Coastal Condition as a System: Designing for a Dynamic Landscape

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In the following text I explore the unique qualities of an Irish landscape with a particular interest to me. The study of architecture has enhanced my understanding and appreciation of the meaning of place. In attempting to convey that meaning to others it is important to create an awareness of our everchanging landscape and its effects on our coastline. Landscape for me is no longer stagnant but constantly changing and evolving - something that must be recognised in the design process.

I have always had a particular interest in our seascape especially along the west coast. Having spent many years on the Aran Islands I developed a greater awareness and respect for the sea and its potential and influence. In relation to landscape and its dynamics it is fair to say that Aran is a microcosm of Ireland. As a result of this liaison I achieved competence as a swimmer and lifeguard, thus allowing me indulge further with the sea and its power. For six summers I was employed as a beach lifeguard for Galway County Council patrolling various beaches. My duties required me to be vigilant and constantly aware of the dangers of the sea. I saw at first hand the movement of tides, currents and swells and their pervasive power over the coastline.

Built edges have been designed and constructed to enable us access and enjoy our seashores in a safe and healthy environment. These built edges have in turn shaped the coastal landscape in their manipulation of coastal processes through either reducing the seas erosive power at one point but amplifying it elsewhere.

An "awareness for the sea as something that can provide hours of recreation while also providing an endless resource in terms of sustaining a living."

1. Taking the plunge in Tramore, Co. Waterford.
2. Collecting lobster pots, Youghal, Co.Cork.
3. An evening stroll along Bray promenade, Co. Wicklow.

All images author's own.
Ireland, as an island nation, has an indisputable relationship to the coast ingrained in its heritage. The recurrent diurnal rhythms of tide and surf, its evolving coastal edge and various experiences of the sea have collectively shaped our cultural heritage and our physical landscape. The margin of the wild Irish coast encompasses over 7,500km\(^1\) of magnificent and contrasting landscapes. These landscapes have provided a series of coastal conditions that have developed and continue to evolve over time.

Defining the limits of our coastline is not an easy task as the coast itself is such a dynamic area any attempts to impose a boundary or to map its extents proves difficult. Tim Robinson described this process in “Setting Foot on the Shores of Connemara”:

“The ever-changing interpenetrations of rock and water and I preferred to let my pen run on for hours in minute lyrical effusions of dots and twirls. All around the coast, a fiction, the high water mark, posed a similar problem; rather than indicate it by a line I relived with my pen the hourly give and take of land and sea”\(^2\).

In this piece of text I am exploring the dynamic nature of the coast in its cultural and spatial aspects and the complex system of forces that interrelate to create this coastal condition over time. In understanding the coast as a site of change I examine some existing designed coastal edges and reiterate the importance of incorporating change and the recognition of the dynamic qualities in design for coastal conditions.

In the words of William M. Marsh, “shorelines are dynamic systems. It is becoming evident that building permanent structures and attempting to impose a static equilibrium to these dynamic landforms is both doomed to failure and damaging to ecosystems.”\(^3\)

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The Coast and Culture

Our relationship to the coast has been depicted in various ways over time through our heritage. The alternating tides and our various experiences of the sea have all featured throughout Ireland’s history, both visually; in the form of old maps, photography and artworks, and orally, in the poignant words of Irish songs and poets.

In the poem “Na Blatha Craige” (The Rock Flowers), poet Liam ÓFlatharta describes the adaptation of ecology to an extreme coastal condition. In a “bradach” (treacherous) and “suarach” (squalid) site where the steep limestone cliffs of Inis Mor, The Aran Islands, meet the “farraighe chaite” (raging sea) of the Atlantic, a cluster of flowers grow and flourish, impervious to the sea spray and dense fog. He considers the threatening site and questions the ability of the delicate fauna to adapt to such a harsh environment. The poet concludes that it is through the soothing and enchanting qualities of the raging sea and rhythmic tide below them that has allured this fauna for they are “faoi dhraiocht Ag ceol na farraige” (under a spell by the sound of the sea.)

The romantic and alluring poetic qualities of the coast have been described and portrayed in many other pieces of work over time. In “The Edge of the Sea” Rachel Carson expresses similar admiration at the existence of “creatures so exquisitely fashioned... their beauty too fragile to exist in a world of crushing force.” She observes the functionality of every detail of a species “every petal-like tentacle fashioned for dealing with the realities of existence”. It is through the evolution of that species that it has come to adapt to its environment, in this instance, uninterrupted by human interference.

This desire to desire to dwell by the sea is not just a phenomenon demonstrated by nature. In our architectural heritage our attraction to the coast, to isolate one-self, to spend some silent moments in contact with the elements has been depicted in various ways over time through our heritage. The alternating tides and our various experiences of the sea have all featured throughout Ireland’s history, both visually; in the form of old maps, photography and artworks, and orally, in the poignant words of Irish songs and poets.

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This desire to desire to dwell by the sea is not just a phenomenon demonstrated by nature. In our architectural heritage our attraction to the coast, to isolate one-self, to spend some silent moments in contact with the elements has been demonstrated through old Irish settlements such as the monastic beehive huts of Skellig Michael where the captivating coastal settings provided a medium for architecture and sensuality to come together. Even in stormy conditions the sea offered protection by being impassable for the Viking predators. “The wind tonight is bitter, it touses the sea’s white hair; I have no fear that gentle seas will bring fierce warriors rom Norway.”

Earlier instances of coastal dwelling include promontory forts such as DunAenghus, The Aran Islands the same cliff site described by ÓFlatharta in “Na Blatha Craige.” This dramatic coastal setting was chosen to provide protection from invasion to the coast and adequate surveillance from a height to anticipate advancing invaders. Nowadays, the turbulent Atlantic’s relentless force continues to erode the cliff edge that was once inhabited by Iron Age dwellers. According to Thomas J. Westropp “it may have stood on a hillside adapted to an already existing cliff, though... the cliff stood much farther southwards in earlier time.”

However, the same body of water that can grant peace, protection and solitude possesses a highly changeable nature that demonstrates a much more powerful and unforgiving force. This can be seen through the writing of J.M. Synge in the play “Riders to the Sea.” The plot is based on an island community who depend on the sea for their livelihood but continue to struggle against its impersonal but relentless cruelty. In contrast to the work of ÓFlatharta, Synge describes the struggle of man against the Atlantic’s hostile forces. The same “farraighe chaite” of the Aran Islands has claimed the life of an islander’s husband and her four sons:

“They’re all gone now and there isn’t anything more the sea can do to me… I’ll have no call now to be up crying and praying when the wind breaks from the south, and you can hear the surf is in the east, and the surf is in the west, making a great stir with the two noises and they hitting one on the other... I won’t care what way the sea is.”

It is interesting to bear in mind that these are different depictions of the same body of water, the Atlantic Ocean, Aran Islands. Through these descriptions ÓFlatharta and Synge reflect our conflicting relationship to the sea at different points in time. In “Na Blatha Craige” to inhabit the coastal edge (“brach na haile”) represented a romantic way of life with its enchanting landscape. In contrast, “Riders to the Sea” portrays man’s inevitable defeat by the ultimate force of nature under dramatic coastal conditions.

In order to understand the coast and the various conditions that are generated by the sea, it is necessary to consider the coastal condition as a product of complex interactions in its environment. These interactions refer to ecology, systems, landscape (both natural and built) and time.

This product (the coastal condition) exists as a place in time. The quality and sense of this place is produced by its environment; the sea, habitats, nature and its forces. By a “place” I mean a physical landscape. However by a “place in time”
I don’t refer to the physical landscape as it exists in a single moment in time, but instead that coastal condition as a series of places that are changed and sculpted by both natural systems and manmade forces on the coast over time. In this way it is important to consider the coastal condition as a dynamic landscape that is generated, changed and influenced over time by a system of complex forces.

**Time Governing a System**

Time is a quintessential element in generating a coastal landscape. It is through time that the coast can generate different conditions (sea swaying or surging) that may be experienced on a variety of levels (soothing, terrifying). This is demonstrated earlier in the text when Liam O’Flatharta and J.M. Synge experienced the same body of water at different points in time under different conditions. It is also evident in Westropp’s suggestion of the erosion of land by the sea at Dun Aengus over the past 2,000 years.

It is through time that we may experience the coast as a series of places that exist as products of a system in time. This awareness of time is described by Rachel Carson in her opening chapter of “The Edge of the Sea”:

“For no two successive days is the shoreline precisely the same. Not only do tides advance and retreat in their eternal rhythms, but the level of the sea itself is never at rest... Today a little more land may belong to the sea, tomorrow a little less.”

In her closing chapter she acknowledges once again the endurance of tides and time;

“These shores, so different in their nature and in the inhabitants they support are made one by the unifying touch of the sea. For the differences I sense in this particular instant of time that is mine are but the differences of a moment, determined by our place in the stream of time and in the long rhythms of the sea.”

Carson refers to two levels of time in this piece; a shorter time frame of tides (days) and secondly, the “long rhythms of the sea”. A relatively short time cycle of tides and daylight hours are elements of part of an overall system that operates on a much larger time frame of sea level change, re-routed currents and coastal landform morphology. It is necessary first, to examine the shorter time frame of time and tides.

On a shorter time frame tides can be understood as “the periodic rise and fall of coastal water”. These can be observed on a day to day basis where the tide rises flooding a bay or engulfing marsh only to retreat hours later to reveal the same bay or marsh and returning it to the land. This rhythm of the rising and falling tide occurs in sequence day in day out. The strength and force of this rhythm however is governed by a much larger system, astronomical conditions.

In Ireland the diurnal nature of the tides and ranging daylight hours of our seasons offer a day to day sense of time passing. In Galway, for example, the predicted tide height for April 7th is 6.6m at 6.27pm. Low tide occurs 6 hours later 8th at 12.30am at a predicted height of 0.1m.

This sequence of tides and time is understood by both the ecology of a shoreline and our own inhabitation of the intertidal zone. Marine life has adapted to this constantly changing environment. Their experience of submersion by the sea and exposure to the land and the elements have caused the species of plants and animal inhabiting the intertidal zone (the area between high and low tide) to adapt to these harsh conditions. Seaweed has developed a mucous membrane that forms an effective seal against moisture loss preventing it from drying out at low tide. Sea anemones retain water inside them until high tide. It is because of these adaptations and adjustment to change that shoreline ecology can live and thrive in the coastal environment. The ebb and flow of the tide is also an overriding feature of our own life on the coast. It is a major factor in the use of coastal ports, of fishing and sailing and it helps to flush out waste water from enclosed bays and estuaries.

The adaptation of ecology and our own understanding of tides suggest a much longer time frame of evolution. This time frame of millions of years is demonstrated in nature through ecologies (as evolution) and in the physical landscape of the coastal condition. “Sedimentary rocks representing untold millions of years of pre-Cambrian history must have disappeared... been repeatedly eroded, washed away and newly sedimented.”

To investigate the evolution of our coastline over time, it is necessary first to examine the interconnected systems that shape and sculpt the coastal landscape.
Sequence of images showing waves crashing at Molhes Do Duoro, Porto taken in February, 2011 on a study trip.

All images author's own
Systems:
In order to understand the dynamics of the coastal edge “where land, water and air meet,” it must be understood as a system of interdependent elements that operate over time. As mentioned earlier in this text it is important to consider the coastal condition as a dynamic landscape that is generated, changed and influenced by a system of complex forces. To understand coastlines in physical terms firstly requires the recognition of all the elements (sea, air, land) not as single fixed bodies but as complex energy flows that are part of a system. These systems are interdependent on, and exist as part of, other larger systems (solar, lunar, inhabitation by ecologies and humans.)

The most dominant system of forces along a coastal condition is nature. Within this system lies a hierarchy of elements- nature’s agents; the tide, storms, rain, wind, waves, currents, etc. are ultimately governed by the dominant systems; the moon, the air, the sea. These dominant systems can be considered the architects of the coast in that they are constantly designing and sculpting the landscape over time, changing and shaping the coastal condition, carving into it in parts, constructing it elsewhere. These agents of change are controlled by a hierarchy of systems and it is in how these systems come together that various coastal conditions are generated.

As discussed in terms of time, the tide demonstrates a system that operates on a twice daily basis. The tides affect the shoreline ecology and its use. However this system of tides is governed by the sun and moon and their relative position to the earth\(^17\). In this way the sun and the moon govern the tides. The tides (and tidal range) in turn, affect the coastal landscape and the landscape determines the ecology. In this system of astronomy, tides, landscape, inhabitation and time there is no finality or ultimate fixed reality for a coastal condition because this system is only part of a number of systems that interact at a coast.

It is how and when these systems interact that determines the force of the sea on a coastline. A full moon, a clear sky and varying pressure ranges may have minimal effect on a sheltered inland site. However these systems on a coast can prove detrimental. Conditions such as a high spring tide combined with strong onshore winds and a high diurnal temperature range at a soft limestone cliff face\(^18\) would generate a very different landscape over a long period of time or coastal flooding at a low-lying coastline over a short period of time.

So the coastal condition is influenced by natural elements such as tide, swells, wind and surges that comprise a system. However each of these systems interrelates at the coast. The coastal condition is responsive to the natural elements (the sea erodes a beach) as, in turn, the behaviour of the elements are manipulated by the coastal condition (an underwater sandbar, deposited by the sea causes waves to break over it.) The relationship between these coastal processes and the coastal edge remain inextricably entwined, creating a condition that allows ecology to adapt and inhabit.

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17. It is the gravitational pull of the sun and the moon on the Earth’s surface produce a disproportionate movement in the ocean’s waters.
18. As opposed to a sheltered bay with a low tidal range and calm sea during a half moon period.

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Above: The Front Strand, Youghal, Co. Cork. Wooden stakes in the sand are remnants of revetments that were constructed perpendicular to the shore to reduce coastal erosion. Behind these a sea wall runs along the beach with rock armour at its base.
The Coast as a Product of systems:

Earlier in this text I stated that “in order to understand the coast and the various conditions that are generated, it is necessary to consider the coastal condition as a product of complex interactions in its environment”. I have considered these interactions in terms of time and systems and demonstrated how the relationship between them remains inextricably entwined.

All these interactions (time, systems) produce a dynamic coastal landscape. This coastal landscape is composed of a series of coastal features which erode and build up and change over time. For this reason no coastal condition remains the same. It is these evolving features and that induce coastal morphology thus producing the dynamic landscape that is a coastline.

“To understand the shore... only comes when standing on the beach we can sense the long rhythms of the earth (systems) and sea that sculpted its landforms and produced the rock and the sand of which it is composed.”

As with all natural forms, the coastal forms/features produced by the sea have emerged, evolved, some persisted through time, some collapsed and new forms have emerged through their reorganisation. This sequence of states demonstrates that coastal forms develop very complex morphologies through the coupled process of erosion and deposition which is a direct product of the dynamic systems that interact at coasts as described earlier.

The processes of erosion, transportation and deposition occur in the high energy zone\(^{20}\) that is the intertidal zone of the coast. Coasts are extremely sensitive to sea level changes inflicted by tides, storm water levels and global sea level rise. These level changes along with the strength and timing of the systems create variations in energy zones which in turn leaves impressions on landforms in the forms of cliff notches, beach runnels and sand bars.\(^{21}\)

These relentless processes mean a coastal edge is subject to change, whether instantaneous or gradual. The macro-tidal diurnal nature of Ireland’s coast means change and the evolution of a new edge is particularly evident, especially along its more exposed Atlantic Coast. This was referred to earlier in the description of Westropp’s cliff face erosion at Dun Aengus.

Beaches, for example experience transition stages in the form of domains whereby “each beach may move through a temporal sequence of states to achieve an equilibrium... caused by sudden increases in wave energy”.\(^{22}\) Where wave energy is at its highest, erosion takes place and accordingly, when at its lowest, deposition. The gradient of the beach is affected by these processes according to their force and frequency.

Cliffs are also products coastal processes. These features develop over a longer period of time\(^{23}\). Where the sea exerts its force on the face of a cliff it erodes a notch. This process leads to an overhang which eventually, under its own weight, becomes unstable and collapses.

20. Area between high and low tide that may experience the full force of the sea.
22. Dependent on rock type and exposure of coastline. Limestones, a softer rock erodes at a faster rate than granite.

Above: Seawall, rock armouring and remains of revetments at Tramore, Co. Waterford.
The desire by humans to control and in some case dominate their environment is an increasing phenomenon. Mankind seeks to overcome what the natural environment has presented and somehow enforce a state of control over nature. In the case of the coastal edge in Ireland, we have designed and built seawalls, breakwaters, revetments and placed bars of rock armour in an attempt to manipulate coastal processes, interfering with the natural systems of a coastal edge and attempting to impose a stagnant dimension on this fluctuating phenomenon. As discussed earlier in this text, the coast is a dynamic landscape and change is normal in the natural world, but its intricate choreography is now accelerated and manipulated by human activities and these built interventions in the form of direct physical change.

To appreciate the full implications of this confrontation it is necessary to gauge briefly, the history of coastal management in solving coastal problems. For centuries the issue of coastal management has been an issue for engineers. Time after time defences were built to defy and resist the sea’s surging force. In the words of Sir John Rennie at the presidential Address to the Institute of Civil Engineers in Lindon, 1845:

“Over time humans have proliferated across the earth until all forms on the surface of the earth have been modified to greater or lesser extent by their works. All the forms of the world, of nature and civilisation interact with each other.”

Human Intervention:

breaks off and falls into the sea. This process is repeated as the coastline retreats inland. The notch that was eroded from the cliff is worn down into particles and transported by the sea to an area of low energy where it is deposited. Debris is collected at this point and builds up resulting in the development of a sand bar. Coastal landforms such as this sandbar, (a product of dissipative elements - coastal deposition) seek to move shore-ward and in succeeding (wave energy regenerating,) sediment is eroded from the bar and transferred to the beach. It is interesting to bear in mind that while these landforms (beaches, cliffs, sandbars) are products of agents of change (tides, waves, storms, air) they retain the qualities of the systems that formed them in that they too are dynamic features.

Above: Rock armour and promenade at The Front Strand, Youghal, Co. Cork. This image shows the layering of the promenade to reduce the erosive power of the sea. Image author's own.

(Hoboken, N.J.: Wiley, 2010.) 326
"Where can man find nobler or more elevated pursuits... than to interpose a barrier against the raging ocean."

This attitude coerced a defiant mind-set of coastal design in relation to the sea. However as time progressed and nature once again demonstrated its ceaseless force over mankind it became increasingly obvious that the problem lay in this very approach. In December 1981, Geotimes issued a paper entitled "Old Solutions Fail to Solve Problems". This paper justifiably questioned existing methods of design and recognised "the price we pay for the installation and maintenance of a "stabilised" shoreline, whether in esthetic(sic) or fiscal terms, is enormous and it is accelerating." In this statement the cost was not just in reference to the direct financial burden in implementing coastal defences but also to the ecological and environmental cost incurred on our coastline.

Huge expenditure has been made along the Irish coast on engineered structures in an effort to improve navigation reduce shore erosion and protect coastal development.

Scottish Engineer Alexander Nimmo has been commended for his role in surveying, designing and implementing extensive infrastructure including railways, roads, bridges and piers along the West coast. In 1812, Nimmo set about surveying the land of the West of Ireland in terms of its geology, topography and agricultural land. Along the south coast, the shore and islands were well inhabited. He noticed in these regions that people seemed to have a preference for fishing over farming.

In 1840, following an extensive survey of the West Coast, Nimmo proposed a number of developments to piers around Galway. In Nimmo's opinion the site chosen for each pier ought to be judged against the "geographical peculiarities of the coast". Cut limestone brought to the mainland from the Aran Islands was used in the construction of new piers and maintenance work was carried out on older existing piers such as the dredging of basins.

In Galway city, The fishery employed a large section of the population, more than in any other town on the west coast, and the fishermen almost all resided in "The Claddagh". Following his extensive survey of the Galway coastline, Nimmo was employed to advise and prepare plans and estimates for its development. The

25. Sir John Rennie, 1845

Above: Seawall and promenade at Tramore Beach, Co. Waterford.
Layering of Sea Wall and the inhabitation of the promenade suggested by lamp posts and railings.
Image author’s own.
proposals included the construction of a reef in front of the quays that would join an existing Slate Pier to the mainland. The connecting pier has since been known as Nimmo’s Pier. This was an asset to fishermen and offered protection to the old quays against southerly and westerly gales, which formerly wrecked vessels lying there.

These built interventions or designed edges have been implemented and are broadly accepted across Ireland as an effective means of regulating the coastline. However in recent times a new reality is coming to light. In attempting to preserve the coastal edge condition these structural controls (seawalls, breakwaters, revetments) are doing the opposite. Ironically these measures have become one of the most damaging modifications. In Ireland over half of its length of soft coast (3,000km) is considered to be at risk from erosion. Most erosion controls prove to be not only ineffective in halting erosion in the long run but are also a source of serious damage to the coastal environment, especially intertidal habitats but also recreational and aesthetic resources.

Research findings indicate that shoreline armouring can actually increase erosion and contribute to more severe slope failures by effectively lowering the level of beaches and interrupting the movement of sediments along shorelines. An example of this can be seen at Happisburgh, Norfolk, England where the cliffs have retreated inland by over 150 metres in just 12 years claiming property and prime agricultural land. Coastal defences have been implemented in the form of timber revetments and rock armouring at the base of the cliff but to minimal effect.

Seawalls are designed to defend developed land along a shore and linearise a coastline, if placed in an inappropriate site often increase the scouring effects of waves resulting in deeper water immediately near shore. Eventually the wall fails but before it does it may cause increased erosion on adjacent unprotected properties as waves converge on the projecting seawall and refract to the right and left.

Groins, jetties and breakwaters are designed to trap sediment and build wider beaches or protect harbour openings by interrupting the long-shore flow of sediment. Since these structures function like dams they commonly deprive areas down-shore of their sediment supply, thus leading to beach erosion and shoreline retreat. Furthermore, the construction of erosion preventing barriers
such as revetments inhibits accessibility to the sea and seems to ignore the potential and rich intertidal zone.

We continue to realise these issues of coastal processes but neglect to acknowledge them. In recent years the defiance of nature has become increasingly obvious and environmental stress on the coast is growing rapidly, on scales ranging from local destruction of dunes and wetlands, to global rises in sea level. Flooding and tsunamis remain an unstoppable force for both developed and developing worlds and the threat of Global Warming becomes a reality.

Conclusion:

It is through understanding the forces that have shaped our coastline over time that we come to appreciate the coast as less of a physical place – existing in one moment in time but instead as a series of systems that interrelate to create a dynamic landscape. While it is widely accepted that our coast is a dynamic landscape it is important to consider this feature in its design.

Nature continues to triumph and remind us of its ultimate power over mankind. The physical parameters of the changes from Global warming to all the forms of the world are now becoming clearer and it is evident that its consequence will be an amplified dynamic of coastal processes. This has in turn called into question the traditional engineering methods for “holding a coastline”. In order to design in a coastal condition we must consider it as a dynamic system that strives to continue in this way constantly evolving in its form. The collective nature of water and solid means the coast is never static, whether in tidal motion and swells along the shoreline twice daily or progressing inland by the decade. In the words of R.W.G Carter “It is only through [an integrated] approach that views the land and sea as interdependent can we evolve a genuine understanding of coastlines, which can then be used in the development and implementation of effective strategies for management.”

Issues regarding coastal management are present, but does the building of coastal “defences” resolve the fluctuating nature and ecology of a coast? To design for a coastal condition implies that we do not try to dominate or defeat the systems and processes at play on a coastline, but that we design to accommodate them.
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Right: The Front Strand, Youghal, Co. Cork. February, 2012. Photograph was taken through the railings of steps to the beach. The wooden stakes in background are the remains of timber revetments which were constructed perpendicular to the shore to reduce beach erosion due to longshore drift. In the foreground further measures to reduce the sea’s erosive power are evident in the curvature of the concrete seawall and rock armour at its base.

Image author’s own.
Study of an Edge: Galway City West

Main image:
Figureground showing development along Galway's coast from Galway City Centre (facing page) to Furbo village (below).

Right:
Map showing context of site with regard to the Aran Islands and Co. Clare.
Plan of Salthill Promenade at Low Tide
(From Blackrock to Nimmo’s Pier)

The Promenade connects various conditions along the coast. 
The west end of the promenade serves mostly recreational facilities including Blackrock diving tower, ladies beach, the crab pool and slipways. The seafront is dominated by hotels and an indoor swimming pool and gym.

The seaside resort village of Salthill meets the promenade at a public green area. Here the prom develops a rock armour edge as most of the land on which Salthill is built is reclaimed.

Breakout points can be seen on the plan where people can sit on picnic benches and relax.
The seaboard at this point is occupied by apartment blocks.
At Grattan Beach the tidal range is vast. A large area of the beach is exposed at low tide but it is completely submerged at high tide.
Development on the land-side consists mostly residential and guest houses.
Access to Mutton Island Causeway is restricted.
The promenade continues along the Swamp (reclaimed land) and on to Nimmo’s Pier.
Comparative drawings showing the evolving edge of Galway City West to Salthill from 1842 - 2010. Dark water shows extent of low tide, light grey shows high tide and white shows the coastal edge as drawn according to maps of the time.

Mutton Island Lighthouse: This was built in 1817 by request from the merchants and shipowners of Galway in the 19th century. Previous to the construction of the lighthouse a small castle existed on the site.

Slate Slate Quay, Claddagh Quay, Ballyknow Quay: These quays and jetties were used by the fishermen population of The Claddagh. At the time of Nimmo's arrival to Galway (1820, around the time this map is based) these were in desperate need of repair.

Nimmo's Pier: This map shows the beginning of the construction of a breakwater pier across the mouth of the Corrib carried out under the instruction of Alexander Nimmo.

Spanish Arch: Constructed in 1584, the arch served as a gateway to Galway for merchants arriving by sea to the city. The city was surrounded by a boundary town wall at the time.

Old and New Dock: Old dock (Eyre's Dock) was constructed in 1760s. New Dock (floating dock) commenced construction in 1830.
Blackrock Diving Tower: This concrete tower was preceded by temporary diving boards at this site. The immense popularity of Salthill as a seaside resort resulted in the development of this site in the 1950s. Blackrock was originally a men only swimming area.

Lifeguard Huts: Temporary steel cabins placed along the Salthill promenade serve as bases for lifeguards during the summer season, (June, July, August.) There are a total of four huts along the edge of the promenade.

Slipways: A number of slipways exist along the promenade. One slipway is a designated launch slip for boats and jetskis, the three others are used merely as a means for swimmers, kayakers, paddlers to enter the water.

Nimmo’s Pier extension: Following Nimmo’s suggestion in 1845, a dyke was constructed along the marshland and connected Slate Quay back to The Claddagh.

Weir: A special fisheries tower was constructed in to supervise any illegal fishing (without licence) that took place at the fishing weir.

Expanded Docks, Harbour Masters Offices: Docklands underwent major development in 1890.

Dockland Industrial Park: The marshy edge along this site was constructed and the land infilled to provide site for the storage of oil (in tanks) and coal.
Section A: The Claddagh

Section B: Salthill Promenade

- Canal Basin
- Locke Gates
- Fisheries Tower
- River Corrib
- Spanish Arch

- Hotel
- Outdoor area
- Shelters
- Promenade
- Ramp to beach
- Lifeguard hut
- Viewing area
The changing edge condition over the 2.5km of Salthill Promenade gives this site an interesting relationship with the water. At points the underlying rock is exposed, further along the prom, concrete has been cast onto these rocks to form steps. Some parts are more developed than others including Blackrock diving tower (model shown left.) These various conditions along the promenade have strengthened its variety of uses which include beaches, slipways, parks, fishing amenities, benches, and pools.
As part of a college photography elective I acquired a better understanding in the use and technique of photography in portraying different conditions that exist along a coastal edge.

This involved visiting a number of seaside resorts along Ireland’s coastline in an attempt to explore how human intervention has shaped an edge, in some instances providing a safe sheltered harbour for boats to moor and in other cases taking the form of a few steps along the shore to the water. Each of these interventions have shaped the coastal edge and continue to affect the way in which we perceive and use an edge.

Seaside resorts visited included:
Lahinch, Co. Clare.
Youghal, Co. Cork.
Tramore, Co. Waterford.
Bray, Co. Wicklow
Greystones, Co. Wicklow
Courtown, Co. Wexford.
Salthill, Co. Galway

This image shows the harbour entrance at low tide. The structure is relatively new, however the effect of the tide can already be seen through the tide markings on the concrete piles. The curvature of the perimeter sea wall causes the waves to refract back onto themselves.

Right:
This image shows concrete steps cast onto the rocky shoreline at low tide. The concrete steps were built for recreational purposes as a means for swimmers to access the water. Their constant immersion and exposure by the tide has caused a heavy coating of moss to develop on the surface of the steps rendering them very slippery.

Inset:
The remains of timber revetments on The Front Strand, Youghal, Co. Cork. These structures were put in place in an attempt to reduce beach erosion by longshore drift.

Facing Page

Main Image:
Guillamore Swimming Cove, Tramore, Co. Waterford.
Concrete cast into the rock creates a swimming facility at the cove. Diving from the platform depends on the tide.

Inset:
The remains of timber revetments on The Front Strand, Youghal, Co. Cork. These structures were put in place in an attempt to reduce beach erosion by longshore drift.
Knocknacarra is located adjacent to the bay however there is little relation of the suburb to the sea in comparison to Salthill.

The densification decreases to the West of Rusheen Bay where the Galway City Council’s boundary ends and the County Council’s borough begins.

The lighter grey shade shows the intertidal area of the site.
Designing for a Coastal Edge: Rusheen Bay

Rusheen Bay is located approximately 6km west of Galway City and just over 1km from the end of Salthill promenade. The bay itself and its perimeter encompasses an area of over 1.5km².

In terms of the physical landscape, Rusheen has been shaped by a combination of glacial deposition and coastal erosion. During Ireland’s last ice age, 20,000 years ago glaciers deposited their load of boulder clay at this site, creating 3 dome-shaped hill features called Drumlins. The unstratified and soft composition of the boulder clay and the exposed coastal location of the drumlins has resulted in severe coastal erosion. Today large boulders remain scattered around the foot of the eroded cliffs suggesting where the footprint of the drumlins once extended.

This coastal erosion of the drumlin cliff face is a matter of concern for local authorities. Proposals by Galway City Council include the construction of rock armour along the cliff face to reduce power of the sea at high tide level. Plans are also underway to extend Salthill promenade as far as Rusheen Bay.

The area surrounding Rusheen Bay has experienced heavy development in recent years. The relatively new suburb of Knocknacarra with a population of over 12,000 people exists more or less oblivious to the Bay itself. The main road to Connemara acts as a buffer to any development to the South/Bay side of the suburb.

The bay is used year round by a windsurfing school located in the North Western corner of Rusheen. The proximity to the small lake at low tide and relatively exposed conditions which allow the prevailing south-westerly winds blow into the bay make this the ideal location for the school.

At low tide on the same site birdwatchers observe various species of bird on the tidal sand banks from the perimeter of the bay.

Silverstrand beach (shown below) to the South of Rusheen on the sea side has a gentle gradient and a sandy shore making it very popular with swimmers.

Left:
Contrasting conditions at Silverstrand.
This image was taken from Silverstrand beach looking across to Knocknagoneen cliff face. Knocknagoneen is the Southernmost drumlin on the site.

The soft composition of the boulder clay means that choppy conditions such as those shown are sufficient to erode the drumlin substantially.

The first photo, taken at low tide, shows people using the beach for recreational purposes.

The second photo shows the same beach under much more extreme conditions.
Top:
Images taken from tidal time lapse recorded over the course of a day on April 7th, 2012.
First image shows site at low tide (12.12pm) at a tidal log height of 0.2m.
The incoming tide is recorded until the high tide (6.34pm) at 5.6m.
Full moon conditions on this date meant this was the highest tidal range of that month.
These are taken from the top of the central cliff looking across Rusheen Bay to Co. Clare.

Main Image:
Aerial view of Rusheen Bay at low tide. Part of the suburb of Knocknacarra can be seen in the top right corner.
More recently, kitesurfers have been making use of the South Westerly wind and taking advantage of entire expanse of Galway Bay.

The relentless power of the sea and the effect the sea has on the inhabitation of the coast is particularly evident at this site. As discussed in my essay, coastal conditions are subject to change. This theme of change is very evident at Rusheen in the flooding of the bay by the tide twice daily (shown above in the sequence of photos) and the force of the water at the neck of the bay (rapids) as the tides surges into the bay only to reverse its flow six hours later with the draining of the bay when low tide occurs.

These are features that I hope to enhance and develop in my design on this site.

### Schedule of Areas

**Public Baths and Galway Bay launching area: (Advanced Users and Kitesurfers)**
- Parking at Gentian Hill (60 cars) 1,000m²
- Equipment preparation area 20m²
- Launching area (extent of beach at low tide) 250m²
- Bathing pool deep 80m²
- Paddling pool 80m²
- Current manipulation bars (varying depth and length) 30m²
- Toilets 20m²
- Showers 15m²
- Total Area: 1,415m²

**Cliff-face Café: (Along a Route to Kitesurfers Bay)**
- Additional parking at Silverstrand (20 cars) 1,600m²
- Reception area 35m²
- Common room 40m²
- Kitchen 20m²
- Class rooms 40m²
- Changing Rooms 60m²
- Toilets / Showers 55m²
- Equipment store 500m²
- Wet Room 150m²
- Jetty 400m²
- Gear preparation area 150m²
- Total Area: 3,050m²
My proposal for Rusheen Bay takes the form of three different sites located along the perimeter. These sites were chosen as each of them display strong and very different characteristics of a coastal landscape.

The first site experiences a change of conditions due to tide variations and is fairly exposed to wind by the prevailing South-Westerlies. I realised that this combination makes the site an ideal location for beginner windsurfers and cross-wind sailing and so my proposal for this site is a watersports centre.

The second site is located at the neck of the bay. This is a highly dynamic site where the strong current changes direction according to the tidal condition. When the tide is going out the current flows sea wards until the tide returns.
to the lake and the current direction reverses. This site is also the only point which prevents the Bay from being accessed from the promenade and circumnavigated by foot. My proposal for this site is a public baths facility and a means to access Kitesurfers Bay.

Site three encompasses the area to the front of this cliff. This site is being eroded by the sea at high tide. My proposal is to develop a way of reducing erosion that could also be inhabited which lead to shallow paddling pools connected by pontoons.

The materials chosen are concrete and timber. However, the relationship of these materials to each other varies according to the conditions of that site.

It was intended that the way in which they move create an awareness of the conditions at that site.

Site 1 – timber pontoons float alongside the wind break wall. These move vertically according to the rising and falling of the tide. Notches in the wall allow it to step down gradually as the tide falls.

Site 2 – the concrete basins contain water but the timber elements swivel according to the direction of the current.

Site 3 – The rock pools contain water at low tide, as the tide comes in the timber pontoons move horizontally according to the force of the water.
Site 1: Watersports Centre

Site 1 to the north of Rusheen Bay is currently used by a small number of windsurfers who use this site to learn windsurfing within the safe enclosure of the bay. My proposal is to strengthen this amenity by providing a permanent facility for these users.

The layout of the watersports centre was generated by a windbreak wall which allows for a small enclosed calm area for beginners to get used to using their equipment. It also provides a wind-free facility for others to rig-up their gear.

This windbreak wall is designed in such a way that it breaks and overlaps midway to become a current manipulator. It is designed in such a way that the slow current would flow through the break in the wall at low tide and

Above:
Photo of 1:750 site model of site 1. The yellow card represents the area affected by the tide.

Main image:
Section perspective taken through windbreak wall showing floating pontoon on sheltered side, watersports centre in background and existing development in the distance.

Inset:
Site plan showing location of building.
be deflected towards the pools to prevent the build-up of sediment thus draining the site.

Breakout points along this wall also provide birdwatchers with a way of observing birds on the tidal flats. There is a strong culture of bird-watching already on the site.

The centre itself is laid out according to how it is used. Arrival, reception, changing, showers, common room. Its structure responds to its use, (sails are hung from rafters, kayaks in frame – all north facing light – away from direct sunlight.)

The elevation of the windbreak wall showing the stepped profile of the pontoons at low tide (top) and their interlocking nature to create a single level pontoon at high tide (below). The recesses in the wall control the height to which the pontoons come.

Cross sections: Showing the different conditions at high (left) and low (right) tide.

Above: 1:200 model of watersports school showing the varying make-up of the wooden roof structure according to its use; hanging equipment, props, equipment against or providing shelter in the form of a roof.
The bathing pools are located at the neck of the bay. The strong current has carved out a deep channel at this point. These pools break down the distance between either side of the banks and provide a stable docking point for the pontoons. This design allows for the rapids to still be used by kayakers while also allowing for windsurfers to pass through at high tide.

The pools are located at either side of the channel. The juxtapositioning of the still contained water against the strong current creates an interesting experience of the site. The placement these bars are arranged in such a way as to deflect the outgoing current away from the soft boulder clay cliff.
Reducing the sea’s erosive power but also providing a means of inhabitation and a way of accessing the other side of the bay for walkers and kitesurfers and other users.

This takes the form of shallow bathing pools scattered along the cliff face that would difflood at high tide but also dissipate the energy of the waves as they approach the cliff.

The force of the sea at this location means the exposed cliff face is under attack at high tide. The wave-cut platform at the base of the cliff is scattered with erratics and rock debris at low tide which makes crossing at this point difficult thus reducing accessibility to Kitesurfers Beach.

Proposals by Galway City Council include the development of a line of rock armour to reduce coastal erosion. My proposal is to design a means of reducing the sea’s erosive power but also providing a means of inhabitation and a way of accessing the other side of the bay for walkers and kitesurfers and other users.

This takes the form of shallow bathing pools scattered along the cliff face that would difflood at high tide but also dissipate the energy of the waves as they approach the cliff.
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