The winter storms of 2013/14 caused significant damage to the coastal defences along the Conwy coastline. The scale of the devastation was a result of unusually high tides, low pressure and strong westerly winds causing widespread flooding to the Conwy coastline. The storms caused in excess of £5 million in damages to sea defences along the Conwy coastline and the Flood Risk & Infrastructure Group of Conwy Council were successful in securing £3.8 million in funding from Welsh Government to repair and reinforce those areas at risk.

Since grant funding approval, the Council has successfully completed repair works at thirteen locations - Morfa Madryn, Llanfairfechan, Conwy Morfa tip and coastal path, Deganwy promenade and cycle path, West Shore Llandudno, North Shore Llandudno, Penrhyn Bay, Colwyn Bay, Llanddulas car park and tip and Kinmel Bay.

The repair work has included the replenishment of beach foreshores, reconstruction of damaged rock revetments, sea wall repairs, bespoke flood gate installation and repairs to promenades.

A number of the affected areas are located within designated conservation areas and the Council’s Engineers have worked closely with Conservation Officers, from both Natural Resources Wales and the Councils Countryside Department, to protect fragile coastal habitats during the work and help preserve the areas.

A full closure of the coastal path was necessary in a number of the affected areas enabling the repair work to be undertaken safely and efficiently. All coastal paths have since reopened following completion of the work.

Conwy County Borough Council would like to thank Welsh Government for providing the funding that has enabled the Council’s Flood Risk & Infrastructure Group to undertake repair works to reduce the flood risk to nearby properties and businesses.
The timber revetment coastal defence at Morfa Madryn was severely damaged during the winter storm events. Morfa Madryn Nature Reserve lies adjacent to the site and is classified as a designated conservation area. Due to the sensitivity of the area, Engineers from the Councils Flood Risk & Infrastructure Department worked closely with Conservation Officers from the Council's Countryside/Open Spaces Department to minimise disruption to wildlife during the works.

Works were completed in March 2015 with materials salvaged that had washed-up on the shoreline following the storm event; reinstating approximately 230m of timber revetment sea defence.
Severe overtopping of the sea defences occurred during the storm events and post storms topographical surveys identified that beach levels had fallen below the trigger level for action. Welsh Government funding enabled the Council to import 1800m³ of quarried carboniferous limestone to site, reducing overtopping to minimise the risk of future flooding and protect the sea defence wall from further undermining.

The site is located within a number of conservation sites (Traeth Lafan SSSI, Menai Strait and Conwy Bay Special Area of Conservation, Lavan Sands, Conway Bay Special Protection Area) and prior to works taking place Engineers from the Flood Risk & Infrastructure Group consulted with Conservation Officers from the Councils Countryside Department to ensure the works had minimal impact on over-wintering wildlife in the area.
Situated below the sand dunes at Conwy Morfa lies a historic bottle tip that was exposed during the storm events. Permissions were sought, from the Councils Planning Department and Natural Resources Wales, to undertake works to cap the tip with 4000m³ of naturally rounded shingle to be in-keeping with the surrounding environment and to prevent further dispersal of tip material into the Aber Afon Conwy (Site of Special Scientific Interest).

**Conwy Morfa Tip post-storms**

**During works**

**Completed works**
Sand dune fencing that protected the dunes from erosion and assisted in the regeneration of the sand dune system was badly damaged during the storm events. Welsh Government funding supported the reinstatement of approximately 750m of fencing with material salvaged from the foreshore following the storms where possible.
Coastal defences protecting the coastal path and landward assets in Conwy Morfa suffered severe damage during the winter storms of 2013/14. As a result a large section of the coastal pathway and primary coastal flood defence was eroded. Following Planning and Marine Licence approval Welsh Government provided funding support to reinstate the coastal defences with the importation of 1500m³ of quarried carboniferous limestone.

**Conwy Morfa Coastal Path post-storms**

**Completed works**

**During works**
Natural Resources Wales (NRW) necessitated a mitigation measure to be imposed for the works due to a loss of vegetation during the reinstatement of the coastal defence. NRW requested the further removal of approximately 300m³ to land adjacent to the works to provide a healthier habitat for the endangered belted beauty moth.

Surplus material excavated from this area enabled the Council to reinstate the coastal path in the area at no additional cost.
Deganwy Cycle Path

The National Cycle Route 5 between Deganwy and West Shore, Llandudno was severely eroded during the storm events. Funding was secured from the Tourism Infrastructure Fund to reinstate approximately 20m of the cycle route to enable the National Cycle Route to be open for the summer period.

During works

Deganwy Cycle Path post-storms

Completed works
To protect the National Cycle Route 5 and landward assets the primary sea defence in the area was replenished with 1600m$^3$ of quarried Carboniferous Limestone to achieve the required coast protection design profile. The works were undertaken following approval of funding support from Welsh Government and consent of the Councils Planning Department and Natural Resources Wales Marine Licencing division.
Deganwy Promenade

The winter storms had demolished a significant portion of the seawall at Deganwy resulting in the closure of the promenade and a portion of the National Cycle Route with critical sewerage and rail assets being put at risk from future extreme events.

After local consultation and the receipt of funding from Welsh Government, the necessary design and consents were obtained for the restoration works.

The reconstruction works were completed over a 4 month period and involved the construction of 160m of seawall, installation of rock armour toe protection, localised beach replenishment, rebuilding of 1000m2 of promenade and renewal of the street furniture. The promenade and cycle route re-opened for the Easter Holidays in 2015.
Sand dune fencing, that protected the dunes / National Cycle Route 5 from erosion and assisted in the regeneration of the sand dune system, was severely damaged during the storm events. Welsh Government funding supported the reinstatement of sand dune regeneration areas that provide the naturally coastal protection.
Coast protection works were undertaken at West Shore beach, Llandudno that included the replenishment of the beach foreshore following the storm events.

The beach foreshore in this area is of high amenity value and it was deemed necessary to strip and stockpile the existing beach shingle material to sand level prior to the importation of 1500m³ of quarried Carboniferous Limestone. The imported material was then graded to the required coast protection design profile before being overlaid with the stockpiled beach material. This method of construction provided the desired coastal protection whilst maintaining the beaches amenity value.
North Shore, Llandudno

Following the 2013/14 winter storms, the level of protection afforded to the concrete revetment at Llandudno Promenade had fallen below the trigger levels for replenishment works.

Conwy Council were successful in securing funding from Welsh Government to reinstate the foreshore back to the original coast protection level and design profile. The works comprised the importation of $30,000m^3$ of naturally occurring rounded shingle and were completed in May 2014.
Penrhyn Bay

Beach material at Penrhyn Bay beach naturally moves down and to the east along the foreshore. The winter storms of 2013/14 exacerbated the movement of the material exposing the footings and increasing overtopping of the seawall. With Welsh Government support Conwy Council were able to relocate the displaced material to help reduce overtopping and protect the sea wall from further undermining.

Penrhyn Bay post-storms

Completed works
Following the winter storm events it was necessary to undertake repair works to the sea defence wall at Colwyn Bay. The works comprised the repointing of approximately 500m of the sea defence wall to prevent further erosion and damage to the adjacent infrastructure.
The coastal defences at Llanddulas Beach Car Park had been overtopped during several recent storm events which, combined with flooding from the adjacent river, had caused several residential properties to suffer flood damage.

A scheme was designed to improve the existing rock armour revetment by increasing its height and depth and to bring it in line with the existing defensive structures located immediately to the west. Following a grant of funding from Welsh Government, 8,000 tonnes of rock armour was imported over an 8 week period via the existing road network.
Successive winter storms had taken their toll on the Armourflex protection at the upper reaches of the Llanddulas Tip which fronts onto the Conwy coastline. During the extreme events of the winter storms, up to 300 linear meters of historic tip material was exposed to the sea as the material was stripped away by the force of the waves.

Following a design review and a successful grant of funding from the Welsh Government, it was decided to remove the failed Armourflex and reinforce the tip face by extending the existing geotextile and rock armour protection that existed in the lower reaches of the revetment over the 810m tip frontage.
The loss of beach material during the storm events from the beach foreshore at Pensarn increased the risk of future undermining to the flood defence wall and failure of the rock revetment. The Council secured funding support from Welsh Government to enable the Flood Risk & Infrastructure Group to import 5,000m³ of similarly matching material to reinstate the beach levels.

The funding also enabled the Council to be able to realign the existing rock revetment to tie in to the existing flood defence wall to minimise future scouring and failure of the rock revetment sea defence.

Additionally, the shingle ridge foreshore at Pensarn lies within an area designated as a Site of Special Scientific Interest designation (SSSI) and due to this the Engineers from the Council have been working closely with Conservation Officers, from both the Councils Countryside Department and Natural Resources Wales, to ensure the repair works were conducted in such a way as to minimise the disturbance to the SSSI and help preserve the area for future years.
A flood gate at Kinmel Bay was severely breached during December 2013 storm event which resulted in internal flooding to 8 residential properties and a commercial premises. The Council, with funding support from Welsh Government, constructed two access ramps to maintain access to the promenade / beach whilst reinstating the secondary sea defence walls.

A new bespoke sliding flood gate has been installed that now provides an increased level of flood defence for the area.
Post storm topographical surveys identified that the beach levels in Kinmel Bay had fallen below the trigger level for action and it was necessary for coast protection works to be undertaken in the area. Works were completed in April 2014 and comprised the importation of 26,600m³ of naturally rounded shingle to be in keeping with the surrounding area. The imported material replenished coast protection works were necessary completed in March 2014 at Sandy Cove, Kinmel Bay; maintaining the design standard of the areas coastal defences. The works comprised the replenished a 1.2km section of beach foreshore, reinstating beach levels to their original levels with the importation of 26,600m³ of similarly matched naturally rounded shingle. The imported material was graded to the required profile to maintain the design standard of coastal defences for the area.