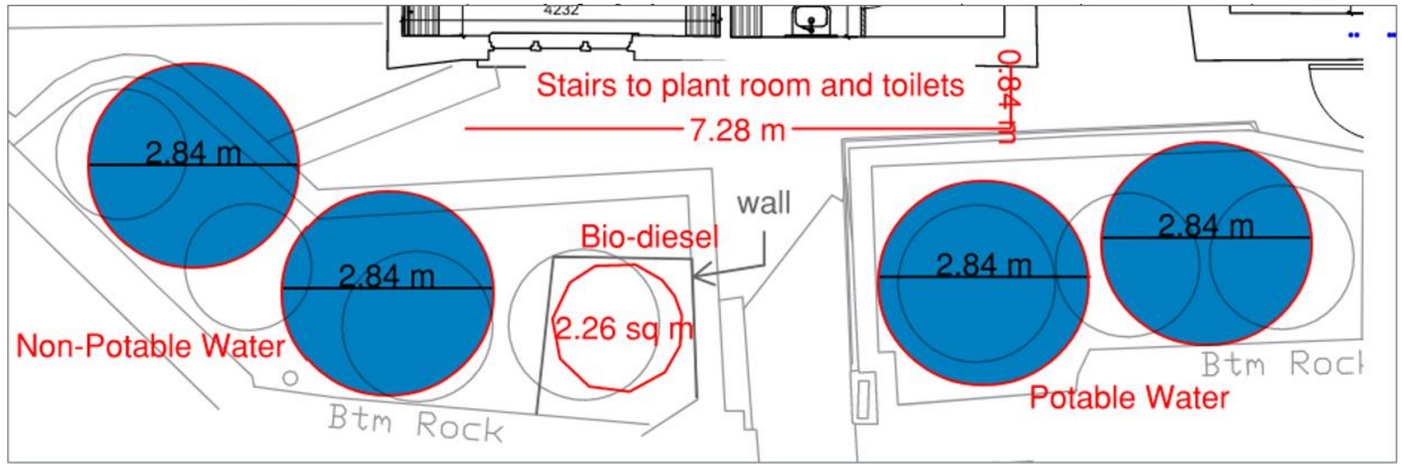
Towable water bowser 2000 L. Code 142200-HT

Storage Tank Size

ARUP

Location of Storage Tank

- To sit where old diesel tanks used to be
- Tanks must not impede access around lighthouse
- Four 20m^3 tanks linked in two pairs for pumping water to 2 day tanks in first floor plantroom: https://www.agrismart.co.uk/product/30000-litre-vertical-water-tank/
- With efficient water use, and 80m^3 of storage capacity, deliveries of 20m^3 of water, 2 to 4 times in the season would be required.



Waste Treatment

Dry Composting Toilet – Clivus Multrum

ARUP

- 2 toilets to be above the tank – for a waterless composting system
- 1/3 of tank to be emptied at the beginning of every season of occupancy.
- Drainage of leachate to old latrine

CL200 - Dry Toilet (Ceramic)

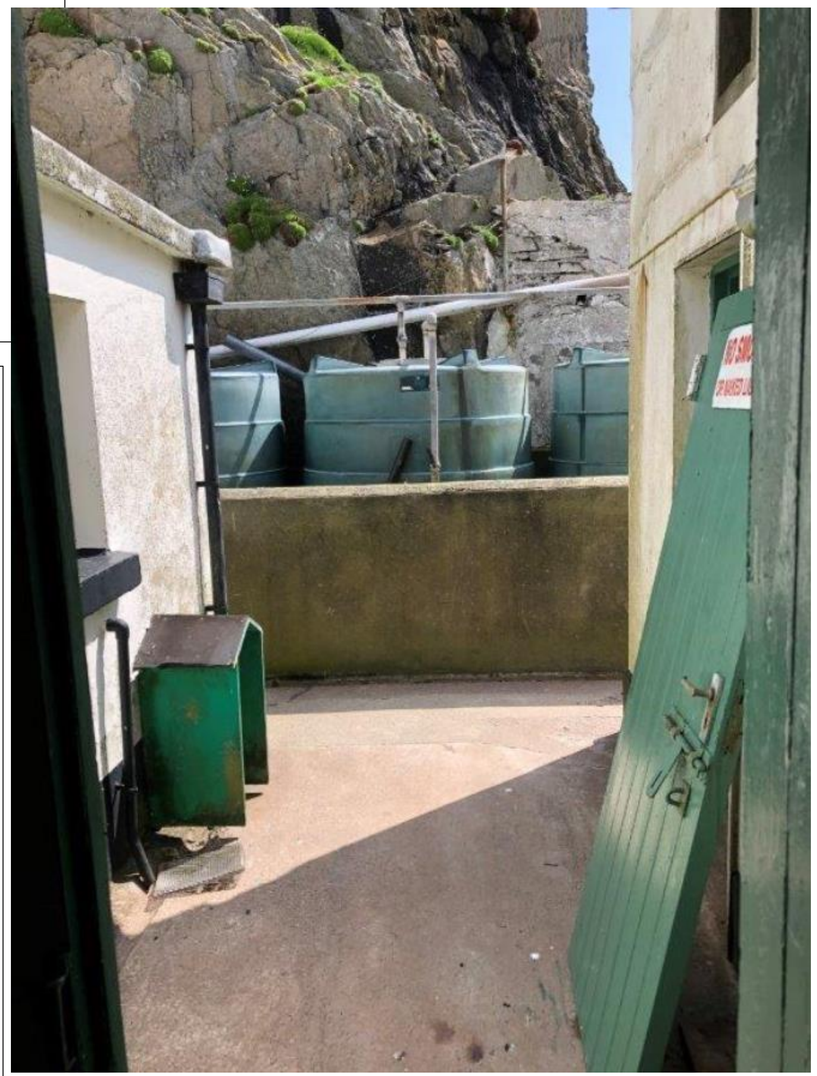
H x D x W = 43 cm x 48 cm x 35 cm

Color: White

This waterless / dry toilet fixture is mounted right above the composting tank. It connects to a 250mm discharge pipe.

Stylish - Easy to clean

Made of vitreous china.



M300

H x D x W = 176 cm x 200 cm x 167 cm

The M300 tank is aimed at public facilities with a larger number of visitors.

The upper and lower parts of the tank can be separated for transport. Individually the parts fit through a standard size door.

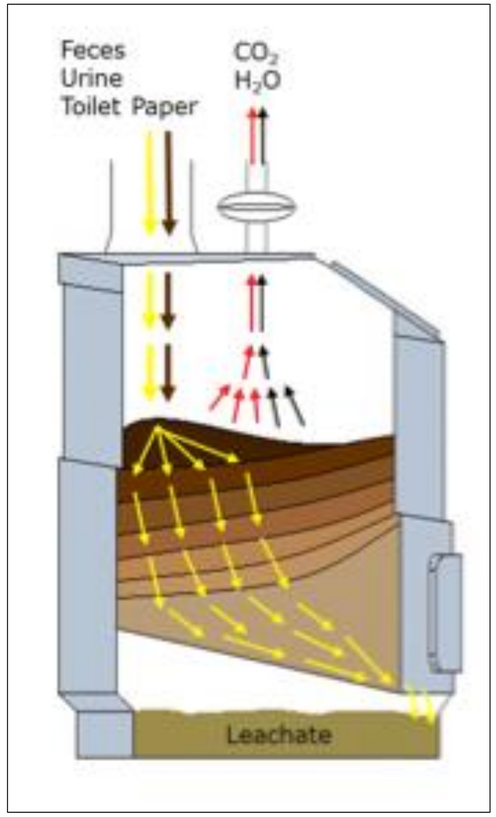
Volume :

- 4,200 litres(total)
- Max. 2,280 litres compost
- Max. 1,120 litres leachate
- Starter bed is ~300 litres

Capacity :

- Max. 25,000 visits per year
- Fits 2-4 toilet fixtures

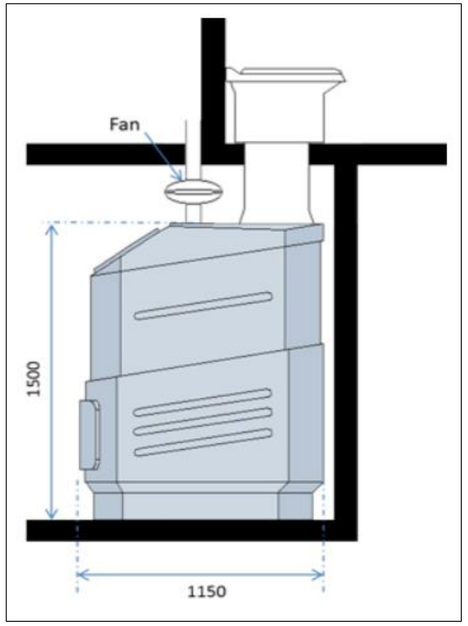
Made of durable black recycled (and recyclable) polyethylene. The walls have a 9 mm thickness.

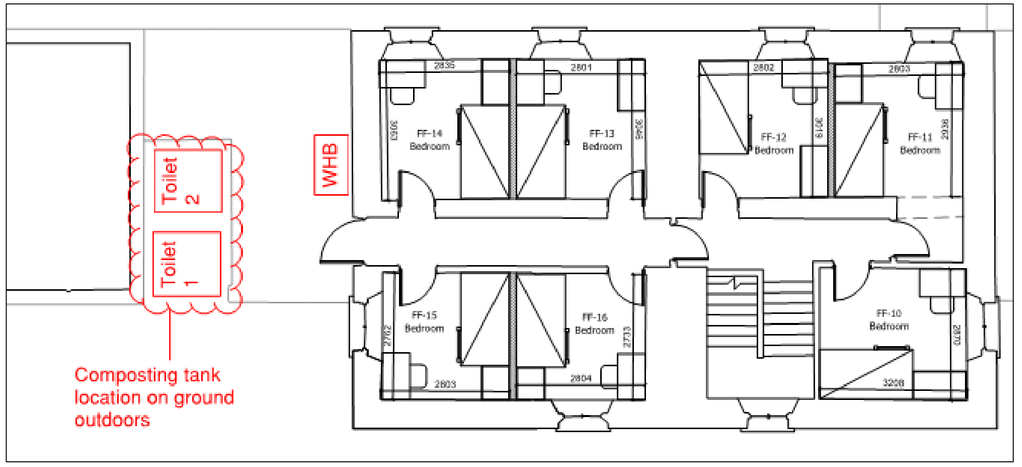


Toilet Location

ARUP

- Platform to be constructed above the tank for the location of the toilets.
- The 2 toilets to be located close to bedrooms on the upper floor. Accessible from the outside as well as from the bedrooms.
- Unisex toilets to provide for both genders.
- Accessibility to back of tank is needed for yearly servicing to remove completely decomposed solid product. Further planning discussions required with OPW
- Worms and chemicals are to be added at the end of the occupied season in the tank, in order to have promote composting for removal from the island at the beginning of the occupied season.



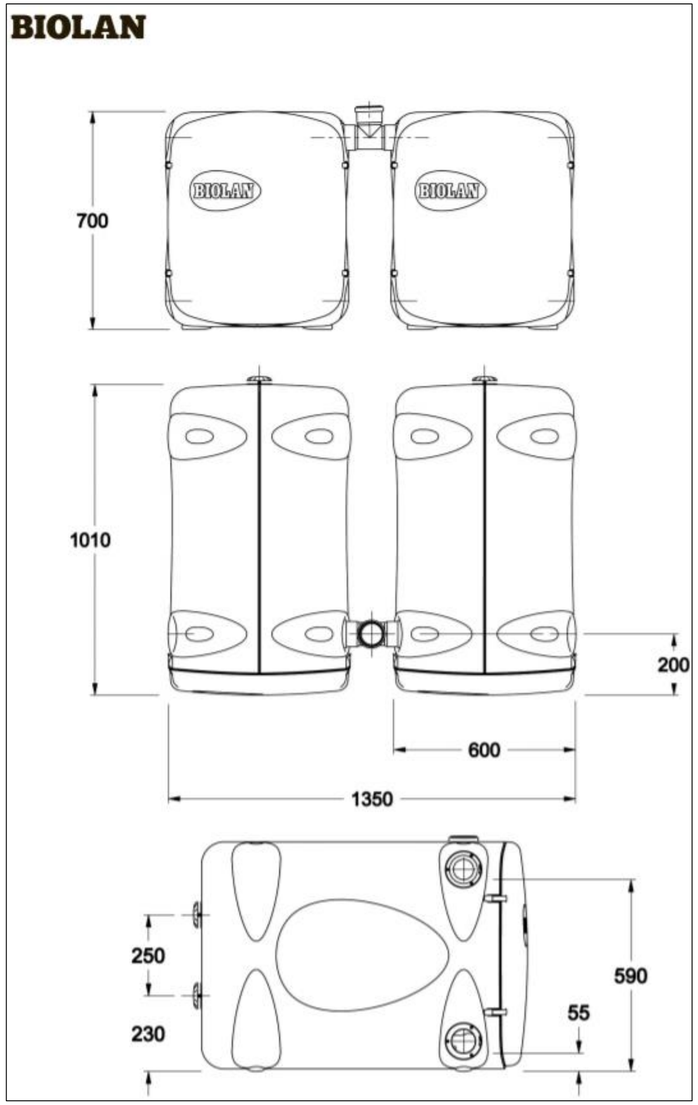


Washing Water Drainage

ARUP

- Purifier of all water used for washing before drain to ocean to minimise ecological impact
- Capacity ~ 960 litres a day
- Locate in the latrine in a way that is accessible and below all water drainage points for free-flow of waste water by gravity.
- Normally, the filter material in the purifier must be replaced every 100 days of operation
- Existing latrine to be reused for waste-water run-off from WHBs and washing machine

Grey Water Filter



Waste

ARUP

Food Waste (Composting) & Other Waste

- **All rubbish to be separated as required and removed from the Island.**
- **Recyclables:** Must be washed (using last of dish-washing water before pulling the plug) for clean storage
- **Non recyclables** to be collected for return to mainland
- **Compost**: Separate storage required to ***prevent attracting rodents/smell*** etc.

Consider opening up this window to make a door to access Toilet composting units (if located inside beneath toilets overhead)

Data & Communications

Data/Comms

ARUP

- Communications link to mainland is critical for the remote monitoring and operation of the plant throughout the unoccupied season.
- Will need satellite dish to link up to mainland using 3G mobile network.
- Weather station recording capacities is to be installed near the monastery with link to Valentia weather station. However this will not have a link to the lighthouse.
- Communications link between upper and lower lighthouse – wireless connection (walkie-talkies for people, wifi network for data).

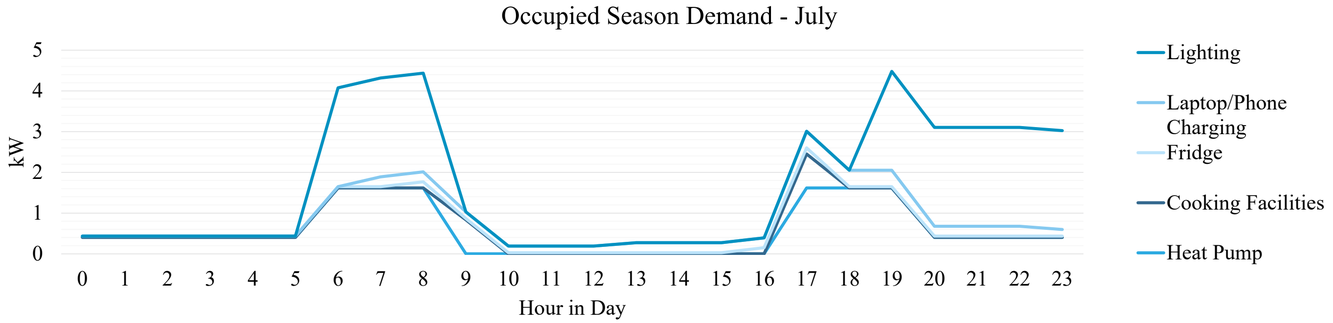
Upper Lighthouse

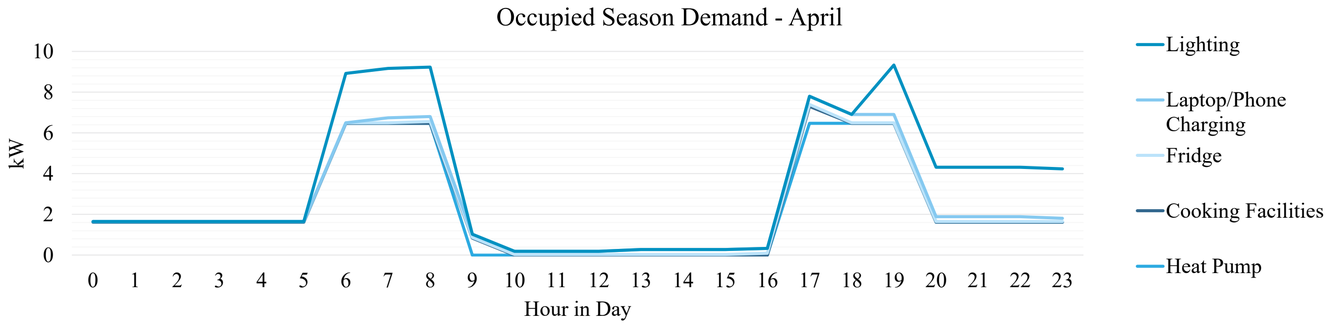
Energy Demand

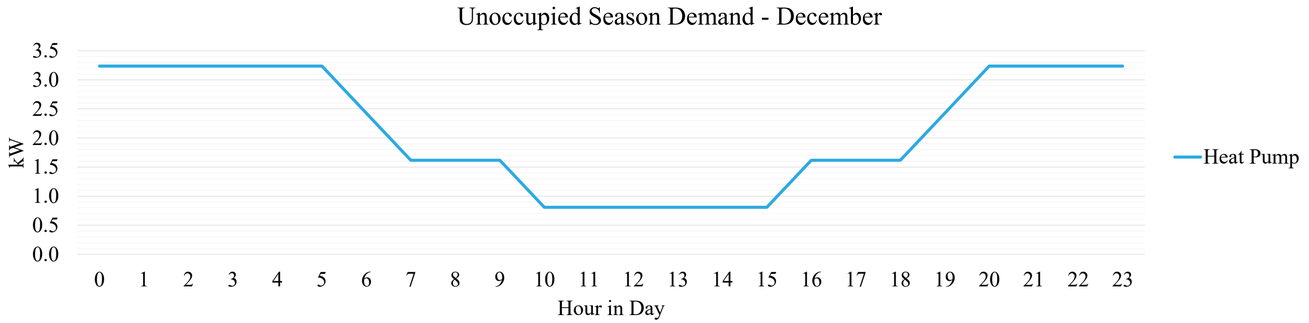
ARUP

Upper lighthouse will reflect on times past and serve as a research facility for two people.

- Assume water demand of 60 l/day.
- Cooking facilities consist of a LPG fuelled stove and kettle, electric microwave, toaster, and small fridge.
- Daily Load estimated at **82 kWh/day*** during occupied season.
- Electrical heating load for unoccupied season is estimated at **52 kWh/day***
- *These loads are high-level estimates and will be reduced significantly through detailed design







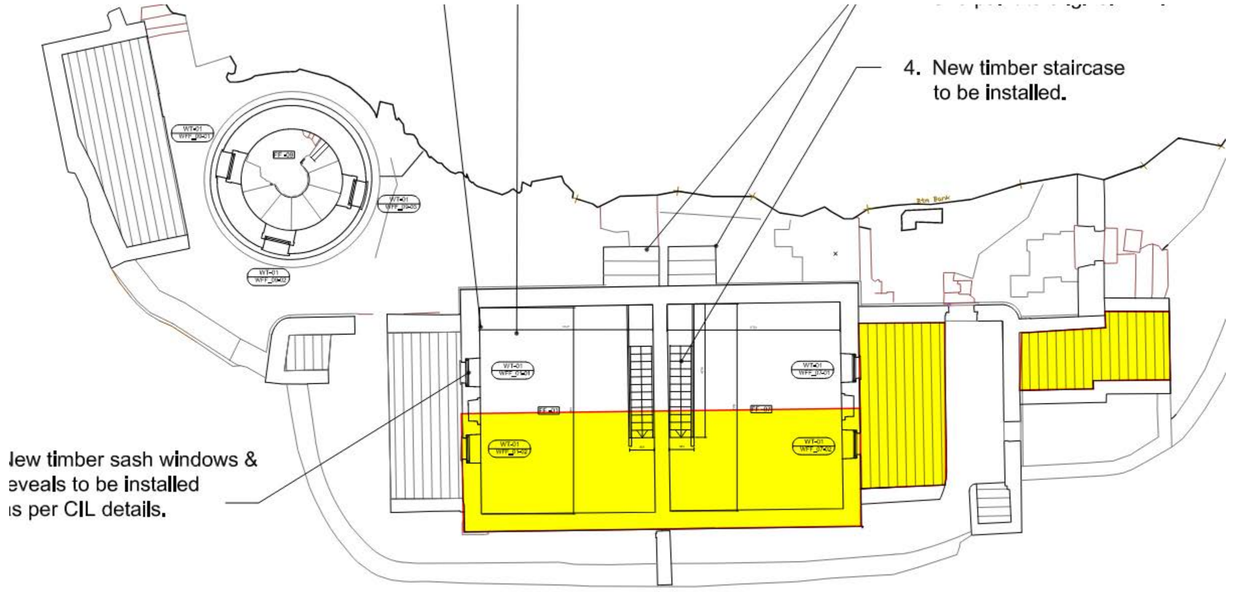
Energy Supply

ARUP

The available area on the structure roofs (highlighted yellow) is not enough to cover the demand in any season. Further options for energy supply will need to be investigated. Possible electrical connection of the lighthouses to allow overflow of energy from the lower lighthouse to be supplied here.

Total Area Available	93.76	m2
75% Actual PV Area	**70.32**	**m2**
Annual Output	9.187	MWh
System Size	11.79	kWp

	January	February	March	April	May	June	July	August	September	October	November	December
KWh/month	208.34	368.61	719.78	1,165.51	1,521.81	1,515.60	1,415.09	1,222.75	867.38	506.44	253.65	164.93
kWh/day	**7**	**13**	**23**	**39**	**49**	**51**	**46**	**39**	**28**	**16**	**8**	**5**



PROPOSED FIRST FLOOR PLAN
SCALE 1:150 @ A3

Water Supply & Demand – Upper Lighthouse

ARUP

- Water demand significantly lower than lower lighthouse. Water to be manually transferred from lower lighthouse to upper lighthouse
- Assumed occupants shower and wash clothes in lower lighthouse – water only used for drinking, light cooking and handwashing
- DHW for hand wash hand basin and sink heated by kettle on gas cooker

Toilet facilities – Upper Lighthouse

- Provide one composting toilet unit similar arrangement to lower lighthouse
- Compost to be removed and transported to quay on far side of island for ferrying to mainland

Commissioners of
IRISH LIGHTS
Navigation and Maritime Services

Irish Lights Operational Interface

Irish Lights

At a meeting with Irish Lights on 9th October 2020, the following points were noted:

ARUP

- The Aids for Navigation located in the lighthouse tower will continue to be maintained by Irish Lights. The naval light beacon will be powered by its own battery pack which will be maintained by Irish Lights.
- The tower will be ventilated by exhausted warm air from adjacent heated spaces. The tower has an exhaust vent incorporated in the roof of the lantern housing.
- The tower will be maintained by the OPW. Note that smoke detection is required to be monitored.
- The helipad area will be maintained by the OPW. Location of visitors' composting toilet provisions near the helipad to ensure there are no loose items / materials left around this area.
- Rainwater collection is not considered appropriate due to bird droppings (puffins from March to July) and salt spray falling on surrounding rocks and roof areas. Gutters on roof have the potential to clog up – need to plan for un-manned period over winter.
- Communications links to the mainland can be achieved through a GSM mobile network (Vodafone Eircell) using aerial / dish located on gable wall of old coal store building.
- More information on the history of the Skellig Lighthouse can be found here .

Visitor Toilets at Helipad

Visitor Toilet Requirements

ARUP

Seasonal visitors to the island, between April to October.

- Phased installation, 2 toilets installed in 2021 with a further two for 2022.
- **Option 1:** Bio R21 can be specified to include wash hand facilities with own rainwater collection system (bamboo charcoal purification, not suitable for consumption). This system is complex and requires maintenance. PV panel on roof to power fan to ventilate composting chamber. The waste treatment process is therefore very fast, small tank size. One structure to house all toilets with centralised treatment for all toilets, i.e not readily scalable.
- **Option 2:** Kazuba Waterless Toilet cabins. Simple waterless, powerless system. Proper sizing will allow annual removal of solid waste. Modular, scalable design of individual pods/structures for each toilet.

Option 2 is the recommended solution.

Appendix A

Minutes of Meetings

1 WORKBOOK #2 REVIEW MEETING

Attendees: Fergus McCormick (OPW), John Burgess (Arup), Rosie Creedon (Arup)

Date: 24/04/2020

1.1 Minutes:

- Back-up generator:
  - Diesel fuel not a good option.
  - Must investigate option of using biofuels.
  - Need a bunded tank for this installation.
  - Generator set location to be confirmed. Take account of gravity feed on bio-fuel supply.
- The roof can be kept as a flat roof to accommodate solar thermal panels, and possibly an option for a small scale wind turbine(s). Solar thermal panels to be demountable for winter months.
- Heating System:
  - By heat-pumps only.
  - There will be no log stove provided for in the refurbished lighthouse. (storage and transport of timber are not feasible)
  - Heat-pumps can be operated and monitored remotely (provided there is sufficient power)
  - Underfloor heating on ground floor. Timber floors on upper floor. Use tall wall-mounted radiators in all bedrooms. Needs careful planning to coordinate location of radiators.
- Potable Water System:
  - Safety concerns with docking / anchoring will not allow pumped water from boat to lighthouse.
  - 40 litre containers of potable water brought to island on boat and transported to lighthouse on caterpillar truck. Then emptied by hand into larger tank for storage.
  - Several 40 litre containers to be kept aside for emergency potable water supply.
  - Tank capacity to be capable of storing drinking water for the summer season.
  - All existing tanks to be removed. Only new tanks will be considered.
  - Potable water to come from kitchen sink (of which there are 2). Hot water at kitchen sink to come from potable water tank.
  - Under-sink water heater or pipe run to heat pump are 2 options for heating the water. Lowest energy solution to be adopted.
- Rainwater Collection System:
  - Store as much water as can be collected (during winter) in the available space
  - Existing storage tanks and bund walls are being removed.
  - New storage tanks to be designed for the area – consider sectional tanks than can be accessed for cleaning. Beware of corrosion of metallic components.
  - Water to be treated to be suitable for washing clothes and showering. Not suitable for drinking or washing food.
- Wind Energy:
  - Needed to minimise use of standby generator
  - Fergus to seek comment from ornithologist on issue of using wind energy on a island that is a bird sanctuary.

    - 3 kW turbine – supplier to be spoken to re: structural forces of turbine base and cage for bird impact. Post meeting note – consider smaller wind-turbines, say six 0.5kW units, that would impose less structural load on existing structure and less risk to bird-life.
    - Weather data from Valentia/main-land cannot accurately anticipate island weather. The PV performance could be affected on cloudy, misty days. A wind turbine would help greatly with renewable energy generation.
- Toilets:
    - Composting tank can accommodate 4 dry toilets.
    - 3 toilets to be located on 1st floor between bedrooms and plantroom.
    - Male/female toilets segregation to be provided.
    - Second set of stairs to be set up for access to toilets at back of building. These will also provide a second means of egress from first floor bedrooms.
    - Latrine can be used for discharge of shower water, sinks and washing machine.
- Showers:
    - All showers located on ground floor next to drying room
    - Locate shower hot water plant overhead. No need for pressure booster pump.
    - Separate hot water heating plant for showers to that used for kitchen sink.
- LPG bottle storage behind building in smaller alleyway for connection to both kitchens. Access the LPG bottles from both ends of the alleyway.
- Kitchen: Extract fan from cooker canopy will be required. Back-flap damper required to eliminate drafts.
- There is a lean-to structure near existing PV that is currently used for storage.
- PV cannot extend as far as the gate as there is not enough space. PV must end before this to maintain clear access for caterpillar.
- No gardens in use on island. All waste must be removed from island.
- Data Communications:
    - Satellite Dish at lighthouse will be in 'shadow' of Skellig Michael when looking towards the mainland?
    - Optimal location to be determined? Allihies?
    - Existing communication links by Irish Lights – FMC to contact Irish Lights to explore opportunities. Weather station recording capabilities may already be installed.

1.2 Actions:

1. Arup to put together text to outline main strategy & revise workbook based on above notes.
2. Arup to sketch up block plan for first floor plantroom and for rear yard tanks, LPG bottle storage, potable water storage, stairs and other plant to illustrate spatial requirements
3. OPW to investigate existing data communications.
4. OPW to update layouts on foot of Arup report.

Skellig Michael – Upper and Lower Lighthouse Design Review Meeting

Date: 25th September 2020, Location: MS Teams Call

Attendance: Fergus McCormick (OPW), John Burgess, John Smyth, Rosie Creedon (Arup)

- Drinking Water Supply
    - Fresh water cannot be brought by tanker and pumped to lighthouse. Water will be delivered by boat and transferred using the caterpillar transporters.
- Non-potable Water Supply
    - Cannot collect rainwater due to excessive bird droppings from the puffins (March to July). Also cannot collect rainwater due to saltwater dilution from sea spray during high swell conditions. The Lighthouse keepers used to control the collection of rainwater at appropriate times using a hand valve and a testing regime to tell if salt was present in the rainwater. This will not be possible with the plans for future occupancy of the lighthouse.
    - Therefore, non-potable water will need to be transported to the island. In essence, all water use (both for drinking and washing) will be transported to the island and stored in tanks for use for both drinking and food prep (kitchen sink taps) and for showers and washing purposes.
    - Consideration should be given to collection of 'dirty' water for washing down external areas – pathways, walls, etc.
    - Concrete tank on path next to entrance lobby will be removed. Concrete tank on roof of single storey room on north side of building could be retained for water storage for wash-down of external facilites.
    - **Action:** Assess water storage requirements and amend report.
- Showers
    - Guides currently use the hand-pumped cannister showers "Rain-man". Low tech option to use, less on-going maintenance, and less water demand.
    - Less pipework and maintenance required for central plant.
    - Can store some spares easily for swapping out. Shower cubicle might need a ledge to sit the cannister on.
    - Will need to shower once per day as a Covid-19 measure possibly
    - **Action:** Review 'Rainman' cannister solution and prepare a note on pros and cons of this option versus central plant storage heating system.
- Renewable Energy power generation
    - Solar PV generated a surprising amount during the winter – Irish lights documented evidence always gave enough power to turn the Fresnel Light Glass which is critical to precent solar ray magnification and risk of fire. Even in winter on cloudy days, the existing panels generated power.
    - 3 stage approach to energy infrastructure
        - Replace existing PV and battery storage – store in old coal sheds
        - If PV not enough for winter demand, provide a steel frame on roof of the accommodation building to host a series of small VAWT units (similar to those used on yachts – ie small and easy to handle and replace)
        - If not enough power, provide for a standby generator in the old coal shed and provide space for 2 bio-diesel storage tanks with sheltered bund (do not wasn't bund to fill with see spray or rain.
    - **Action**: amend report to identify stages

- Toilets/Waste Management
    - Composting toilets still feasible.
    - Drainage from showers and sinks should go to latrine.
    - Needs a filter for grease etc. – encourage occupants to not cook greasy food. Wipe greasy plates with paper towels before washing.
    - Must check the latrine's capability of filtering before drainage to the ocean – speak to water colleagues. Use a box arrangement?
    - Needs excavation and investigation, needs a roof on the latrine
    - **Action**: Speak to water colleagues re appropriate drainage filter arrangement.
- Air Filtration
    - Generator room has an air filtration system to limit the salt/erosion penetration – would damage the machine.
    - **Action**: Must be noted in report for the plant room equipment
- Lighting
    - Light the path at night for safety
    - Need to check with Irish Lights about interference for lighthouse operation
    - Bird interference should be considered – NPWS to approve
    - Best solution is to provide torches (2 to be available for back-up) for people walking the path between both lighthouses.
- Helipad Toilet
    - Helicopter that lands here is not the large sea-rescue unit. Down-draft will need to be assessed but tourists toilet block should be designed for using appropriate tying down anchors and stay cables.
    - Composting toilets to be installed in advance of next summer season in 2021.
    - Min 2 toilets, max 4.
    - Need to check any additional requirements for dealing with COVID19 precautionary measures. Hand sanitiser, soap and hot-water?
    - Thermal panels for hot water, storage?
    - **Action:** Amend the report to include a section on compostable toilets for tourists.
- Climate
    - Is it necessary to shutter the windows – yes.
    - Battery-driven mechancial heat recovery ventilation system - yes
    - Irish lights contact – John Burgess to contact Eoin Lehane, experience on renewable energy systems for lighthouses.
    - **Action:** Amend report to note that during winter, heat-loss through windows and doors will be reduced through the use of insulated shuttering.
- Upper Lighthouse
    - Solar PV can be included on south facing roof of main building
    - There should be a shower and some cooking facilities – small fridge, kettle, cooker, rainman shower.
    - One house is accommodation and full amenities
    - One is over flow accommodation/a museum downstairs
    - Ventilation and heat needed for the space
    - **Action:** Electricity demand update and include in report.

Arup to follow up on above actions and incorporate in update to existing report by mid-October.

Minutes

ARUP

Project title	Skellig Michael Lighthouse Property Restoration	Job number	273170-00
Meeting name and number	Irish Lights Operational Input 1/20	File reference	
Location	MS Teams Call	Time and date	3pm 9 October 2020
Purpose of meeting	To discuss proposals for lighthouses and to listen to advice from those who manage and operate lighthouses		
Present	Irish Lights - Eoghan Lehane - Operations and Property Manager, Rory McGee - Operations Engineering Manager South - Dublin to Clifden Arup - Edith Blennerhassett, Rosie Creedon, John Smyth, John Burgess		
Apologies			
Circulation	Those present Fergus McCormick - OPW		

		Action
1.	OPW in process of Lease agreement with Irish Lights. Skellig Michael was transferred to State ownership from Irish Lights in 1989. This was necessary to manage responsibilities for maintenance of the island arising from public access to the island to visit the monastic settlement. Irish Lights continued to operate and maintain the lower lighthouse and helipad.	Note Irish Lights
2.	There are considerable operational and engineering challenges on remote rocky islands that are difficult to access in poor weather and that are not connected to mainland electricity.	Note
3.	Irish Lights has been using solar PV renewable energy generation coupled with energy storage to minimise diesel fuelled generation of power. The last lighthouse to be de-manned and put in the automation was done in 1998. Since then the conversion of the lighthouse lamps to LED has led to a major reduction in energy consumption and power generation for the lighthouses.	Note
4.	Julie Ascoop (ex Arup Maritime team) has just joined Irish Lights as Director of Coastal Operations.	Note
5.	Changes in light technology over the decades has been transformational. From fuel oil to electricity, and since early	

Prepared by	John Burgess
Date of circulation	2 November 2020
Date of next meeting	

		Action
	2000's from filament lamps to Light Emitting Diodes (LEDs) – this last evolutionary step has seen the mothballing of the rotational Fresnel lenses at some stations and a major reduction in power requirements that removes the need for standby generation plant.	Note
6.	The OPW has gone to some trouble to decant the decommissioned standby generator diesel fuel tanks (7 number). The reason for such a large storage capacity in the past was driven by the need to maintain lighthouse operation for 18 months without delivery (access is weather dependent).	Note
7.	Given the major operation in removal of fuel oil from Skellig Michael, Arup has proposed an energy generation strategy that adopts a 3 phase approach to meeting the demands of future planned use and occupation of the lighthouse property by the OPW: 1. Solar PV and battery storage, 2. Wind and battery storage, and 3. (as a last resort) standby power generation with bio-diesel storage in a bunded tank that is protected from rain and sea spray ingress. Spatial provision only for stages 2 and 3 in the plans.	Note
8.	RMcG noted that while the existing solar PV located on the lighthouse balcony and associated battery storage was able to provide power for the aids to navigation equipment during overcast winter days, this was mainly attributable to the longer-term storage capacity of the battery system as daily energy generation of the PV in winter is very much reduced. Batteries can be down to 50% of charge towards end of winter season.	Note
	Point of note for design team to consider seasonal storage and not just diurnal storage.	Note
9.	Existing large PV array (currently redundant) will be replaced with a new array using higher energy generation capacity panels. Planning to extend the array on either end and to add another row on top if structure can be supported and take the added wind load. Arup to assess maximum generation capacity and battery storage accommodation needs.	Note Arup
10.	Old coal sheds are proposed to locate the new battery racks and provision for a future standby generator (should that ever be needed). Battery rack storage capacity to be checked. RMcG noted that existing PV panels are connected to the existing battery store in the lighthouse with several sizable cables running through an existing cable duct.	Arup

Minutes

Project title	Job number	Date of Meeting
Skellig Michael Lighthouse Property Restoration	273170-00	9 October 2020

		Action
11.	Existing communication to the mainland has been provided by aerials located on the gable wall of the coal shed. Aerials are still in place. Monitoring of the Navigation Light and battery storage system is via the AIS (Auto-Identification Systems) (VHF based) network to a base station on the mainland. Before this, Irish Lights was using a Supervisory Control and Data Acquisition (SCADA) system linked through a Global System for Mobiles (GSM) network. Arup to note GSM comms link to Vodafone Eircell network is an option (in the scheme report).	Note Arup
12.	More useful information on the history of the lighthouses and the systems deployed there is to be found on the Irish Lights web-site linked here .	Note
13.	Irish Lights have had early versions of wind turbines deployed at a few stations – but these proved to be more trouble than they were worth - needed a lot of maintenance due to moving parts. Trinity House in UK are using some of small turbines to top up battery banks in the Winter period. Arup is suggesting the use of small direct current (DC) vertical axis wind turbines (VAWT) similar to what would be fitted to yachts. The concept being to have an array of 6 to 12 small units mounted on a stainless-steel frame that would sit on top of the flat roof of the lower lighthouse. Arup to review and finalise concept design through sourcing of an acceptable product.	Note Arup
14.	The heating strategy for the lighthouse property should consider natural ventilation as a means for controlling humidity. Irish Lights allow the buildings to breath throughout the colder weather. While this may lead to high relative humidity levels during a rain or storm event, allowing air to pass through the building helps minimise condensation and mould. Consideration should be given to use of materials in the interior fitout that can respond well to fluctuation in temperature and relative humidity.	Note OPW
15.	Conditioning of the lighthouse tower in the past was provided for by allowing warm air to pass through from the standby generation plantroom (when warm air from the engine cooling air was used to ventilate the tower). Arup to consider passing warm air from adjacent rooms through the tower to allow it to breathe as it has done before. There is no intention to provide space heating to the tower. Smoke detection in the tower is required to be maintained on existing fire alarm systems.	Note Arup

		Action
16.	EL noted there was a need to install a second LED lamp on the tower along with battery back-up supply and auto-changeover arrangements to provide a main/standby configuration.	Irish Lights
17.	While the OPW will maintain the lighthouse tower, access will be controlled to protect against un-intentional disturbance of the Aids to Navigation equipment. Vent on top of tower to be checked for extent of opening. Note that the linoleum treads in the staircase has asbestos and should be allowed for in the repairs plan.	OPW
18.	When the lighthouse was occupied by the lighthouse keepers and families, rainwater was collected when there was no risk of bird droppings (outside the puffin season of March to July), when there was no salty sea spray in the air, and after the initial rainfall had washed away the salt and bird droppings from the collection areas on the roof and nearby concrete surfaced collection area.	Note
	This was a very specialised process requiring innate knowledge and experience of when best to collect the water. Collection of water in this manner will not be possible in the future use of the lighthouse not least because the lighthouse will only be occupied from mid-April to mid-October, leaving just 2 months of the year to be in a position to check if the rainwater is acceptable for washing purposes.	Note
	Therefore, all water to be utilised must be shipped out from the mainland. The OPW would need to make arrangements to transfer the water arriving by boat from Port Magee from the quay to the lower lighthouse.	Note
	EL suggested that consideration could be given to seeking assistance from Irish Lights to avail of the ILV Granuaile to deliver water directly to the lower lighthouse water storage tanks by anchoring close to the cliff next to the lighthouse and pumping up from the vessel. While no guarantee could be given on the availability of this vessel, it does provide an opportunity to reduce the impact of transporting the water on the island's paths.	IL & OPW
	If there is a need for any water for external wash-down, then consideration should be given to retaining the existing tank that is located on the roof of the old utility room at the north end of the lighthouse accommodation building, and to collect rainwater when the conditions are appropriate for this use only.	Note
19.	To reduce water consumption, consideration should be given to the use of the 'RainMan Camp Shower' canisters, the same as what is in use on the island for the maintenance team. These	Arup

		Action
	devices are simple to use and easy to prepare for a hot shower. They are also effective in minimising the amount of water being used for showering purposes. OPW and Arup to review and consider these in lieu of a large central hot-water (for washing) heating plant. This may also help in the management of stagnant water in shower heads and in legionella risk mitigation.	OPW
20.	All materials to withstand the corrosion effect of the salty environment. 316 marine grade stainless steel (not 304 st.st.), PVC / plastic washers. Note in scheme report.	Arup
21.	Be mindful of potential for clogging of gutters on roof when unmanned in winter months. Arup to note in scheme report.	Arup
22.	Helipad also transferring to the OPW for maintenance reasons. Irish Lights will continue to use it for maintenance personnel visits. The helipad is too small for Coast Guard helicopter rescue use but they can use winching mechanism to lift injured people up in stretchers. Edging (safety nets) galvanised sheeting showing age and in need of replacement. There is no aviation lighting on the helipad. There is no storage unit with fire extinguishing equipment present anymore. Important that there is no loose material near the helipad that could be drawn into the helicopter blades.	Note OPW
23.	Toilets for visitors to the island could be located on lower ledge next to helipad provided they are secured and that there are no loose attachments to these structures. It is assumed that OPW staff would check the helipad and restrict access whenever a helicopter is landing or taking off.	Note OPW
24.	Irish Lights are interested in solutions being developed for Skellig Michael lighthouse property. Other isolated lighthouse towers like the Fastnet, Tuskar Rock and the Kish need to have provision for heat and power within the tower now that standby generators are being decommissioned for the large energy needs of the past. There is a need to provide for maintenance teams working on these remote lighthouses who might get stranded in the event of bad weather. Are there options for renewable energy and battery storage? Arup to review.	Note Arup

Appendix B

Historical Report

Skellig Michael – Lighthouses Historical Report

Located in county Kerry, the island of Skellig Michael is home to a spectacular early medieval monastic site. References to Skelligs rock date back to pre-Christian times, while the beehive dwellings, oratories, and crosses are attributed to Saint Finian and date back to the 6th century. The monastic site was occupied by monks probably until 1538 when Henry VIII ordered the dissolution of monasteries. Although the island is famous for its cultural and natural significance, it is also home to two lighthouses with a fascinating history.

Figure 1: Aerial image showing the two Skelligs lighthouses

In 1816, the Knight of Kerry, Maurice Fitzgerald reminded the Corporation of Preserving and Improving the port of Dublin that the Grand Jury of County Kerry has been, for over 20 years, looking into a lighthouse project on Bray Head, Valentia. After 18 months, George Halpin, inspector of lighthouses, made a suggestion to the board to build two lighthouses on Skelligs rock. The reason for positioning two lighthouses instead of only one was to prevent confusion with the light on Cape Clear Island to the south. As a result, the Board agreed and Trinity House was informed giving sanction in November 1820. The Board bought the island one year later for £780 from Mr. J. Butler of Waterville, Co. Kerry. The construction of the lighthouses began in 1821. The upper light functioned until 1870, and the lower light until 1987 when it was fully automated.

In 1880, the OPW took the monastic remains into guardianship and became responsible of maintaining them. In 1989, the Irish State purchased the island from the Commissioners of Irish Lights except for the two lighthouses and helipad area. The Commissioners of Irish Lights also retained right of way over

the road. Nowadays, the upper lighthouse is in ruinous state, while the lower lighthouse is still used by the OPW staff. Solar power was introduced to the lighthouse in 2001.

Figure 2: Image showing the lower lighthouse building from the upper lighthouse road

Originally, the lighthouses, rock cutting and roadway were designed and directed by George Halpin and construction works began in August 1821. The lighthouses were positioned 260 yards from each other, and consisted of towers and dwellings that were built of rubble masonry with slate cladding on the outside walls. Only granite was imported and used in lantern blocking, tower floors and stairs, windowsills and certain wall coping stones. The lower lighthouse dwelling had a 2 storeys building, and the upper lighthouse dwelling only had one storey with attic rooms. The original design of the lower dwelling included a pitched roof which was removed in 1910 and replaced by a flat concrete roof. It was asphalted during the 1960s renovations.

In 1823, the roadway was cut to provide access to the lighthouses. Unfortunately, the east landing road at Blind Man's cove required blasting tons of rocks into the sea which resulted in the permanent destruction of some parts of the lower path and steps leading to the beehive settlement. Finally, on Monday 4th December, the lighthouses were ready and the lights exhibited. Both lights were fixed (non-rotating) when they were first constructed. The upper light could be seen from 25 miles and the lower light from 18 miles.

Many modifications to the lighthouses took place during the years and the upper light only functioned until 1870 due to the establishment of a new light on Inishtearaght, 22 miles north of Skelligs. Also, options for increasing the size of the lower lighthouse arc were considered which resulted in the construction of a new 120,000 candles light with a rotating machine in 1909.

On 13th June 1914, the fog signal was built between the two lighthouses. After a month, it was temporarily discontinued due to difficulties. After being re-established, it was discontinued again in 1948 and then permanently stopped in 1960. Major modifications took place at the lower lighthouse when in 1962 an inspecting committee on tour recommended its modernisation. During their visit they requested repairs to include the installation of electric light, central heating, bathroom and toilets. They also proposed an office for the principal keeper, increased storage space, and the destruction of the tower and connecting corridor, followed by the building of a new tower and adjoining engine room. The modernisation works were monitored by chief engineer Mr. H. Martin and the newly built light started operating in 1967. In 1981, the Skelligs lighthouse became automatic.

Figure 3: Image showing the entrance to the lower lighthouse building

After operating for many years, the lower Skelligs lighthouse became unmanned on 22nd April 1987 and the lighthouse became fully automated. During their operating years, the lighthouses on Skelligs rock formed a challenging place to live and work in. Communication with the mainland was difficult and in the mid-1930s, keepers used to light a fire at the monastery to send signals. The number of keepers increased during the years, from 2 keepers to 4 keepers, in order to allow for the relieving

system and to ensure that at least 3 keepers remain on the island at any times. The keepers lived on the island with their families and a teacher remained there to provide education for their children. Sadly, in the years 1868-69, two children died of illness on the island and were buried in the medieval chapel. In 1899 following requests, families were moved to their shore dwellings on Valentia. Other tragedies also took place on the island and surrounding ocean. On 27th February 1944, an American navy aircraft crashed into the island resulting in the loss of all crew.

OPW entered into negotiations in 2018 with the Commissioners of Irish Lights to take over the lower lighthouse. It is proposed to refurbish the building to provide accommodation for OPW personnel and consultants.

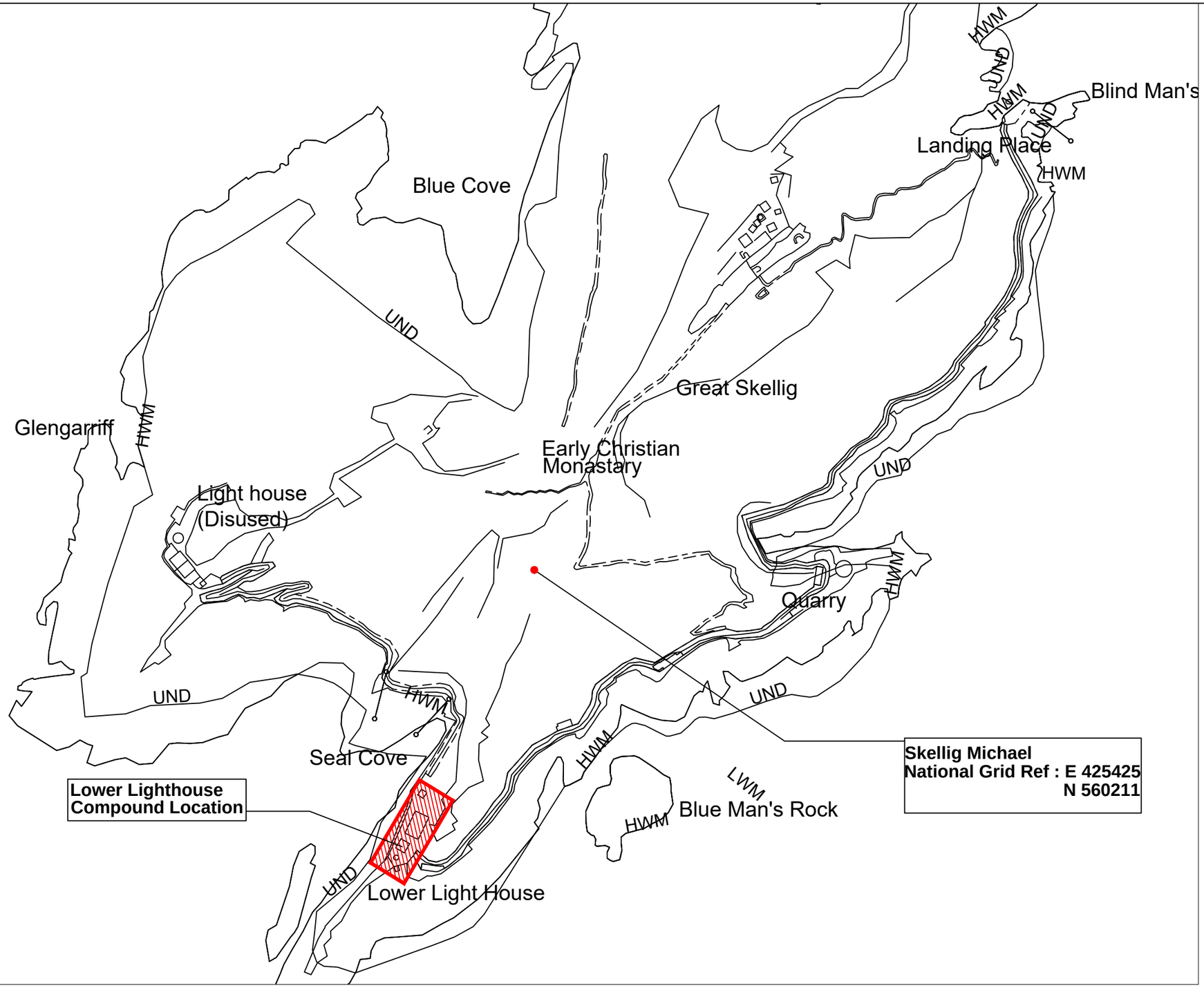
Figure 4: Aerial image of the lower lighthouse building

Melissa Nicolas, Graduate Architect

05.12.2018

Appendix C

Consent Application Drawings - Living Quarters



Legend

Area subject to consent

National Monument Details

Name : Skellig Michael

Address : Skellig Michael,
Co. Kerry.

Nat. Grid Ref. : E 425425, N 560211

OSI SITE LOCATION MAP
SCALE 1:2500 @ A3

O.S. Map Ref : 7099
"Ordnance Survey Ireland Licence No EN 0021018
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Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

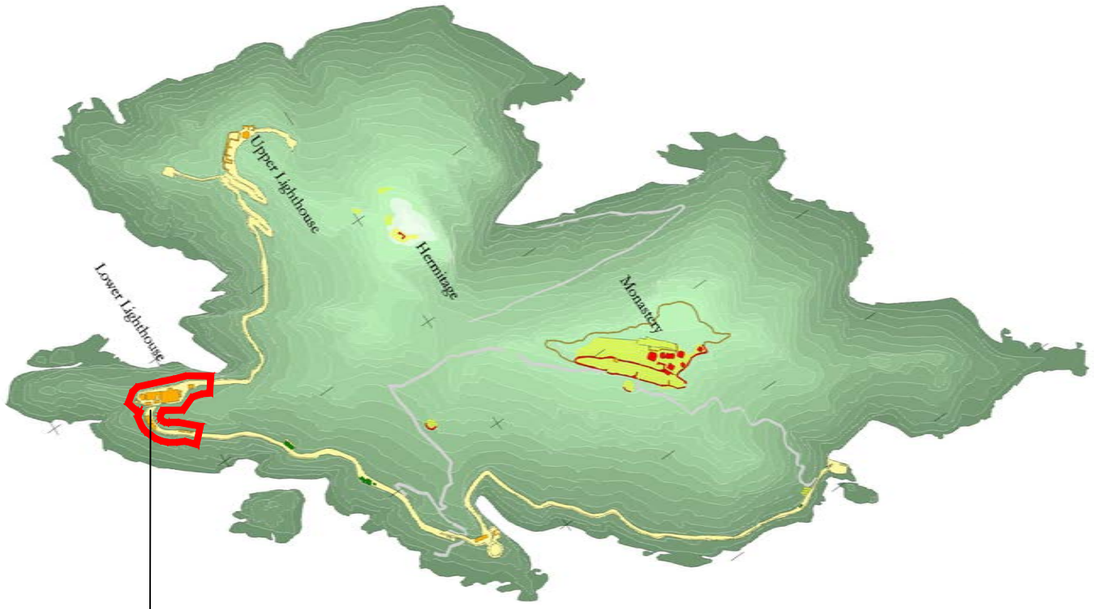
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: OSI Site Location Map

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	1:2500	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	001	



SKELLIG MICHAEL - SITE PLAN
SCALE 1:5000 @ A3

SITE PLAN - LIGHTHOUSE COMPOUND
SCALE 1:500 @ A3

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

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John Cahill - Assistant Principal Arcihtect
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title

Site Plan

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
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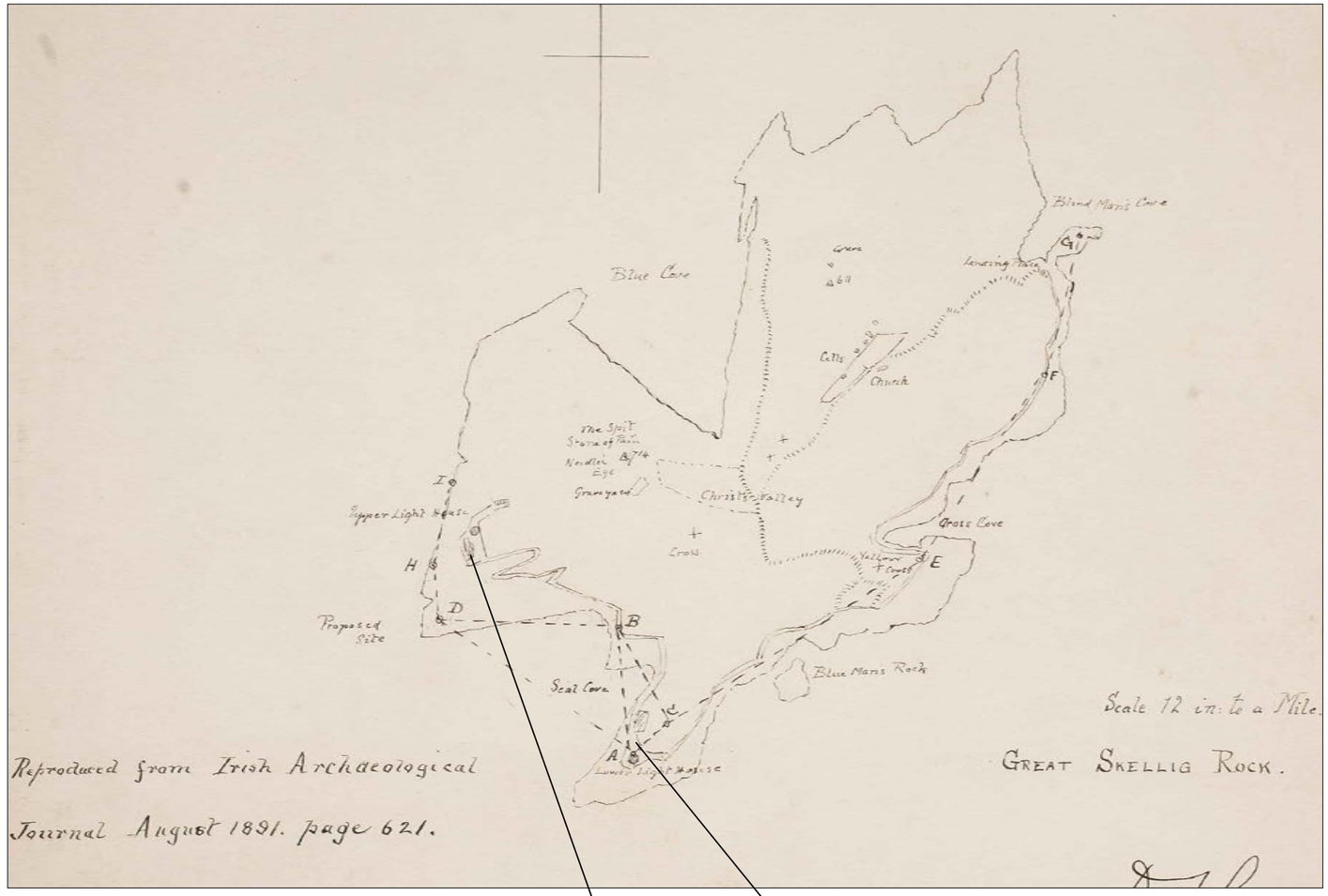

01/003 Archival reproduction from the Irish Archaeological Journal (1905)

02/003 Archival image of the Irish Lights survey team (1905)

Upper Lighthouse

Lower Lighthouse

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title
Archive Drawings & Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
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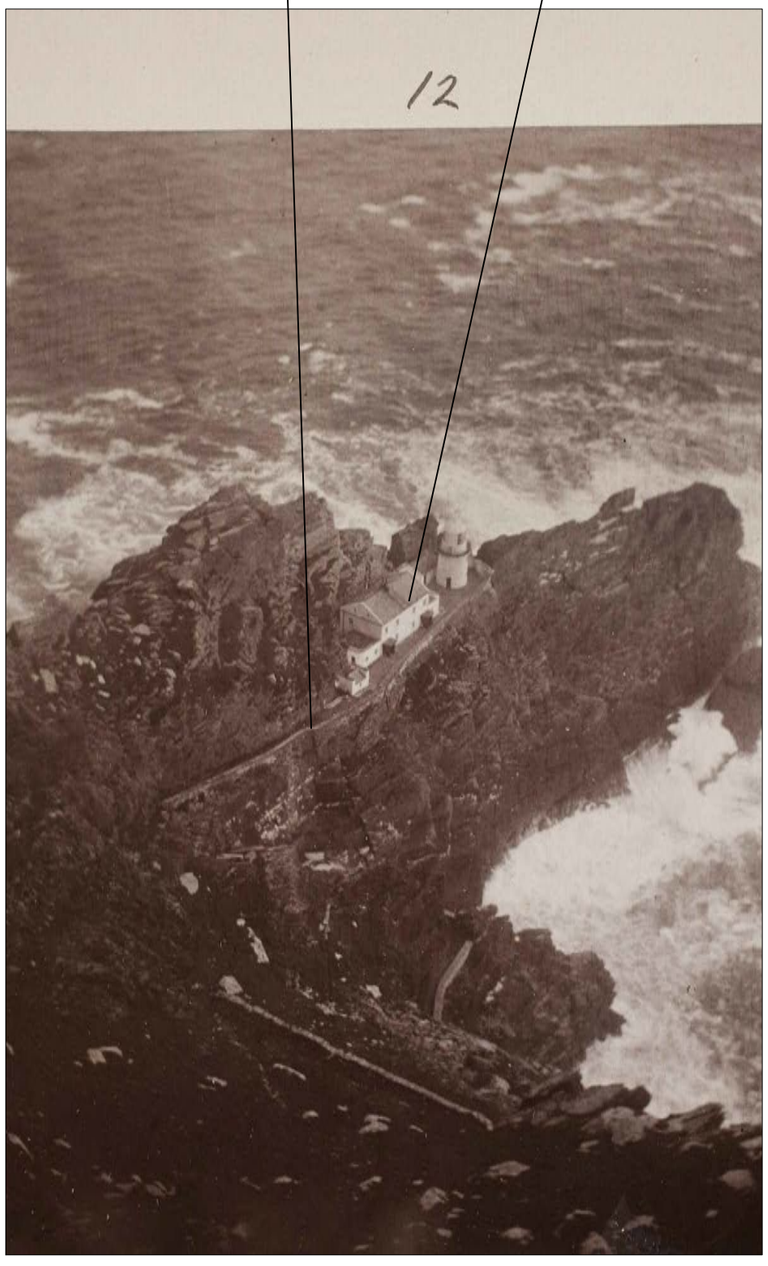
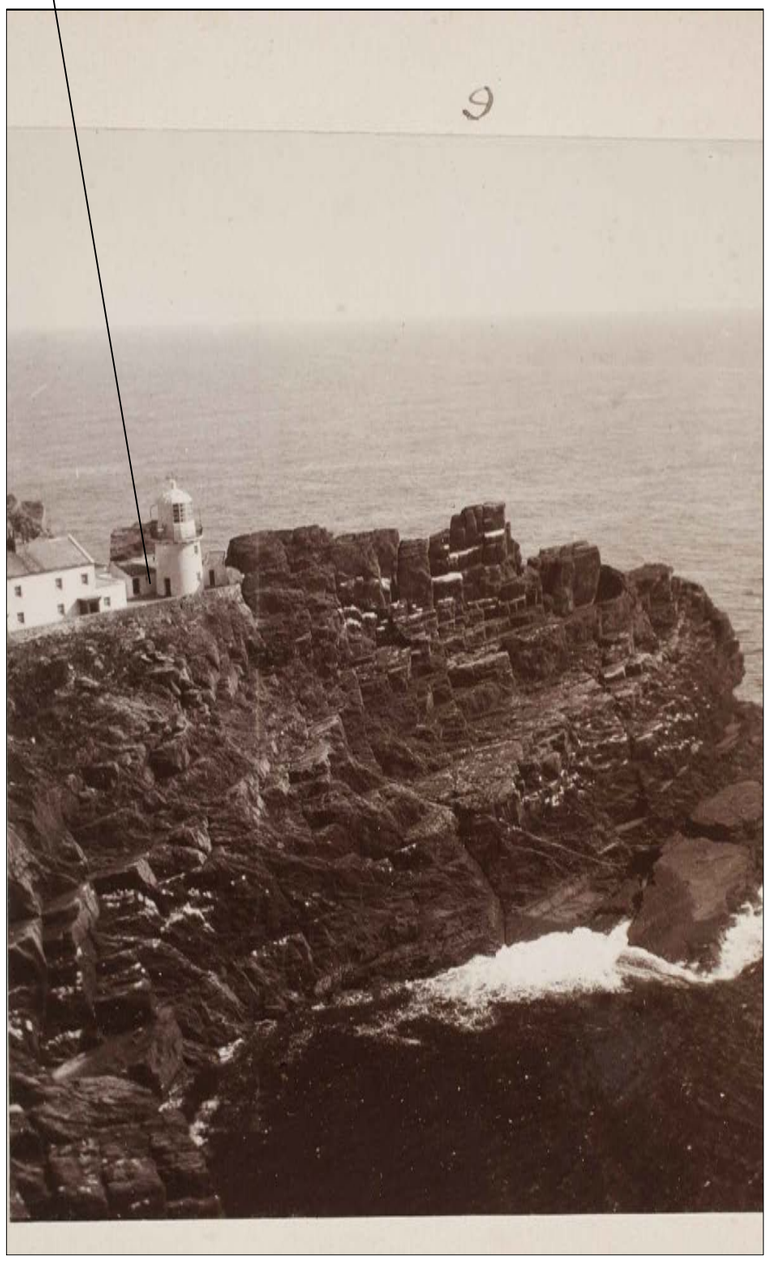
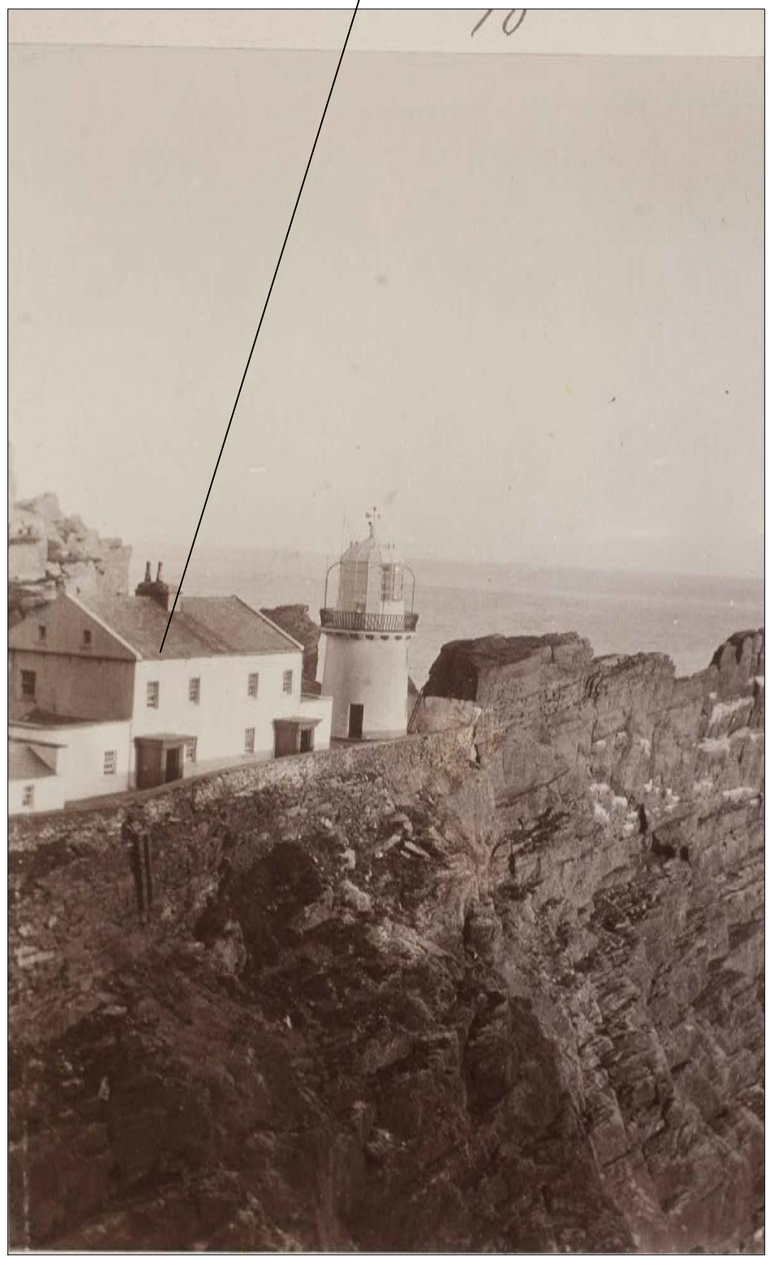


01/004 Archival image showing the original lower lighthouse and upper lighthouse road (1905)



02/004 Archival image showing the setting of the lower lighthouse (1905)



03/004 Archival image showing the original lower lighthouse tower and dwelling before renovation (1905)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title
Archive Images

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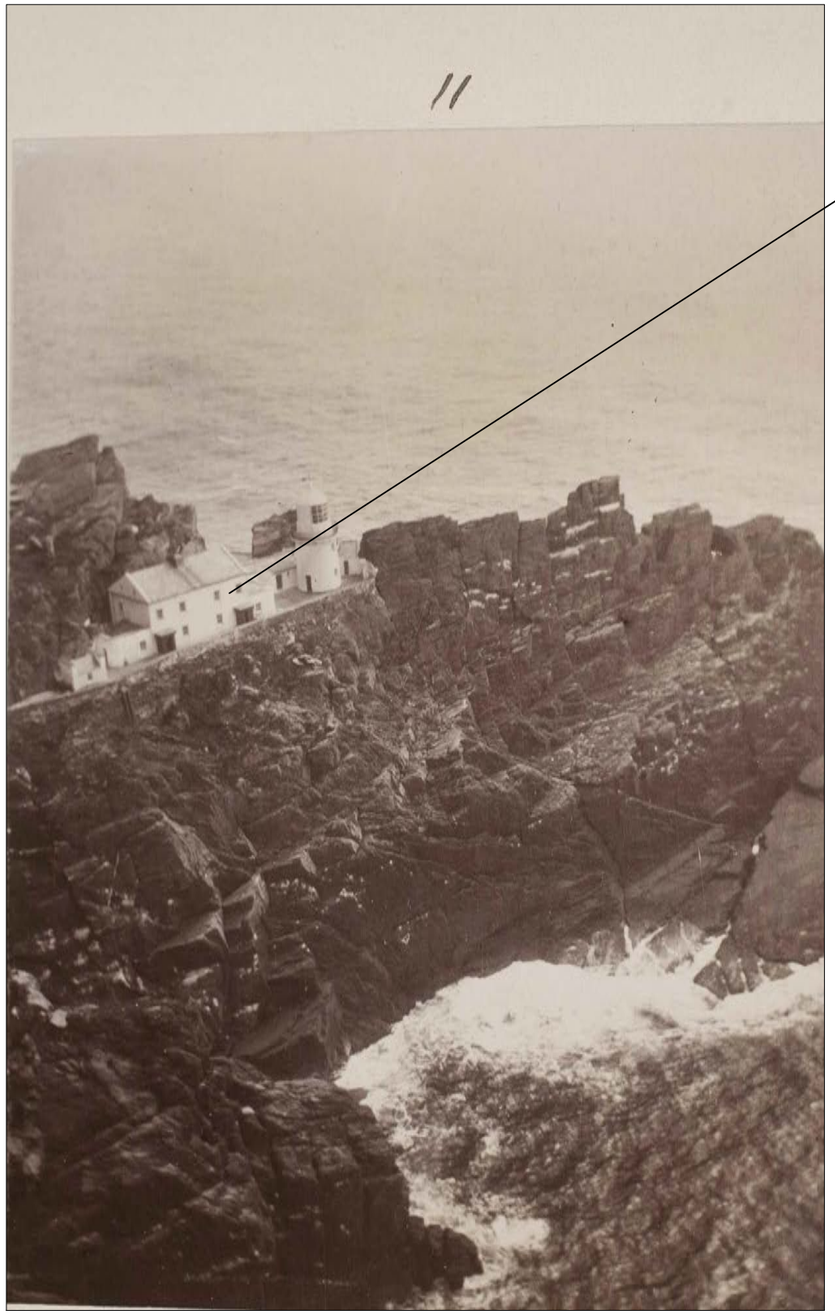
MN	F. McC	NTS	05 December 2018

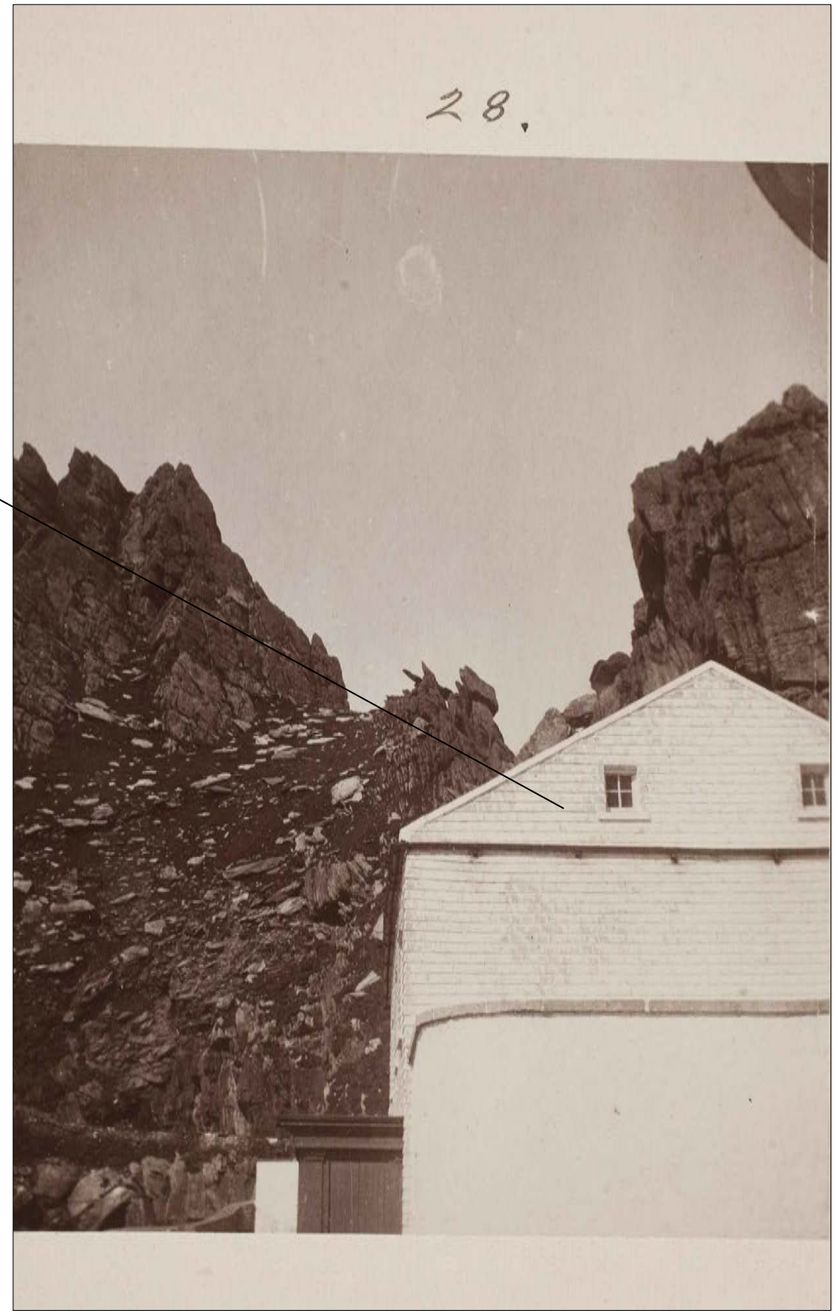
Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	004	



Original Lower Lighthouse

Lower lighthouse with pitched roof and slates on walls before the renovation



01 / 005 Archival image showing the context of the lower lighthouse (1905)

02 / 005 Archival image showing the original shape of the pitched roof before it was removed and replaced by a new concrete flat roof in 1910 (1905)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

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Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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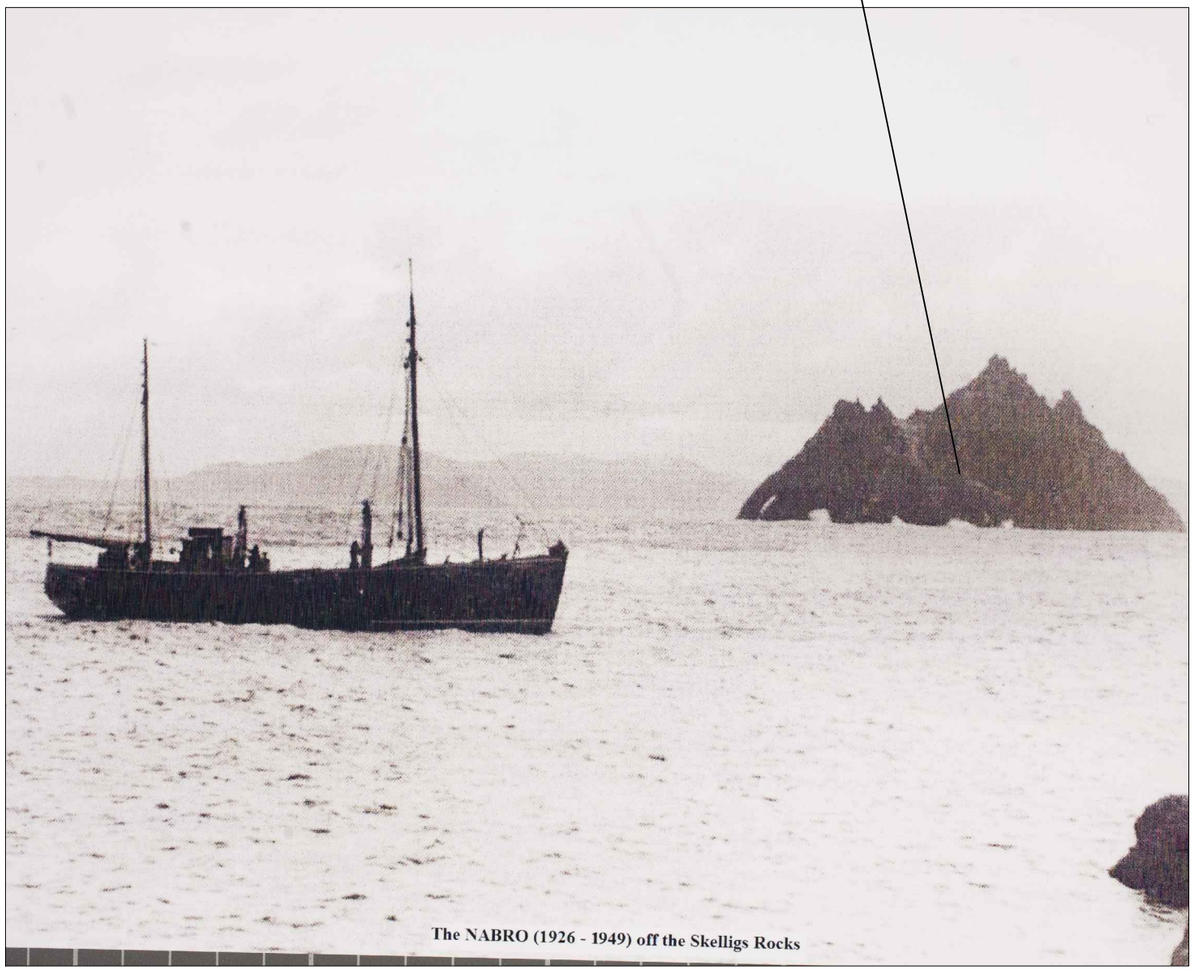
Archive Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

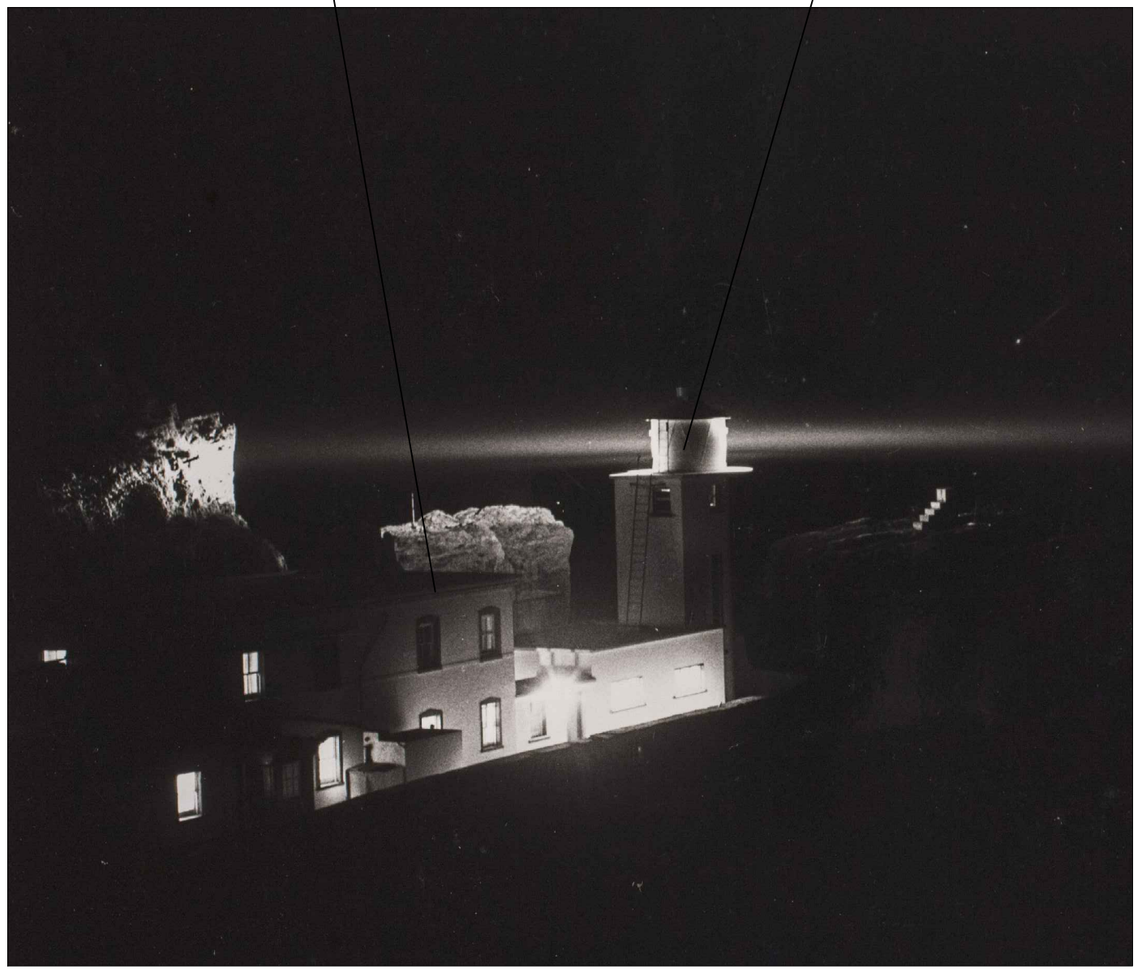
Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	005	



01
006

Archival image showing the NABRO crew boat which supplied the Skelligs Lighthouse (1926-1949)



02
006

Archival image showing the renovated lighthouse at night time (1926-1949)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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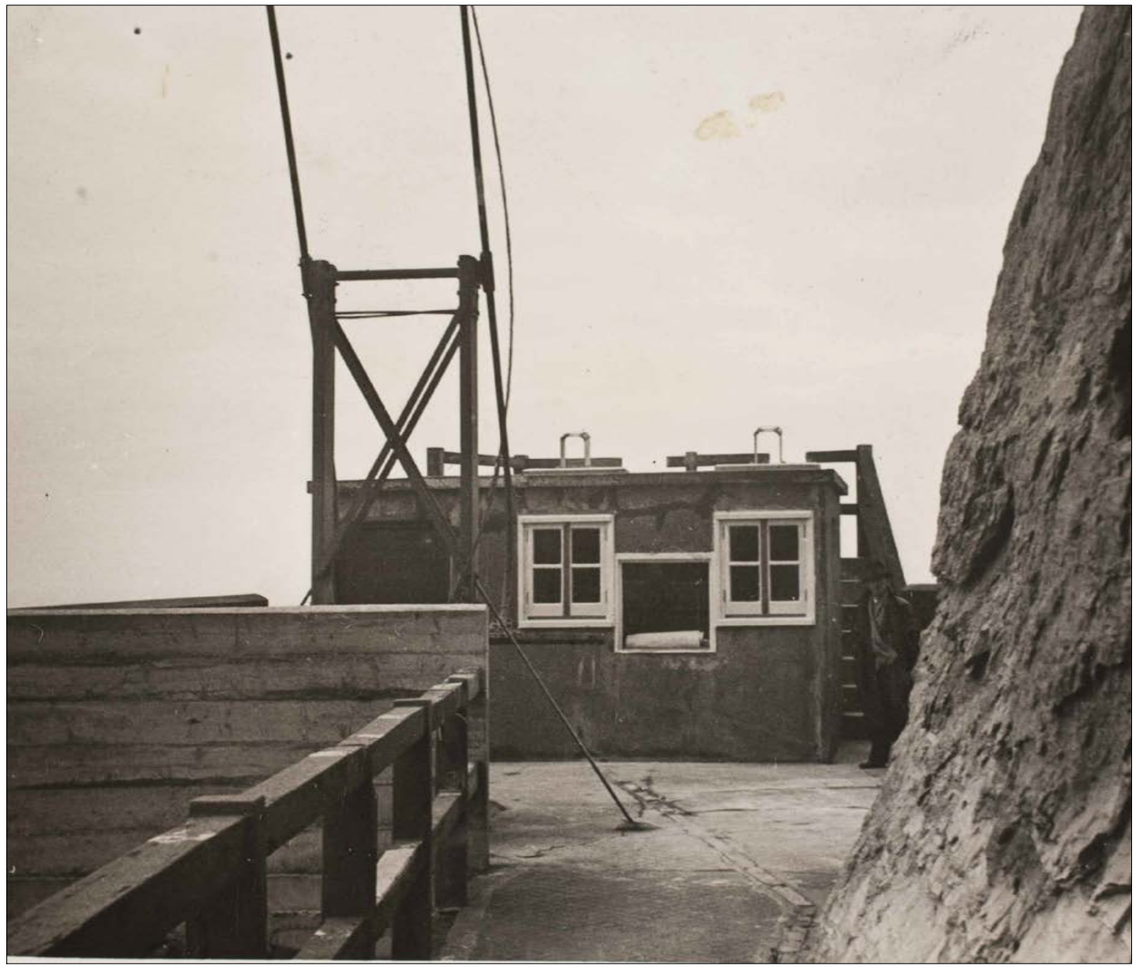
Archive Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

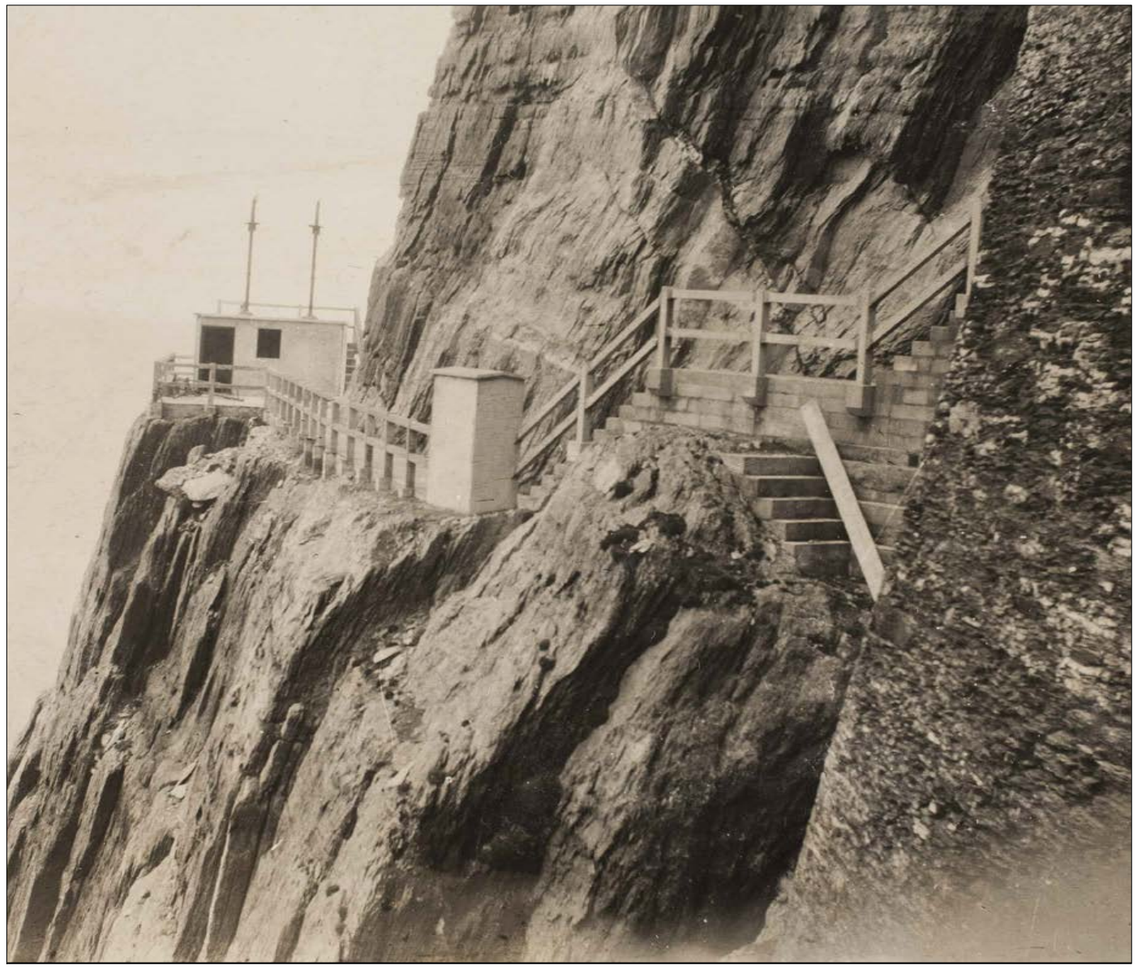
Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	006	



01
007

Archival image showing the explosive fog signal station (c.1930)



02
007

Archival image showing the explosive fog signal station (c.1930)

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
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Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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MN	F. McC	NTS	05 December 2018

Project Title

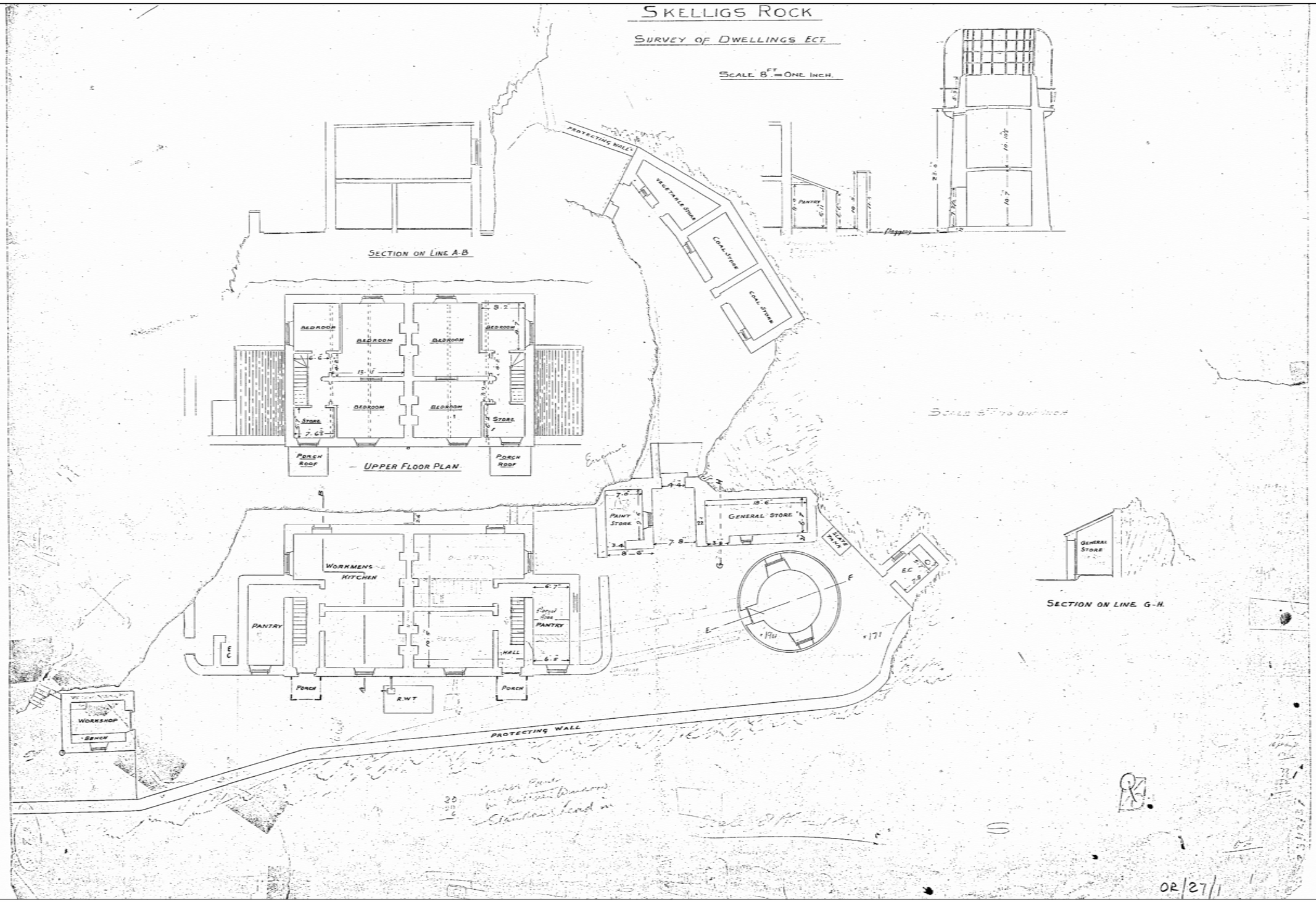
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	007	

SKELLIGS ROCK

SURVEY OF DWELLINGS ECT.

SCALE 8 FT. = ONE INCH.



01
008

Archival drawings of the plans and sections of the original lower lighthouse (c. 1821)

Architectural Services	Principal Architect	Design Team		Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Arcihtect Grellan Rourke - Senior Architect Fergus McCormick - Conservation Architect Melissa Nicolas - Graduate Architect	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	Archive Drawings DRAWN CHECKED SCALE DATE MN F. McC NTS 05 December 2018	Skellig Michael - Lower Lighthouse Consent Application PROJECT NO. STATUS NUMBER REV. SKE.01.2018 CONSENT 008

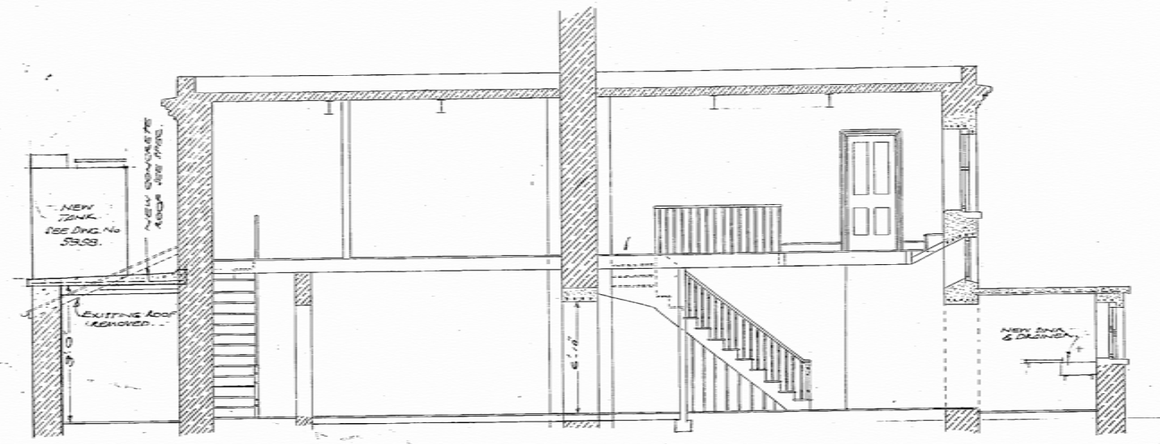
SKELLIGS ROCK LIGHTHOUSE

DRAWING No 4489

Issue No 2 3/4/48

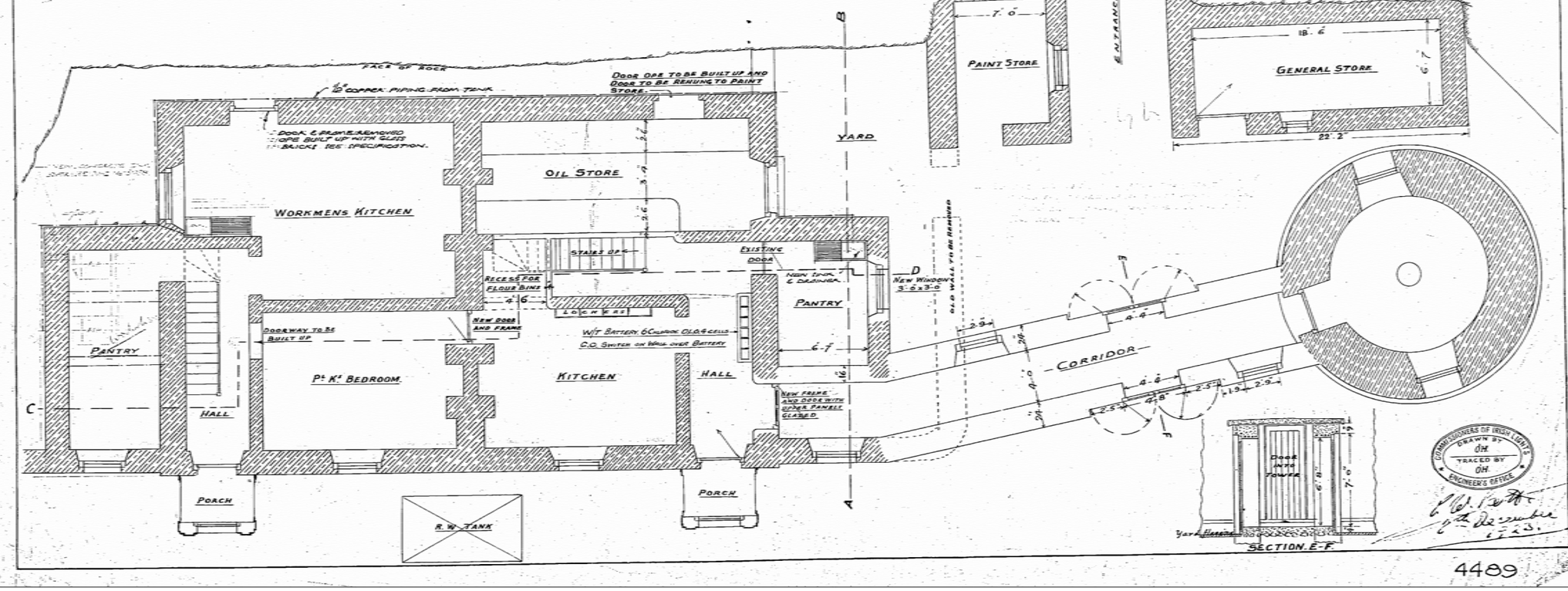
ALTERATIONS TO KEEPERS DWELLINGS & NEW CORRIDOR TO TOWER

SCALE 4FT = ONE INCH



SECTION ON LINE C-D.

SECTION ON LINE A-B



COMMISSIONERS OF IRISH LIGHTS
DRAWN BY dH
TRACED BY dH
ENGINEER'S OFFICE
6th December 1923.

4489

01
009

Archival drawings of the ground floor plan and sections of the ground floor level of the lower lighthouse (1923)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title
Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

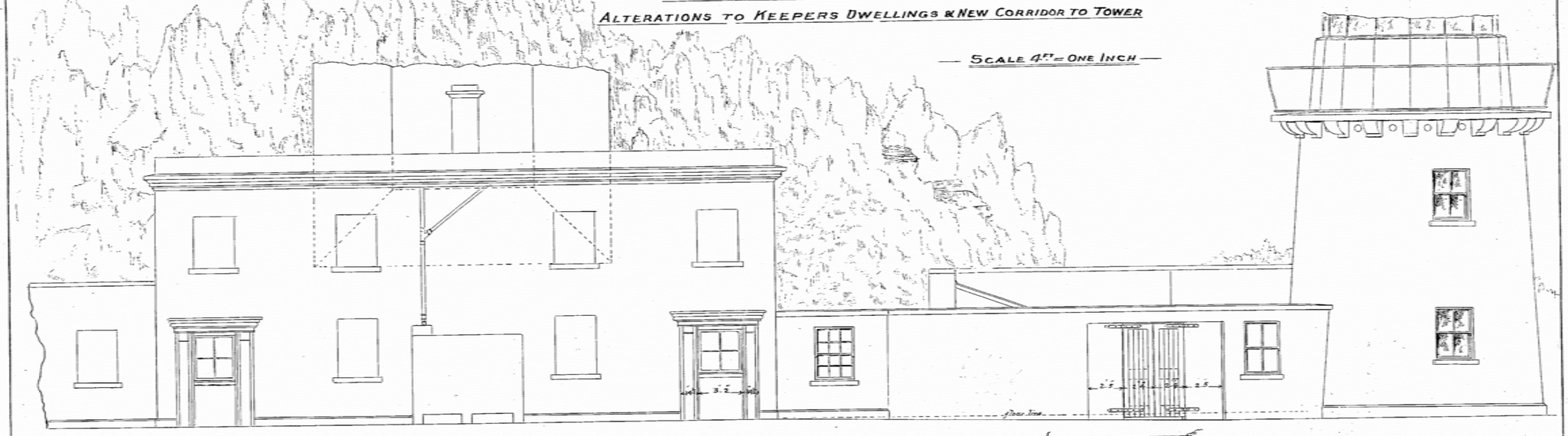
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	009	

— SKELLIGS ROCK LIGHTHOUSE —

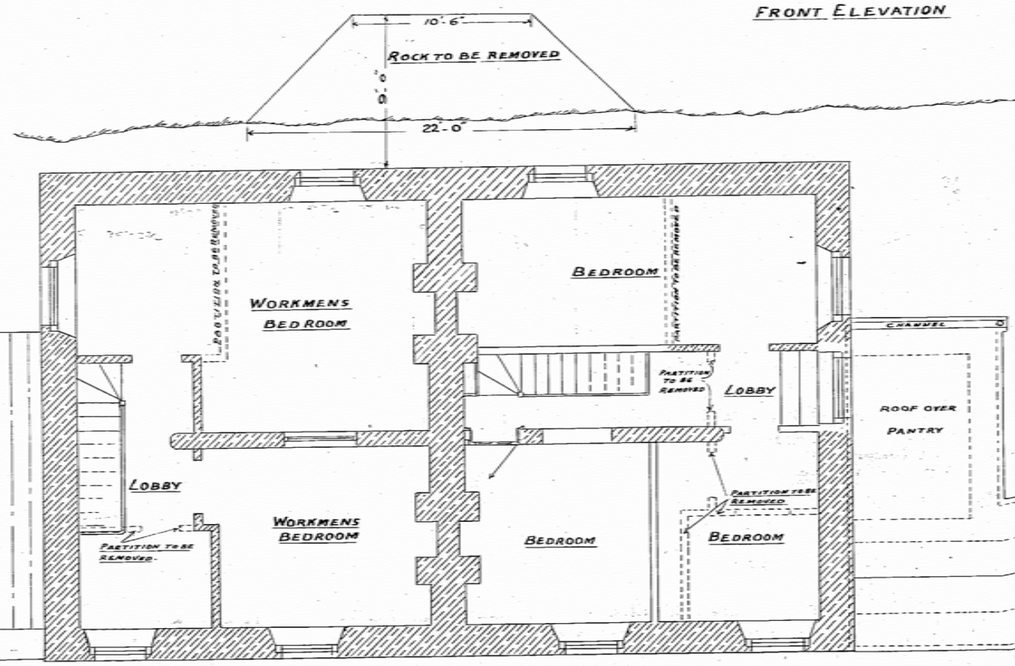
ALTERATIONS TO KEEPERS DWELLINGS & NEW CORRIDOR TO TOWER

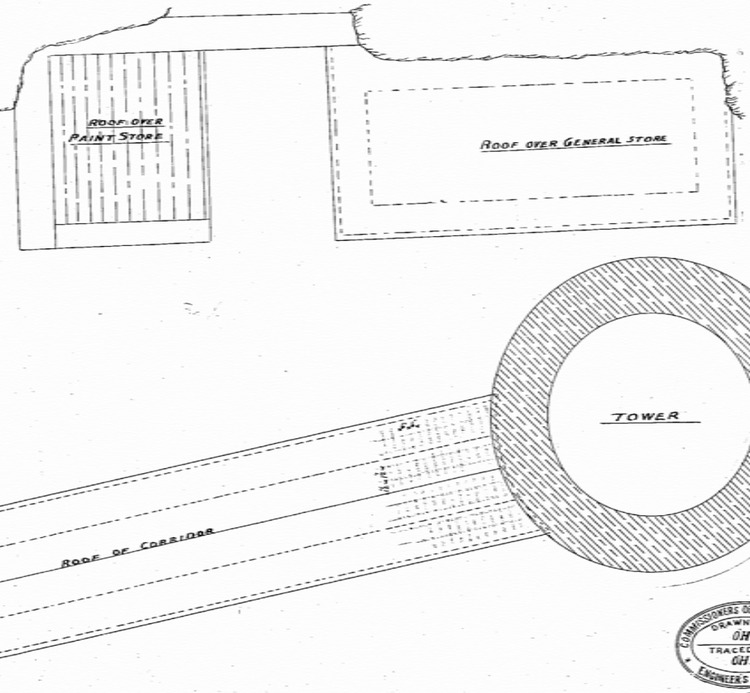
— SCALE 4FT = ONE INCH —

DRAWING Nº4490



FRONT ELEVATION





UPPER FLOOR PLAN

4490

01/010 Archival drawings of the upper floor plan and front elevation of the lower lighthouse (1923)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title
Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	010	

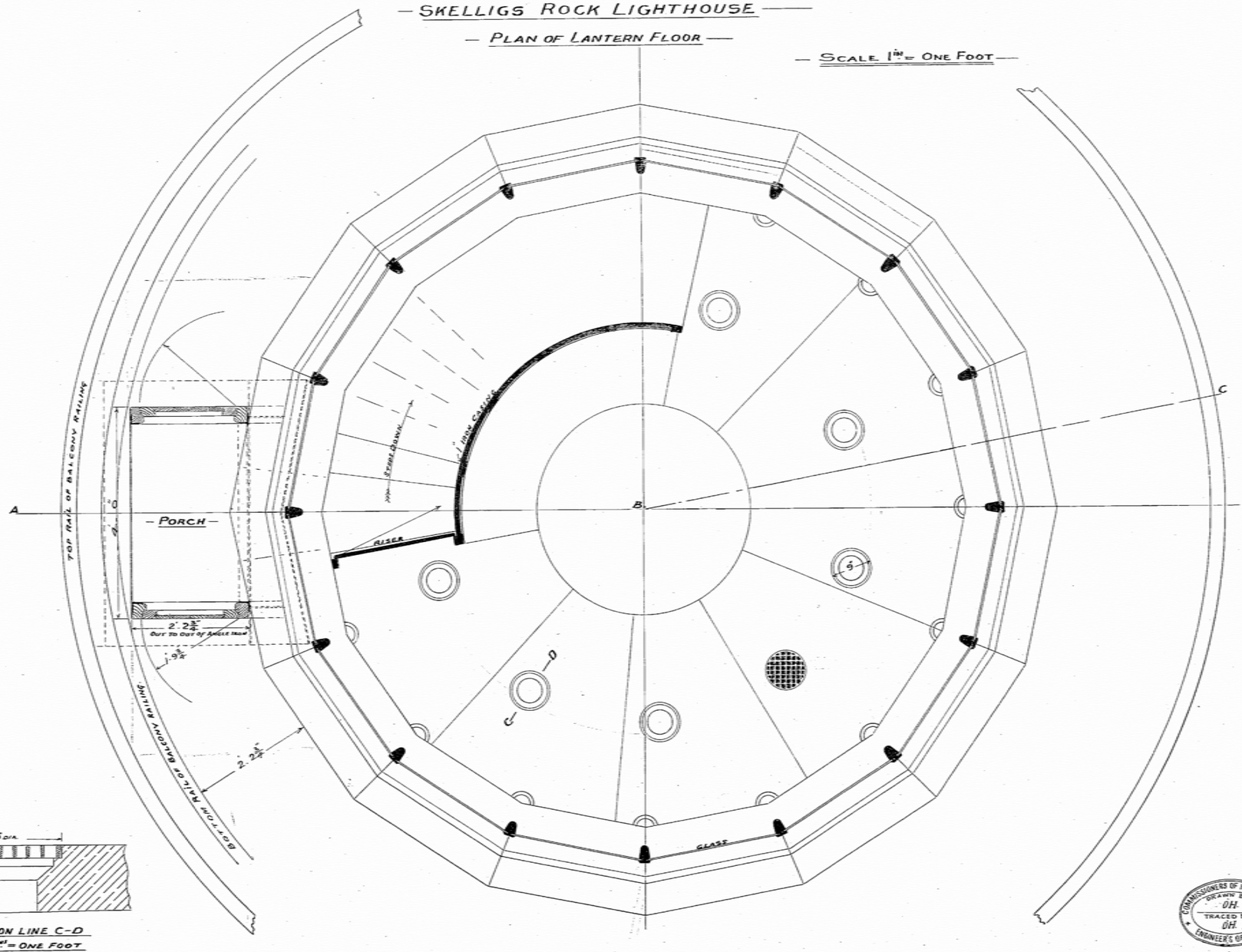
DRAWING Nº 4494

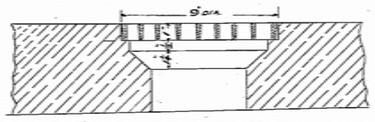
— COMMISSIONERS OF IRISH LIGHTS —

— SKELLIGS ROCK LIGHTHOUSE —

— PLAN OF LANTERN FLOOR —

— SCALE 1in = ONE FOOT —





SECTION ON LINE C-D
SCALE 3in = ONE FOOT

COMMISSIONERS OF IRISH LIGHTS
DRAWN BY O.H.
TRACED BY O.H.
ENGINEER'S OFFICE

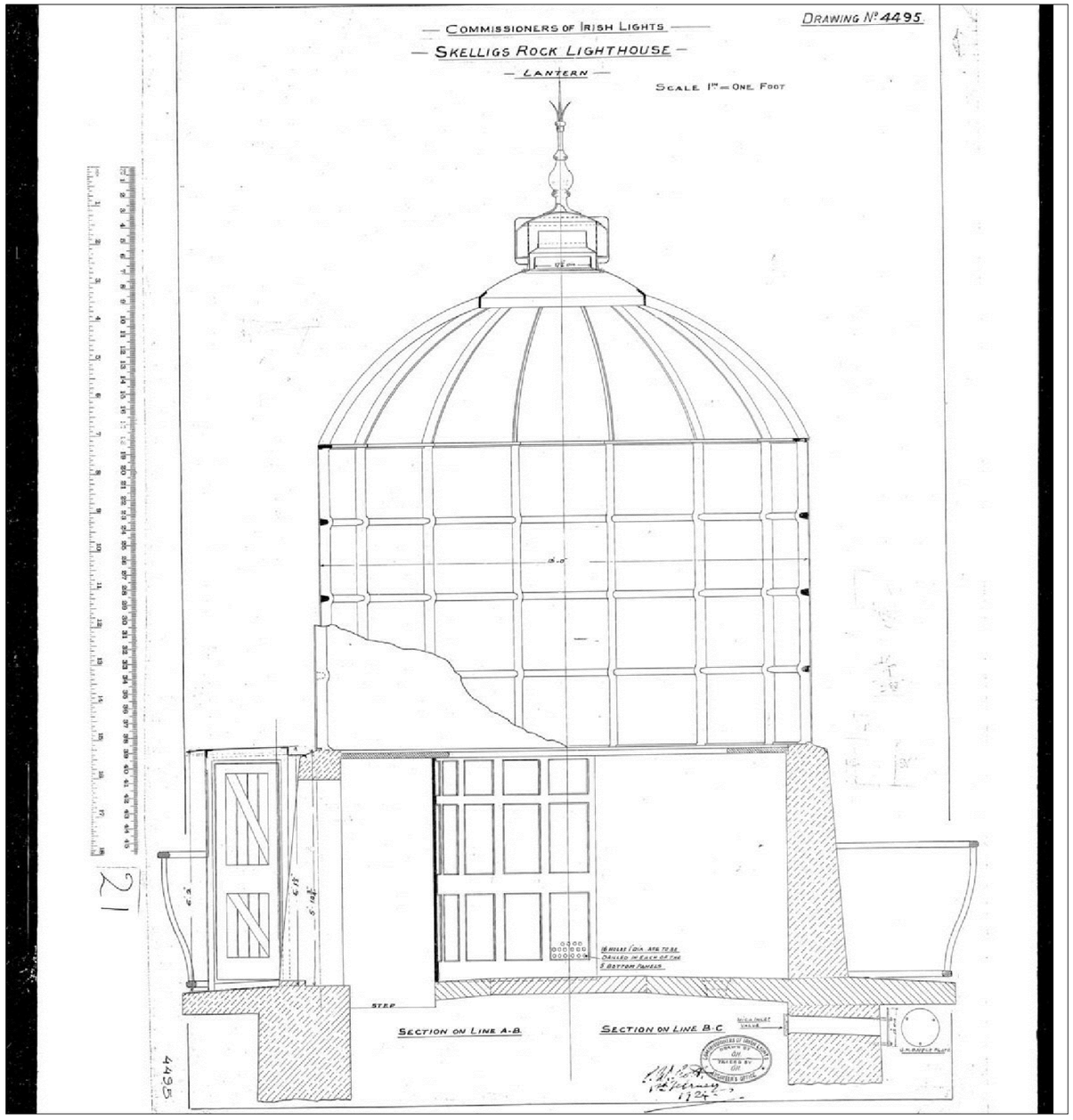
1st February 1924.

4494

01
011

Archival drawings of the lantern floor plan of the lower lighthouse (1924)

Architectural Services	Principal Architect	Design Team	Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Arcihtect Grellan Rourke - Senior Architect Fergus McCormick - Conservation Architect Melissa Nicolas - Graduate Architect Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	Archive Drawings DRAWN MN · CHECKED F. McC · SCALE NTS · DATE 05 December 2018	Skellig Michael - Lower Lighthouse Consent Application PROJECT NO. SKE.01.2018 · STATUS CONSENT · NUMBER 011 · REV.



01/012 Archival drawing of the section of the lower lighthouse lantern (1924)

02/012 Archival image showing the lantern and keepers on the lower lighthouse (1905)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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Drawing Title
Archive Drawings & Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

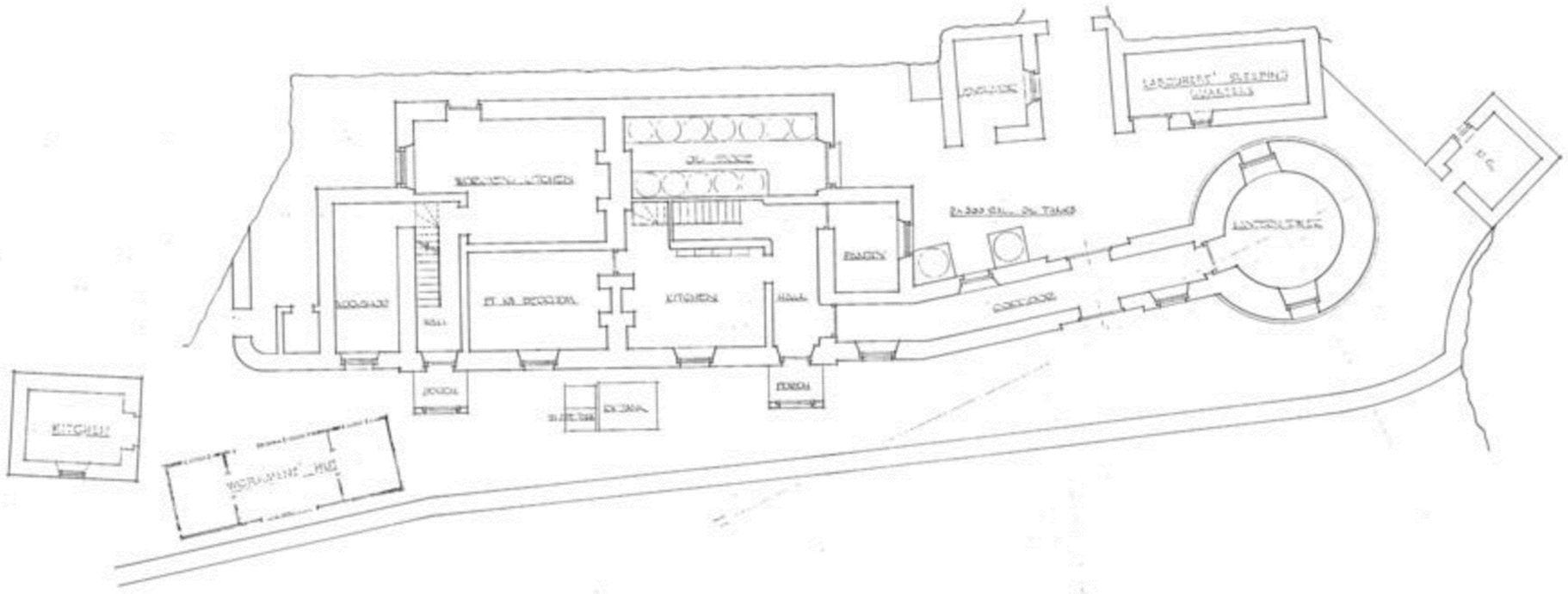
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	012	

DRAWING Nº 7255.

COMMISSIONERS OF IRISH LIGHTS.

SKELLIGS ROCK LIGHTHOUSE — SURVEY PLAN.

SCALE ·8 FT TO 1 INCH.



7255

01
013

Archival survey drawing of ground floor plan of the lower lighthouse (1954)

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
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Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title

Archive Drawings

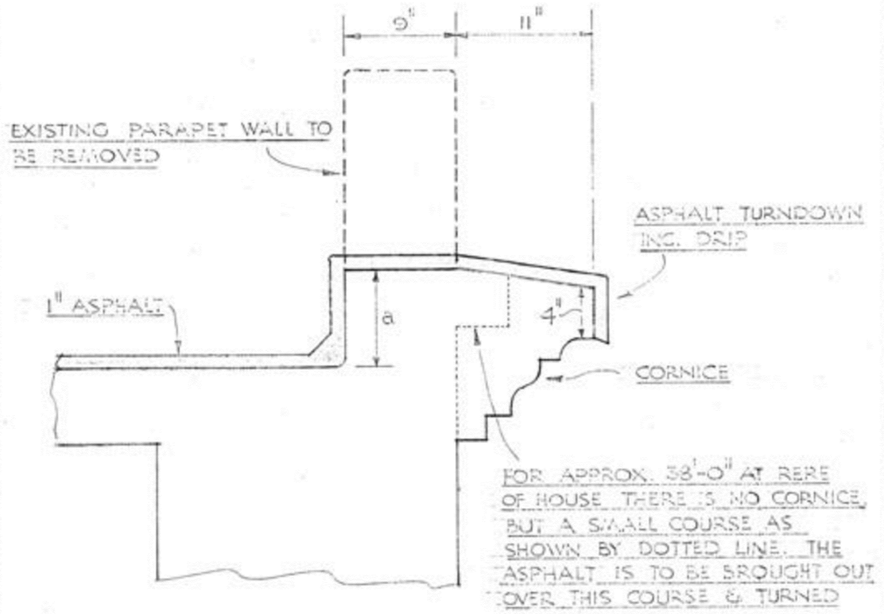
DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	013	

DRG. No. 9159



SECTION THRO' PARAPET

NOTE - DIMENSION "a" VARIES BETWEEN 5" (AT BACK OF HOUSE) & 10" (AT FRONT)

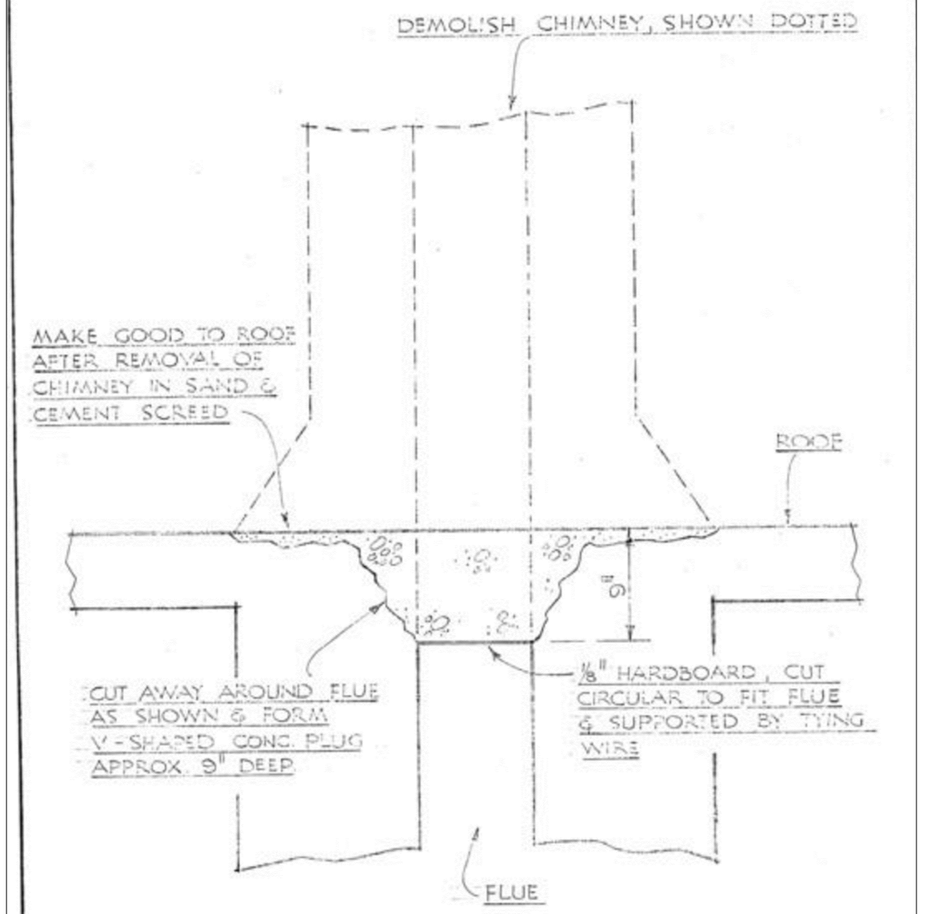
I	DATE	SIG.

REVISIONS

COMMISSIONERS OF IRISH LIGHTS	SCALE 1½" TO ONE FOOT
STATION: SKELLIGS ROCK	DATE: 27. 1. 65.
DRAWN: Thompson	ASPHALT DETAIL
CHECKED:	DRAWING No. 9159
TRACED:	
APPROVED: [illegible]	

01/014 Archival drawing of the section of parapet (1965)

DRG. No. 9175



I	DATE	SIG.

REVISIONS

COMMISSIONERS OF IRISH LIGHTS	SCALE 1½" TO ONE FOOT
STATION: SKELLIGS	DATE: 22.2.65
DRAWN: Thompson	BLANKING OFF CHIMNEYS
CHECKED:	DRAWING No. 9175
TRACED:	
APPROVED: [illegible]	

02/014 Archival drawing of the details of chimney (1965)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title: Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

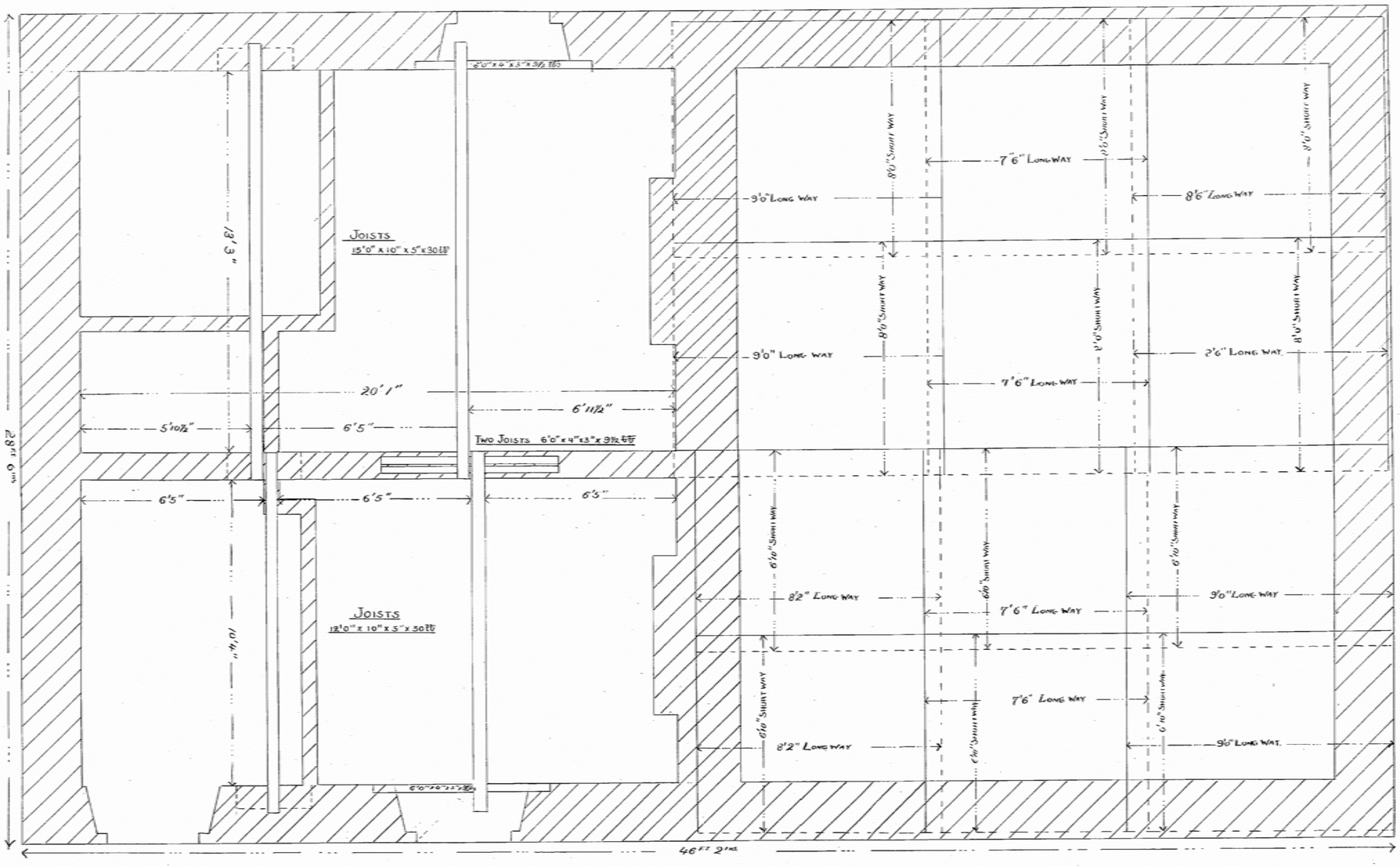
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	014	

COMMISSIONERS OF IRISH LIGHTS

DRAWING Nº 2948.

SKELLIGS LIGHTHOUSE ROCK DWELLINGS

PLAN SHOWING POSITION OF GIRDERS AND EXPANDED METAL ON ROOF



COMMISSIONERS OF IRISH LIGHTS
15th March 1909
H.A.31.
ENGINEERS OFFICE

S. Almyard
16th March 1909

01
015

Archival drawing of the steel work of the flat concrete roof (1909)

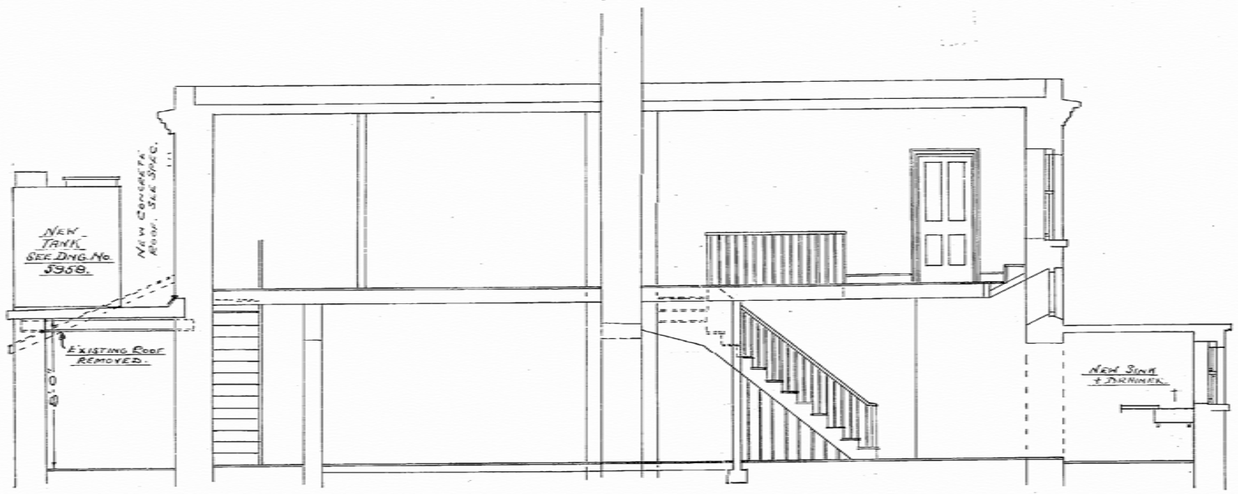
Architectural Services	Principal Architect	Design Team		Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Arcihtect Grellan Rourke - Senior Architect Fergus McCormick - Conservation Architect Melissa Nicolas - Graduate Architect	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	Archive Drawings DRAWN MN · CHECKED F. McC · SCALE NTS · DATE 05 December 2018	Skellig Michael - Lower Lighthouse Consent Application PROJECT NO. SKE.01.2018 · STATUS CONSENT · NUMBER 015 · REV.

COMMISSIONERS OF IRISH LIGHTS

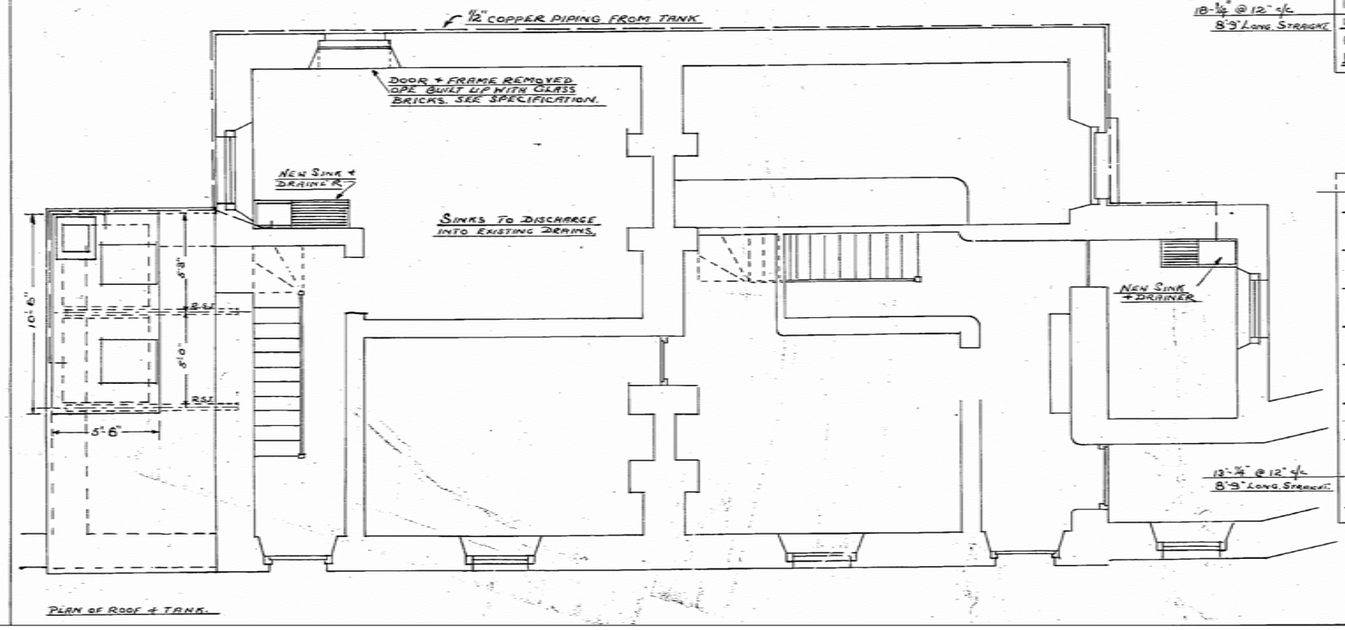
SKELLIGS ROCK LIGHTHOUSE

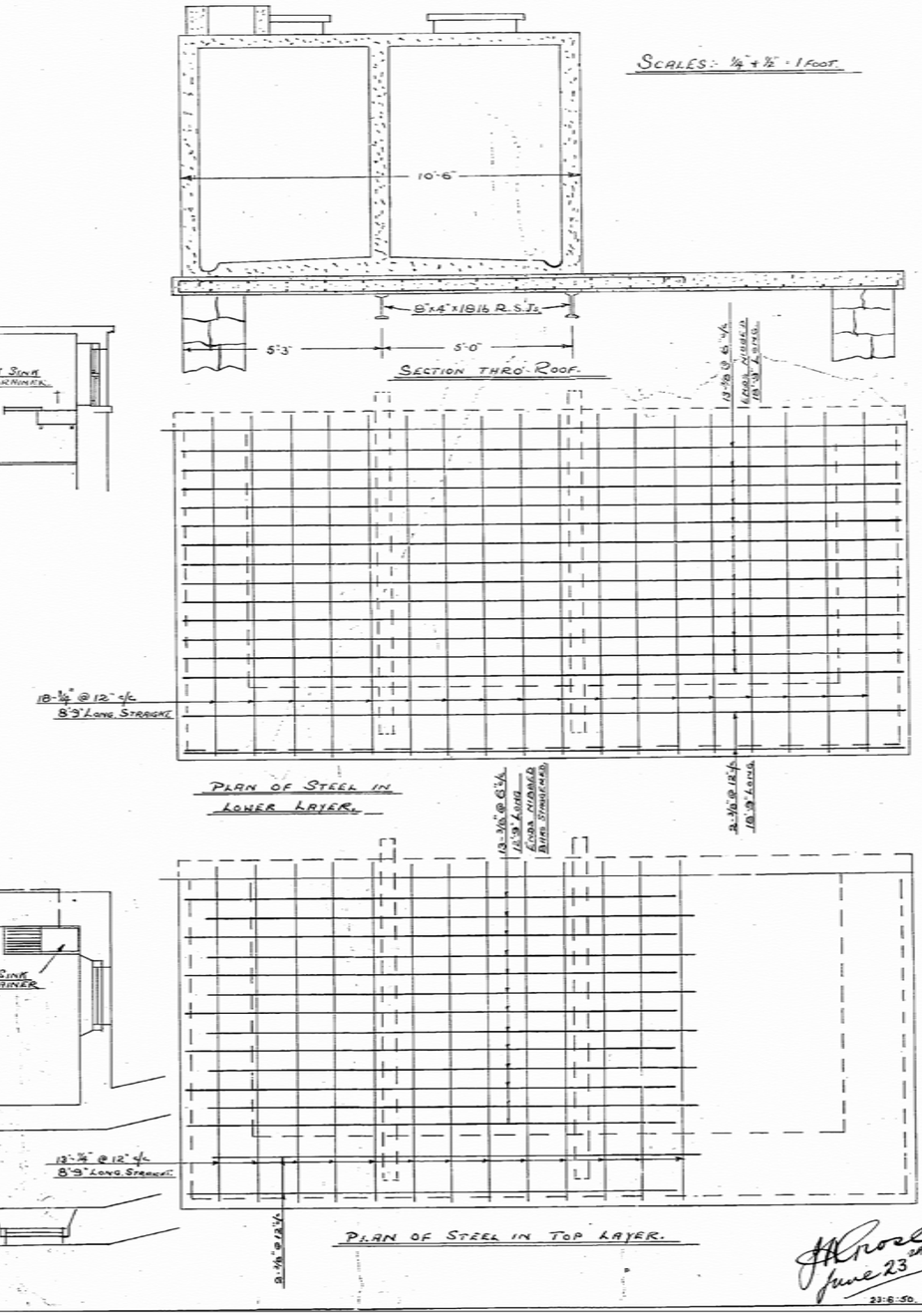
NEW ROOF & WATER TANK OVER WORKMENS' PANTRY.

DRG. NO:- 6362.



SECTION & PLAN TRACED FROM DRG. NO. 4489.





01
016

Archival drawing of plans and sections of the roof and water tank over the workmen's pantry (1950)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
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Design Team
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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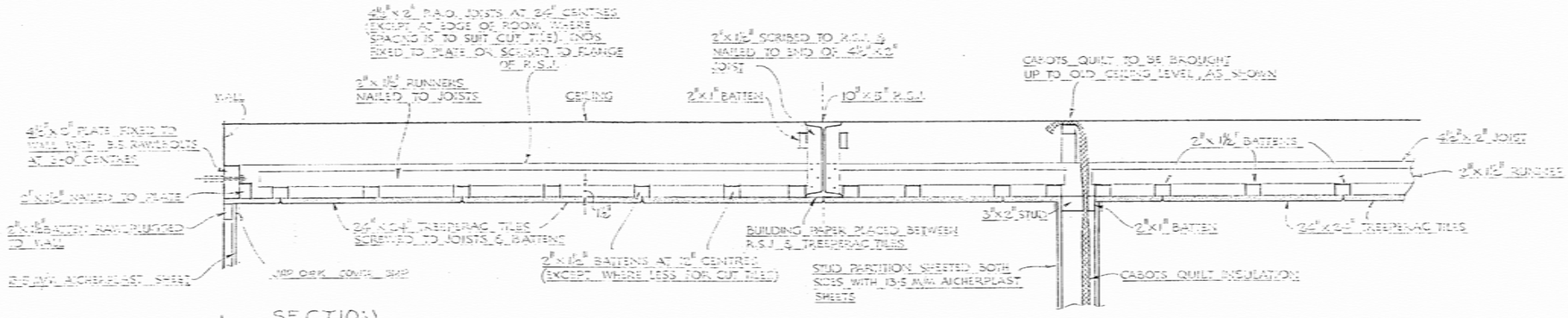
Drawing Title
Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

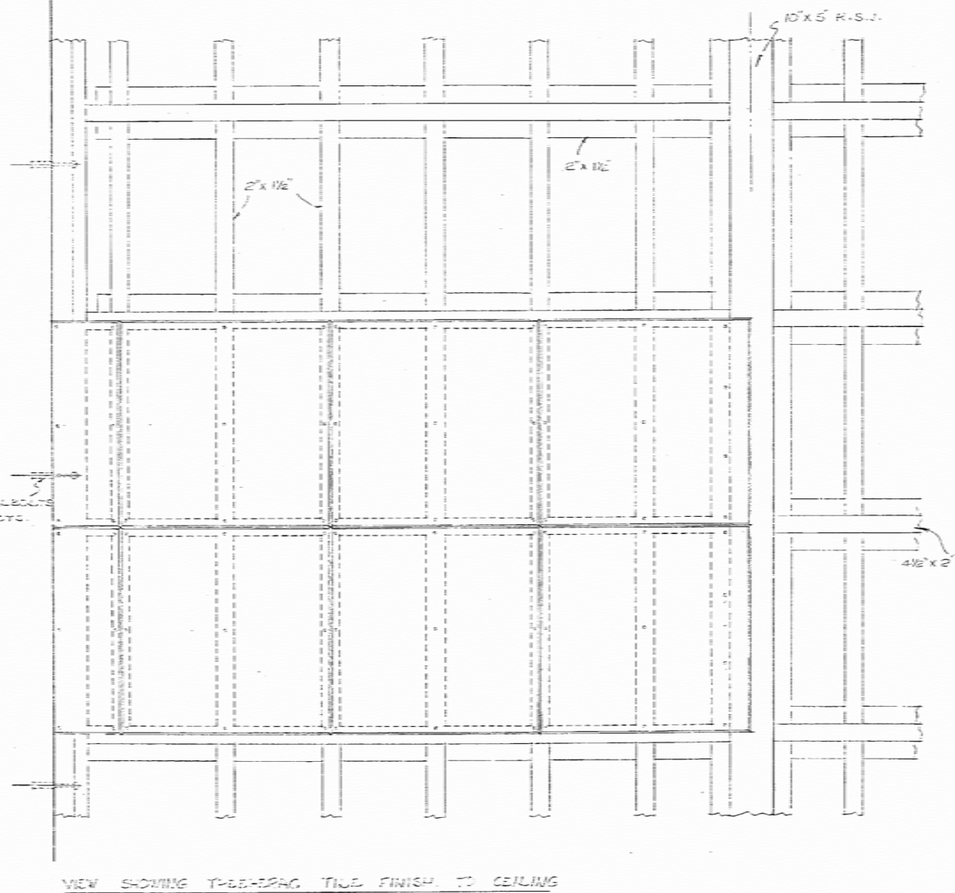
Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	016	

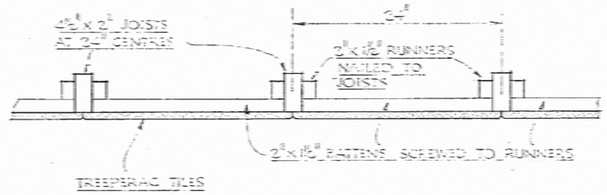
DRG. No. **9269.**



SECTION.



VIEW SHOWING TREEBRAC TILE FINISH TO CEILING



SECTION.

COMMISSIONERS OF IRISH LIGHTS		SCALE 1½" TO 1'-0"	
STATION	SKELLIGS ROCK.	DATE 28TH JUNE '65	
DRAWN	MODERNISATION	DRAWING No.	
CHECKED	DETAILS OF CEILING	9269.	
TRACED			
APPROVED			

REVISIONS		
	DATE	SIG.
1		

01
017

Archival drawing of details of ceiling (1965)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

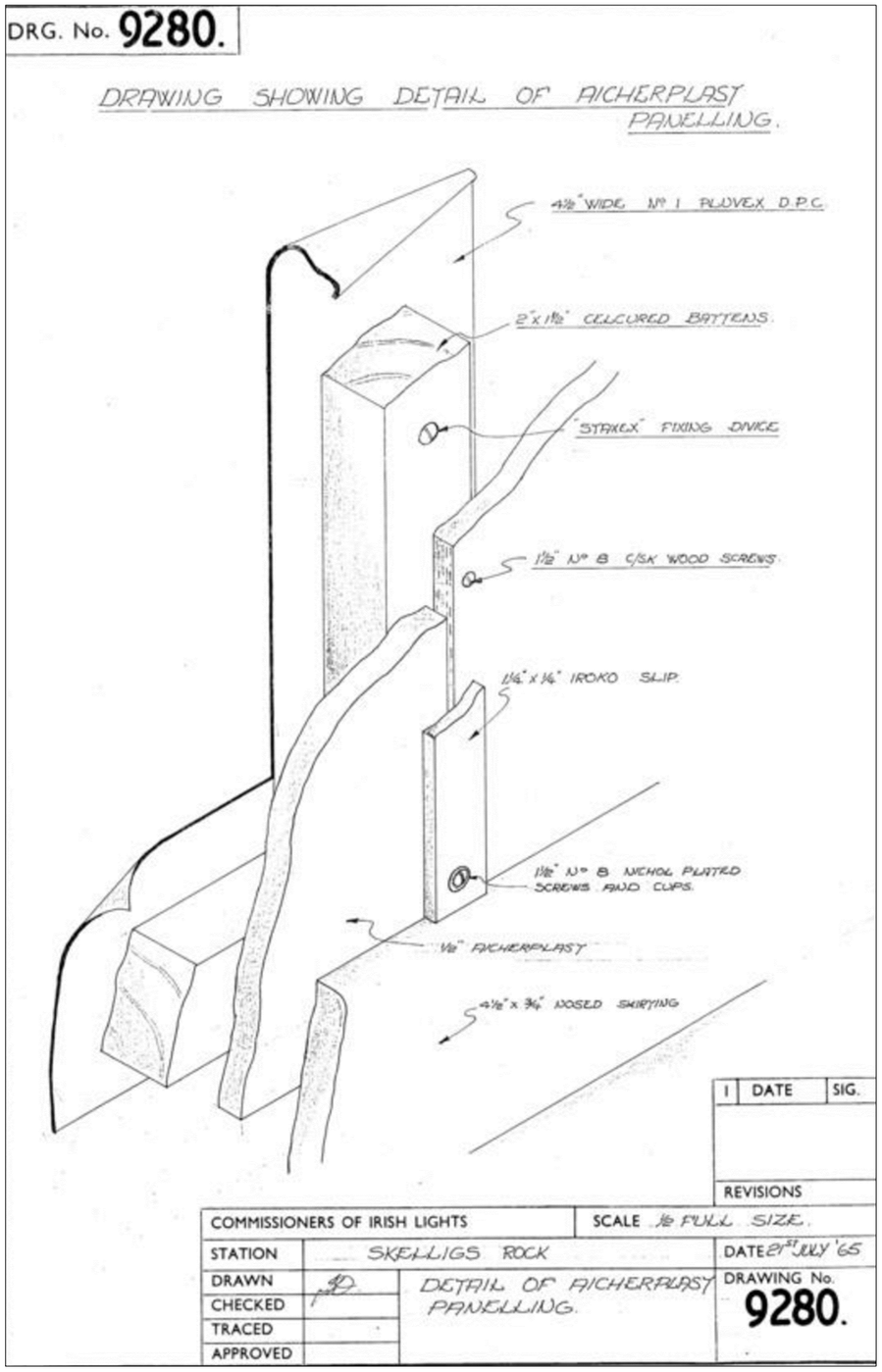
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

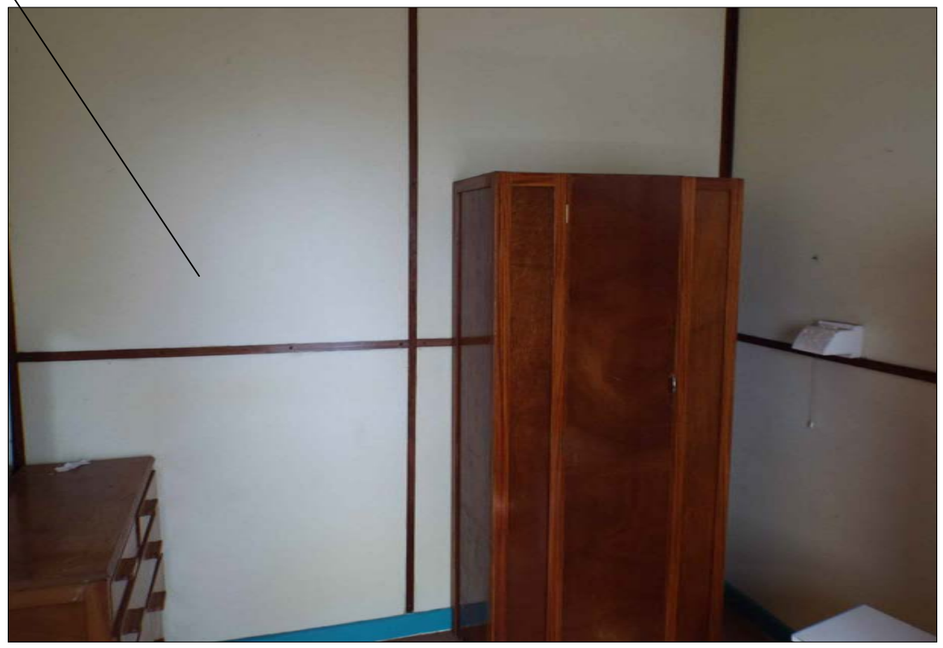
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	017	



01/018 Archival drawing of the detail of aicherplast panelling - Dry lining (1965)

Existing internal dry lining

02/018 Internal image showing the existing dry lining



03/018 Internal image showing the existing dry lining

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

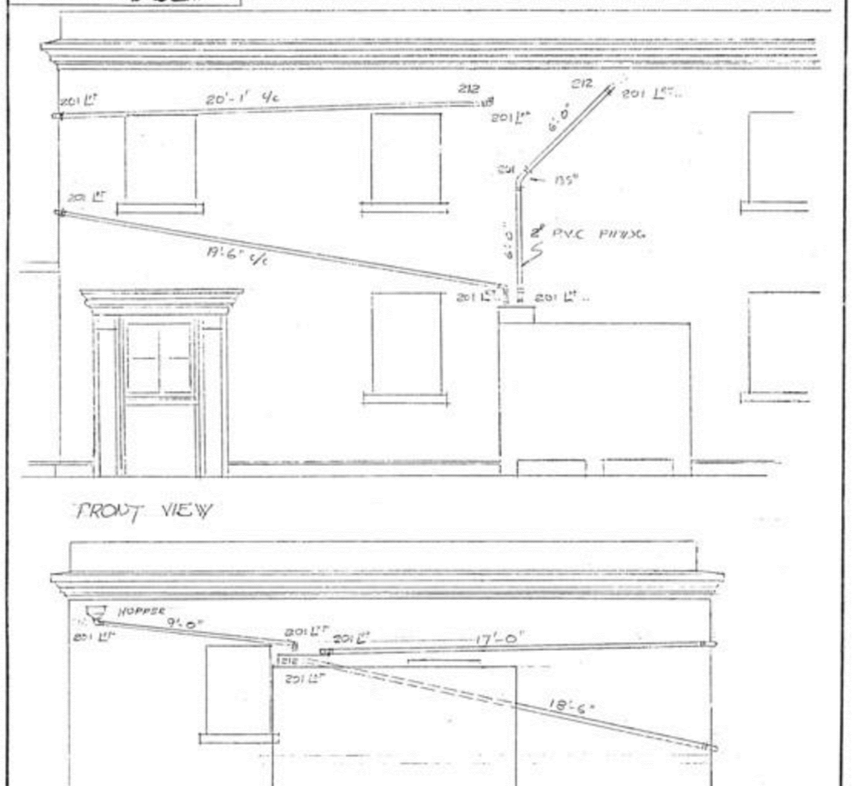
Drawing Title
Archive Drawings & Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	018	

DRG. No. 9321

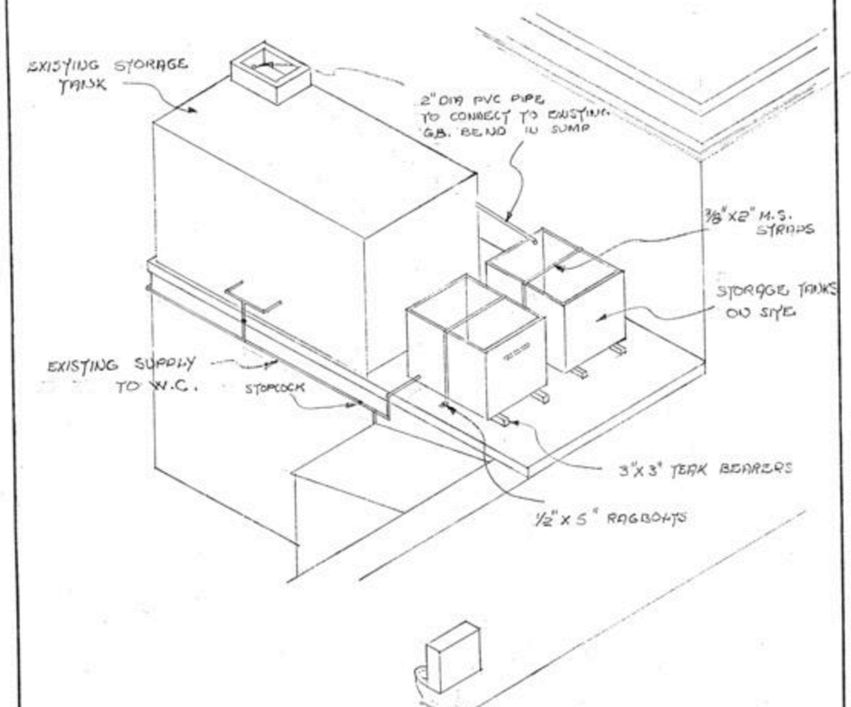


		1	DATE SIG.
			REVISIONS
COMMISSIONERS OF IRISH LIGHTS		SCALE NOT TO SCALE.	
STATION	SKELLIGS ROCK.		DATE 8/10/65.
DRAWN	J.B.	WATER CATCHMENT PIPES.	DRAWING No. 9321
CHECKED			
TRACED			
APPROVED			

01
019

Archival sketch of the water catchment pipes (1965)

DRG. No. 9343



MATERIALS:-

1 - 10'-0" 1/2" DIA COPPER PIPING.
4 - 3" x 3" TEAK BEARERS
2 - 3/8" x 2" M.S. STRAPS
4 - 1/2" x 5" RAGBOLTS
3 - 1/2" No 350 DISTANTOR COUPLES.
2 - 1/2" No 315 " BENDS.
1 - 1/2" No 318 " T-JOINT
1 - 1/2" No 367 " STOPCOCK.
1 - 12'-0" LONG 2" DIA P.V.C. PIPING.
1 - 6'-0" " 2" " " "
2 - No 201 P.V.C. BENDS
1 - No 212 F.I./P.V.C. COUPLG.
6 - No 240 2" DIA BRACKETS.

SKETCH SHOWING ARRANGEMENT OF STORAGE TANKS FOR WASTE SUPPLY TO W.C.

		1	DATE SIG.
			REVISIONS
COMMISSIONERS OF IRISH LIGHTS		SCALE NOT TO SCALE.	
STATION	SKELLIGS ROCK.		DATE 5/11/65
DRAWN	J.B.	WASTE SYSTEM TO W.C.	DRAWING No. 9343
CHECKED			
TRACED			
APPROVED			

02
019

Archival sketch of the arrangement of storage tanks for water supply to w.c. (1965)

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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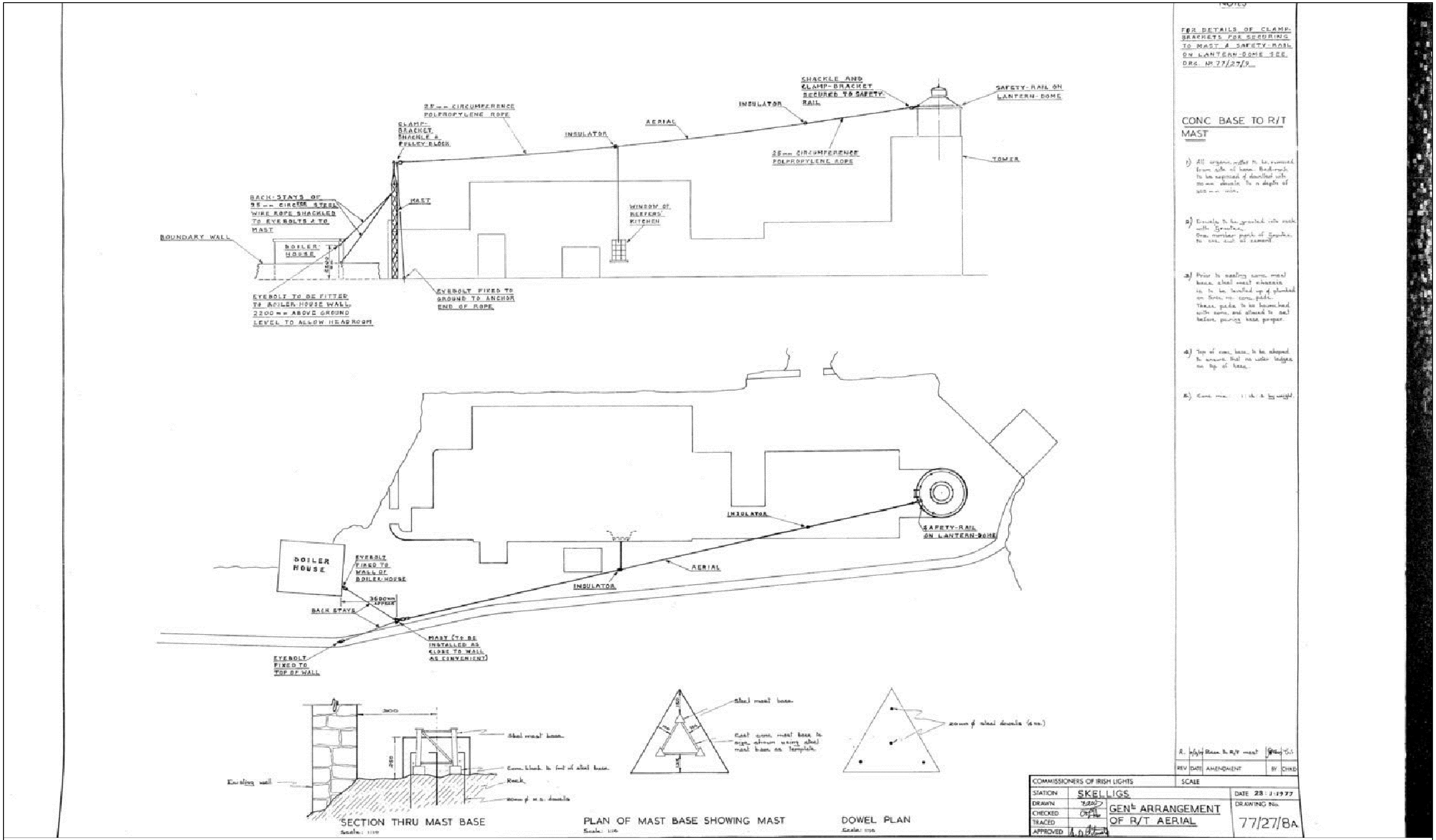
E		

Drawing Title
Archive Drawings

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

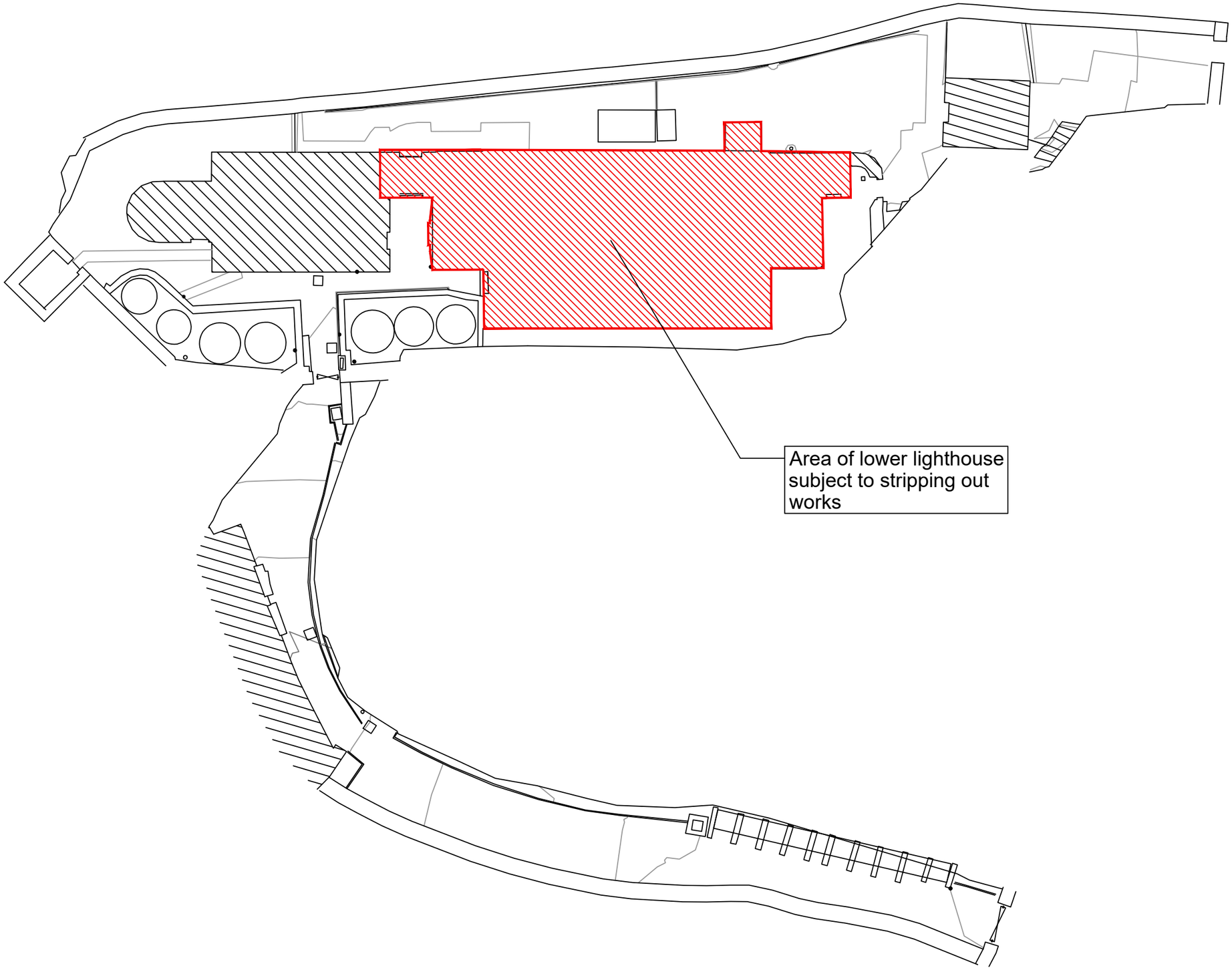
Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	019	



01
020
Archival drawings of the general arrangement of R/T aerial (1977)

Architectural Services	Principal Architect	Design Team		Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Arcihtect Grellan Rourke - Senior Architect Fergus McCormick - Conservation Architect Melissa Nicolas - Graduate Architect	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	Archive Drawings DRAWN MN / CHECKED F. McC / SCALE NTS / DATE 05 December 2018	Skellig Michael - Lower Lighthouse Consent Application PROJECT NO. SKE.01.2018 / STATUS CONSENT / NUMBER 020 / REV.



Legend

Area subject to consent

National Monument Details

Name : Skellig Michael

Address : Skellig Michael, Co. Kerry.

Nat. Grid Ref. : E 425425, N 560211

SITE PLAN
SCALE 1:200 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

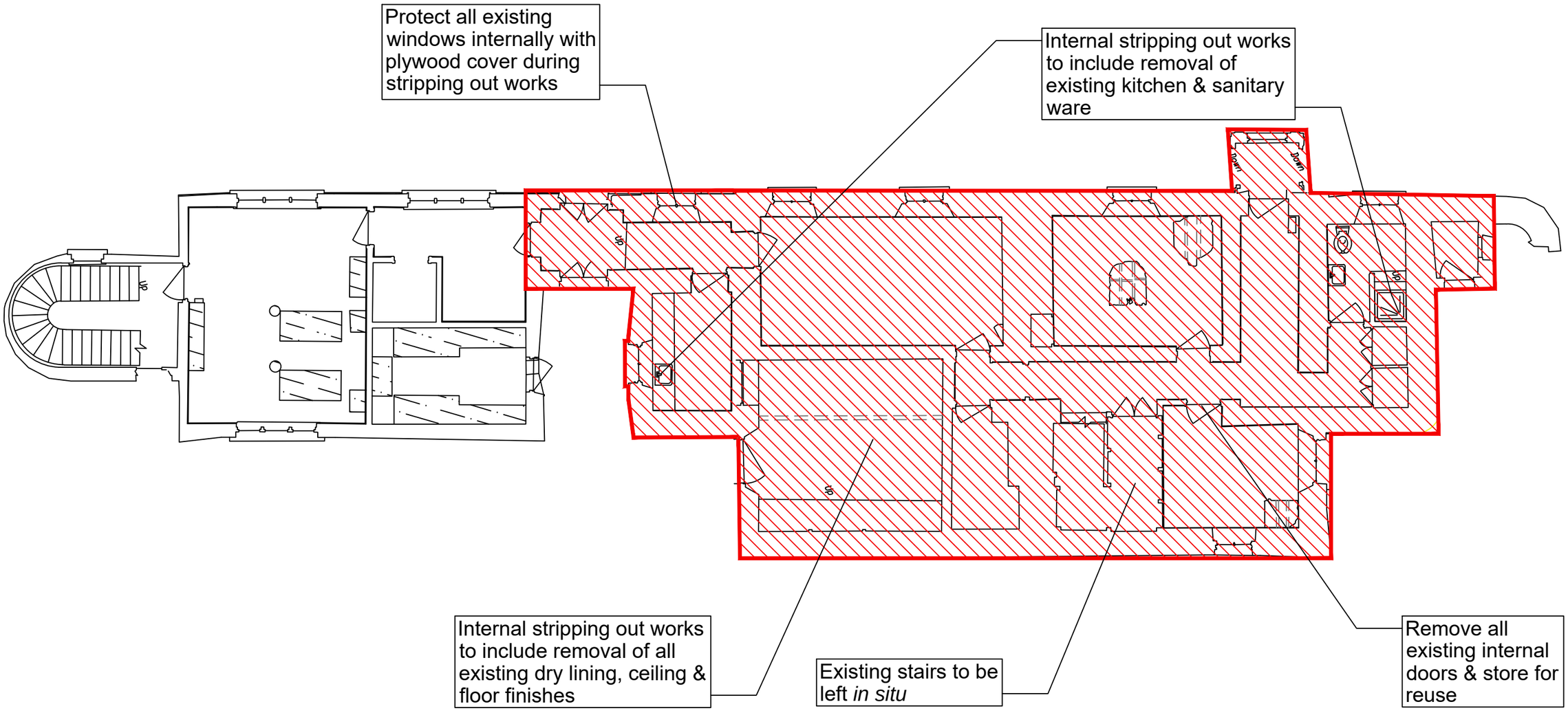
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: Site Plan

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	1:200	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	021	



GROUND FLOOR PLAN
SCALE 1:100 @ A3

Legend	National Monument Details
Area subject to consent	Name : Skellig Michael Address : Skellig Michael, Co. Kerry. Nat. Grid Ref. : E 425425, N 560211

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

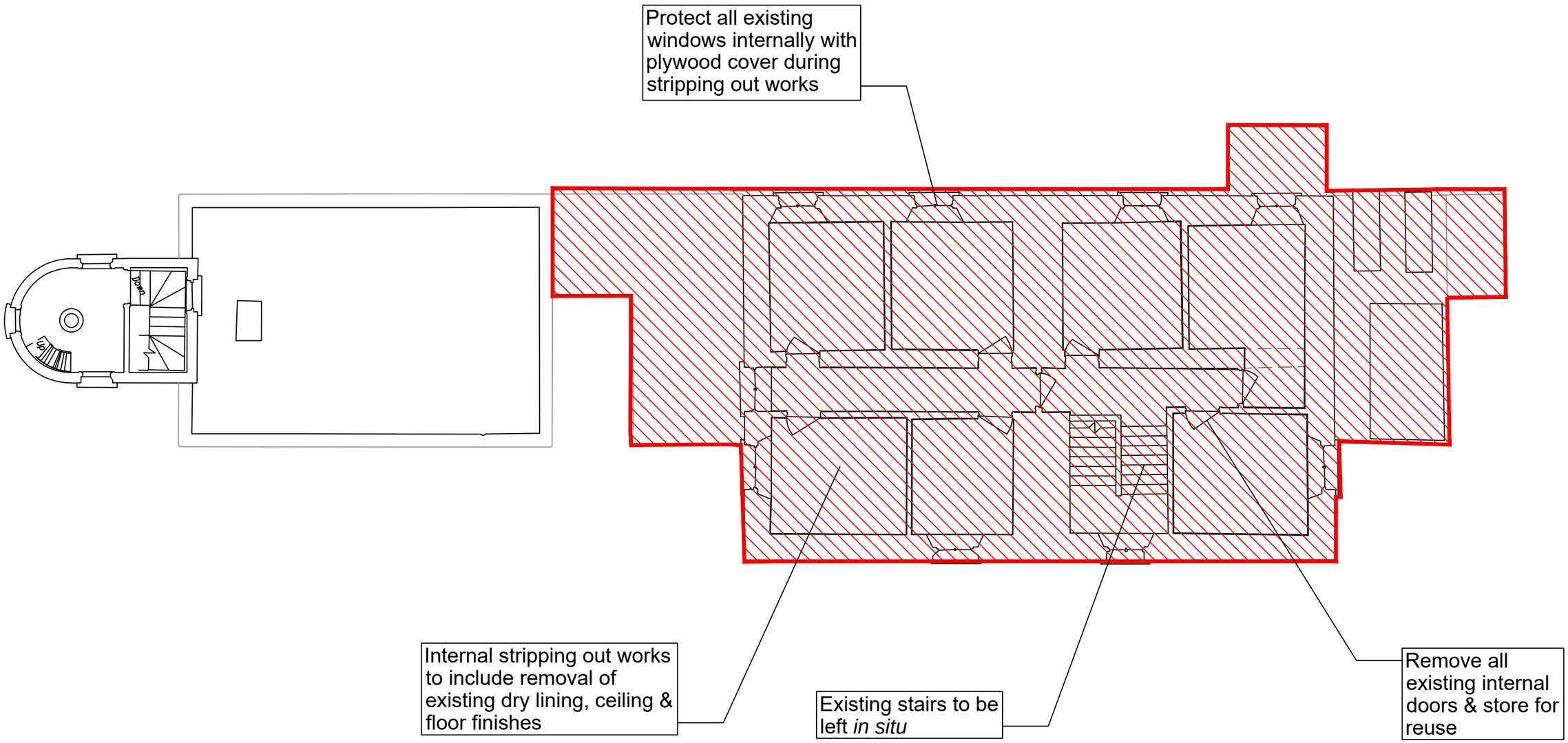
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: Ground Floor Plan

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	1:100	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	022	



FIRST FLOOR PLAN
SCALE 1:100 @ A3

Legend	National Monument Details
Area subject to consent	Name : Skellig Michael Address : Skellig Michael, Co. Kerry. Nat. Grid Ref. : E 425425, N 560211

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

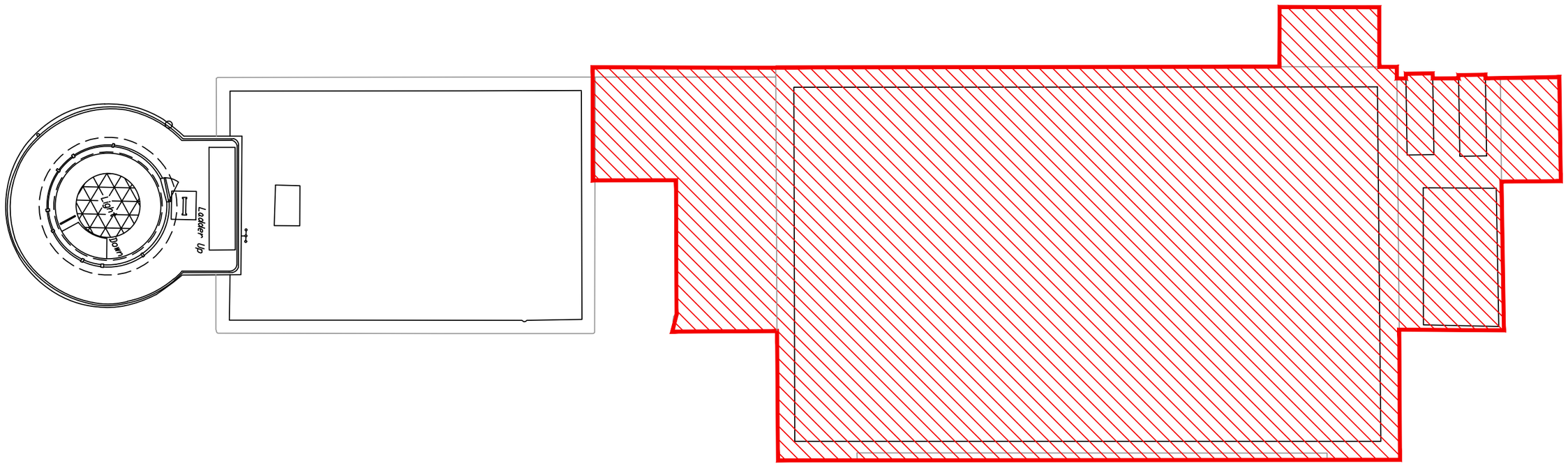
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: First Floor Plan

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	1:100	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	023	



SECOND FLOOR PLAN
SCALE 1:100 @ A3

Legend	National Monument Details
Area subject to consent	Name : Skellig Michael Address : Skellig Michael, Co. Kerry. Nat. Grid Ref. : E 425425, N 560211

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

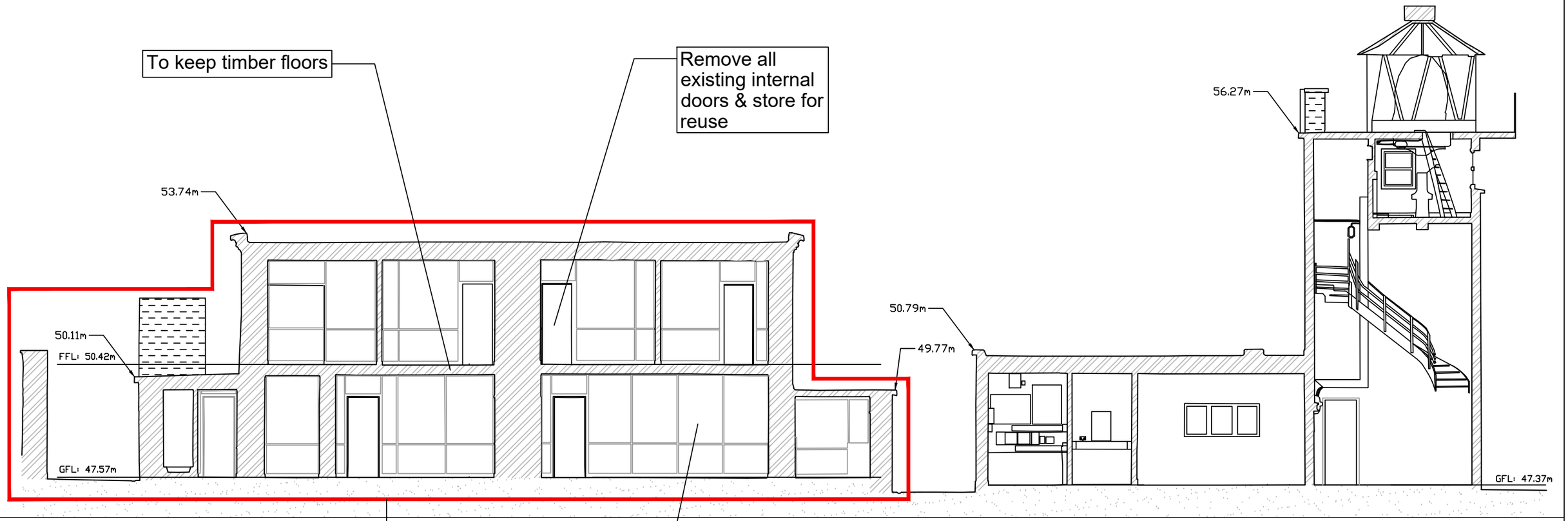
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title
Second Floor Plan

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	1:100	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

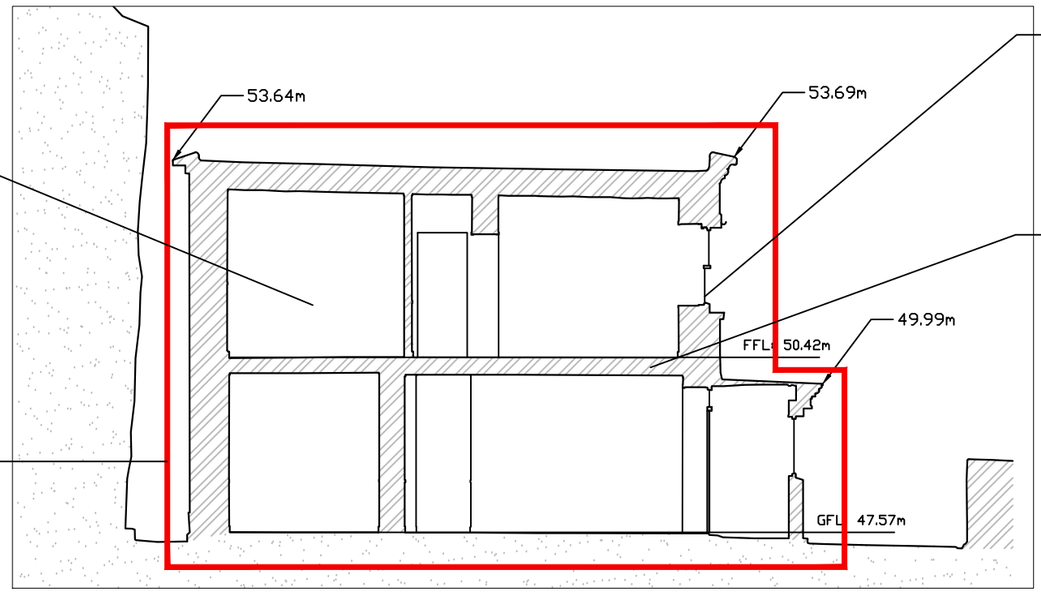
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	024	

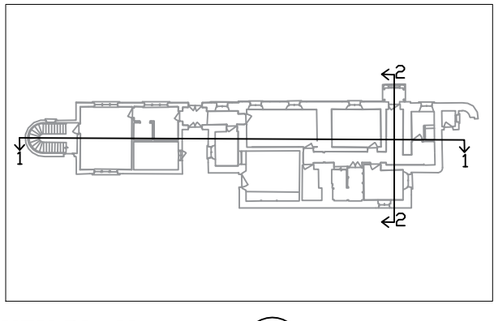


SECTION 1-1
SCALE 1:100 @ A3

Internal stripping out works to include removal of existing dry lining, ceiling & floor finishes

Area of lower lighthouse subject to stripping out works





KEY PLAN
SCALE 1:500 @ A3

SECTION 2-2
SCALE 1:100 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
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Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

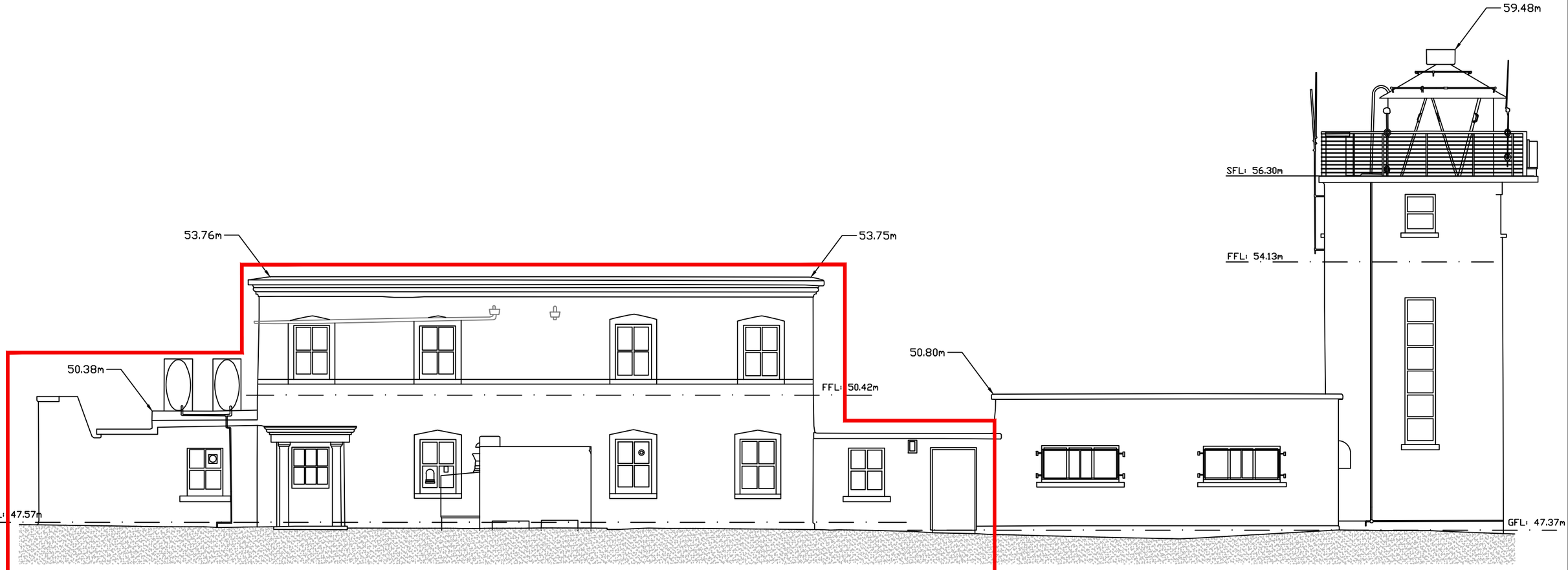
Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

Drawing Title
Sections

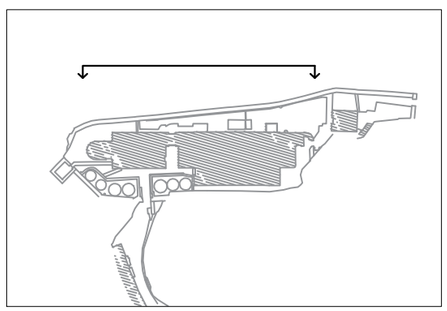
DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	025	



NORTH ELEVATION
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:1000 @ A3

Area of lower lighthouse subject to stripping out works

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
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D
E

Drawing Title
North Elevation

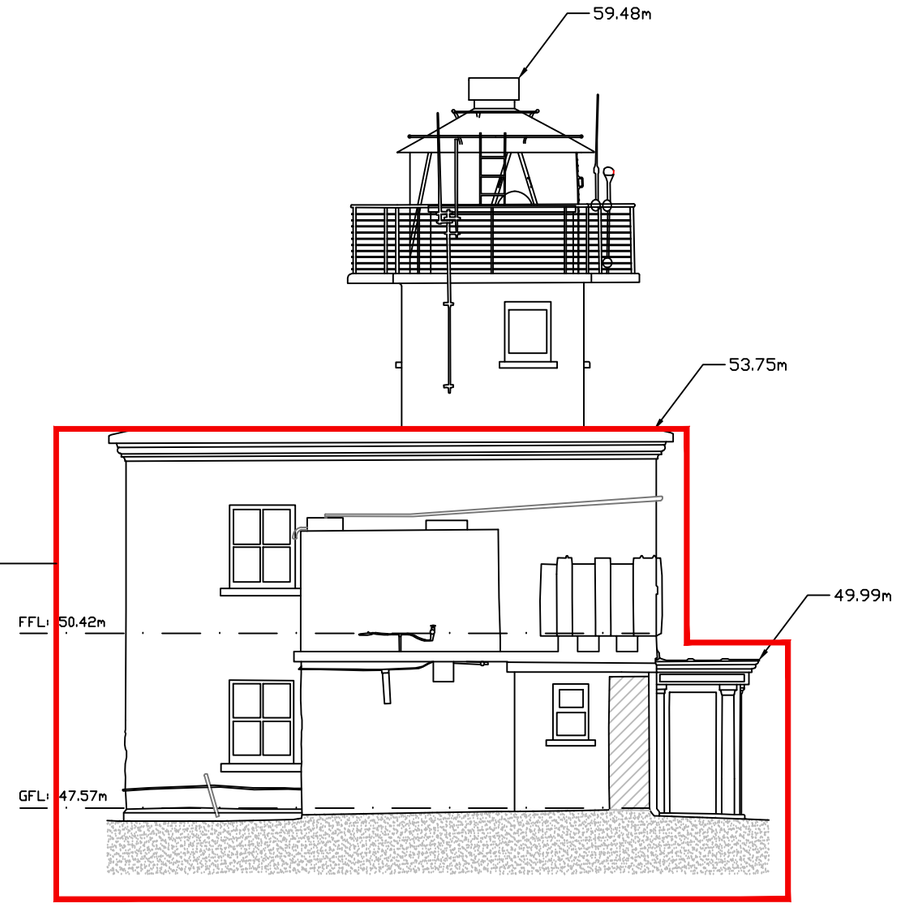
DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	026	

Area of lower lighthouse subject to stripping out works

KEY PLAN
SCALE 1:1000 @ A3



EAST ELEVATION
SCALE 1:100 @ A3

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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D		
E		

Drawing Title

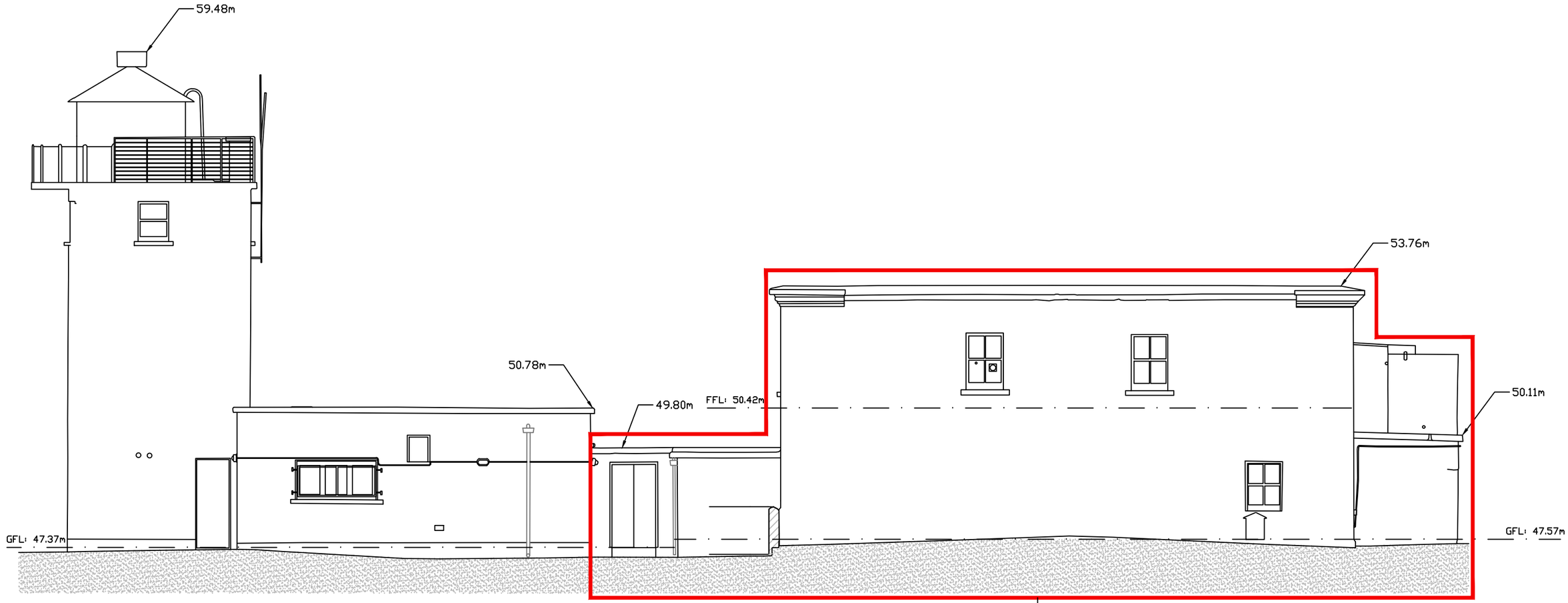
East Elevation

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

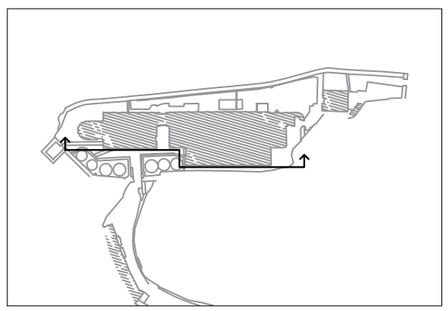
Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	027	



SOUTH ELEVATION
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:1000 @ A3

Area of lower lighthouse subject to stripping out works

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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C		
D		
E		

Drawing Title

South Elevation

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

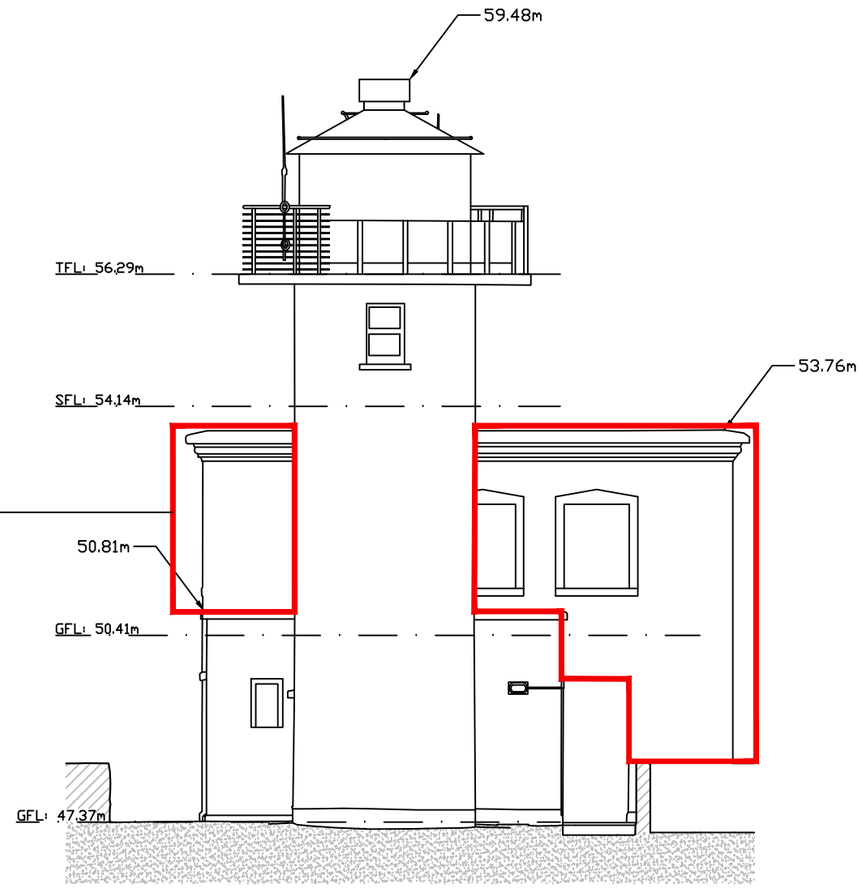
Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	028	

Area of lower lighthouse subject to stripping out works

KEY PLAN
SCALE 1:1000 @ A3



WEST ELEVATION
SCALE 1:100 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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C		
D		
E		

Drawing Title
West Elevation

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	Varies	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	029	

01/030 Drone image showing the context of the lower lighthouse and upper lighthouse along with the road connecting them

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

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John Cahill - Assistant Principal Arcihtect
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
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E		

Drawing Title: Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	030	

01
031

Drone image showing the lower lighthouse and upper lighthouse along with the remains of the explosive fog signal located in between

OPW
The Office of Public Works
Oifig na nOibreacha Poiblí

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title
Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title
Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	031	

01
032

Image showing the existing lower lighthouse compound from the upper lighthouse road

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title

Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	032	

01
033

Image showing the existing lower lighthouse compound

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

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Architectural Services
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Facsimile: (046) 9438409

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Drawing Title

Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	033	

01
034

Image showing the existing lower lighthouse compound

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
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Telephone: (046) 9426466
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Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	034	

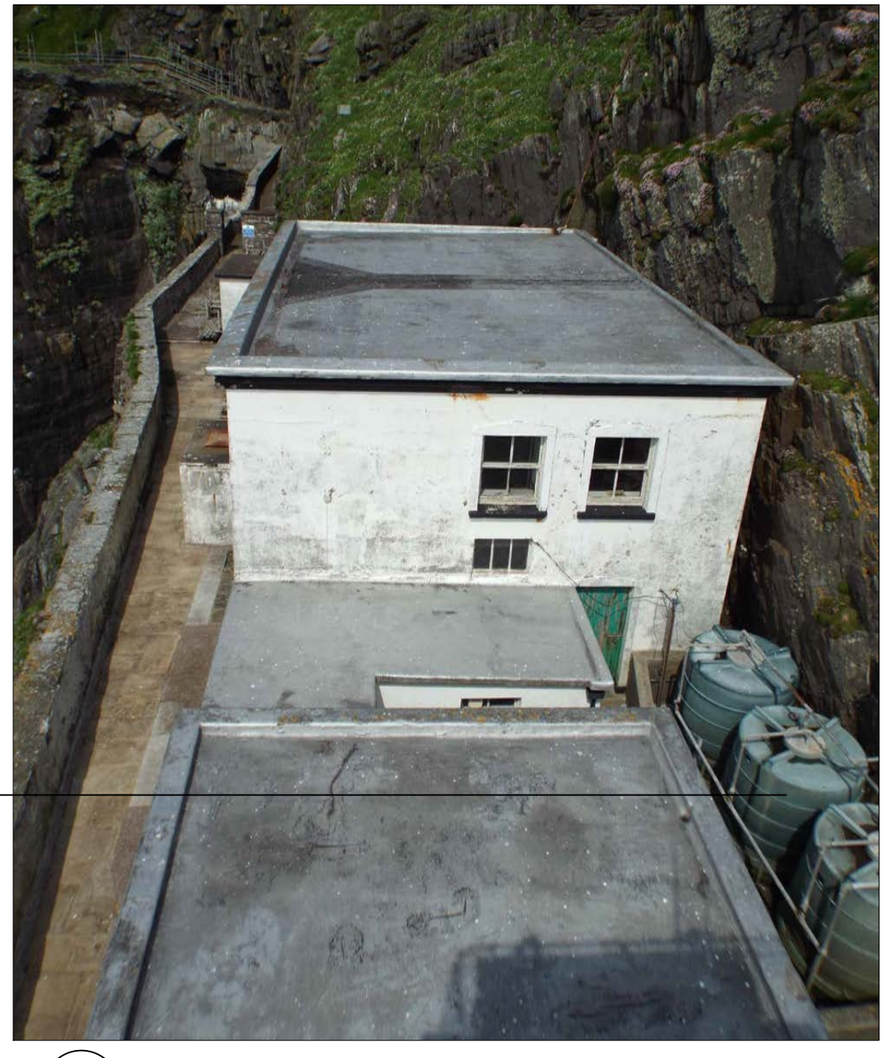
01
035

Image showing the main entrance to the lower lighthouse

02
035

Image showing the tanks on the ground floor level of the lower lighthouse

Existing oil tanks to be left *in situ*



03
035

Image showing the flat rooftop of the current lower lighthouse

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Existing Images

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MN	F. McC	NTS	05 December 2018

Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	035	

Internal stripping out works to include removal of existing dry lining, ceiling & floor finishes

Protect all existing windows internally with plywood cover during stripping out works

Remove existing fixtures & fittings

01/036 Image showing a room located on the ground floor of the lower lighthouse

02/036 Image showing a room located on the ground floor of the lower lighthouse

Internal stripping out works to include removal of existing kitchen

Remove all existing radiators, pipework & electrical wiring

Existing stairs to be left *in situ*

Remove existing floor tile

03/036 Image showing the kitchen located on the ground floor of the lower lighthouse

04/036 Image showing the hallway on the ground floor of the lower lighthouse

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
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Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title: Existing Images

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MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	036	

Internal stripping out works to include removal of existing dry lining, ceiling & floor finishes

Remove all existing internal doors & store for reuse

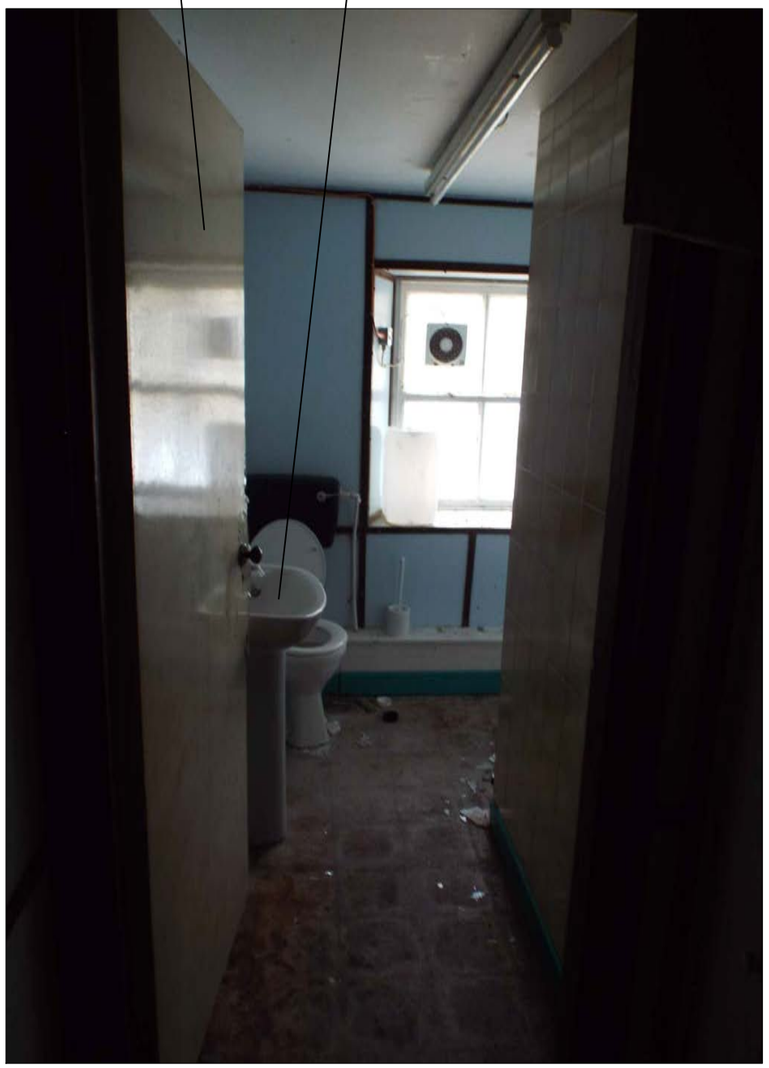
Internal stripping out works to include removal of existing sanitary ware

Protect all existing windows internally with plywood cover during stripping out works

Existing stairs to be left *in situ*

01
037

Image showing the kitchen on the ground floor of the lower lighthouse



02
037

Image showing the toilet on the ground floor of the lower lighthouse

03
037

Image showing the staircase inside the lower lighthouse

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
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CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
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Design Team

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Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title

Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

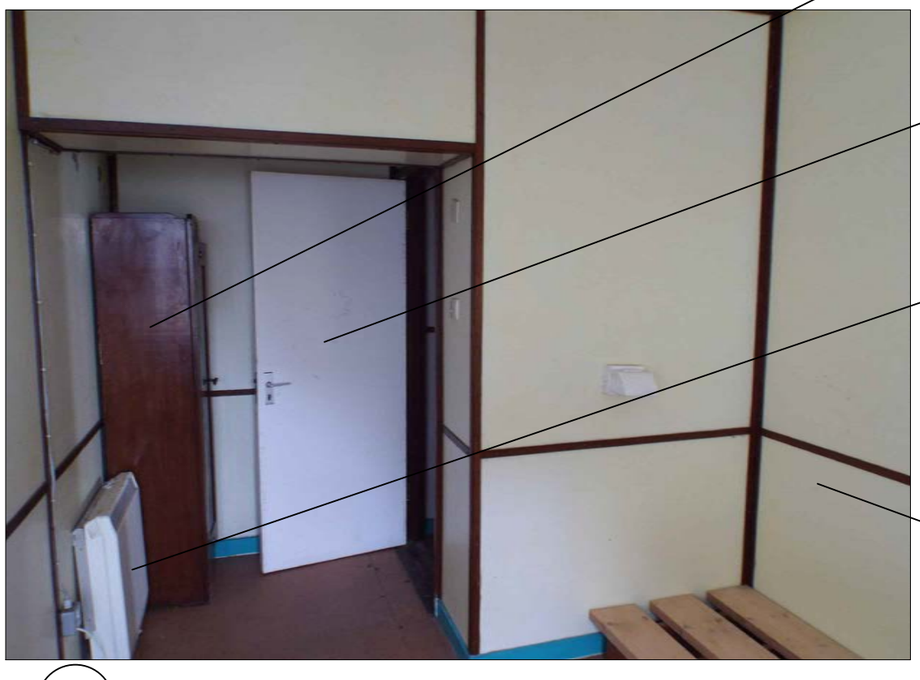
Project Title

Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	037	

Existing engines to be left *in situ*

01/038 Image showing the engine room located on the ground floor of the lower lighthouse



Remove existing fixtures & fittings

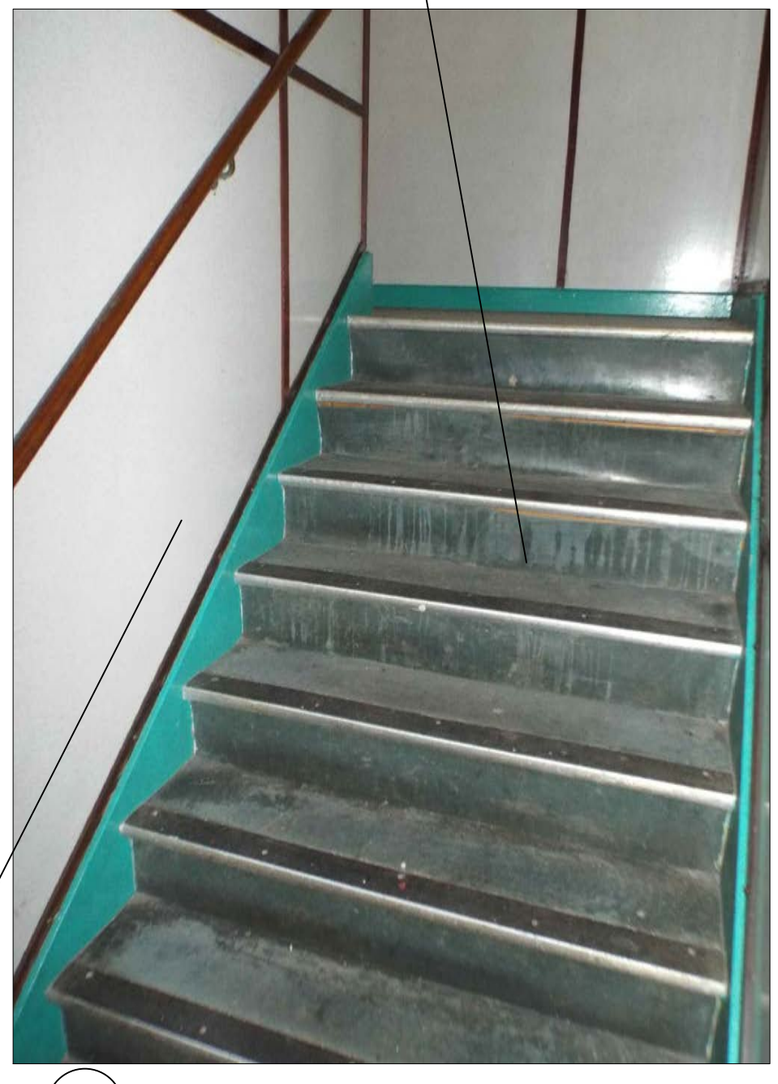
Remove all existing internal doors & store for reuse

Remove all existing radiators, pipework & electrical wiring

Internal stripping out works to include removal of existing dry lining, ceiling & floor finishes

02/038 Image showing a room on the first floor of the lower lighthouse

Existing stairs to be left *in situ*



03/038 Image showing the existing staircase inside the lower lighthouse building

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title: Existing Images

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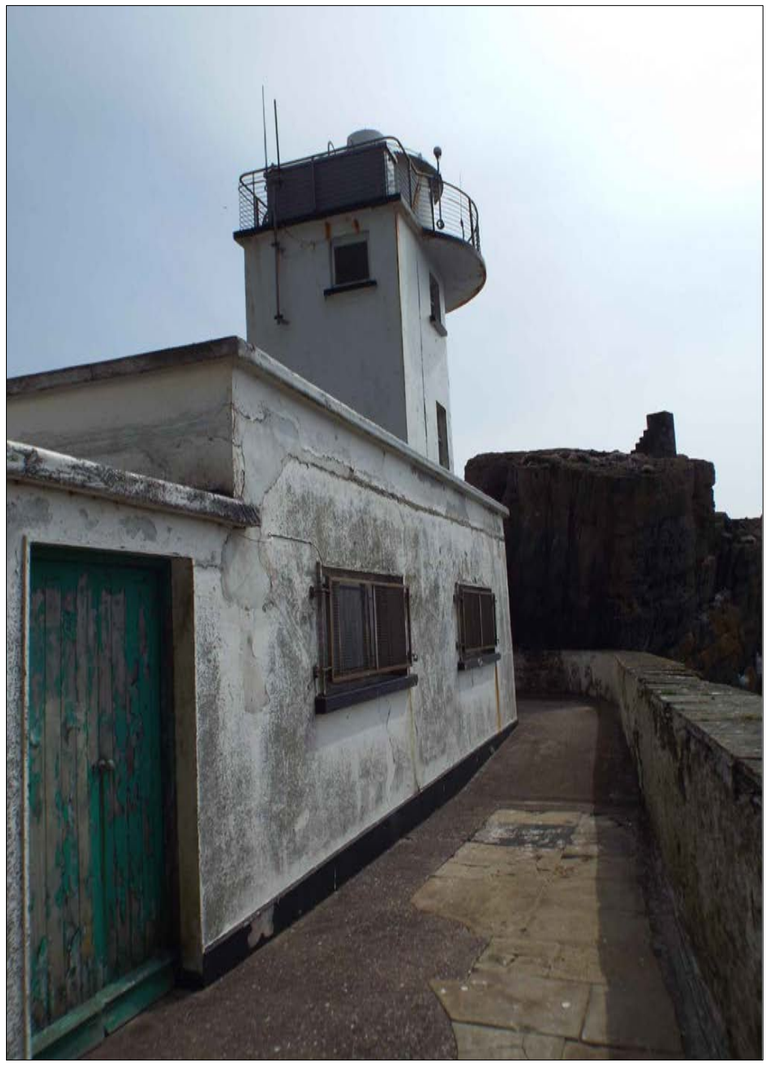
MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse Consent Application

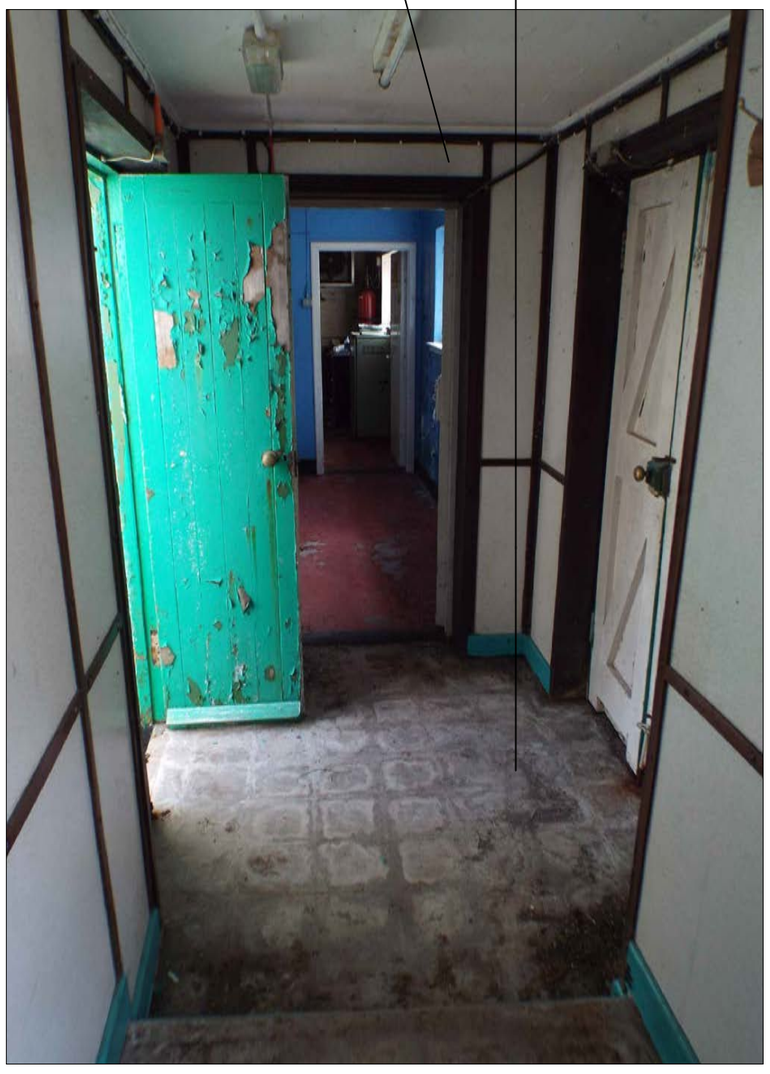
PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	038	

Internal stripping out works to include removal of existing dry lining, ceiling & floor finishes

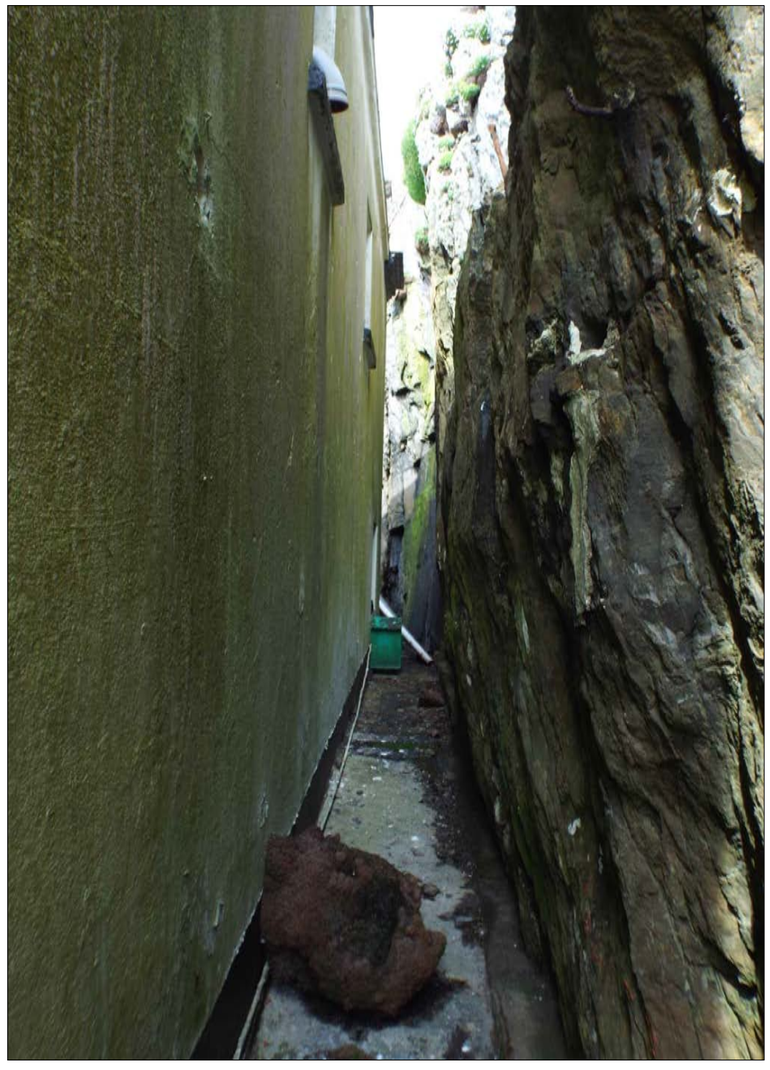
Remove existing floor tile



01/039 Image showing the current lantern of the lower lighthouse



02/039 Image showing the north west entrance to the lower lighthouse



03/039 Image showing the passage on the back of the lower lighthouse

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
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Grellan Rourke - Senior Architect
Fergus McCormick - Conservation Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title: Existing Images

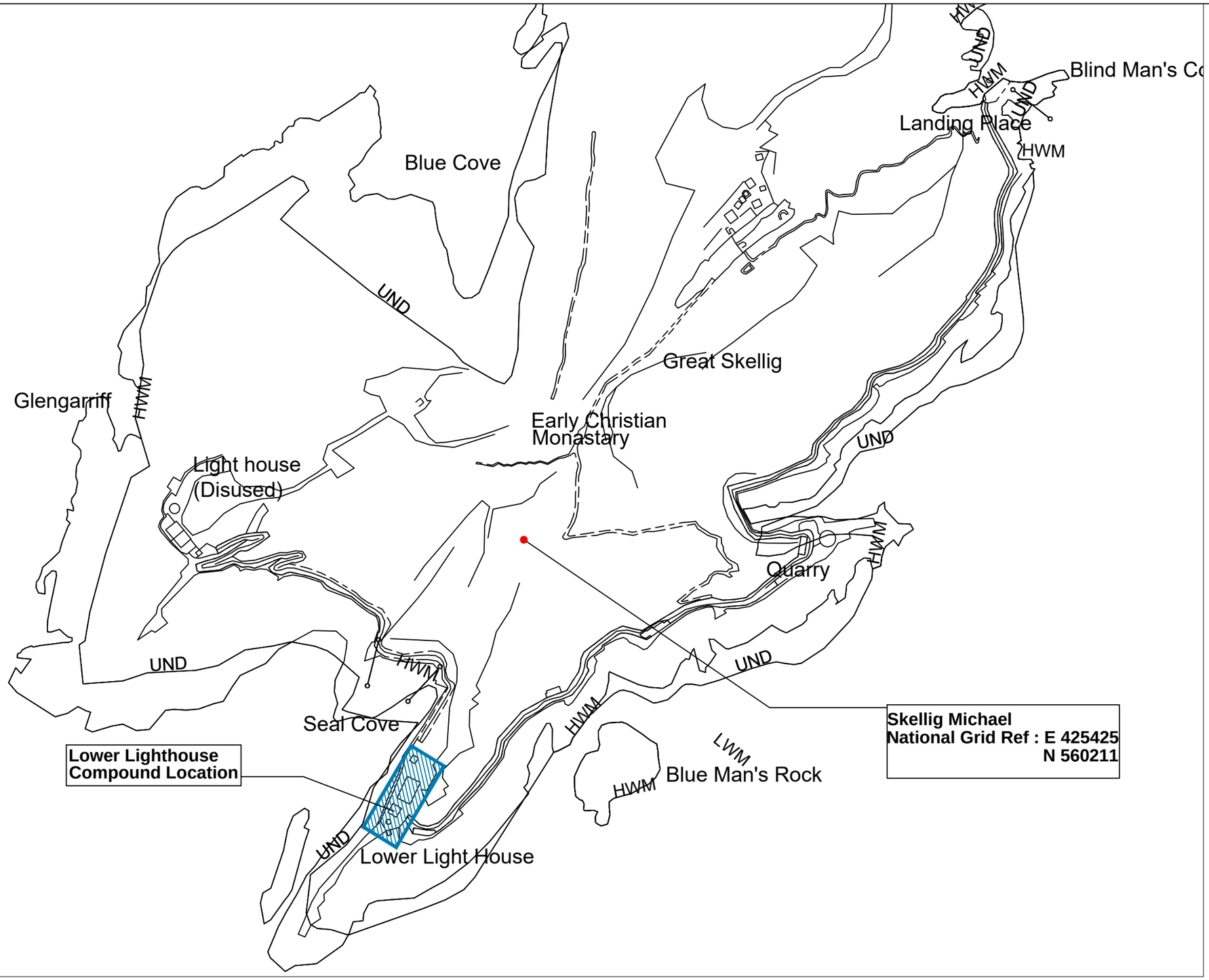
DRAWN	CHECKED	SCALE	DATE
MN	F. McC	NTS	05 December 2018

Project Title: Skellig Michael - Lower Lighthouse
Consent Application

PROJECT NO.	STATUS	NUMBER	REV.
SKE.01.2018	CONSENT	039	

Appendix D

Consent Application Drawings - Engine House



Legend

Area subject to Consent

National Monument Details

Name : Skellig Michael
Address : Skellig Michael, Co. Kerry.
RMP No. : KE104A001
Nat. Grid Ref. : E 425425, N 560211

OSI SITE LOCATION MAP
SCALE 1:2500 @ A3

O.S. Map Ref : 7099
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Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

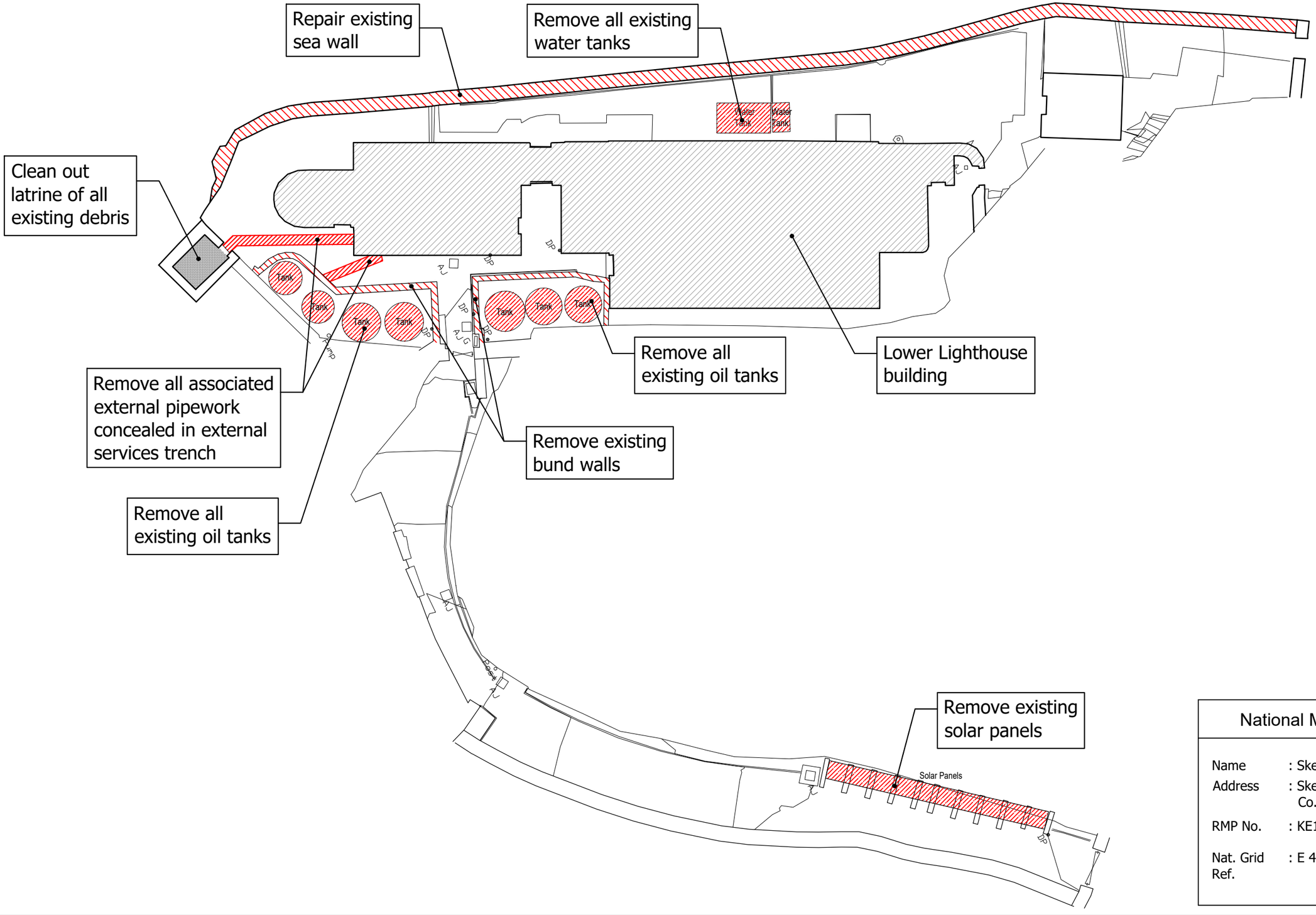
Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: OSI Site Location Map
DRAWN: MN | CHECKED: FMC | SCALE: 1:2500 @ A3 | DATE: 8 January 2020

Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out
PROJECT NO. | STATUS: CONSENT | NUMBER: 001 | REV.



National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

SITE PLAN
SCALE 1:200 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
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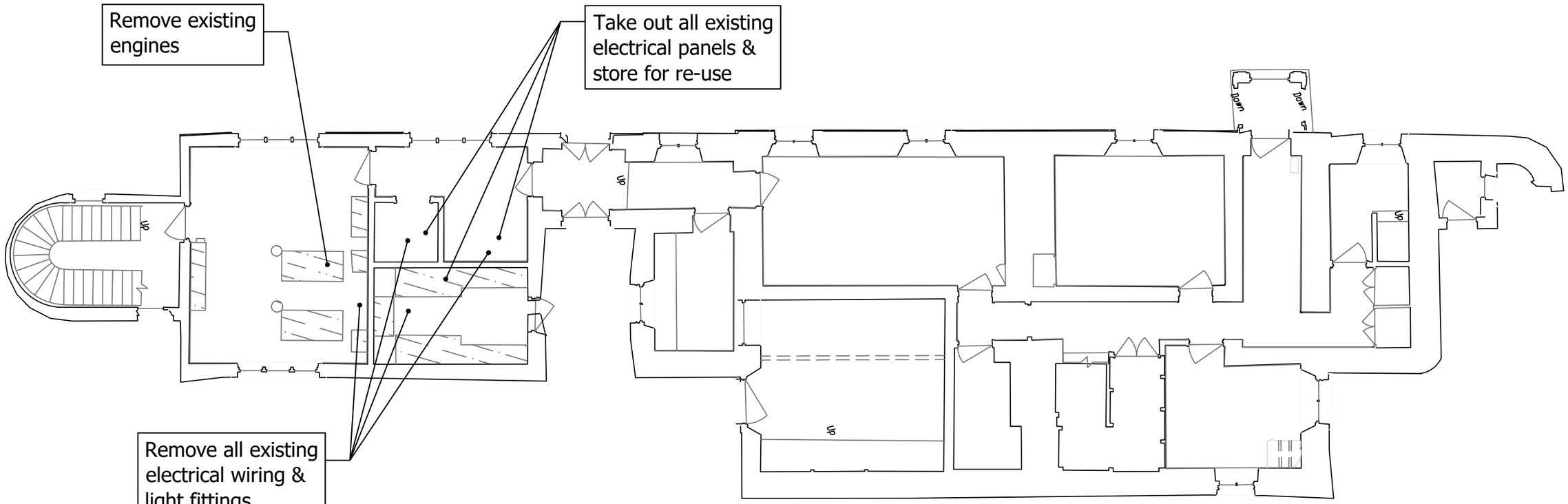
C		
D		
E		

Drawing Title: Site Plan

DRAWN	CHECKED	SCALE	DATE
MN	FMC	1:200 @ A3	8 January 2020

Project Title: Skellig Michael - Lower Lighthouse External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	002	



National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

GROUND FLOOR PLAN
SCALE 1:100 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

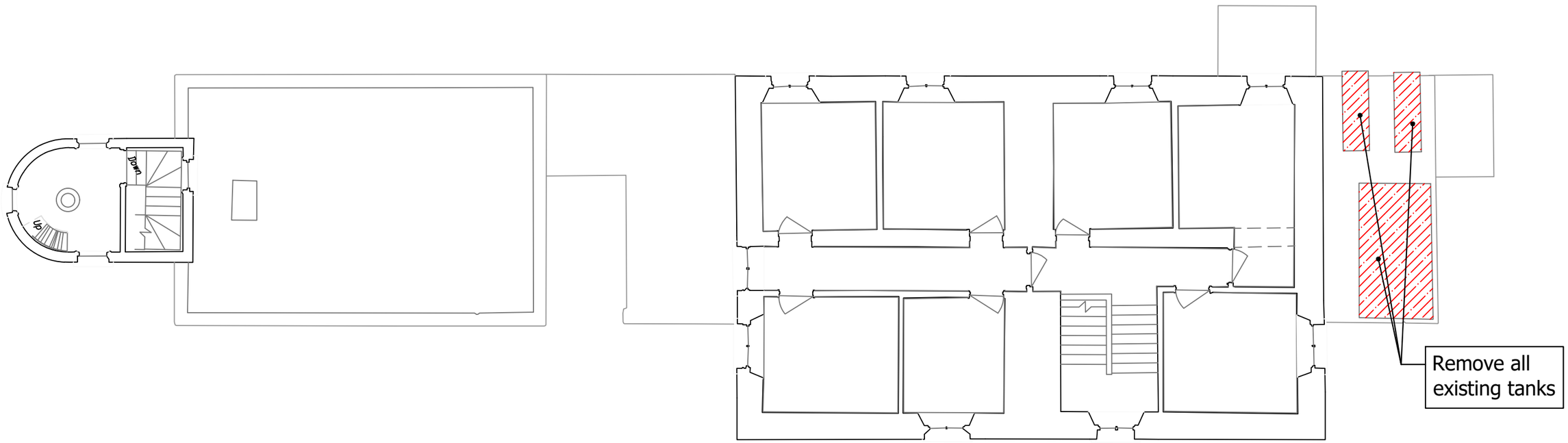
REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

Drawing Title: Ground Floor Plan

DRAWN	CHECKED	SCALE	DATE
MN	FMC	1:100 @ A3	8 January 2020

Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	003	



National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

FIRST FLOOR PLAN
SCALE 1:100 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
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John Cahill - Assistant Principal Arcihtect
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Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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A		
B		
C		
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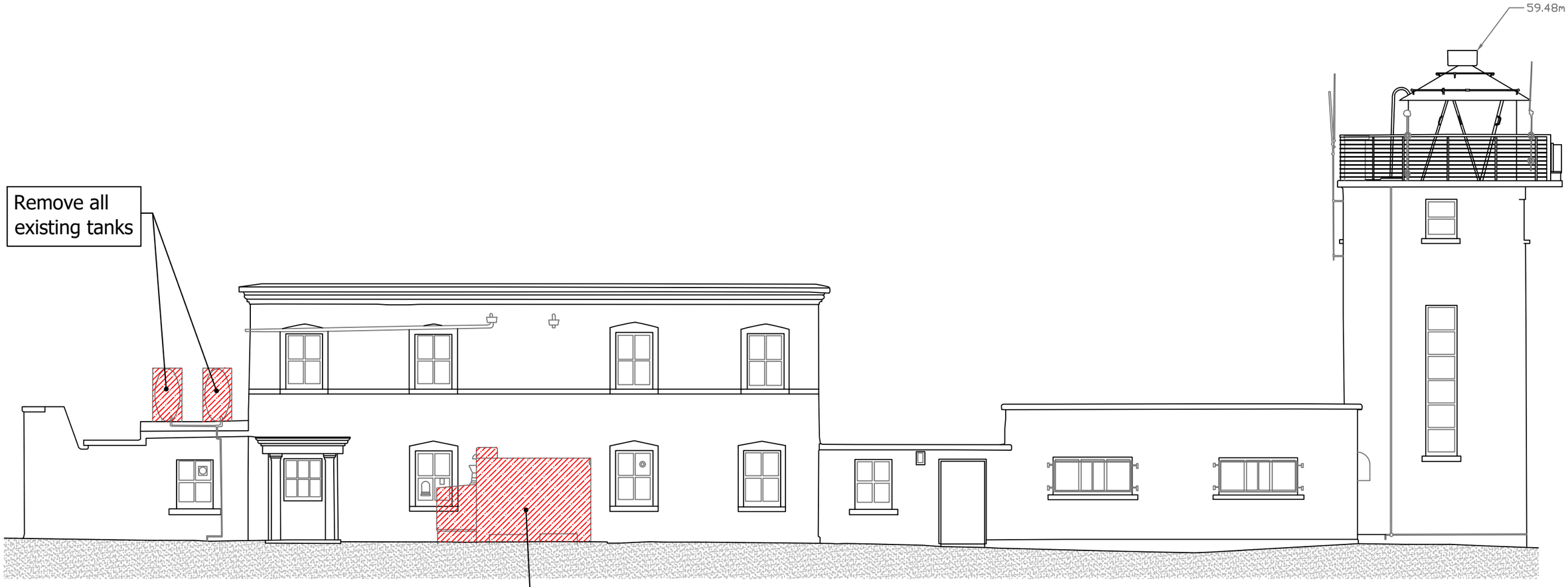
E		

Drawing Title
First Floor Plan

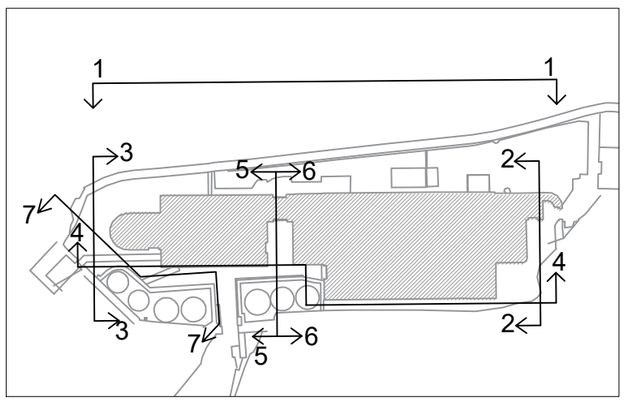
DRAWN	CHECKED	SCALE	DATE
MN	FMC	1:100 @ A3	8 January 2020

Project Title
Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	004	



ELEVATION 1
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:500 @ A3

National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
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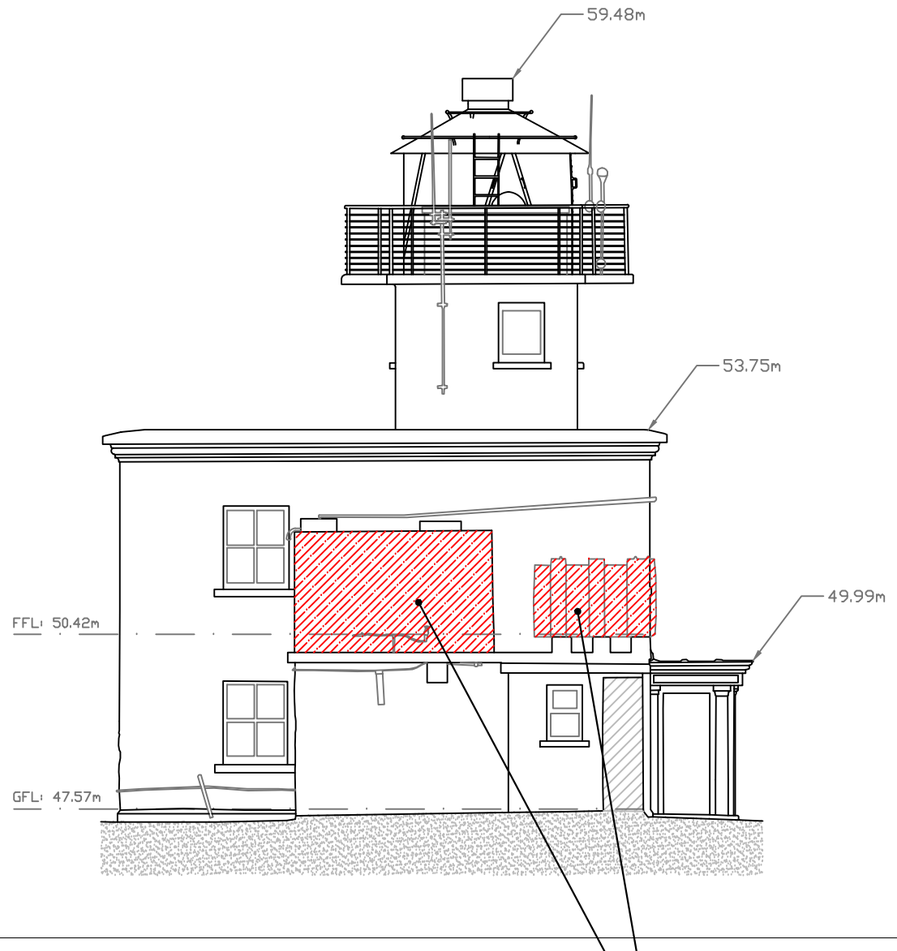
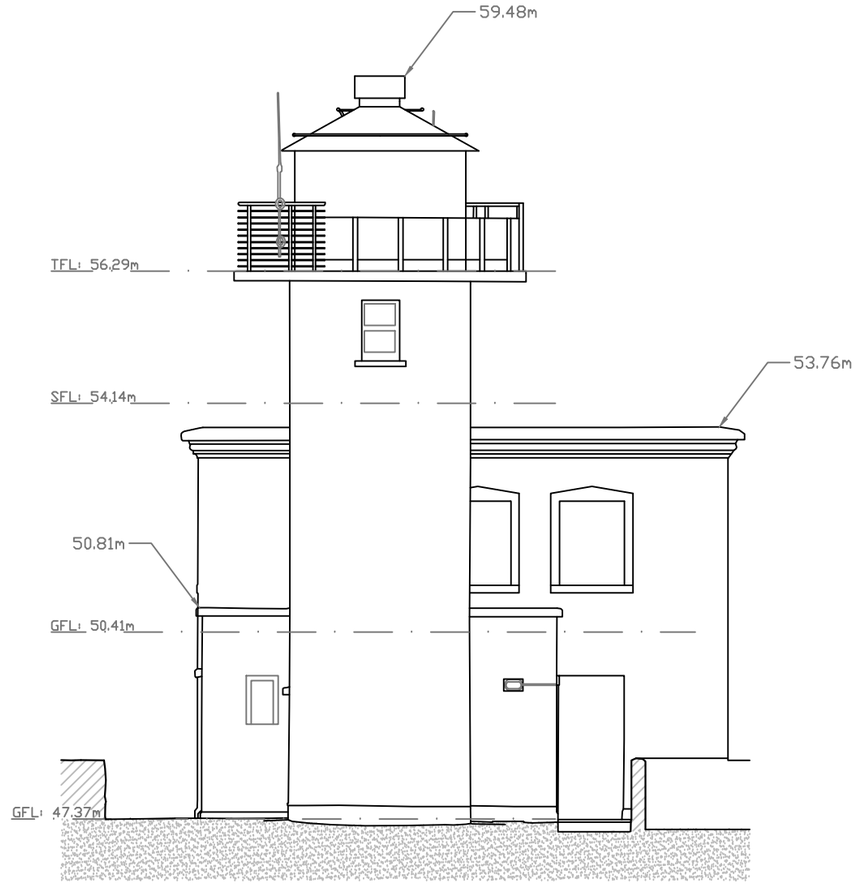
E

Drawing Title
Elevations
DRAWN MN | CHECKED FMC | SCALE Varies @ A3 | DATE 8 January 2020

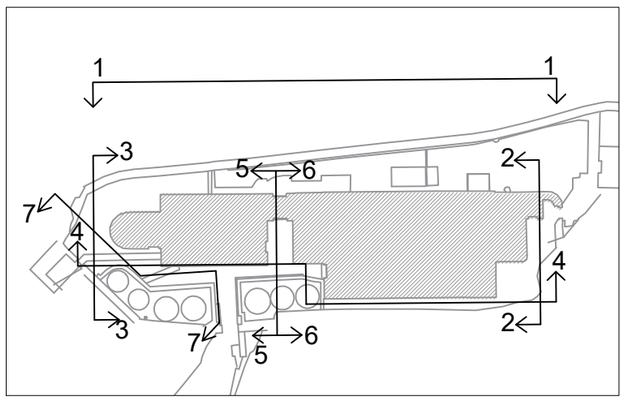
Project Title
Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out
PROJECT NO. | STATUS CONSENT | NUMBER 005 | REV.



ELEVATION 2
SCALE 1:100 @ A3



ELEVATION 3
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:500 @ A3

National Monument Details

Name	: Skellig Michael
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RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

OPW
An Office of Public Works
Oifig na nOibreacha Poiblí

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

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Melissa Nicolas - Graduate Architect

Architectural Services
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Facsimile: (046) 9438409

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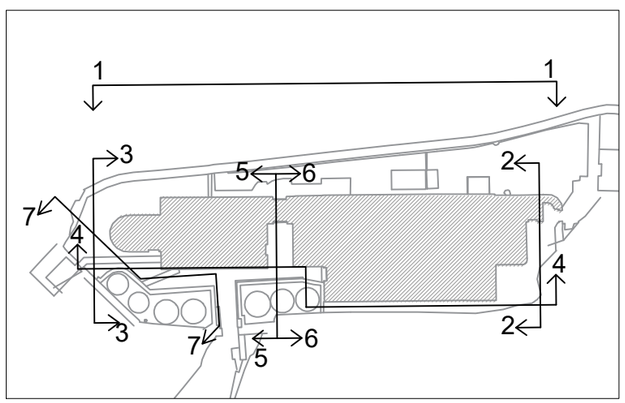
Drawing Title
Elevations

DRAWN	CHECKED	SCALE	DATE
MN	FMC	Varies @ A3	8 January 2020

Project Title
Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	006	

ELEVATION 4
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:500 @ A3

National Monument Details

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Architectural Services
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Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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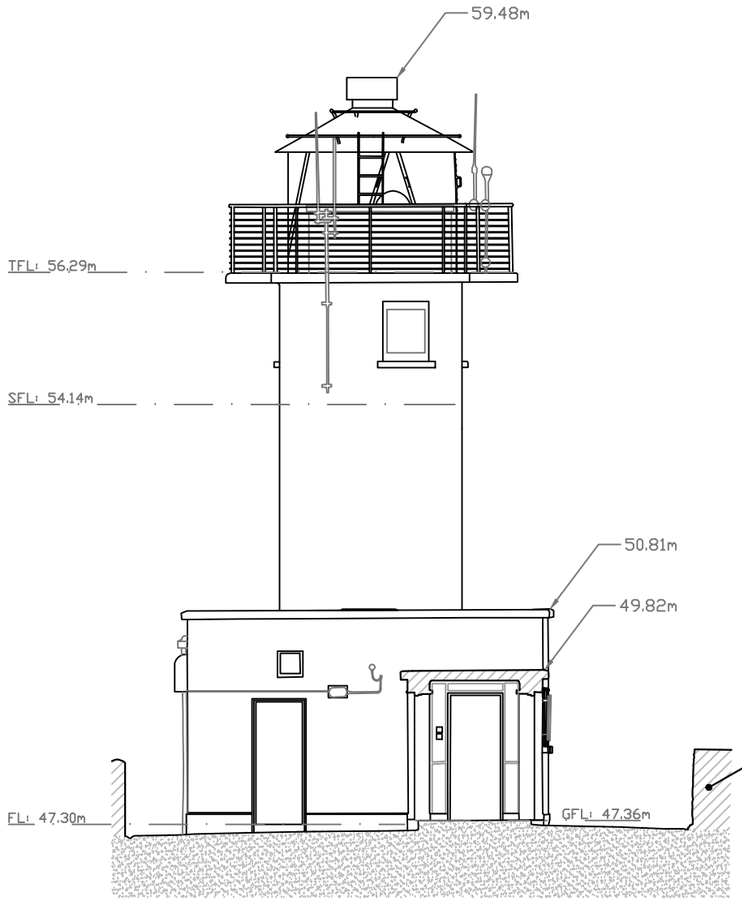
Drawing Title
Elevations

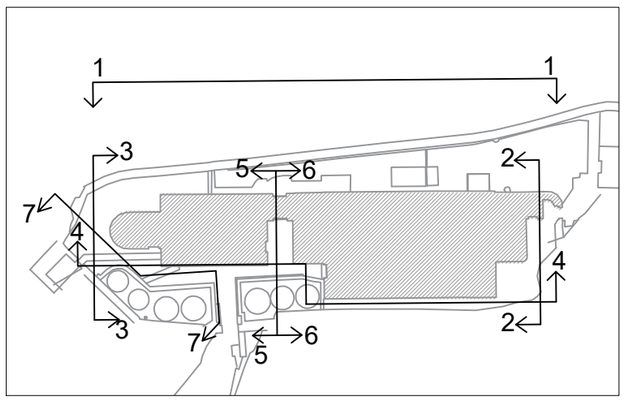
DRAWN	CHECKED	SCALE	DATE
MN	FMC	Varies @ A3	8 January 2020

Project Title
Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	007	



ELEVATION 5
SCALE 1:100 @ A3



KEY PLAN
SCALE 1:500 @ A3

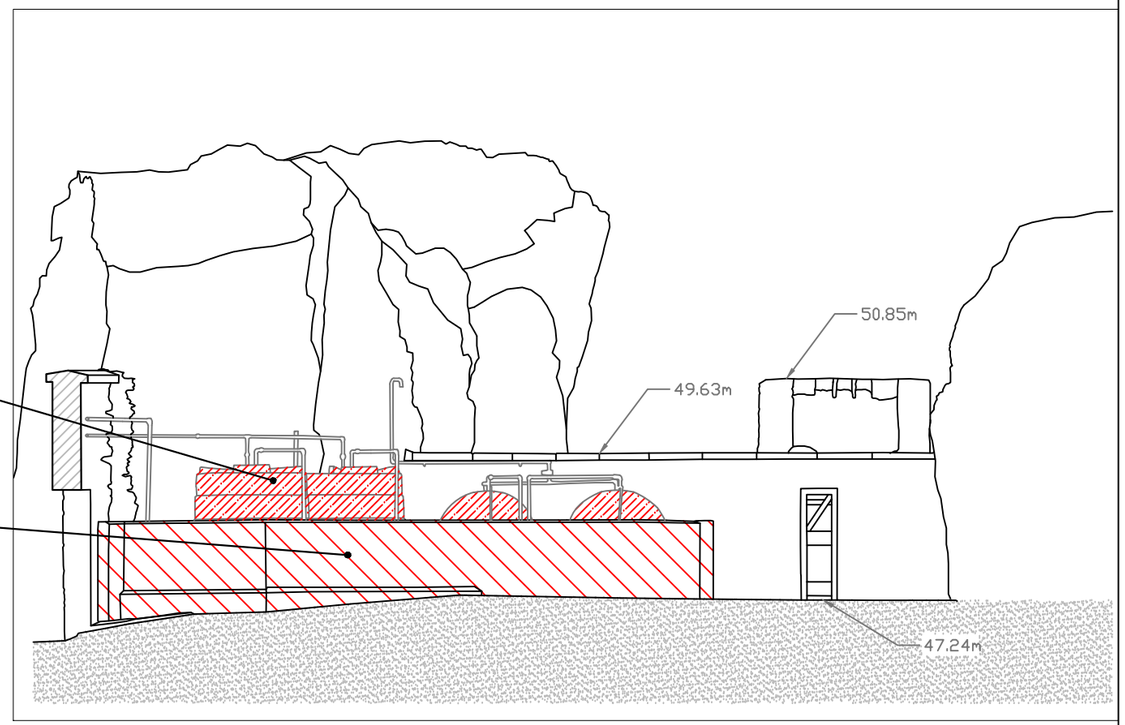
Remove existing tank

Repair existing sea wall

ELEVATION 6
SCALE 1:100 @ A3

Remove all existing oil tanks

Remove existing bund walls



ELEVATION 7
SCALE 1:100 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

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DIRECTOR OF ARCHITECTURAL SERVICES

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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
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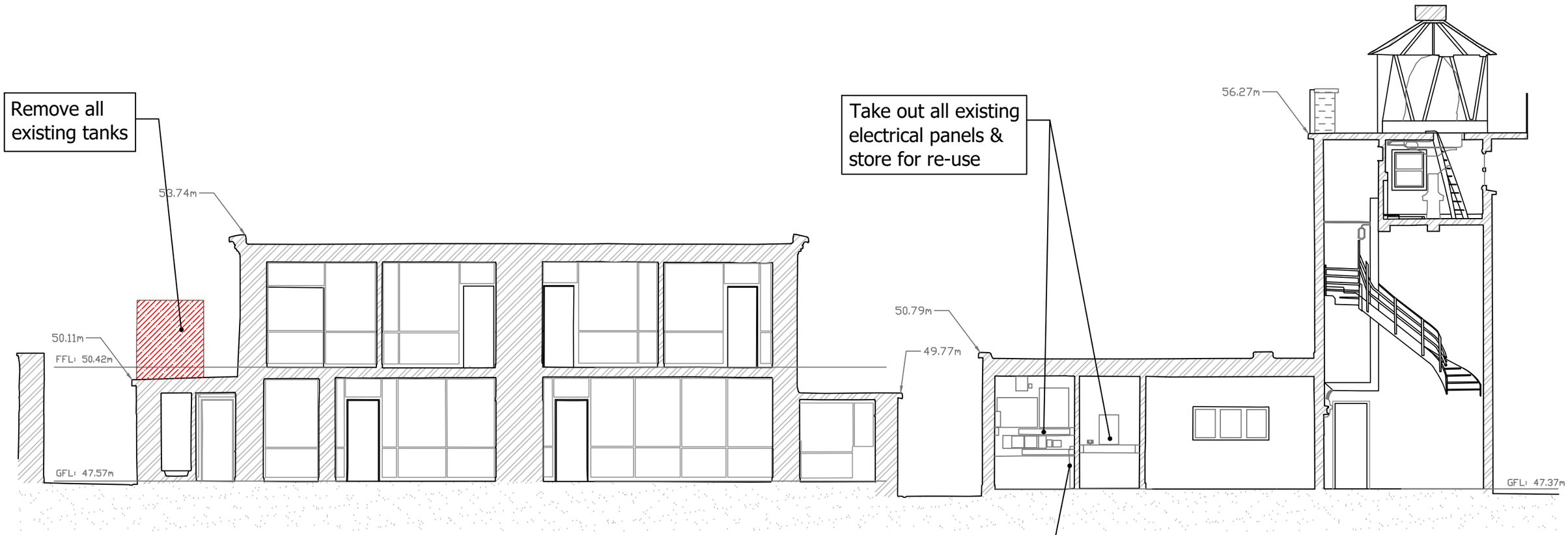
Drawing Title
Elevations
DRAWN MN | CHECKED FMC | SCALE Varies @ A3 | DATE 8 January 2020

Project Title
Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out
PROJECT NO. | STATUS CONSENT | NUMBER 008 | REV.



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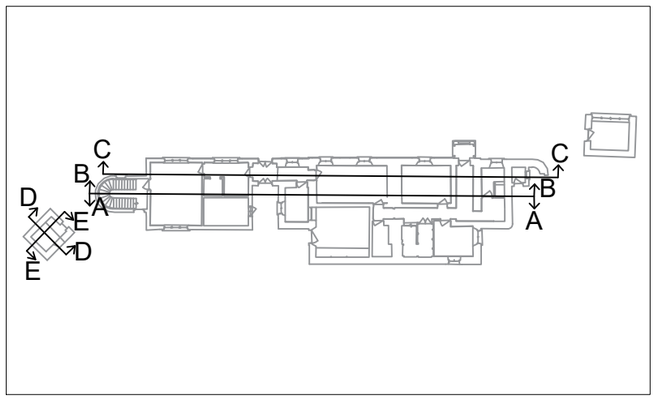

KEY PLAN
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National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Arcihtect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Drawing Title: Sections

DRAWN	CHECKED	SCALE	DATE
MN	FMC	Varies @ A3	8 January 2020

Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO. | STATUS | NUMBER | REV.
CONSENT | 009

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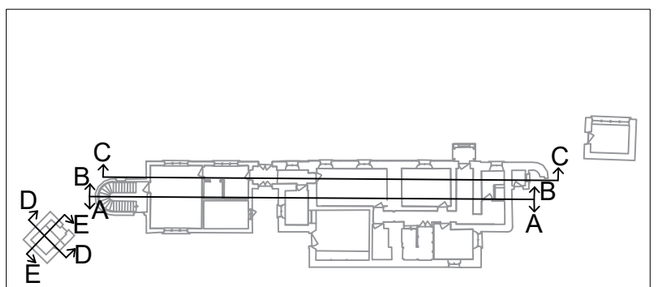

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OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	010	

SECTION C-C
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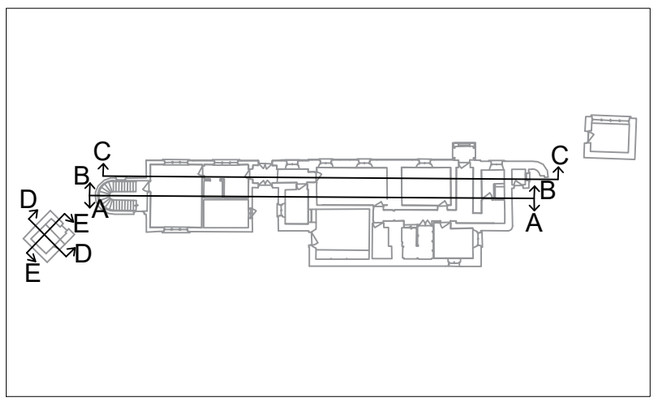
Remove all existing electrical wiring & light fittings

Clean out latrine of all existing debris



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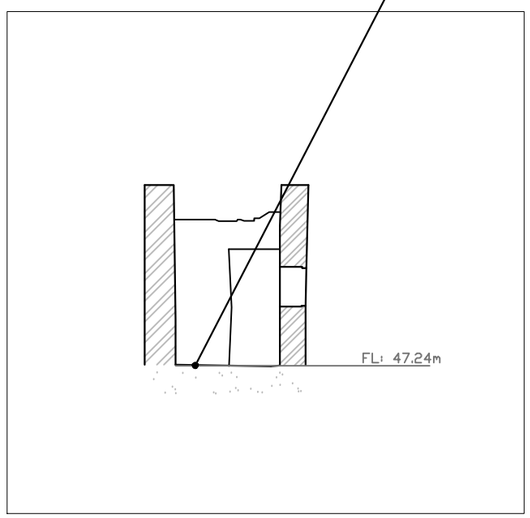

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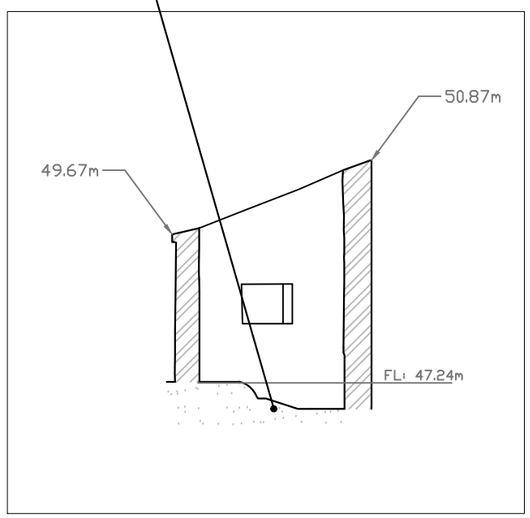

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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	011	

01/012 View of existing oil tanks & bund walls

Remove all existing oil tanks

Remove existing bund walls

Remove all associated external pipework concealed in external services trench

02/012 View of existing oil tanks & bund walls

03/012 View of existing oil tanks & bund walls

Remove all existing oil tanks

Remove existing bund walls

Remove all associated external pipework concealed in external services trench

04/012 View of existing oil tanks & bund walls

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

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Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Drawing Title

Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	FMC	NTS @ A3	8 January 2020

Project Title

Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	012	

01/013 View of lower lighthouse & existing sea wall

Repair existing sea wall

02/013 View of lower lighthouse & existing sea wall

03/013 View of lower lighthouse & existing sea wall

Repair existing sea wall

04/013 Aerial view of lower lighthouse & existing sea wall

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team

John Cahill - Assistant Principal Arcihtect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Existing Images

DRAWN	CHECKED	SCALE	DATE
MN	FMC	NTS @ A3	8 January 2020

Project Title

Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	013	

01
014
View of existing water tank on ground floor

Remove all existing tanks

Remove all existing water tanks

Repair existing sea wall

02
014
View of existing tanks on first floor

Repair existing sea wall

03
014
View of existing sea wall

04
014
View of existing sea wall

Architectural Services

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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Existing Images

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Project Title

Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
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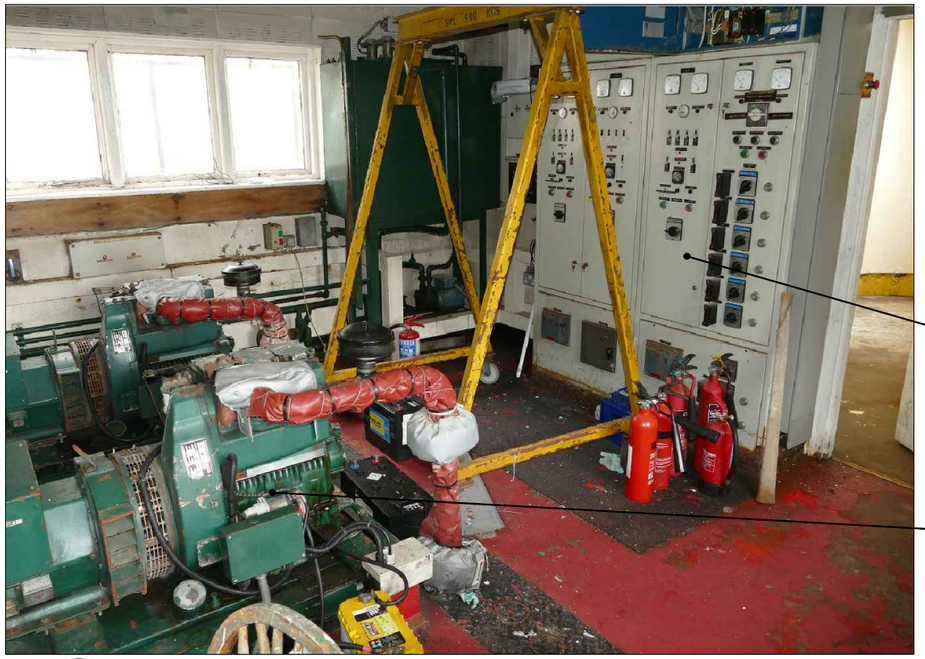

Remove all existing electrical wiring & light fittings

Take out all existing electrical panels & store for re-use

Remove existing engines

01/015 Ground floor existing engine room

02/015 Ground floor existing engine room

Take out all existing electrical panels & store for re-use

Remove all existing electrical wiring & light fittings

03/015 Ground floor existing electrical room

04/015 Ground floor existing electrical room

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

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MN	FMC	NTS @ A3	8 January 2020

Project Title: Skellig Michael - Lower Lighthouse
External Demolition Works & Internal Stripping out

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	015	

01
016
View of existing redundant solar panels

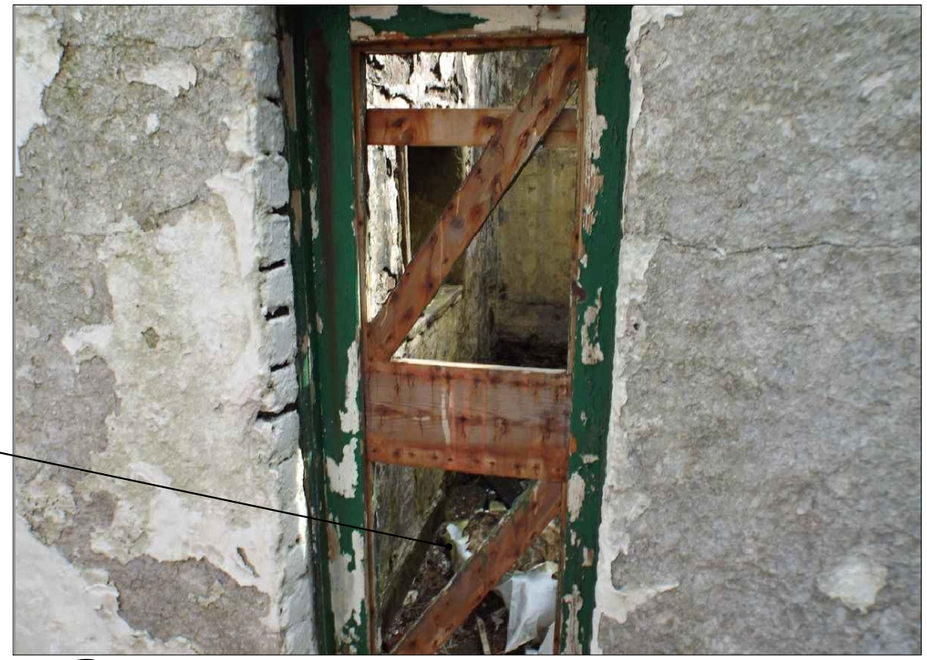
Remove existing solar panels

Remove existing pipe

02
016
View of existing redundant solar panels

03
016
View of existing latrine

Clean out latrine of all existing debris



04
016
View of existing latrine

Architectural Services	Principal Architect	Design Team		Drawing Revisions		Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Arcihtect Fergus McCormick - Senior Architect Melissa Nicolas - Graduate Architect	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION A B C D E	DATE:	Existing Images DRAWN: MN CHECKED: FMC SCALE: NTS @ A3 DATE: 8 January 2020	Skellig Michael - Lower Lighthouse External Demolition Works & Internal Stripping out PROJECT NO. / STATUS: CONSENT / NUMBER: 016 / REV.

Appendix E

Upper Lighthouse

Upper Lighthouse, Skellig Michael

Brief

v. 1.0

Issue Date: 20th August, 2020

Table of Contents

1. Site Introduction

The Upper Lighthouse is situated on the most westerly point of Skellig Michael at an elevation of approximately 100 metres. The lighthouse is the final destination the Skellig Lighthouse road. The lighthouse tower and the accompanying lighthouse keepers' cottages were completed in 1826 . The tower operated for a period of 44 years before being decommissioned in 1870. The lighthouse complex was abandoned and left exposed to the elements. At some stage in the mid 20th century, the buildings were stripped of slate, timber and metals, with the roofs removed.

Fig. 1 – Upper Lighthouse location to West of Great Skellig. Source: Ordance Survey Ireland

The two lighthouse keepers' cottages are constructed of stone externally. The internal walls were originally of brick construction. Much of the original Valentia slate cladding has been retained. The original cast iron entrance lobbies have been retained. The original sandstone flagstones have also been largely retained. The chimneys on all buildings have collapsed. The OPW carried out emergency repair works in 2019 and installed timber lintels at structural opes to prevent further collapse.

The lighthouse tower retains much of its original cladding. The lantern cupola and associated gallery have been removed. Much of the granite base of the cupola has been retained however, with the gallery doorway still intact. The interior cantilevered granite staircase has suffered catastrophic damage due to a collapsed section of the cupola. This section remains in situ on the ground floor of the tower. The railing of the staircase have been removed. The original granite floor slabs are still intact, although there may have been supporting cast iron columns which are missing. Archaeological investigations and wildlife surveys are ongoing.

2. Brief

The brief for works to the Upper Lighthouse comprises the restoration of the lighthouse tower and the lighthouse keepers' cottages.

Lighthouse Tower

It is envisaged that the restoration of the lighthouse tower will reflect its 1826 condition as closely as possible. The internal staircase will be rebuilt and cast iron railings installed. The lantern cupola and gallery is to be rebuilt. The external Valentia slate cladding is to be retained and any missing pieces to be replaced. The Upper Lighthouse tower will provide the finale to the lighthouse road walk and will provide a panoramic viewing platform to those that climb its steps. The lantern room will remain empty but will provide an enclosed viewing opportunity in inclement weather conditions. Tower entry will only be possible with OPW tour guide accompaniment. The lighthouse will require electricity for lighting and a background heating system

Lighthouse Keepers' Cottages

It is envisaged that the lighthouse keepers' cottages will be restored as faithfully to their original construction techniques and materials as much as possible. All timber sash windows and doors will be reinstated externally. The cottages are to be roofed in Valentia slate and the slate cladding is to be retained and repaired. The roof will be insulated with appropriate natural insulation.

Walls are to be lime plastered and rendered internally. Timber stairs are to be reinstalled. Timber floors and first floor loft spaces are to be instated. Chimney breasts are to be reconstructed but are not envisaged to be used as heating sources. Reconstructed fireplaces are to be installed but may be required for ventilation purposes. The cast iron lobbies are to be restored and retained. The sandstone floor surfacing is to be retained and restored where possible.

The cottages may be used as additional accommodation for consultants conducting research on Skellig Michael. The ground floor of one of the cottages will comprise of an exhibition space open to the public. This space will contain 19th century furniture and information displays. The ground floor of the other cottage will contain a study/office space appropriate for field work. One of the rooms on the ground floor may be set aside as a possible additional sleeping space. The upper levels will provide accommodation for two people, one sleeping in each.

Ancillary Buildings

A toilet for private use will be required but may be located externally. A wash hand basin will also be required for sanitation. No mechanical or electrical plant may be accommodated on the external envelope of the cottages or lighthouse tower. However, the ancillary buildings and support structures may provide a possible solution for housing mechanical and electrical equipment. Provision should be made for a background heating system and electrical supply. A small water supply for the wash hand basin may also be required. It is envisaged that cooking facilities and washing facilities will be available in the refurbished Lower Lighthouse complex.

3. Site Images

Fig. 2 – Entrance to Upper Lighthouse Complex

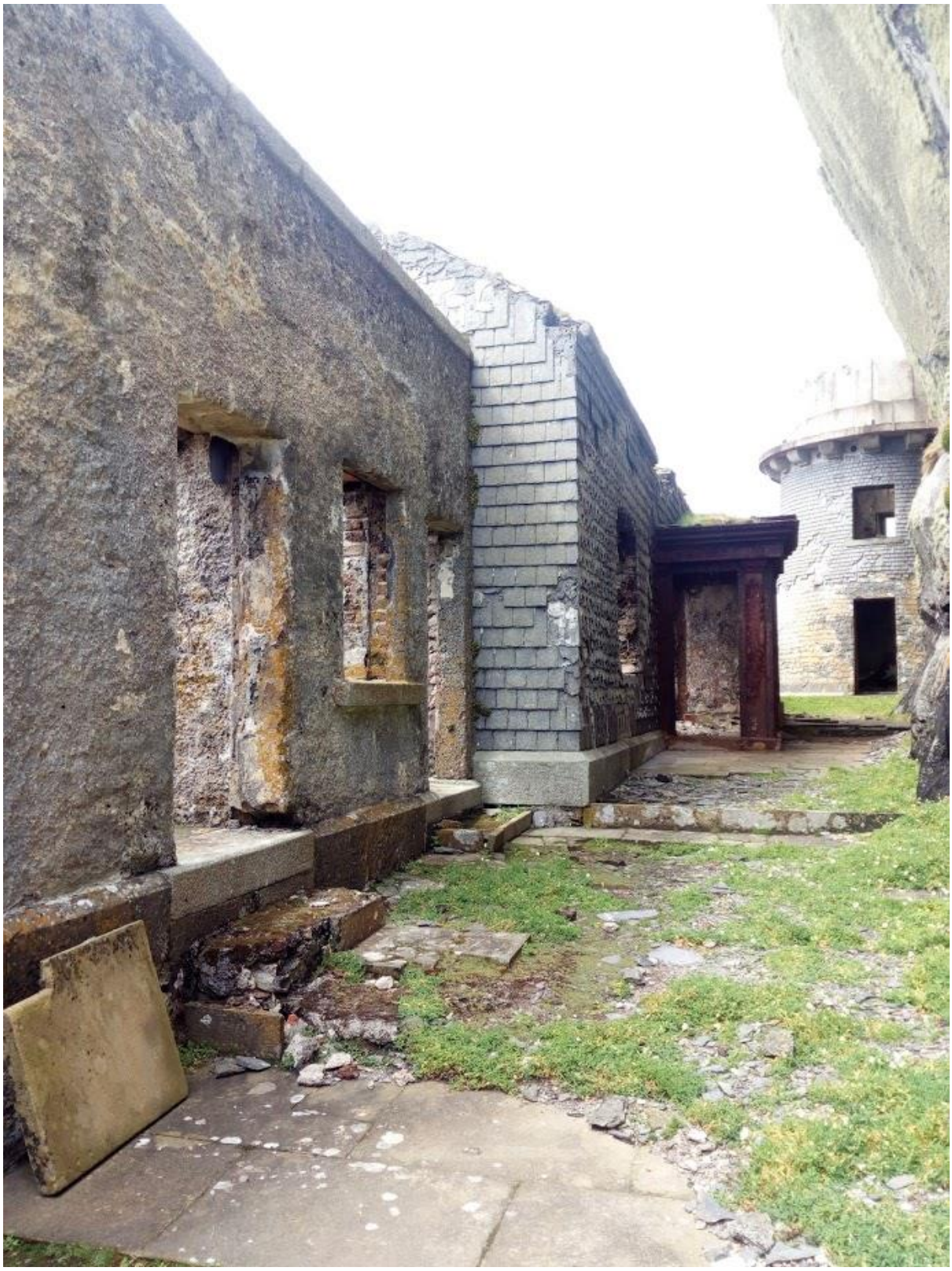


Fig. 3 – View of ancillary buildings, cottages and lighthouse tower.

Fig. 4 – View of interior of lighthouse cottage.

Fig. 5 – View of exterior of cottage from lighthouse tower.

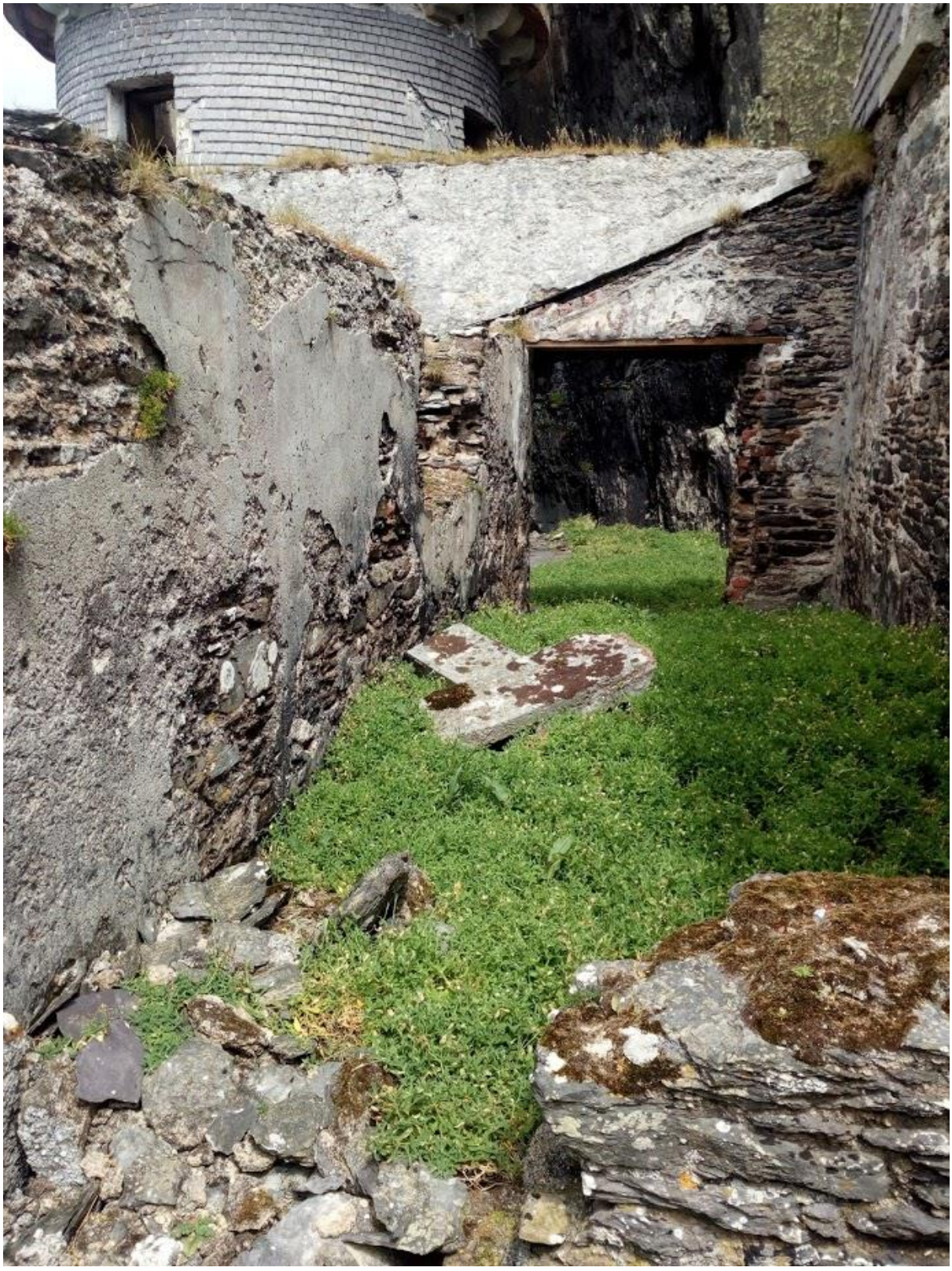


Fig. 6 – View of Interior of ancillary building.

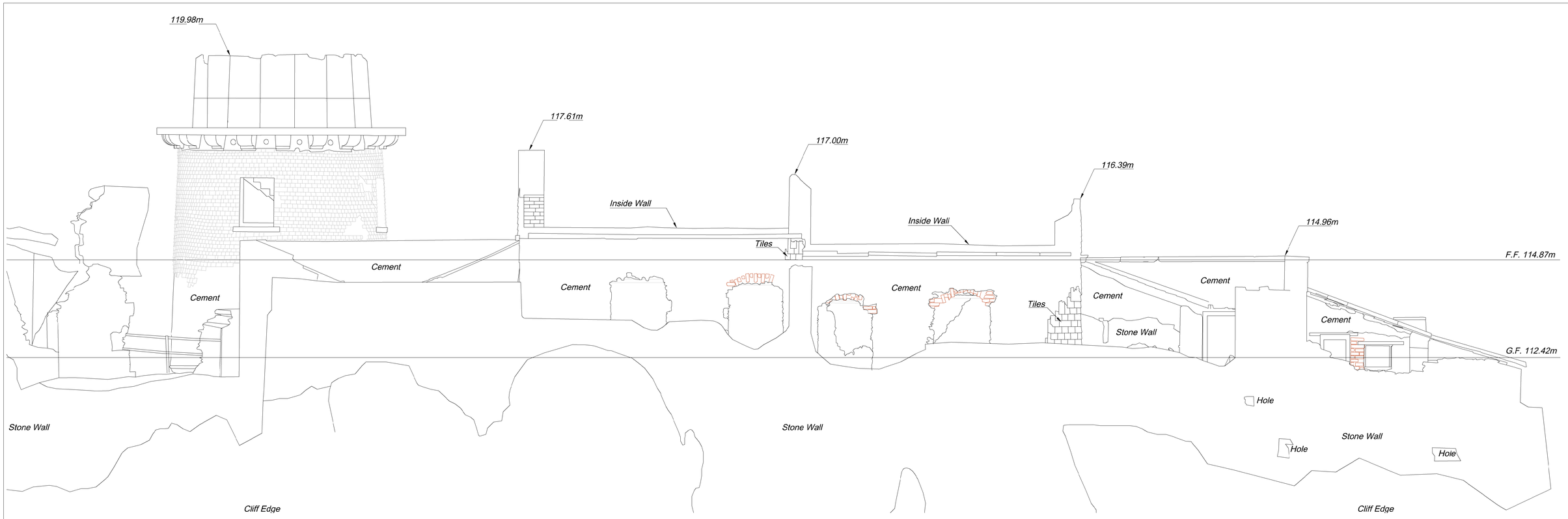
Fig. 7 – View of interior of lighthouse tower and ruined cantilevered staircase.

Fig. 8 – Interior view of ruined granite staircase from lantern room in 2012.

Fig. 9 – Orthophotgraph of Upper Lighthouse complex

Fig. 10 – View of cast iron lobby in 2012 from lighthouse tower.

Fig. 11 – View of remains of lantern room of lighthouse tower in 2012.



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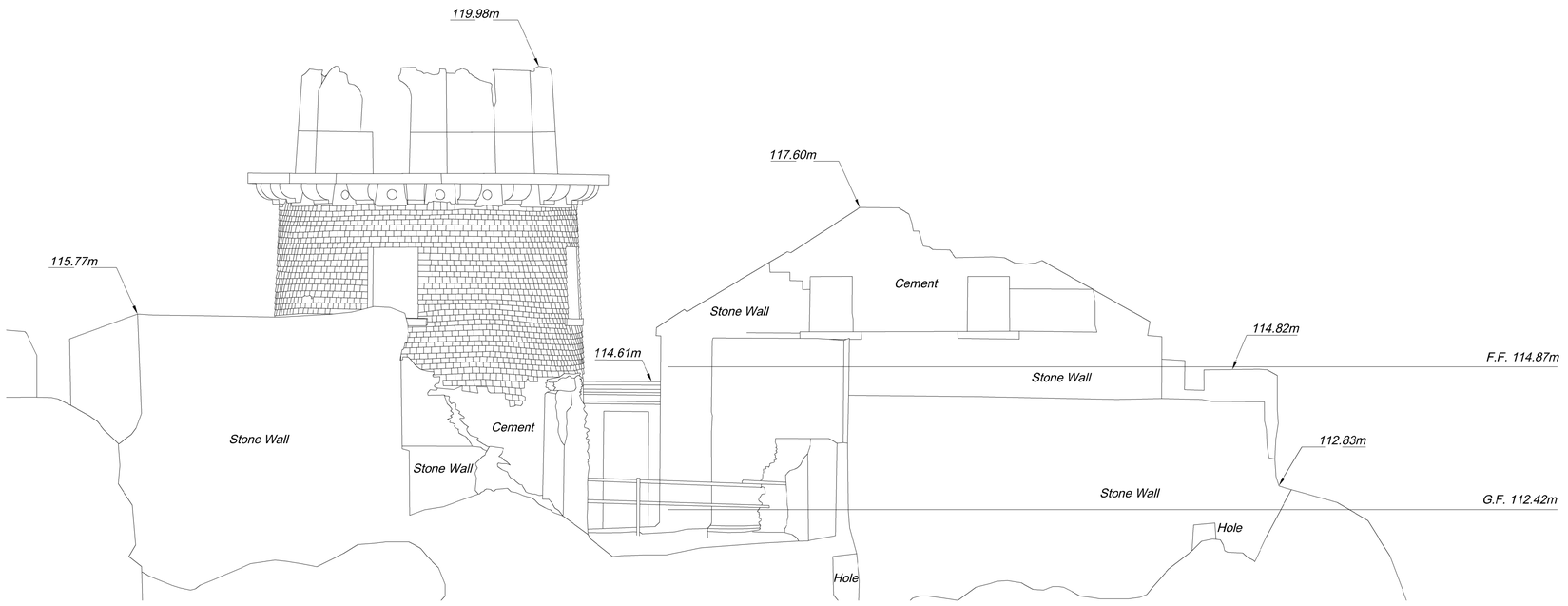

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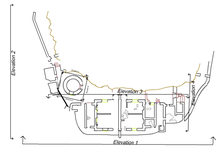

GROUND FLOOR KEY PLAN
NTS

OPW
The Office of Public Works
Oifig na nOibreacha Poiblí

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Bláthmhac Ó Muirí - Architectural Graduate

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

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Existing Elevations

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Skellig Michael - Upper Lighthouse
Repair & Refurbishment Works

PROJECT NO.	STATUS	NUMBER	REV.
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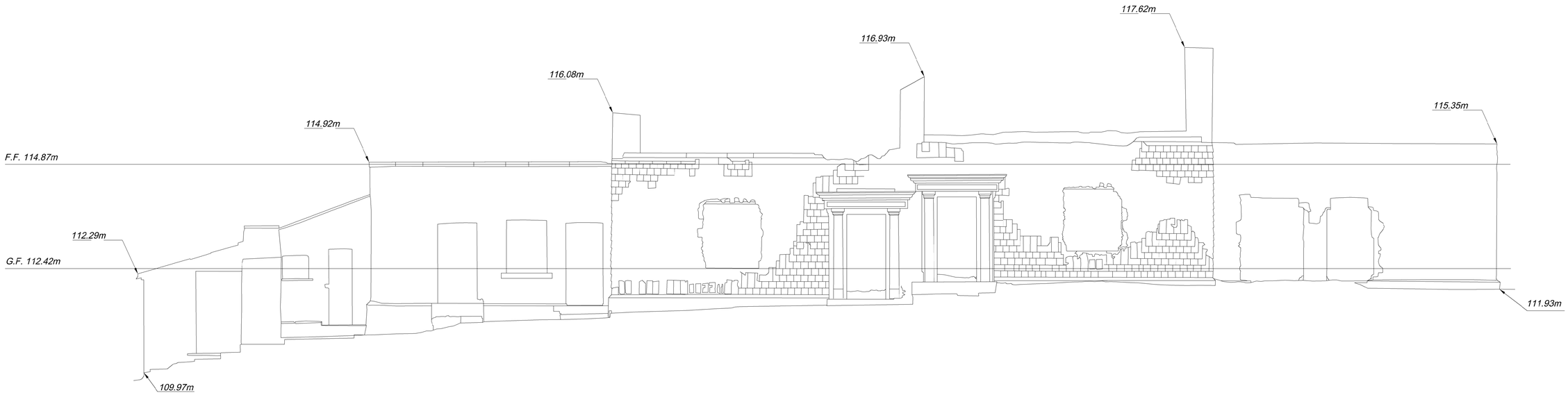

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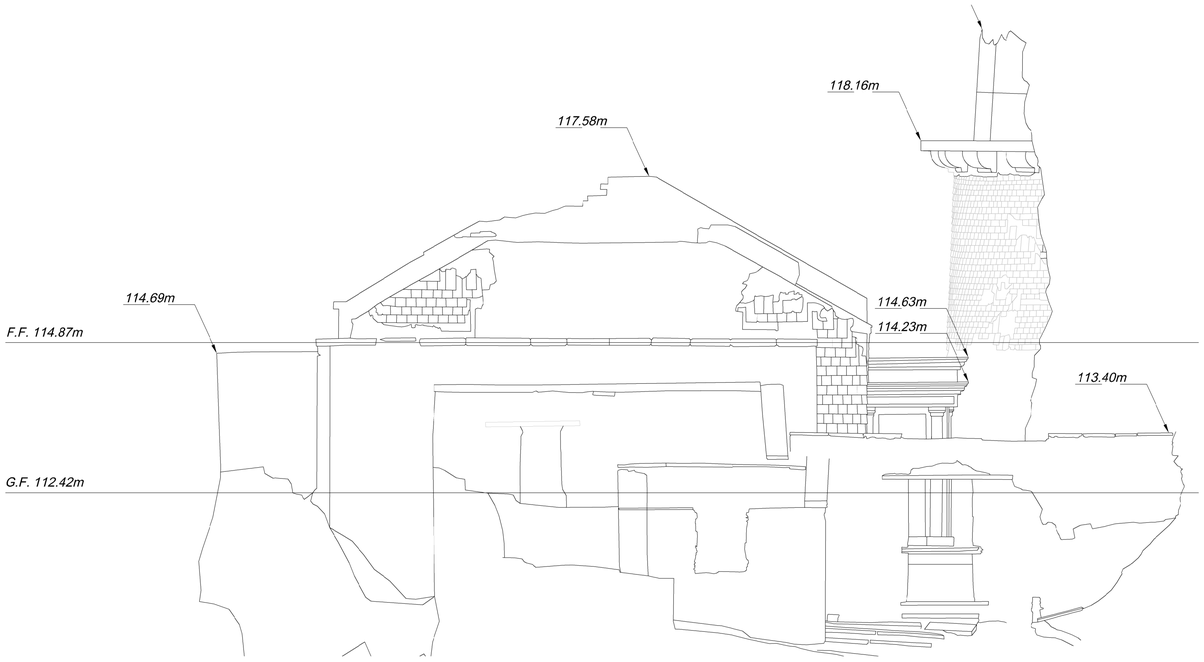

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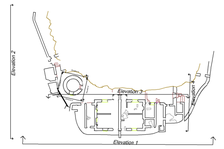

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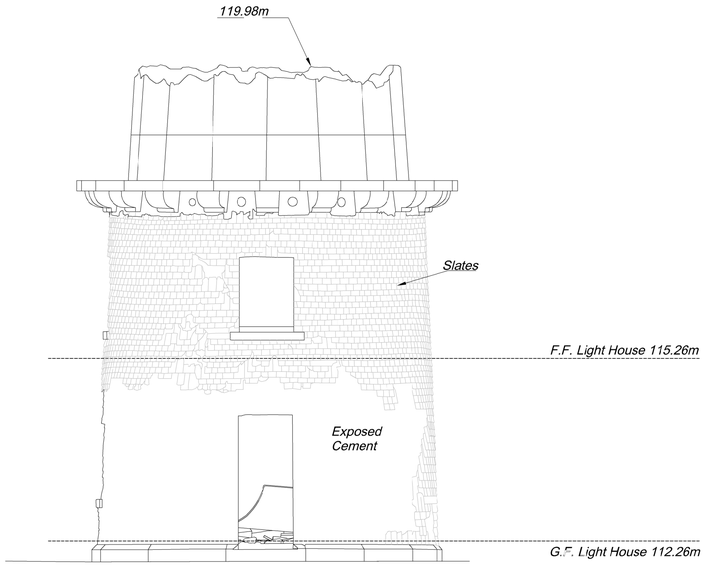

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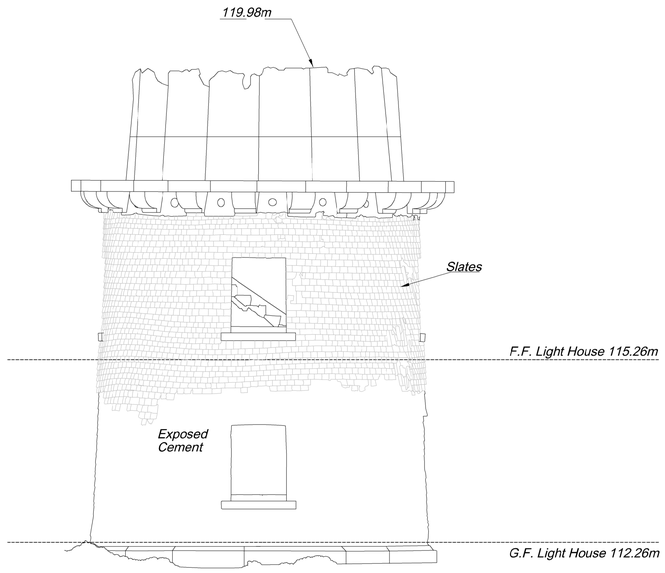

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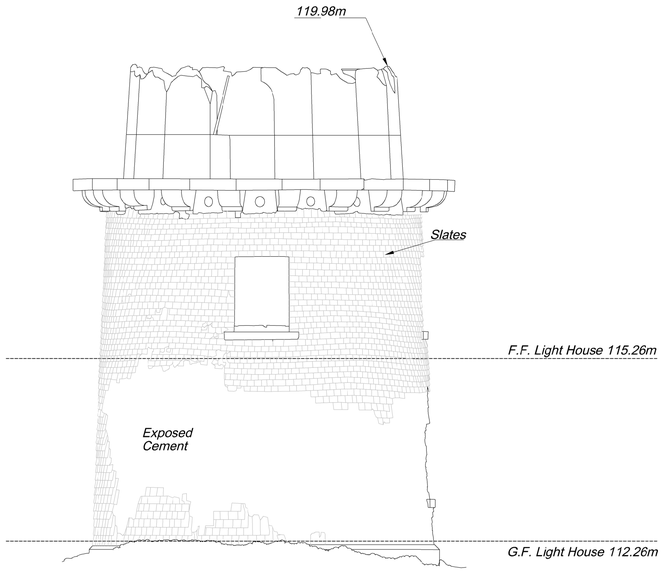

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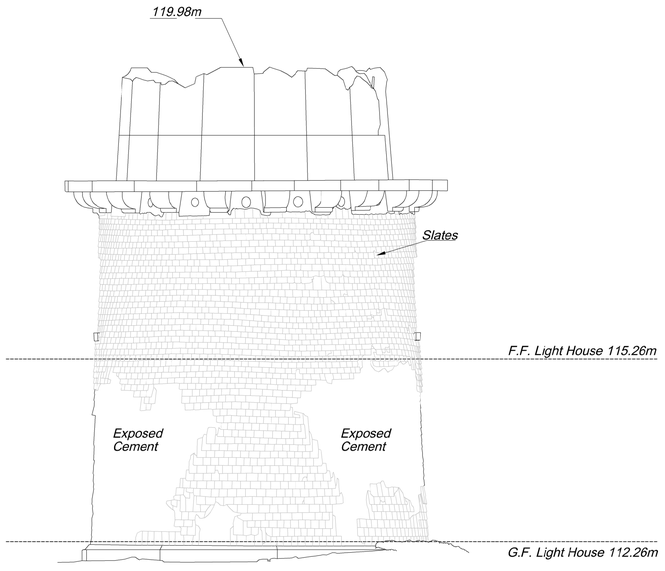

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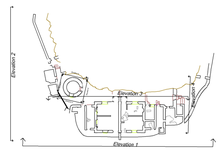

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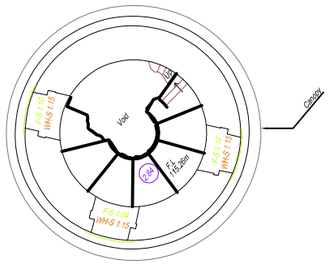
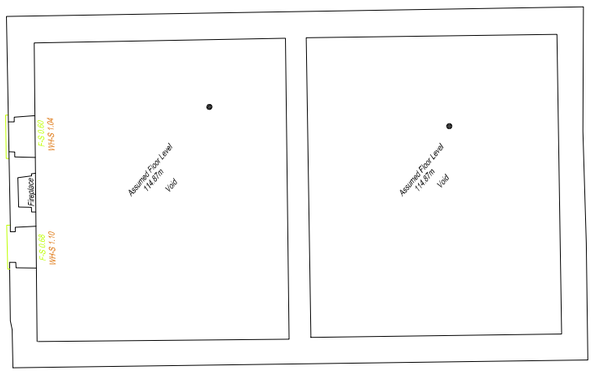
	CONSENT		





EXISTING FIRST FLOOR PLAN
SCALE 1:150 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

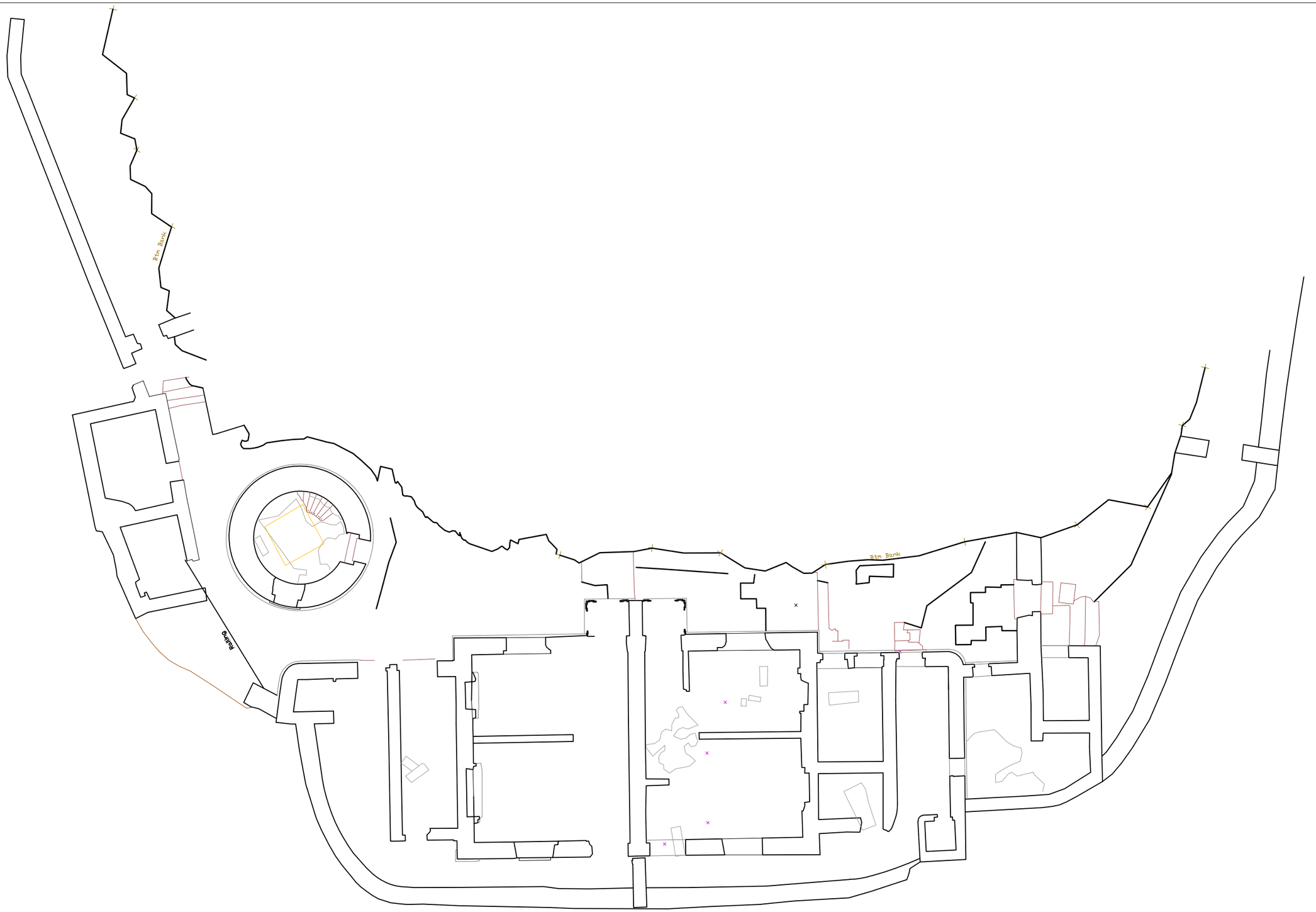
DRAFT

Drawing Title
Existing First Floor Plan

DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:150 @ A3	August 2020

Project Title
Existing
Repair Works

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	003	



EXISTING GROUND FLOOR PLAN
SCALE 1:150 @ A3

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

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John Cahill - Assistant Principal Architect
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Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

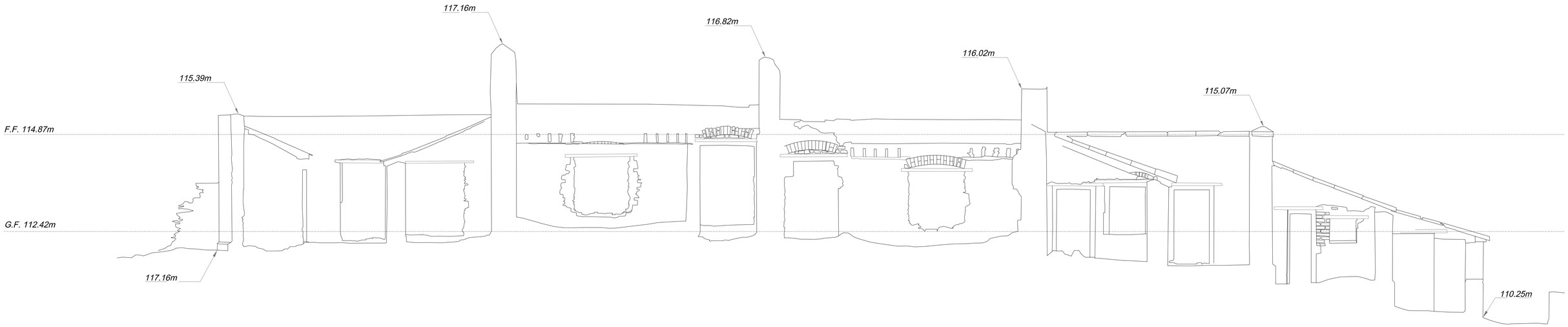
DRAFT

Drawing Title
Existing Ground Floor Plan

DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:150 @ A3	August 2020

Project Title
Skellig Michael - Upper Lighthouse
Existing

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	002	



EXISTING SECTION A-A
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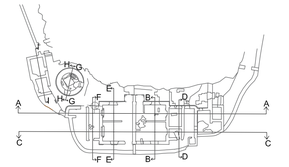
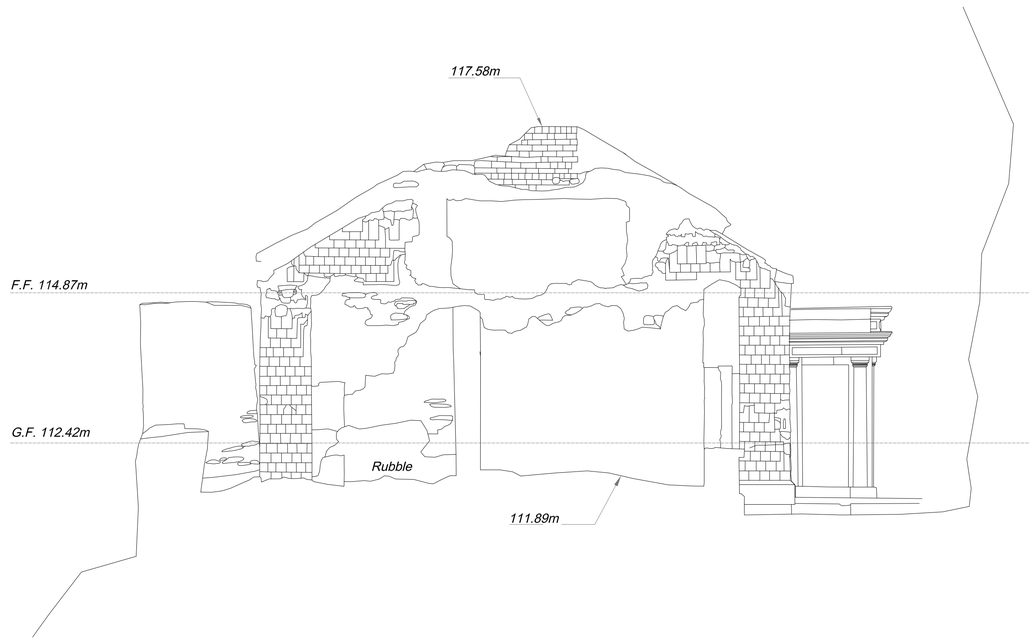


KEY PLAN

GROUND FLOOR KEY PLAN
NTS



EXISTING SECTION B-B
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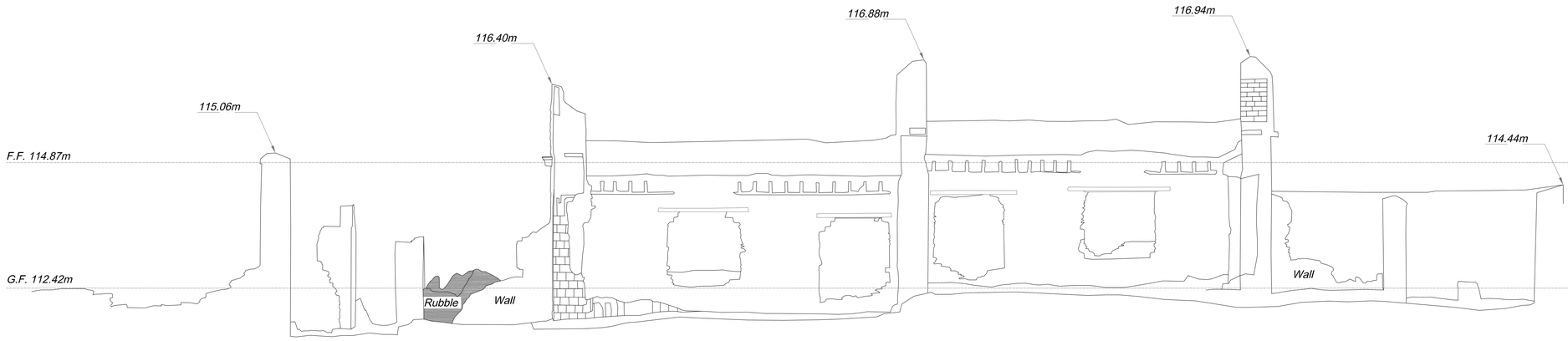
Architectural Services	Principal Architect	Design Team	Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Bláthmhac Ó Muirí - Architectural Graduate Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	DRAFT	Sheet 1 of 4 Existing Sections DRAWN CHECKED SCALE DATE BOM FMC 1:50@A1 June 2020	Skellig Michael - Upper Lighthouse Repair & Refurbishment Works PROJECT NO. STATUS NUMBER REV. CONSENT

SECTION D - D



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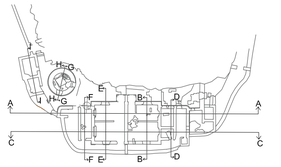
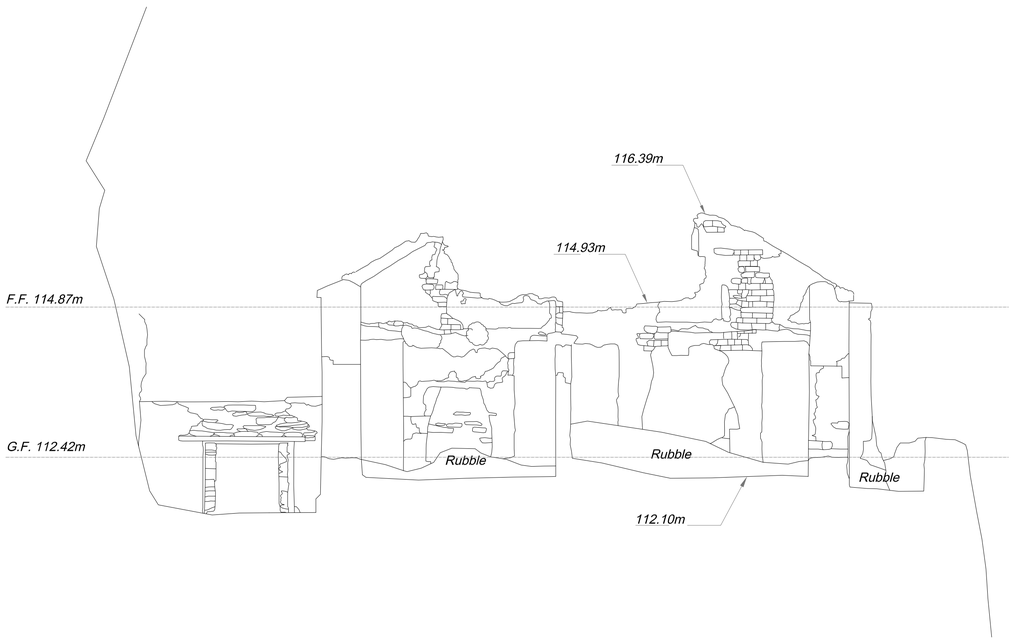


KEY PLAN

GROUND FLOOR KEY PLAN
NTS



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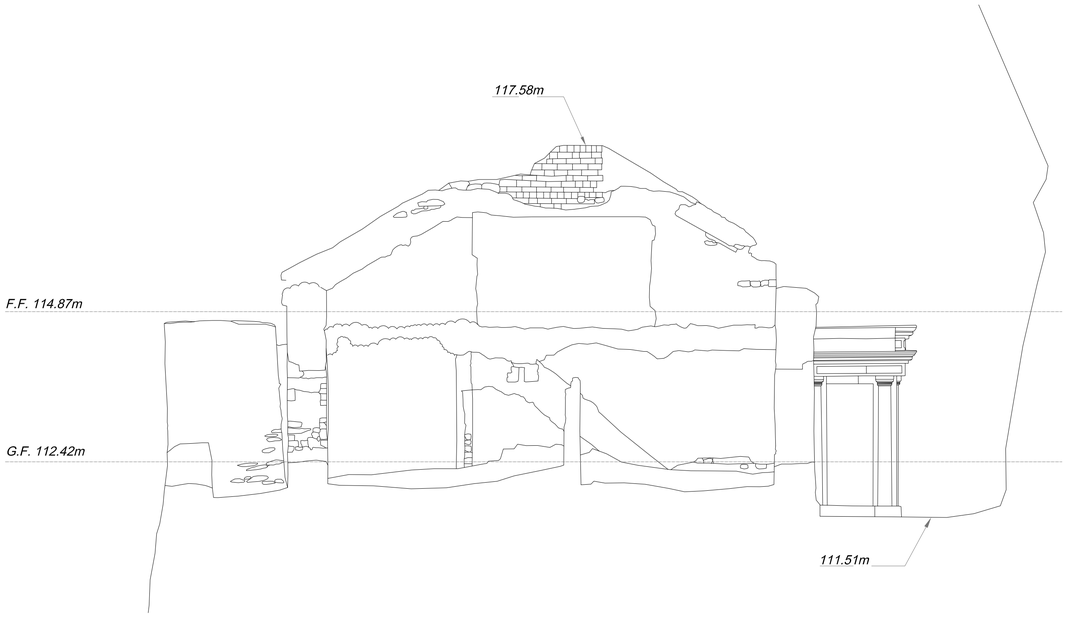
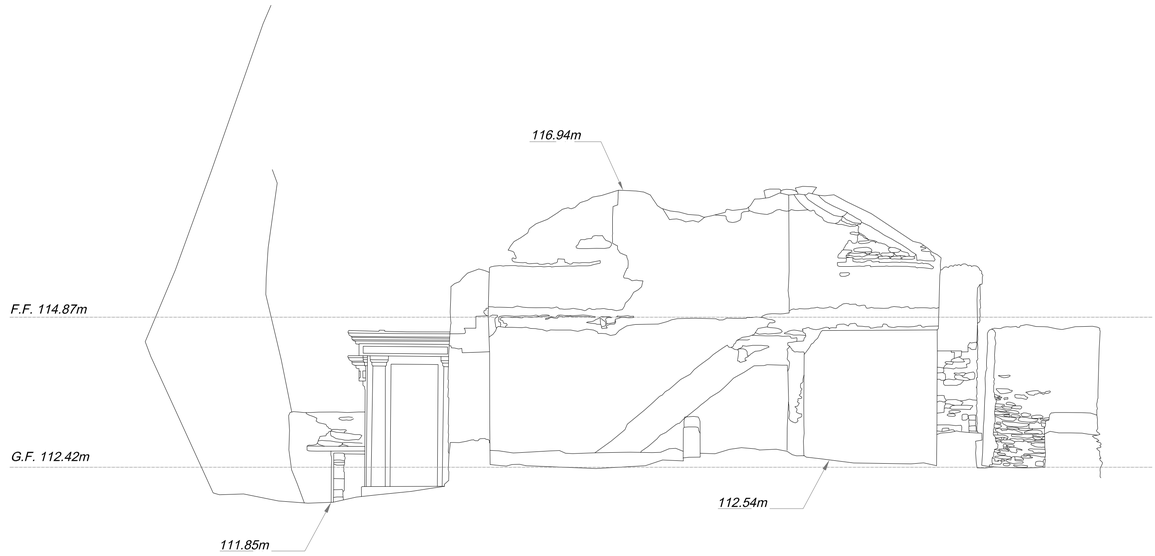
SCALE 1:50 @ A1

Architectural Services	Principal Architect	Design Team		Drawing Revisions		Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Bláthmhac Ó Muirí - Architectural Graduate	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E	DRAFT	Sheet 2 of 4 Existing Sections	Skellig Michael - Upper Lighthouse Repair & Refurbishment Works
						DRAWN CHECKED SCALE DATE BOM FMC 1:50@A1 June 2020	PROJECT NO. STATUS NUMBER REV. CONSENT



EXISTING SECTION E-E
SCALE 1:50 @ A1



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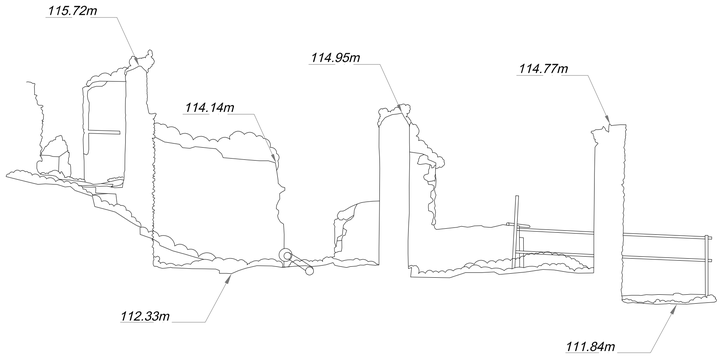
SCALE 1:50 @ A1

EXISTING SECTION G-G
SCALE 1:50 @ A1



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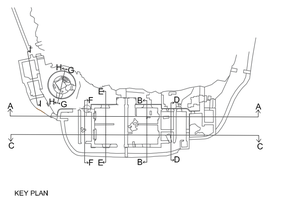
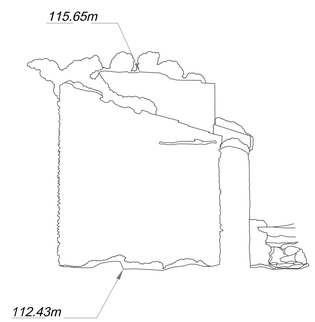


GROUND FLOOR KEY PLAN
NTS



EXISTING SECTION I-I
SCALE 1:50 @ A1

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Bláthmhac Ó Muirí - Architectural Graduate

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
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E		

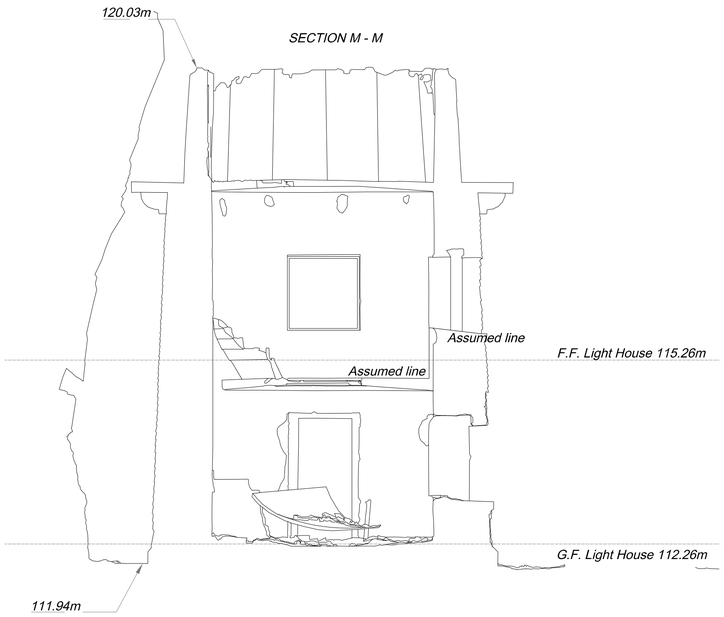
DRAFT

Drawing Title
Sheet 3 of 4
Existing Sections

DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:50@A1	June 2020

Project Title
Skellig Michael - Upper Lighthouse
Repair & Refurbishment Works

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT		



EXISTING SECTION J-J
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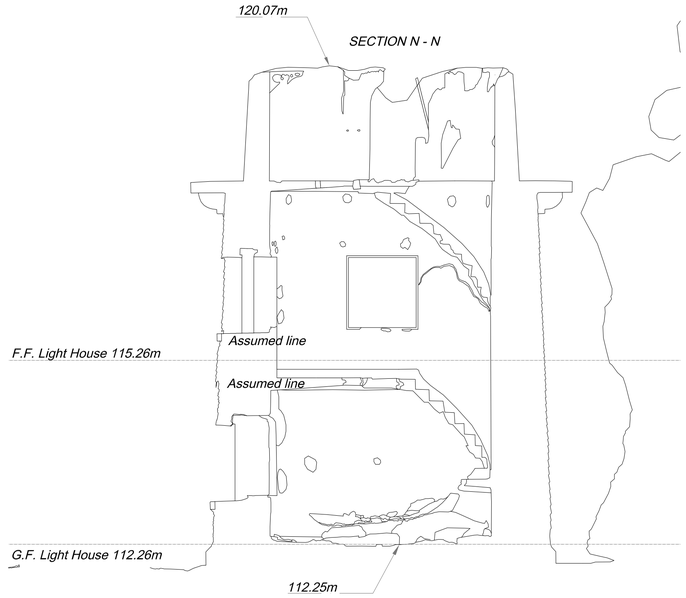

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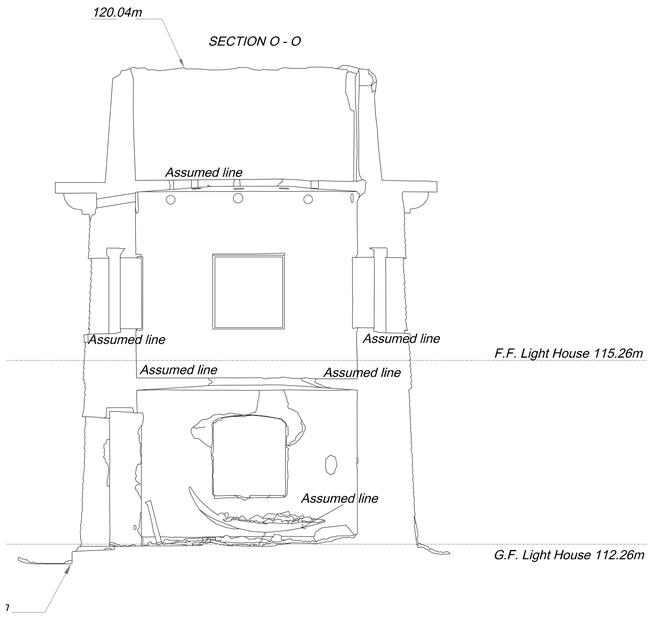

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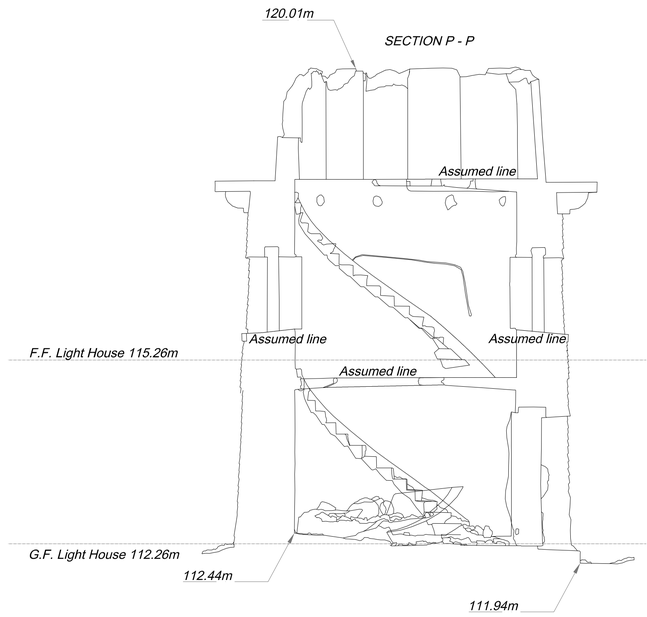
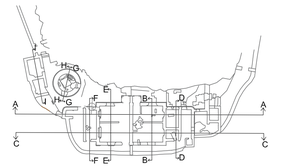


EXISTING SECTION M-M
SCALE 1:50 @ A1

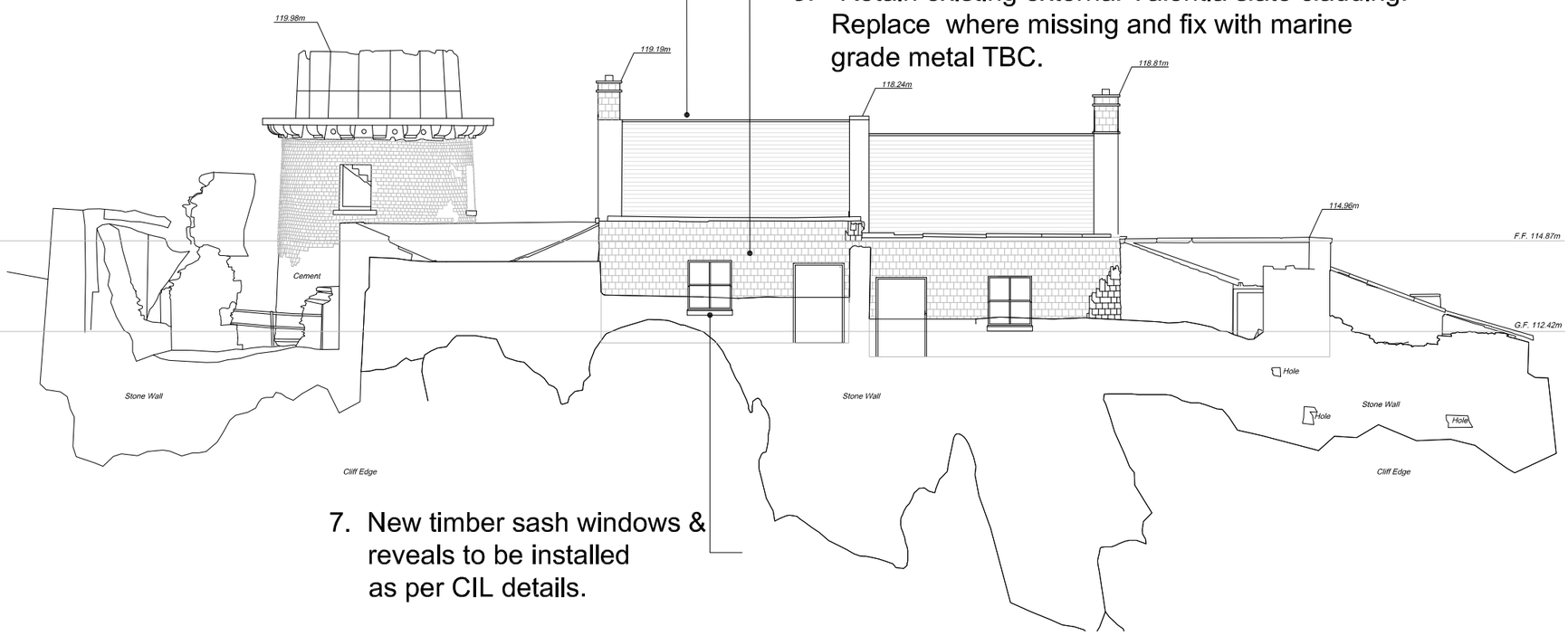


GROUND FLOOR KEY PLAN
NTS

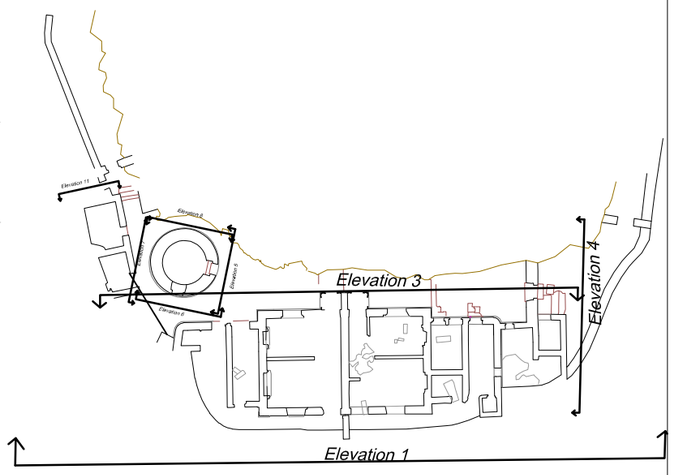
Architectural Services	Principal Architect	Design Team	Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Bláthmhac Ó Muirí - Architectural Graduate Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E DRAFT	Sheet 4 of 4 Existing Sections DRAWN CHECKED SCALE DATE BOM FMC 1:50@A1 June 2020	Skellig Michael - Upper Lighthouse Repair & Refurbishment Works PROJECT NO. STATUS NUMBER REV. CONSENT

13. Install new ridge tiles.

9. Retain existing external Valentia slate cladding. Replace where missing and fix with marine grade metal TBC.



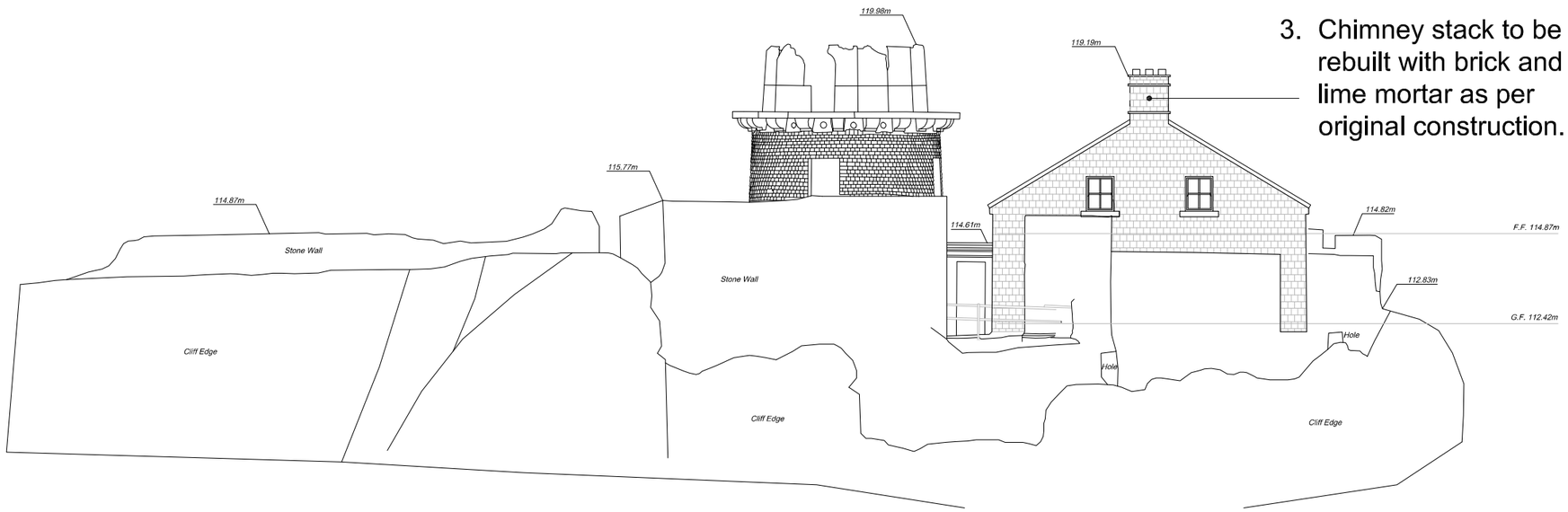
7. New timber sash windows & reveals to be installed as per CIL details.



PROPOSED ELEVATION 1
SCALE 1:150 @ A3

KEY PLAN
SCALE 1:500 @ A3

3. Chimney stack to be rebuilt with brick and lime mortar as per original construction.



PROPOSED ELEVATION 2
SCALE 1:150 @ A3

OPW
An Office of Public Works
Oifig na nOibreacha Poiblí

Architectural Services
OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

Principal Architect
CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES

Design Team
John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Melissa Nicolas - Graduate Architect

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

DRAFT

Drawing Title
Sheet 1 of 3
Proposed Elevations

DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:150 @ A3	August 2020

Project Title
Skellig Michael - Upper Lighthouse Repair Works

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	XX	

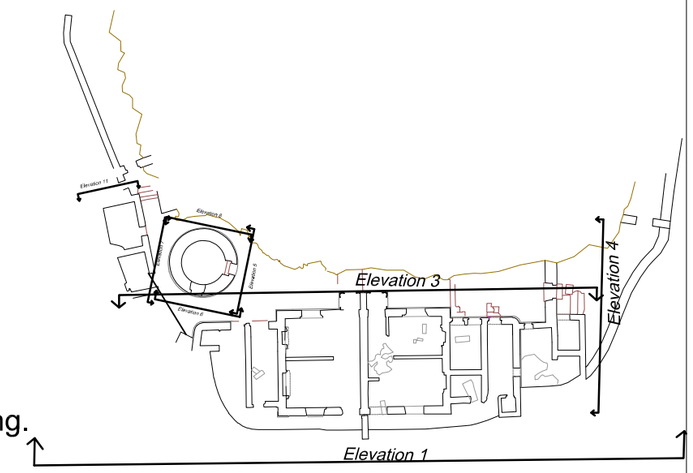
17. Repair cast iron lobby, examine paint samples and paint to original RAL.

13. Install new ridge tiles.

3. Chimney stack to be rebuilt with brick and lime mortar as per original construction.

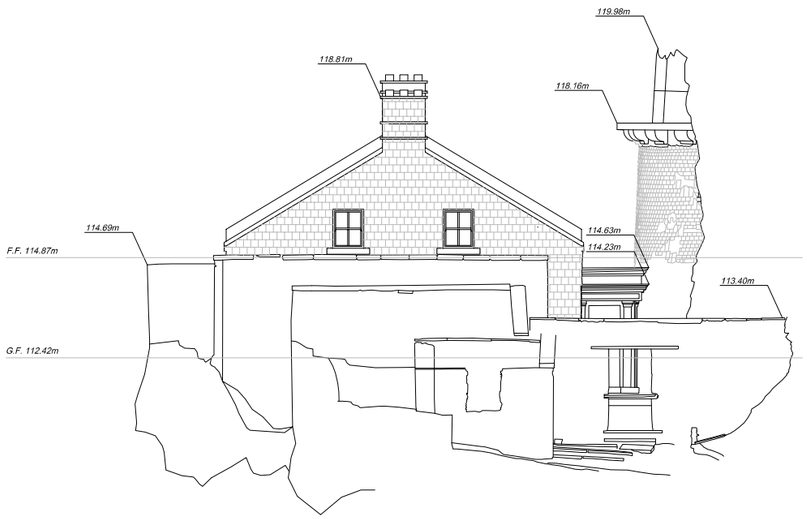
7. New timber sash windows & reveals to be installed as per CIL details.

9. Retain existing external Valentia slate cladding. Replace where missing and fix with marine grade metal TBC.



PROPOSED ELEVATION 3
SCALE 1:150 @ A3

KEY PLAN
SCALE 1:500 @ A3



PROPOSED ELEVATION 4
SCALE 1:150 @ A3

Architectural Services	Principal Architect	Design Team		Drawing Revisions		Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Melissa Nicolas - Graduate Architect	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION A B C D E	DATE:	Sheet 2 of 3 Proposed Elevations	Skellig Michael - Upper Lighthouse Repair Works

DRAFT

DRAWN	CHECKED	SCALE	DATE	PROJECT NO.	STATUS	NUMBER	REV.
BOM	FMC	1:150 @ A3	August 2020		CONSENT	14	

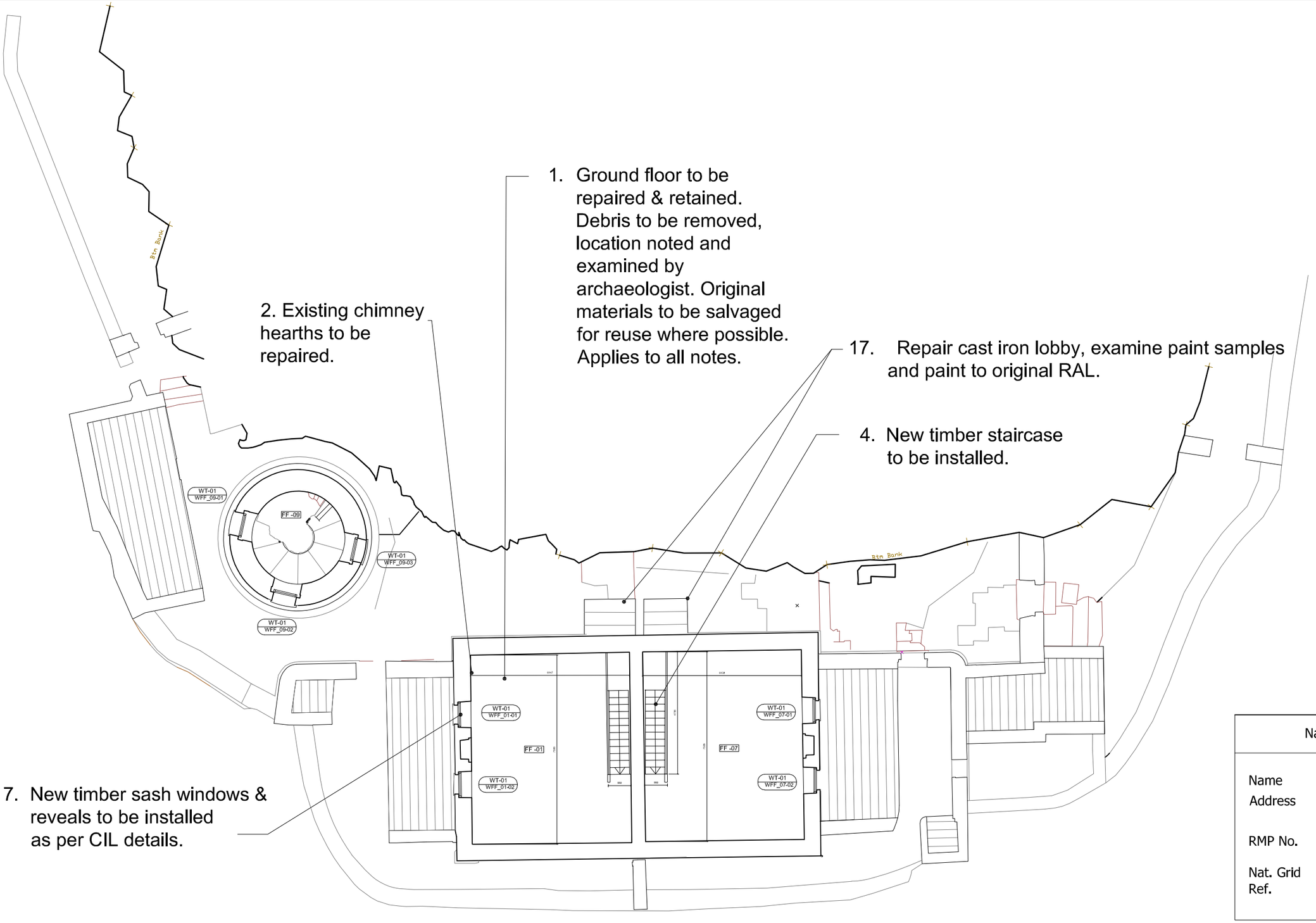
1. Ground floor to be repaired & retained. Debris to be removed, location noted and examined by archaeologist. Original materials to be salvaged for reuse where possible. Applies to all notes.

2. Existing chimney hearths to be repaired.

17. Repair cast iron lobby, examine paint samples and paint to original RAL.

4. New timber staircase to be installed.

7. New timber sash windows & reveals to be installed as per CIL details.



National Monument Details	
Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

PROPOSED FIRST FLOOR PLAN
SCALE 1:150 @ A3

Architectural Services
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Telephone: (046) 942 6000
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Principal Architect
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Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

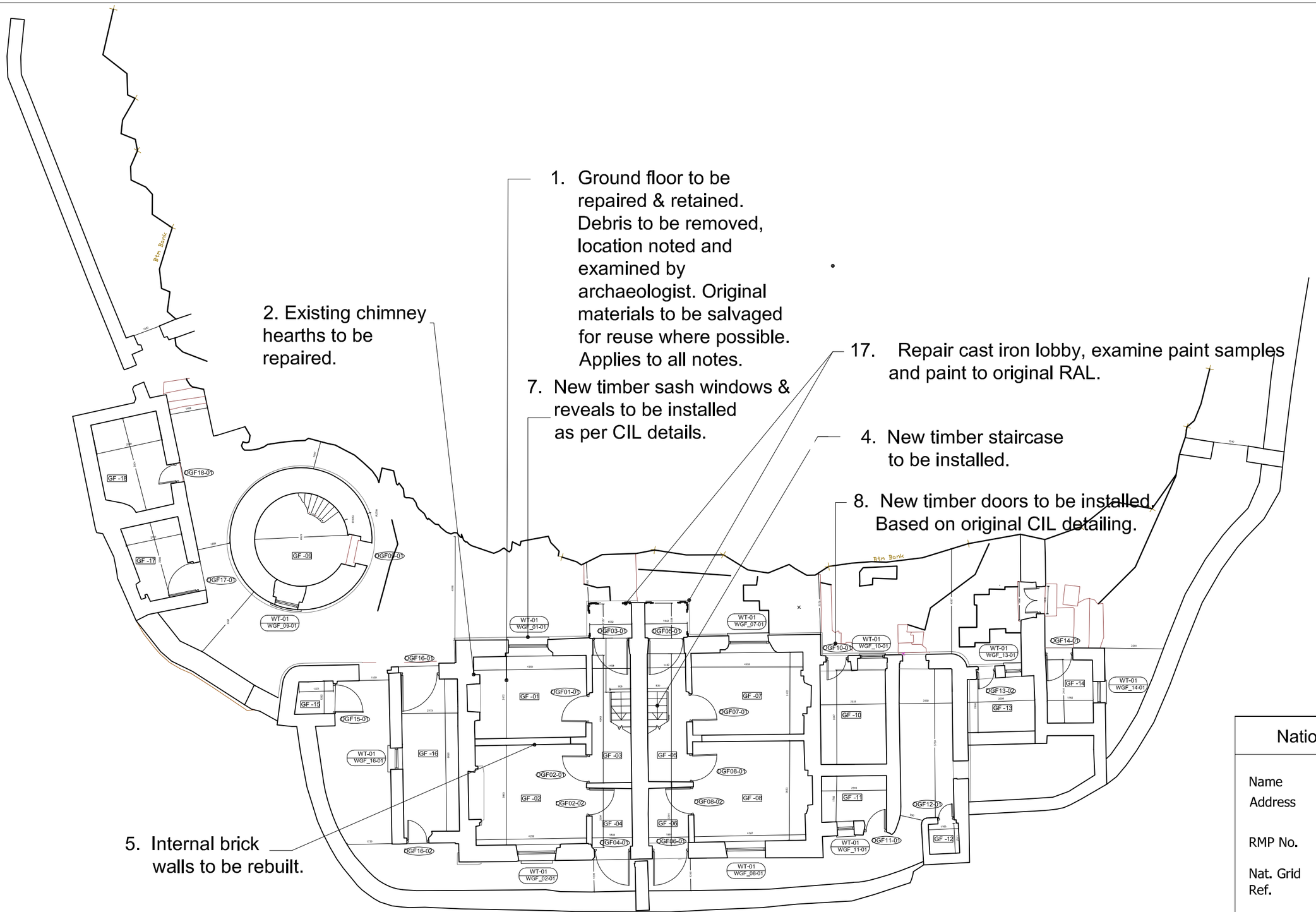
DRAFT

Drawing Title
Proposed First Floor Plan

DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:150 @ A3	JULY 2020

Project Title
Skellig Michael - Upper Lighthouse Repair Works

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	002A	



National Monument Details

Name	: Skellig Michael
Address	: Skellig Michael, Co. Kerry.
RMP No.	: KE104A001
Nat. Grid Ref.	: E 425425, N 560211

PROPOSED GROUND FLOOR PLAN
SCALE 1:150 @ A3

Architectural Services
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Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

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Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions

REF	DESCRIPTION	DATE:
A		
B		
C		
D		
E		

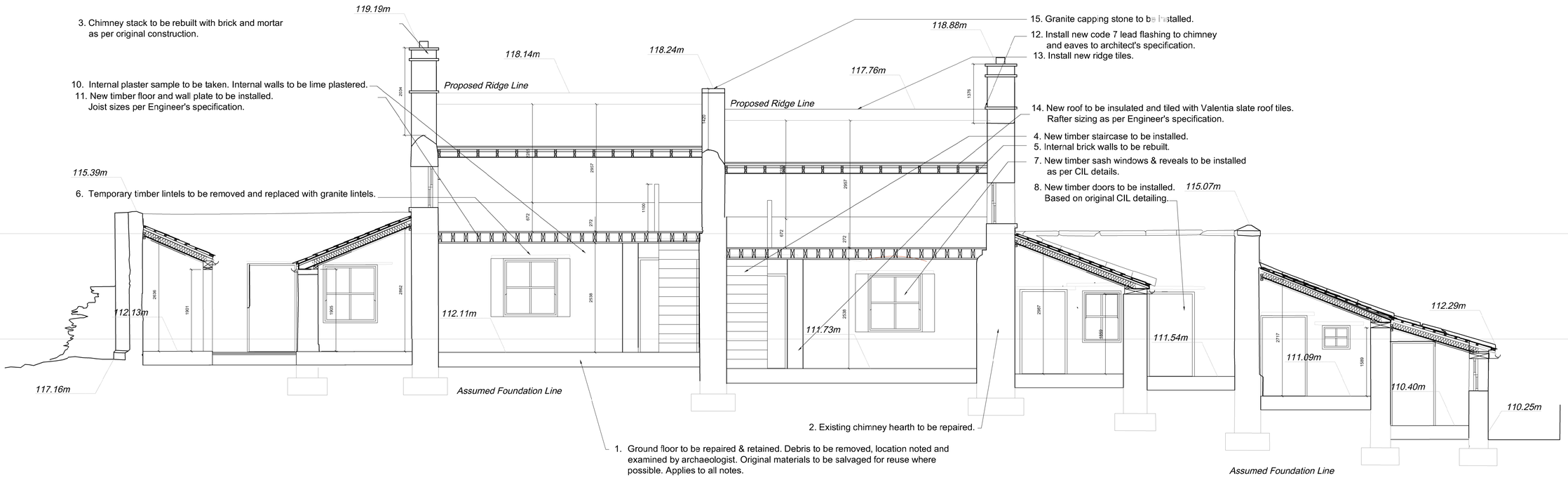
DRAFT

Drawing Title: Proposed Ground Floor Plan

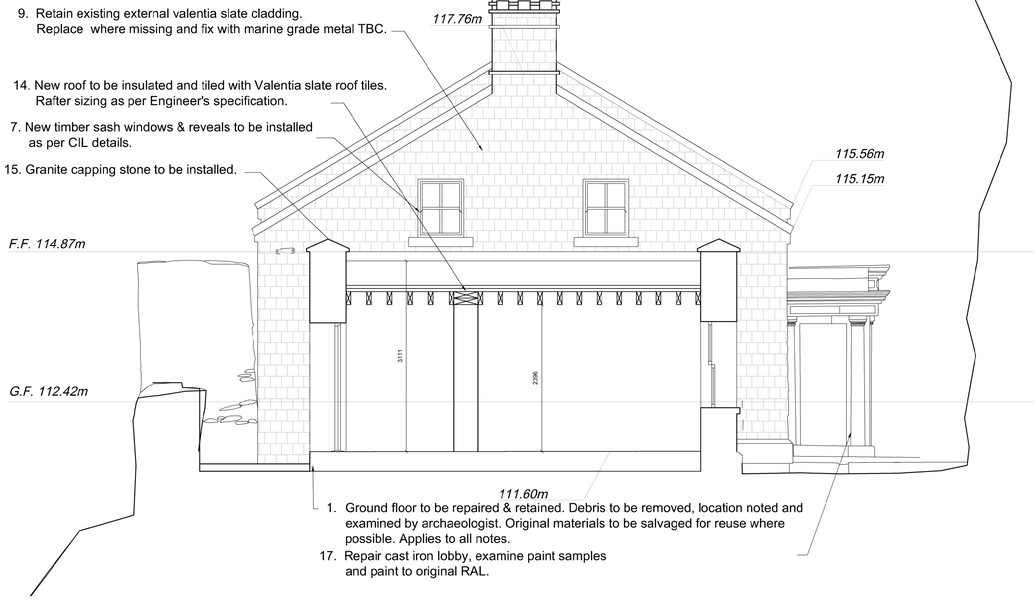
DRAWN	CHECKED	SCALE	DATE
BOM	FMC	1:150@ A3	JULY 2020

Project Title: Skellig Michael - Upper Lighthouse Repair Works

PROJECT NO.	STATUS	NUMBER	REV.
	CONSENT	XX	



PROPOSED SECTION A-A
SCALE 1:50 @ A1



PROPOSED SECTION B-B
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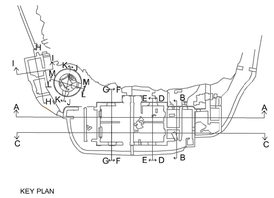
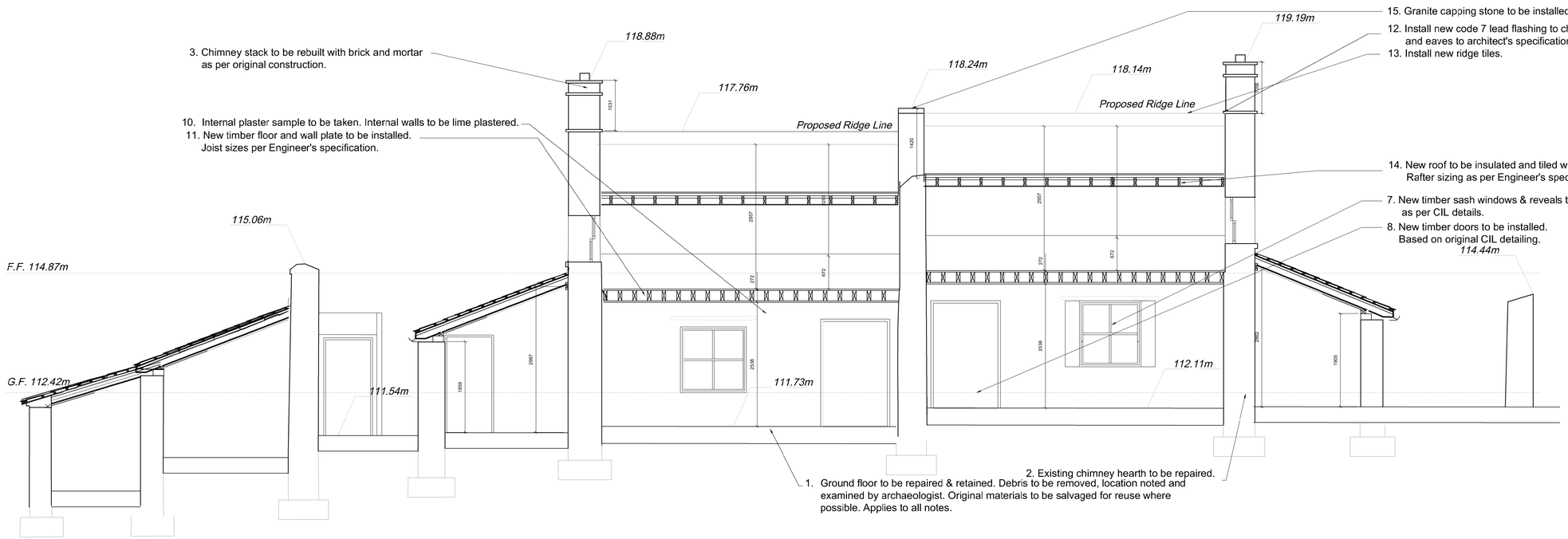
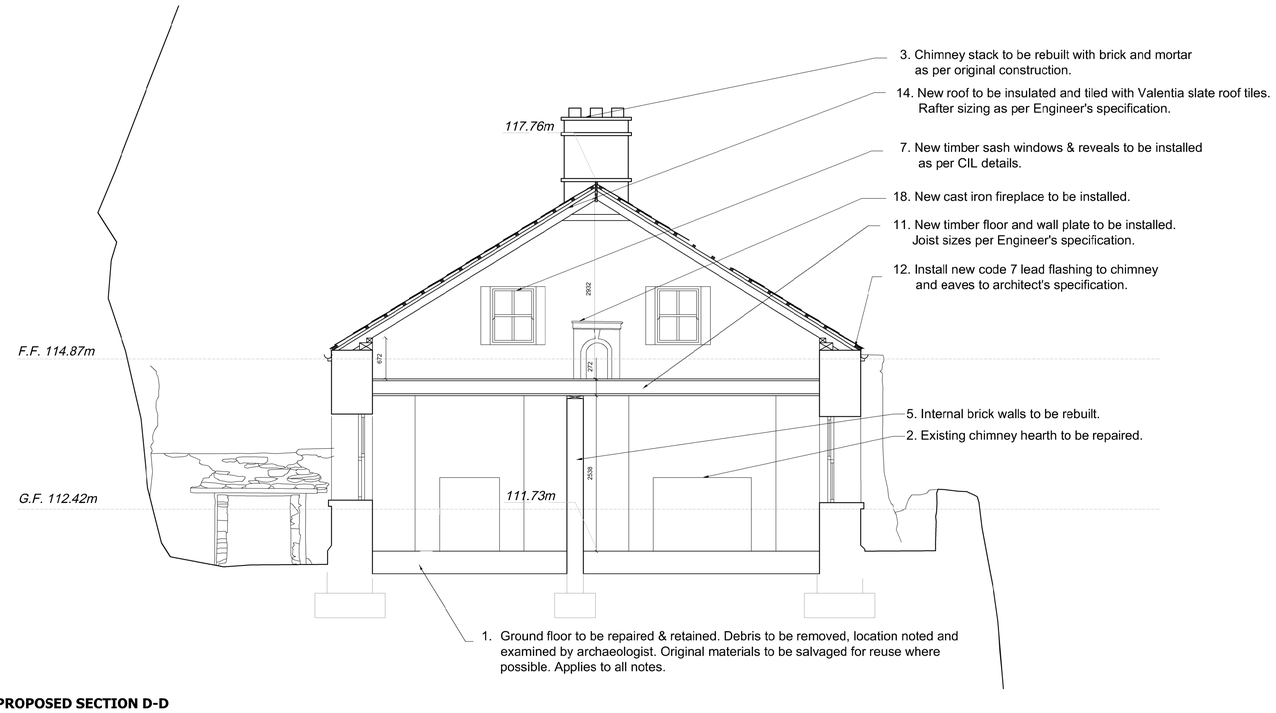


GROUND FLOOR KEY PLAN
NTS

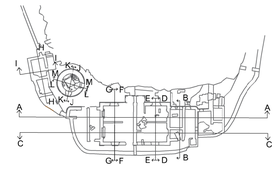
Architectural Services	Principal Architect	Design Team		Drawing Revisions		Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Bláthmhac Ó Muirí - Architectural Graduate	Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION A B C D E	DRAFT	Sheet 1 of 4 Proposed Sections	Skellig Michael - Upper Lighthouse Repair & Refurbishment Works
				DATE:		DRAWN CHECKED SCALE DATE BOM FMC 1:50@A1 June 2020	PROJECT NO. STATUS NUMBER REV. CONSENT



PROPOSED SECTION C-C
SCALE 1:50 @ A1



PROPOSED SECTION D-D
SCALE 1:50 @ A1

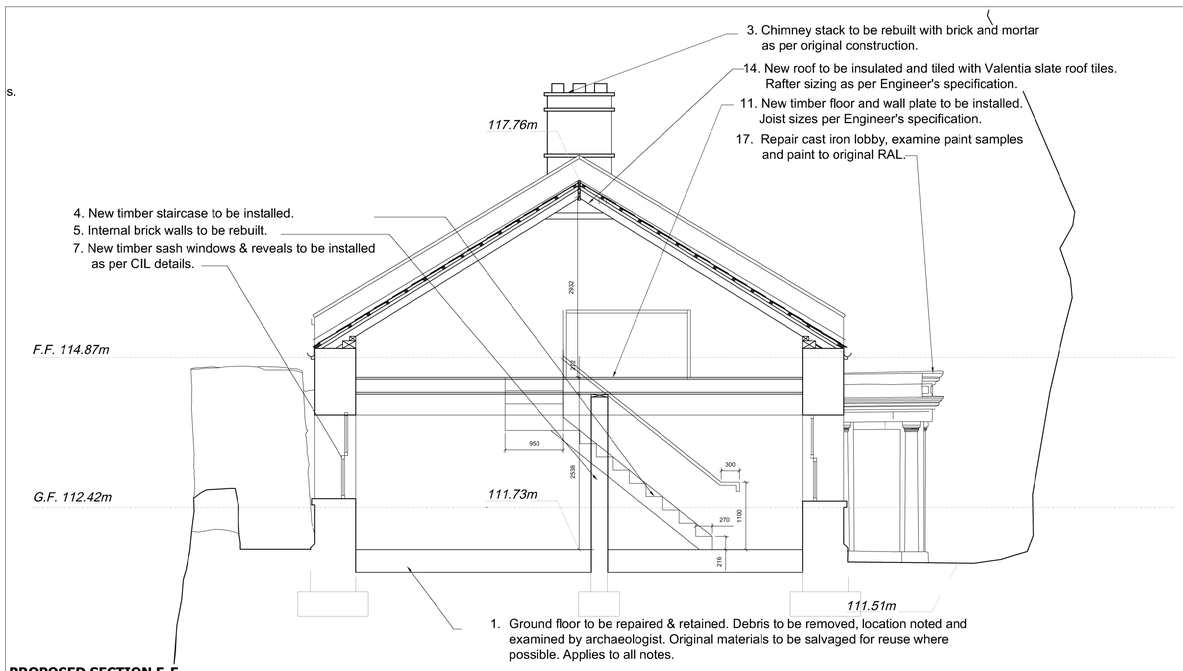


KEY PLAN

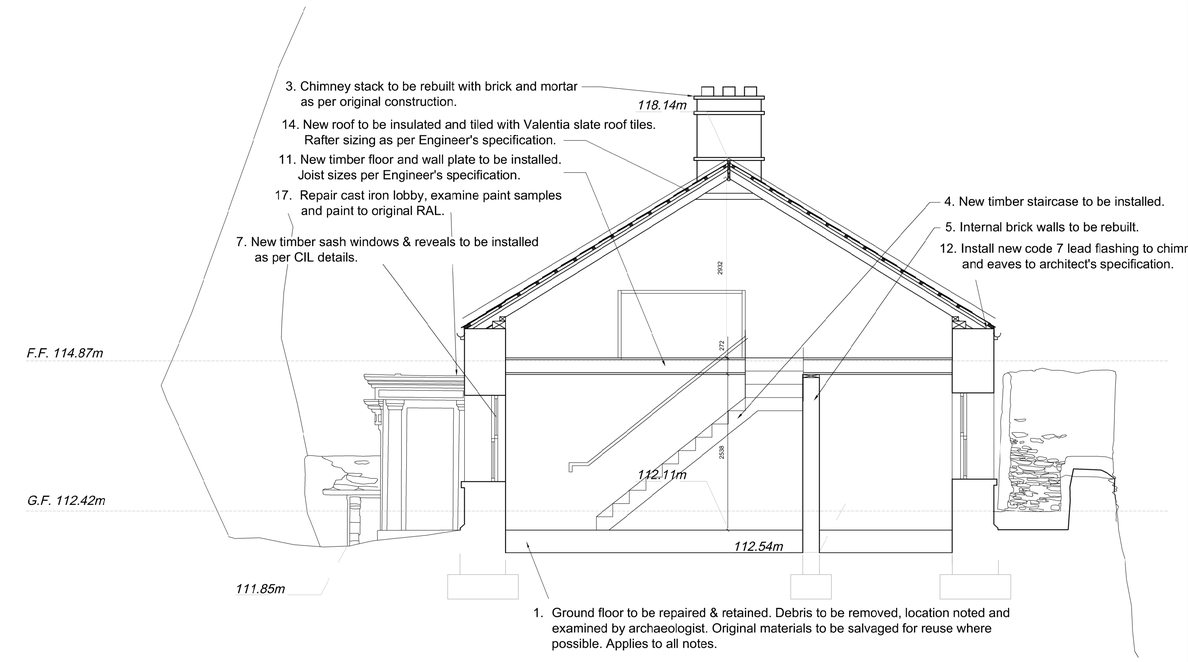
GROUND FLOOR KEY PLAN
NTS

Architectural Services	Principal Architect	Design Team	Drawing Revisions	Drawing Title	Project Title
OPW Head Office, Trim, Co. Meath. Telephone: (046) 942 6000 LoCall: 1890 213414 Website: www.opw.ie	CIARÁN O'CONNOR, PRINCIPAL ARCHITECT, DIRECTOR OF ARCHITECTURAL SERVICES	John Cahill - Assistant Principal Architect Fergus McCormick - Senior Architect Bláthmhac Ó Muirí - Architectural Graduate Architectural Services Telephone: (046) 9426466 Facsimile: (046) 9438409	REF DESCRIPTION DATE: A B C D E DRAFT	Sheet 2 of 4 Proposed Sections	Skellig Michael - Upper Lighthouse Repair & Refurbishment Works

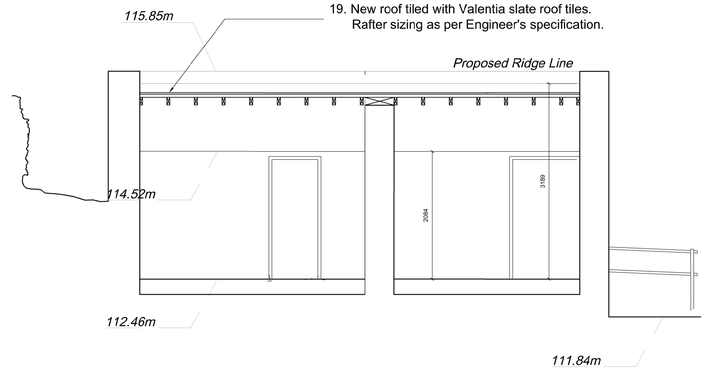
DRAWN	CHECKED	SCALE	DATE	PROJECT NO.	STATUS	NUMBER	REV.
BOM	FMC	1:50@A1	June 2020		CONSENT		



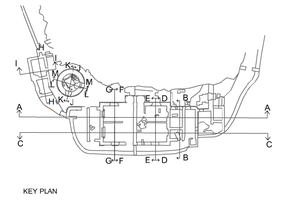
PROPOSED SECTION E-E
SCALE 1:50 @ A1



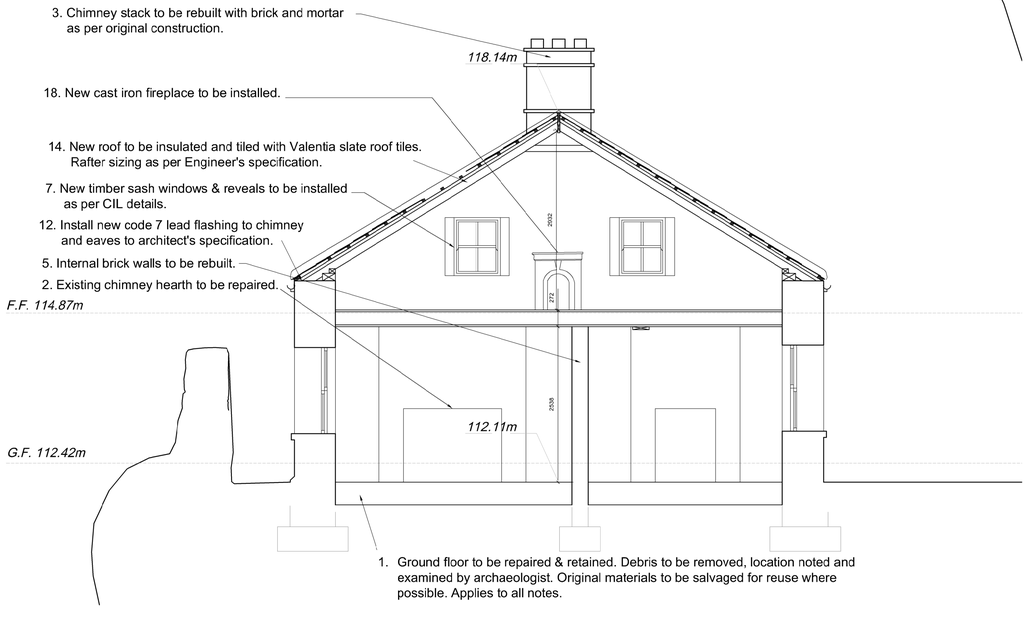
PROPOSED SECTION F-F
SCALE 1:50 @ A1



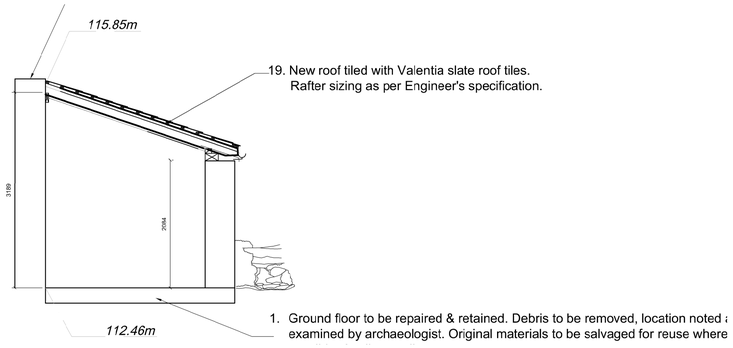
PROPOSED SECTION H-H
SCALE 1:50 @ A1



GROUND FLOOR KEY PLAN
NTS



PROPOSED SECTION G-G
SCALE 1:50 @ A1



PROPOSED SECTION I-I
SCALE 1:50 @ A1

OPW Head Office, Trim, Co. Meath.
Telephone: (046) 942 6000
LoCall: 1890 213414
Website: www.opw.ie

CIARÁN O'CONNOR, PRINCIPAL ARCHITECT,
DIRECTOR OF ARCHITECTURAL SERVICES

John Cahill - Assistant Principal Architect
Fergus McCormick - Senior Architect
Bláthmhac Ó Muirí - Architectural Graduate

Architectural Services
Telephone: (046) 9426466
Facsimile: (046) 9438409

Drawing Revisions
REF DESCRIPTION DATE:
A
B
C
D
E

DRAFT

Drawing Title
Sheet 3 of 4
Proposed Sections

Project Title
Skellig Michael - Upper Lighthouse
Repair & Refurbishment Works

DRAWN	CHECKED	SCALE	DATE	PROJECT NO.	STATUS	NUMBER	REV.
BOM	FMC	1:50@A1	August 2020		CONSENT		