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# Howan House, Orkney

## Renovation and repairs to a 17th century house

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# Howan House, Orkney

Renovation and repairs to a 17th century house

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With thanks to:

Simpson & Brown *Architects*
with Addyman Archaeology

Rachel Mayhew | Architect

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## 1. Introduction

This case study focuses on the conservation work, repair and alterations carried out to a category B-listed property dating from the 1600s. Howan is situated on the east shore of the island of Egilsay, one of the more northerly islands in the Orkney archipelago. It is located approximately 25 km north of Kirkwall and 60 km north of the Scottish mainland. The building is accessible by farm track off of the main road running north/south on the island and had been derelict since the early 20th century. Previous to this it was in use as a byre (Figure 1).

Figure 1: Image from the early 20th century showing the north elevation with roof still intact (© Historic Environment Scotland)

Despite years of disuse, the house was still remarkably intact when work began on the refurbishment project in 2010. The elegant 18th century dining room on the first floor still retained some original panelled shutters, doors, dados, skirtings and architraves (Figure 2). The new owners wanted to repair the building and make it suitable for modern living without losing its innate character. Using a best practice conservation approach, the owners utilised as many of the original building materials as possible. They employed conservation architects, Rachel Mayhew and Simpson and Brown Architects, and experienced local contractors to carry out the work.

Figure 2: Interior of the dining room before works with joinery details still intact

The works at Howan were carried out from 2010 to 2014 in three phases. The first phase was a *holding* phase, where the house was temporarily made wind and watertight to prevent any further damage while construction work was planned. During the second phase, essential structural work was carried out to *stabilise* the building and make it wind and watertight. In 2013, during the third *fitting out* phase, the main joinery fitments and finishes, heating and electrical installations, insulation, interior and exterior finishes were carried out and a wind turbine was installed. The project is an example of how a listed historic building can be sustainably repaired using traditional materials and techniques, whilst incorporating thermal upgrades to the fabric and introducing a renewable energy source with underfloor heating.

This case study describes the refurbishment process and some of the lessons learned during the project. The careful use of appropriate materials and techniques in the repair has shown that changes can be made to good effect, improving the internal living spaces and technical performance of the building fabric without loss of historic character. Many of the conservation approaches taken in this project can be replicated in other refurbishment projects.

## 2. Historical analysis

*The importance of understanding the building and its history*

Before undertaking any repair works, the first step was to establish an understanding of the building's archaeology and history. Not only did this provide information on previous alterations and/or original materials, but also provided an opportunity to document the building prior to, and during alteration. For this project, both the owners and the design team were interested in uncovering the history of the building

while it was still in a readable state (i.e. without external harl and internal plaster finishes). In 2009, the owners commissioned Addyman Archaeology to carry out an Historic Building Appraisal and a further archaeological investigation was carried out by Addyman Archaeology in 2011. The findings of the reports are summarised below.

*Outline history*

Howan was originally a Laird's house of two stories with a loft floor above. In the 16th century, Egilsay was feued to the Monteith family. The lintel above the fireplace in the east gable wall, which was still in situ but badly weathered, was photographed in the early 20th century (Figure 3). Dated 1635, it contains the arms and initials of Robert Monteith and his wife Katherine Nisbet. The same armorial is present in the surviving door lintel, dated 1681 (Figure 4). In addition, there is an initialled skew putt on the north east of the building reading "WD MM", for William Douglas and Marjorie Monteith, which is thought to have been carved after the couple married. The property essentially functioned as a farmhouse for most of its history but by the end of the 19th century it was used as a school. Thereafter it had no domestic function and was used to house cattle and sheep, with storage on the upper floors.

Figure 3: Armorial lintel above fireplace photographed in the early 20th century

Figure 4: Surviving armorial lintel above the south-east doorway dated 1681

*Architectural style and development*

The house appears to be a typical example of Scots-Orcadian architecture of the 17th century. However, many of the surviving details, particularly the joinery, suggest that extensive remodelling occurred during the late 18th century. The structure is rubble-built of locally derived stone, a buff-coloured slabby sandstone, with dressings of a paler yellow fine-grained sandstone of the Eday beds series. On the exterior of the building there is extensive evidence of lime harl (Figure 5).

Figure 5: Extensive evidence of lime harl on north elevation

The building has a steeply pitched roof with crow-stepped gables, which rise to substantial stone chimneys of three flues each. The windows are of medium size and standard proportion, but not all of the same form; some retain well detailed chamfered dressings, while the surrounds of others are more simply fashioned of rubble stone, which suggests later remodelling. There was no principal entrance on the north elevation, however, an ornately carved entrance surround exists internally where it now provides access to a southwards running jamb (Figure 6).

The angle of the surviving early west gable suggests that the original structure was not exactly rectilinear, but rather a parallelogram in plan (Figure 7). It is thought that the east gable is of later construction. The quoining and crow-steps are formed of both dressed and rubble stone, whereas the west gable only employs pale yellow sandstone dressings of better quality. In addition to this, there is a significant change in the ground floor ceiling structure; the most part is formed of hewn square section pine joists, however the last six joists to the east are more finely finished and of a less substantial tall rectangular section (Figure 8). The point of change appears to indicate the position of the original east gable wall (indicated in red in Figure 8); if this is the case, it indicates that the original building was of an L-shaped plan.

Figure 6: Ornately carved entrance surround providing access to the southwards running jamb

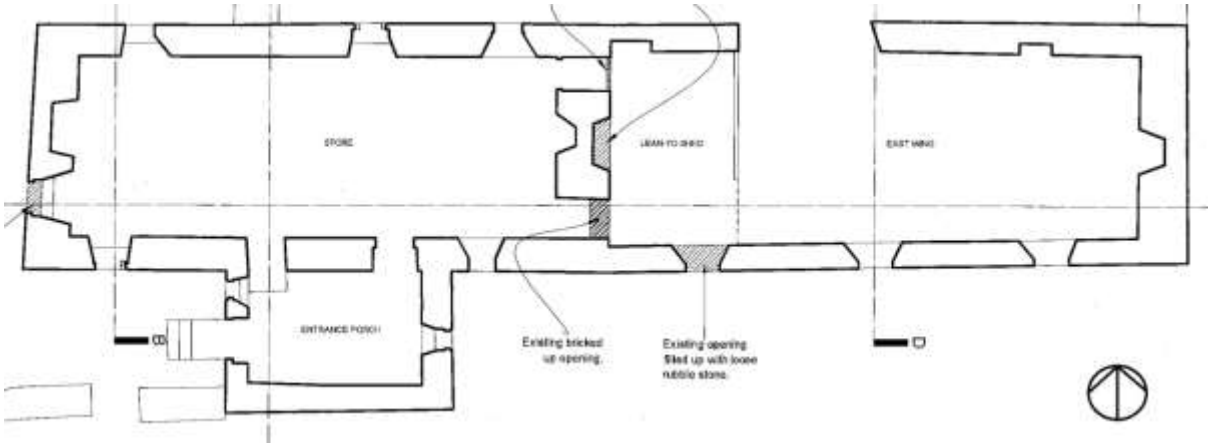


Figure 7: Ground floor plan indicating original form and point of extension

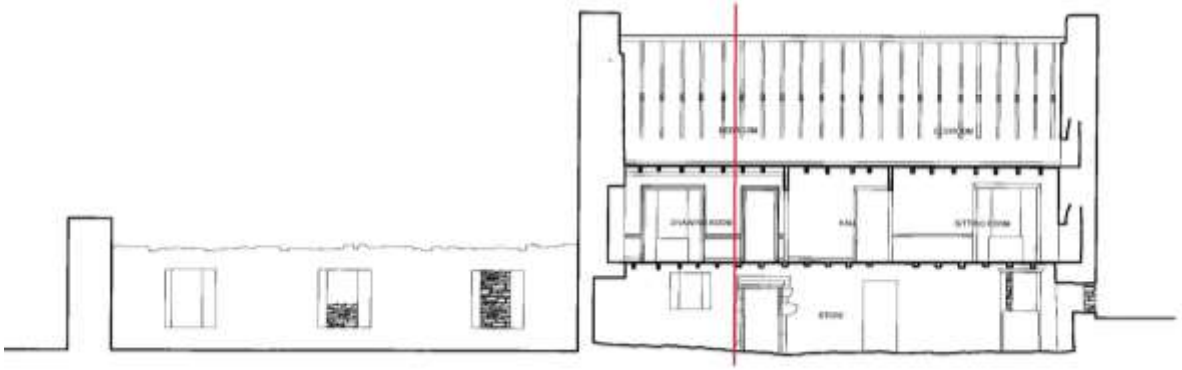

Figure 8: East-west section showing the change in joist form

Although the entrance wing extending to the south first appears to be an extension, there is no evidence of an internal stair to the first floor within the main body of the house. Therefore, it is thought that it was original. In addition to this, the stonework matches that of the original part of the house. Recognisable early features were only readily visible within the ground floor. Within the west wall, slightly offset to the north, were the decayed remains of a substantial and elaborately decorated fireplace (Figure 9).

Figure 9: Remains of fireplace in the west wall on the ground floor

The interior arrangement of the first floor is completely of the secondary, 18th century, remodelling phase. This floor is partitioned into two principal rooms in the east and west, with the central area formed into a straight stair up to the loft and a central chamber that partly extends under the stair (Figure 10).

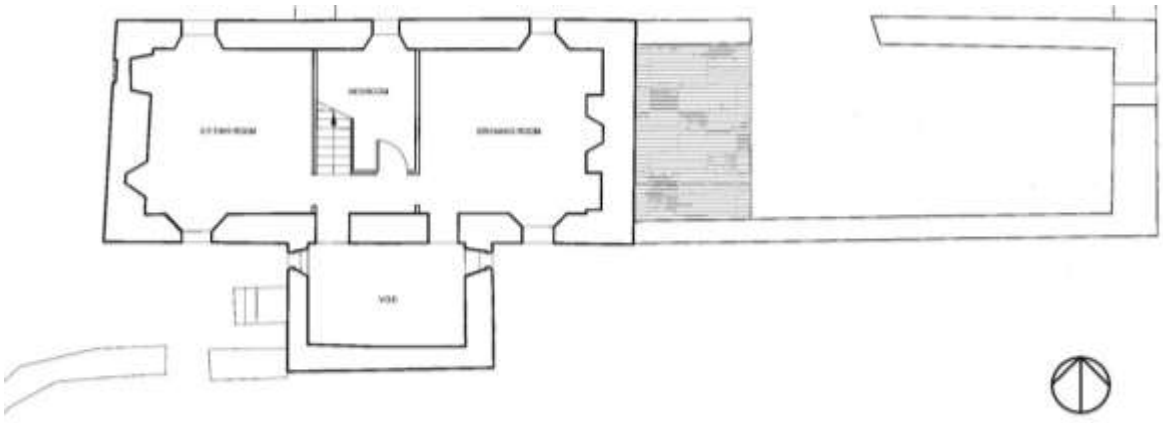

Figure 10: First floor plan showing original first floor arrangement

The first floor partition walls are stud-framed with face-bedded brick in-fill (sometimes called ‘nogging’) which was plastered over (Figure 11). The east first floor room was the best appointed, and assumed to be the former dining room. There is a dado rail, classical timber cornice (retaining extensive traces of vibrant blue paint) and a lath and plaster ceiling. The east wall has a symmetrical arrangement of presses on either side of the fire place. This retained a fine simple classical chimney piece which makes use of the same moulding as the main cornice with an added dentil course beneath and a mantel shelf (Figure 12).

The west room on the first floor is assumed to be the former drawing room. The walls here were either lined or plastered on the hard, and detailed with a dado rail. The fireplace retained a simply detailed moulded wooden surround (Figure 13).

Figure 11: Stud-framed wall with face-bedded brick in-fill

Figure 12: Classical moulding on the chimney piece in the east wall

Figure 13: First floor, west gable hearth during repair, with a simply detailed moulded wooden surround

The roof structure is of common rafter form, comprising twenty-three couples formed of neatly dressed pine. The rafter pairs are jointed and pegged at the apex. The collars are lapped and pegged, half-dovetailed in what is called a gunstock style, and the collar ends are chamfered around (Figure 14).

The rafter foot assembly is bedded into the wall head and plastered over internally. The roof, in the final stages of decay, was sarked in normal Scottish fashion and covered with what appears to be Welsh slate, fastened with galvanised nails (Figure 15).

Figure 14: Timber peg and chamfered collar detail

Figure 15: The roof before works, showing rotten timbers at the apex

*Other Architectural Fragments*

Many loose historic building materials were found on site including dressed stones, crow-steps, a window lintel, and short but substantial ridge stones, crafted from sandstone of a pinkish hue (Figure 16).

Figure 16: Short but substantial ridge stones, formed of sandstone of a pinkish hue, found on site

## 3. Structural Condition

*Engineering assessment*

As part of the information gathering stage, the architects commissioned Ramboll Structural Engineers to carry out a structural condition survey. This provided the architects with a list of the necessary structural repairs for the building. It is important to note that although timbers may be affected by rot and woodworm, they can still retain their structural integrity and may not need to be repaired or replaced.

*Exterior*

There were no visible signs of cracking on the west gable and the sills and lintels of all three windows appeared to be intact. Signs of lateral outwards movement in the north and south elevations were evident nearest the east gable where the crow-stepped gable and chimney had separated from the roof (Figure 17).

Figure 17: North gable chimney stack showing the gable separation from the roof structure

In addition to this, there was a vertical crack near the east gable, widening towards the eaves (Figure 18). Some of the stone window lintels on the south elevation were cracked, possibly due to lateral movement and bowing of the wall. Many of the timber window lintels were rotten and distorted. In the east elevation there were three significant cracks visible on the chimney and around the crow-stepped gable, caused by outwards lateral movement and lack of restraint. In general, the walls were damp at low level due to the capillary action of ground water. Where ridge stones had been removed along the roof there were visible holes where the roof had decayed and partially collapsed (Figure 18).

The entrance wing had separated slightly from the main house, due to a lack of tying in of the stonework. This had caused some of the sills to crack on the west wing elevation. However, on the east elevation the window openings were in a satisfactory condition. There was no roof on the entrance wing but there were indents in the masonry where the rafters would have been bedded into the wall (Figure 18).

Figure 18: South elevation with vertical crack to the east. The pockets in the masonry of the wall in the entrance wing where the rafters would have been bedded are visible

*Interior*

Figure 19: Existing ground floor condition with temporary props supporting the floors and the masonry partition above

At ground floor level, the walls that had been previously plastered on the hard were damp at ground level. Temporary props had been installed to bear the weight of the first floor masonry partition above an area where one of the beams was missing (Figure 19). Some joists looked to be dry and in sound condition, whereas a number of joists were damp from water ingress through the holes in the roof and attic floor.

The first floor had been divided into three rooms; two of the rooms had been framed out and plastered on timber laths, but the eastern room had been largely plastered on the hard. In the eastern and western rooms the wall and ceiling timbers were stained due to dampness, particularly at the gable ends. The joists of the attic floor were newer and narrower and were generally in good condition towards the central bay, with damage near the gables, corresponding to the holes in the roof above.

Figure 20: Existing attic condition

Access to the attic was provided via the staircase in the central bay. In general, the structural timbers were in good condition, probably due to the amount of wind in Orkney and the drying out effect (Figure 20). The only rot occurring was in relation to direct water ingress, with no evidence of dry rot. Where water had penetrated the roof, holes could be seen where timbers had rotted. Several timbers were damp towards the rafter ends and rotten at the apex as they were exposed to the weather.

*Services*

The only services onsite included a BT cable running to a caravan and a water borehole with a broken pump. There was no mains electricity, and therefore no wiring or service voids in the house.

## 4. Objectives of the project

- To prevent the building from falling into further disrepair and save one of the few early and historically important buildings on Egilsay
- To repair the structure of the building to make it wind and watertight
- To conserve as many of the original features as possible
- To reuse as many of the original materials
- To use local contractors and skills
- To create a comfortable house with sustainability credentials

## 5. Design approach

The architects established a clear methodology for restoring and renovating the buildings. In particular, the importance of understanding the building's history and construction fully, before starting work to inform the design and construction decisions. In 2010, the architects carried out a detailed condition and measured survey of the building while it was still readable prior to works. This included profiles of all of the remaining architectural joinery, regardless of condition, such as; sash and case windows, dado rails and doors (Figure 21).

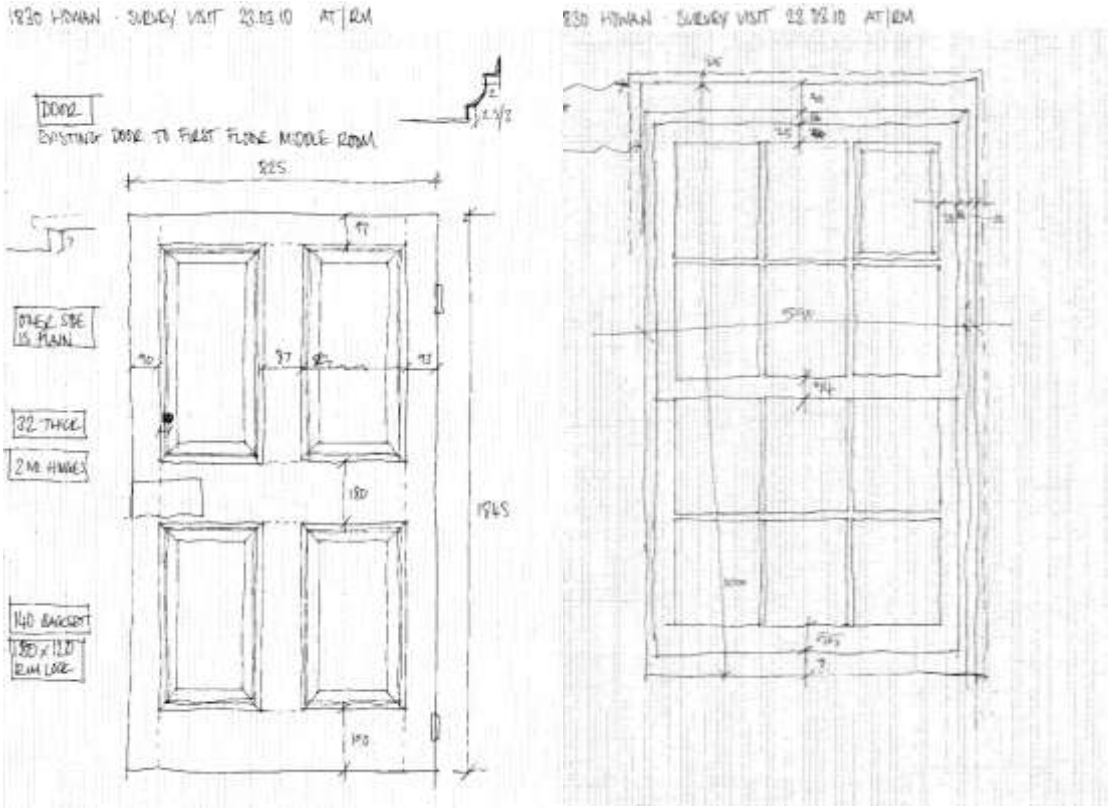

Figure 21: Examples of initial survey drawings, intended to record architectural details prior to works

Although the ground floor was not originally open plan, the decision was made to keep the current layout and create an open plan living space with kitchen and dining. This meant that the ground floor works had to comply more strictly with modern building standards.

Although there was nothing remaining of the original stair, it is thought that it would have been in the lean-to entrance wing. The decision was made to design a new staircase using steel and reusing original timbers, in the position of the original stair hall. However, the new stair had to comply with building regulations and there were issues with achieving the required head room. As there was no existing roof, there was some leeway to build the new roof at a slightly steeper pitch, and thus give adequate head room (Figure 22).

Figure 22: Newly designed timber and steel staircase in entrance wing

The eastern first floor room was made into the drawing room, the western room was changed into a bedroom, and the small central room was turned into a bathroom (Figure 23). The original plasterwork was reinstated; the drawing room plastered on the hard and the bedroom and bathroom lined with lath and plaster. Balustrades had to be added at attic level to comply with building regulations, and the layout of the landing was altered to improve headroom at the top of the stair.

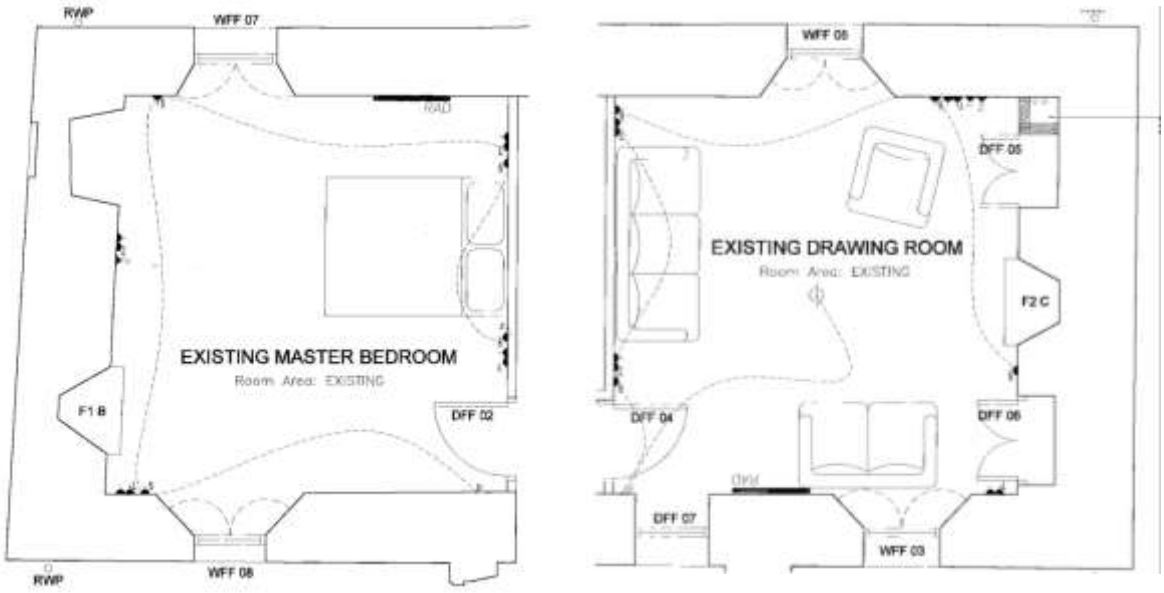


Figure 23: Upgrade plans for the master bedroom and drawing room on the first floor

The attic was split into two bedrooms where there was evidence of previous partitions. The external walls at this level were framed out in timber studwork and filled with insulation to improve the energy performance. The decoration at this level was kept very simple, in keeping with the rest of the house (Figure 24).


Figure 24: Attic upgrades

## 6. Planning permission and building warrants

The proposed changes in the layout of the ground floor required compliance with modern Building Standards. The walls therefore had to be insulated and lined as far as possible. Where there were original details like the carved stone lintel, it was not possible to change the wall line, so these walls were left simply to be plastered on the hard.

The first floor rooms remained largely unaltered so were not required to meet modern Building Standards. The drawing room was conserved as it was and was re-plastered on the hard. The bedroom was strapped with lath and lime plastered. This was a change from the original plaster on the hard finish, but was chosen to help keep the walls dry and avoid potential problems with salts.

## 7. Contract and procurement

A local contractor was appointed as principal contractor, along with local subcontractors to carry out the work. The only work that was not carried out by local tradesmen was the lime work which was subcontracted to a specialist lime consultant. However, local tradesmen worked alongside and were trained onsite in the techniques used and are therefore now able to carry out repairs which may be required at a later date, and can also apply similar techniques to other Orkney buildings (Figure 25). A local architect acted as a clerk of works for the project and communicated with the project architects.

Figure 25: Local plasterers learning how to mix the lime plasters and paint from the lime consultant

Due to the remote nature of the site, the project architects only visited the site three times. During the summer the small car ferry is often fully booked with tourist traffic; this meant that any plant required had to be booked well in advance and any material deliveries had to be timed precisely. A van would then pick up the materials at the quay and transport them to the house. The local contractors were used to working this way, and were very resourceful with materials and time. For this reason, any materials on site that could be reused were salvaged to save on transport, cost and time.

## 8. Improvement works

*Exterior*

The roof was completely stripped and the slates were recorded and laid out. Where slates and ridge stones were missing the timbers were rotten at the apex and some, due to holes in the roof, had suffered more rot. Where it was possible, the timber was supplemented rather than replaced (Figure 26). Rotten sarking was replaced and nailed into place.

The slates were then redressed and the ridge stones that were found lying on the ground were reused. Reclaimed slates were used to fill in any missing gaps (Figure 27).

Figure 26: Repaired timber rafters, with splicing on the furthest right rafter

Figure 27: Repaired timber roof with original and reclaimed slates

The east gable was taken down from the eaves upwards as it was deemed structurally unsafe. The stones were recorded and numbered so that when the wall was rebuilt the stones would be put back in the correct position. Where the stone lintels were cracked, slim steel supports were fitted behind to give the structure strength.

Years of wind and rain had washed mortar away between the masonry joints. The stone work was galleted out to fill any large voids and repointed with lime mortar to make the walls wind and watertight. The mortar was brought to a vertical plane to allow for a smooth application of the harling. The use of natural materials, such as lime mortar, were selected in order to retain the breathability of the construction (Figure 28).

Figure 28: Section of the external wall showing existing lime mortar at the top and new lime mortar

As would be expected of a building of this age and condition, the exposed chimney copes were cracked. The stones were recorded as they were taken down and they were rebuilt. Originally the chimney would have had a mortar skew, however, for minimal future maintenance, a lead soaker was raggled into the base of the chimney (Figure 29). Although not an original detail, short clay chimney cans were added to all flues and haunched in a hydraulic lime mortar mix.

Figure 29: Lead soaker raggled into the base of the chimney

New rhones, down pipes and drains were installed to help the shed of water from the base of the building and taken to a new soakaway. New clay gulley traps were installed with below ground drainage. Perforated pipes were laid beneath the new ground floor, in the natural direction of the topography, leading to a soakaway located 27 metres from the building.

*Finishing joinery repairs*

Parts of three of the original windows were able to be salvaged and reused. The remaining windows were fabricated to detailed designs specified by the architect and taking specifications and profiles from the existing windows. Single glazed reproduction cylinder glass was used for its rippling texture, which blends with the uneven surface of the lime harl (Figure 30). Although double glazing was an option in this refurbishment, shutters are used to keep heat in. Due to the small size of the sashes, there was evidence of sash dogs rather than weight boxes in the sash frames (Figure 31). A new entrance door was constructed of 45mm thick v jointed vertical oak boards (Figure 32).

Figure 30: New single glazed sash and case windows with cylinder glass

Figure 31: New sash dogs on small sash and case windows

There was extensive evidence of a traditional thin lime harl on the exterior masonry. Lime harl is the most effective way of protecting masonry from weather and erosion and was commonly used in Scotland on traditional buildings to form both a protective and decorative finish. There were three samples of local sand tested for best match. The first was Burray Sand from Orkney, which was deemed too fine for use, the second was Melvich Sand from Sutherland which was too salt laden and the third was Fourth Barrier Sand, which was chosen for its balanced composition. Bricks

already onsite that had infilled windows and fireplaces were ground down and used as aggregate for the harl and for pinnings.

*Limewash*

The limewash was batched on site. The coral colour of the lime wash render was chosen to match the naturally occurring lichens on the rocks (Figure 33).

Figure 32: New timber tongue and groove external door

Figure 33: Colour of harl chosen to match the colour of the naturally occurring lichens on the rocks

*Interior*

The interior of the building had been finished in both lath and plaster, and plaster on the hard. Most of the remaining existing plaster on the walls was very damp, salt laden and friable. In some of the rooms, the walls were re-lined with lath and plaster, with insulation behind the laths. Sawn laths were used (Figure 34). A lime plaster was then applied in the standard three layers of pricking up coat, smoothing coat and finish coat of lime putty (Figure 35).

This method allows ventilation behind the plaster and disperses water vapour from the fabric. In the drawing room, the walls were plastered on the hard as per the original; this allowed presentation of legacy architectural features. While the walls were drying out salts in the wall migrated to the base of the inside walls, which caused limited staining (Figure 36). A natural pigment was added to the plaster to make it a green colour, which gave the room a finished look while the plaster was still drying. The plasterer made up a recipe and chart for all of the different plasters he used so that repairs could be made in the future if needed.

Figure 34: New sawn timber laths being fitted to timber framing

Figure 35: The ground floor living area after the works, partly lined and partly plastered on the hard

Figure 36: The first floor bedroom after the works lined with lath and plaster

The first floor timber floor was largely intact and most of the timbers could be kept and reused. Where the timbers were rotten, salvaged timbers from the attic floor were used to replace them. Floors constructed of timber floor boards on beams lack any deadening, and allow sound to travel through the floors. To deaden the sound, the owners have now laid carpet in the drawing room (Figure 37).

Figure 37: Drawing room after works with carpet laid over the timber floor

New Caithness flagstones were laid in the main room on the ground floor. Stone is a good conductor of heat and therefore allows the heat from the underfloor heating pipes to permeate into the room. Insulation beneath the pipes stops the heat from being lost into the ground, and the flagstones were laid tightly together (Figure 38). In the entrance hall the original salvaged Rousay flagstones from the house have been reused. The flagstones were all of different thicknesses which made it difficult to achieve a flat surface.

Figure 38: Caithness flagstones laid tightly together on the ground floor

At first floor level, a few 18th century panelled shutters still remained, either fixed across the window openings, or lying elsewhere in the house having been used for other purposes. Each window was slightly different, and its joinery had to be individually drawn. There were also some existing skirtings, dado rails and window and door facings, especially on the first floor, and the architects made detailed drawings of them so that new joinery finishes could be matched in. Any remaining existing joinery was salvaged and reused if possible (Figure 39).

The central first floor room door was the only existing door that remained (Figure 40). It was too thin to achieve a half hour fire rating regulated by the modern Building Regulations. However, as it was to be used as the bathroom door, it did not need to be a fire door. The other new doors were made based on the moulding design of the existing door, with four panels, and were 30 minute fire rated. Intumescent paper was fitted on the panels of the doors, where the timber was at its thinnest and the beads around the panels were painted in intumescent paint to achieve the required fire protection.

Figure 39: Salvaged timber ready for reuse

Figure 40: Original door still hanging in the central room

In the drawing room most of the dado rails were extant and approximately 40% were reused. In the bathroom the existing skirting and dado rails were retained and 15mm v jointed vertical tongue and groove timber pipe boxing was fitted, with the top of the boxing flush with the existing dado rail. The contractor took profiles of existing mouldings and provided samples of the new mouldings for approval by the architect.

*Fireplaces and hearths*

There were five fireplaces; three on the ground floor and two on the first floor. The fireplace in the west gable on the ground floor was very wide (possibly 17th century) with distinctive reeded jambs. The lintel had been heavily eroded by water running down the flue, and needed to be replaced for structural reasons. No attempt was made to re-create the original carved lintel, instead a simple stone lintel was fitted with a fine stugged surface (Figure 41). The fireplace in the west gable on the first floor had an 18th century timber chimney piece on a lath and plaster wall. When temporarily removed to renew the laths, a 17th century stone roll-moulded surround was uncovered beneath. The 18th century chimney piece was refitted, as this matched the details in the rest of the 18th century remodelled room, but the 17th century moulding is still visible.

On the east side of the building there were two 18th century timber chimney pieces which were largely intact but both lacked their hob grate. The stone left within the fireplace showed the scale and form of what had previously been there. New suitable hob grates were found, repaired and refitted. Slips were added in each case to ensure fires were safe to use. The ironwork of the hearths was finally finished with black grate polish.

Figure 41: New stone lintel in situ above the ground floor fireplace in the west gable

## 9. Services

There was no mains electricity on site when the project started. To install cables for mains electricity, disruption would have needed permissions from a local landowner and a wayleave had to be granted, this required a lengthy legal process. By the time the wayleave was granted, the project was well into phase three and the contractors had to use a generator for most of the works, which had a substantial cost implication.

The remote location meant that electricity was the only viable option for heating and hot water. Off grid was an option; however, the storage battery would have only had a ten year life span and would then have required replacing at a significant cost and would leave a toxic battery to be disposed of. To make the scheme more sustainable, the architects and the clients chose to install a 6.5kW wind turbine to generate electricity to help with the load (Figure 42). As Egilsay is a RSPB protected area the architects had to apply for permission to install the turbine. The RSPB agreed but the turbine had to be installed after the corncrakes had nested. The energy generated from the wind turbine is measured, and fed into the grid; then the house takes its electricity from the grid. It was quickly apparent that the wind turbine was generating a significantly higher amount of electricity than the grid would accept so two electric radiators were installed to act as a heat dump into the house (Figure 43).

Figure 42: 6kW wind turbine just visible through an original restored window

Figure 43: Two electric radiators use to use the excess electricity generated and to keep the house at a constant temperature

Interior service routes had to be built in, either behind the lath and plaster where possible or in cupboards or corners where the rooms were plastered on the hard.

An electric boiler and hot water cylinder were installed to provide both domestic hot water and hot water for space heating. As Howan is built of predominantly solid

heavy materials it takes a long time to heat up the building to a comfortable temperature. A wet underfloor heating system was installed beneath the flagstones on the ground floor which provides a consistent background temperature within the building mass and keeps the fabric dry. A conventional wet radiator system was installed at first and attic floor levels. There is also an electric Aga in the kitchen which can be switched on and off as required.

Water is supplied by a borehole. This was already in place when the current owners bought the property, but the pump was broken, so the reliability of the water supply was unknown. On testing, it was also deemed unpotable. As this is the only source of water it was decided that a certain amount of water should be stored, to avoid it suddenly running dry. The water now runs through a mini water treatment plant of filters and UV steriliser.

Foul water was routed to a new septic tank. A reed bed system was installed to treat the outflow from the septic tank. The first planting of reeds did not prove successful; a second planting with flag irises that the house owners noticed growing well on the island has worked much better. The now cleaned water flows into a stone soak away drain and dissipates into the soil.

## 10. Conclusion

This case study demonstrates an exemplary approach to conservation and renovation. It outlines the importance of taking the time at the start of a project to understand a building's archaeology while it is still in a readable state, and structuring a conservation plan. In addition to this, Howan demonstrates the value of carefully assessing the condition of existing materials for reuse and, where possible, supplementing them with local materials. Key to the success of this project was the close collaboration of local contractors with the design team, using their knowledge and skills to deliver an authentic and sensitive design. The project has been successful in saving a key Egilsay building from falling into further disrepair by giving it a new use and providing a comfortable holiday home.

## Refurbishment Case Studies

This series details practical applications concerning the conservation, repair and upgrade of traditional structures. The Refurbishment Case Studies seek to show good practice in building conservation; some describe projects supported by Historic Environment Scotland, and some are entirely privately resourced projects. The results of some of this work are part of the evidence base that informs our technical guidance. At the time of publication there are 23 case studies covering measures such as repairs to masonry, upgrades to windows, walls and roof spaces in a range of traditional building types such as tenements, cottages and public buildings.
All the Refurbishment Case Studies are free to download and available from the HES website ***https://www.historicenvironment.scot/refurbishment-case-studies/***

## Technical Papers

Our Technical Papers series disseminates the results of research carried out or commissioned by Historic Environment Scotland, mostly related to improving energy efficiency in traditional buildings. At the time of publication the series has 23 titles covering topics such as thermal performance of traditional windows, U-values and traditional buildings, keeping warm in a cool house, and slim-profile double-glazing.
All the Technical Papers are free to download and available from the HES website ***https://www.historicenvironment.scot/technical-papers***/

## INFORM Guides

Our INFORM Guides series provides an overview of a range of topics relating to traditional skills and materials, building defects and the conservation and repair of traditional buildings. At the time of publication the series has over 50 titles covering topics such as: ventilation in traditional houses, maintaining sash and case windows, domestic chimneys and flues, damp causes and solutions improving energy efficiency in traditional buildings, and biological growth on masonry.
All the INFORM Guides are free to download and available from the HES website ***https://www.historicenvironment.scot/inform-guides/***

## Short Guides

Our Short Guides are aimed at practitioners and professionals, but may also be of interest to contractors, home owners and students. The series provides advice on a range of topics relating to traditional buildings and skills.
All the Short Guides are free to download and available from the HES website ***https://www.historicenvironment.scot/short-guides/***