



Scotland's centre of expertise for waters

# Dynamic Coast - National Coastal Change Assessment: Defence Asset Database



**DANGER**  
These dunes are  
very unstable due  
to coastal erosion  
Keep away from  
top and bottom





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# National Coastal Change Assessment Steering Committee



# Defence Asset Database

## *Dynamic Coast – Scotland's National Coastal Change Assessment*

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### Executive Summary

- There is a fundamental requirement within the National Coastal Change Assessment (NCCA) to identify the presence/absence of artificial structures and natural landforms that perform coastal erosion and flooding defence functions.
- The construction of coastal defences against flooding and erosion has been ongoing for well over a hundred years in Scotland and recently Local Authorities have developed their own datasets which document the position and type of these defences.
- In spite of this, the existing information concerning the distribution, condition and nature of coastal erosion and flooding defence assets is nationally patchy and has not yet been assimilated into a single and standardised dataset.
- This review attempts to outline how this might be done.
- However, the scope of this review has been curtailed due to adjustments within the time frame for SEPA taking forward related work areas. As a result this document is limited to outlining the types of information that could be assimilated within the NCCA, and which may be useful to SEPA at some later date.
- The key elements of information and attributes that require to be collected from each individual coastal defence asset are laid out in a table dealing with artificial or built assets, such as seawalls, and a table dealing with natural assets such as beach and dune ridges.
- These are broadly comparable with the data attributes which support the Fife Council Shoreline Management Plan (Appendix A).

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## 1.0 Introduction

This report reviews the current requirement for a national coastal defence asset database in order to establish a baseline from which to identify the current presence, absence and, if possible, condition of the artificial structures and natural landforms in place that serve a coastal protection function be it coastal erosion or flooding.

The aim of such an exercise is to have in place high level but achievable targets so that the Scottish Government, its agencies and Local Authorities can all appreciate a national overview of the current defence resource. They will thus be in a better position to assess the level of protection afforded by built and natural defences within any strategic requirement to support the sustainable management of assets in the face of climate change.

Such a coastal erosion and flooding database allows an understanding of the present performance of the resource to be developed and its likely future performance assessed (see Appendix A for an example).

We need to understand the asset's exposure to pressure, construction materials, present condition and likely future deterioration. In the absence of an assessment of condition and the likely performance of coastal erosion and flood defence assets, it is impossible to support effective decision-making for the management of erosion and flood risk.

## 2.0 Coastal defences

### 2.1 Attributes to be included for coastal defences

Key to any asset condition assessment is to develop a standard template that allows a rapid and objective visual assessment of its condition. This report follows the 5 point scale used by the EA for general asset condition assessment (Environment Agency, 2006):

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Defects that could reduce performance of the asset
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed
5	Very Poor	Severe defects resulting in complete performance failure

An indicative selection of the types of influences that might affect the above visual assessment are listed in Appendix B (from Environment Agency, 2006).

### 2.2 Built coastal defences

Built coastal defences are commonplace on Scotland's coast and may have been constructed for a variety of purposes including protection of the coast from wave impact, erosion and overtopping, coastal flood defences, port and harbour construction, road and railtrack support and protection, and beach nourishment for recreational purposes amongst others. Irrespective of their original position and function, and in common with other structures constructed at, or close to, MHWS, it may be that they are now exposed at, or close to, MHWS and thus should be regarded as part of the asset resource.

The types of information that can be regarded as key to a national database are attributes such as: presence/absence; protection type; linear extent; height above OD; structure age; condition and evidence of deterioration; estimate of future design life; planned renewal date (if known). These attributes are stylised into table 3.1. A good working example of the type and quality of Local Authority derived data aimed at capturing the type and location of the defence assets is provided in Appendix A.

*Table 2.1: Attributes to be included within the Built Coastal Defences Database.*

Name	Information contained	Data type	Essential part of NCCA
ID	Unique Identifier within NCCA. Based on: Cell - Sub Cell - Element#	ID Code	Yes
Start point	Coordinates	BNG coordinates	Yes
End point	Coordinates	BNG coordinates	Yes
Asset type	Concrete wall/wooden groyne	Select from a predefined menu	Yes
Structure Condition	1-5 scoring system	Predefined menu	No
Crest Altitude + position	Min, Max, Representative	mOD + m from MHWS	No
Level of protection	What return period the altitude (above) refers to.	Predefined level	No
Structure age	Date of construction (if known)	Date field	No
Last maintenance check	Date	Date field	No
Checked by	Name of inspecting Engineer	Free text field	No
Owner type	Private / LA owned / Transport Scotland	Predefined menu	No
Further Info	LA contact / Data provider	Free text field	No
Notes	Cracking of masonry joints etc.	Free text field	No
Photo	Photo A, B	Free image field	No

### 2.3 Natural coastal defences

Natural coastal defences are defined as the beaches, dunes and saltmarshes that are commonplace on Scotland's coast and which serve a useful protection function for any assets that lie landward. Although primarily regarded as recreational or aesthetic assets, their role as important coastal protection structures is increasingly acknowledged, albeit that this role has been underestimated in the past. Where these constitute a series of non-active beach ridges, dune ridges or machair that were originally constructed close to MHWS but became isolated inland due to subsequent accretion, it may be that they have over time become exposed at, or close to MHWS on account of erosion, and so should be regarded as part of the asset resource (ie. emerged or "raised" beaches and dunes).

The types of information that can be regarded as key to a national database are attributes such as: presence/absence; asset type; linear extent; height above OD; structure age; condition and evidence of deterioration; land use pressures etc. These attributes are stylised into table 4.2.

Table 4.2: Attributes to be included within the Built Coastal Defences Database.

Name	Information contained	Data type	Essential part of NCCA
ID	Unique Identifier within NCCA. Based on: Cell - Sub Cell - Element#	ID Code	Yes
Start point	Coordinates	BNG coordinates	Yes
End point	Coordinates	BNG coordinates	Yes
Asset type	E.g. sand dune, shingle beach	Predefined menu, multiple responses	Yes
Structure Condition / index of robustness	1-5 scoring system	Predefined menu	No
Crest Altitude + position	Min, Max, Representative	mOD + m from MHWS	No
Level of protection	What return period the altitude (above) refers to	Predefined level	No
Crest width	Width of crest at MHWS	numeric value, m width above nominated flood level?	No
Pressures	E.g. 'grazing, extraction'	Select from a predefined menu	No
Owner type	Private / LA owned / Transport Scotland ...	Select from a predefined menu	No
Further Info	LA contact / Data provider	Free text field	No
Notes	Dune recharge site (date)	Free text field	No
Photo			

## 2.5 A national coastal defence database

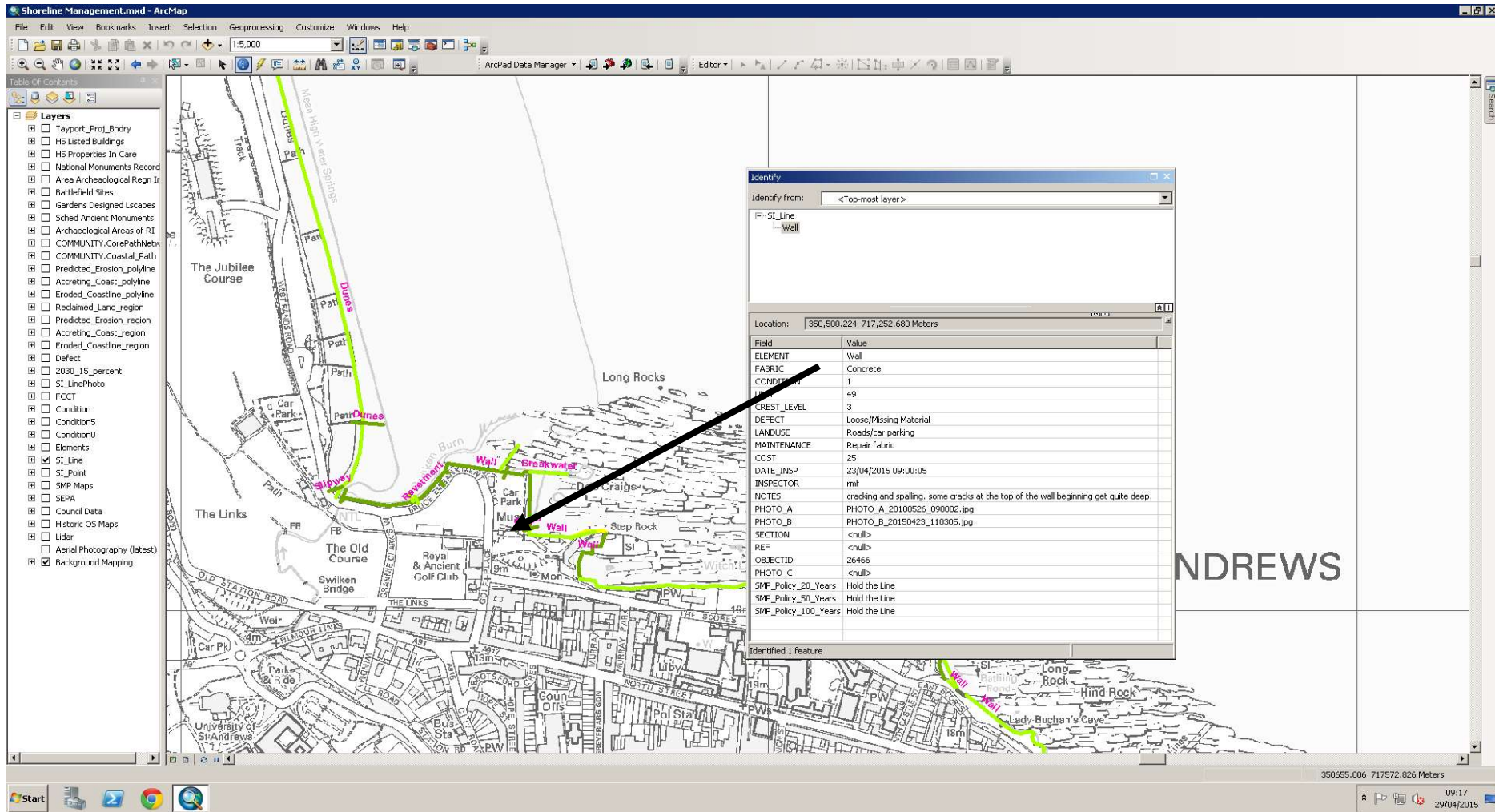
There is a clear need for a national coastal defence database that would allow all levels of Government to understand the present extent and condition of the defence asset resource in order to assess any present and future requirements. For example, there is a need to understand the asset's exposure to pressure, construction materials, present condition and likely future deterioration. In the absence of an assessment of condition and the likely performance of coastal erosion and flood defence assets, it will be problematic to support effective decision-making for the management of future erosion and flood risk. At present the local data bases are patchy and incomplete and a fully functional and comprehensive national data base does not yet exist.



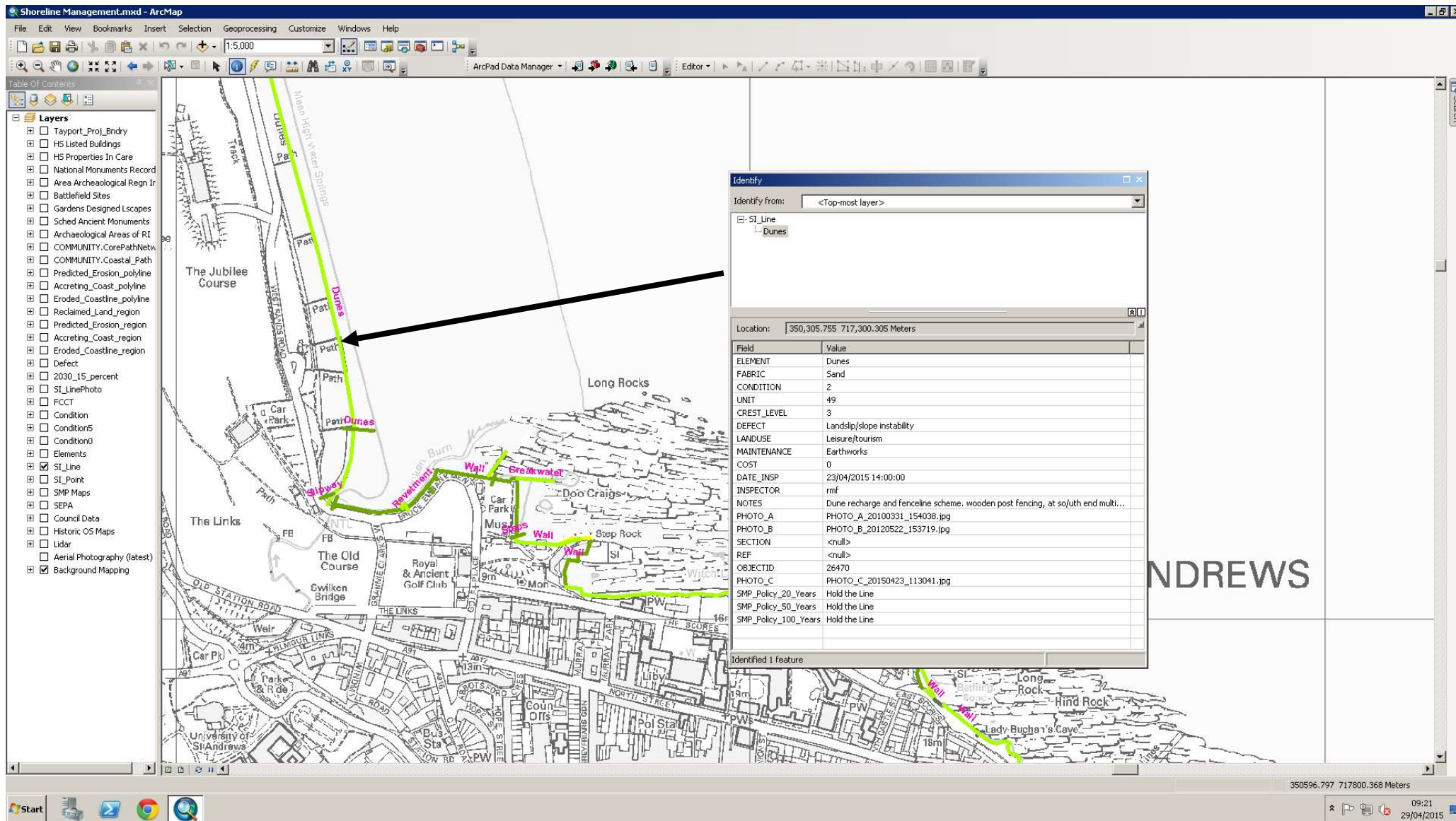
## Appendix A: Fife Council's datasets

Some examples of good data recording practice to comprise a useful dataset by Fife Council.

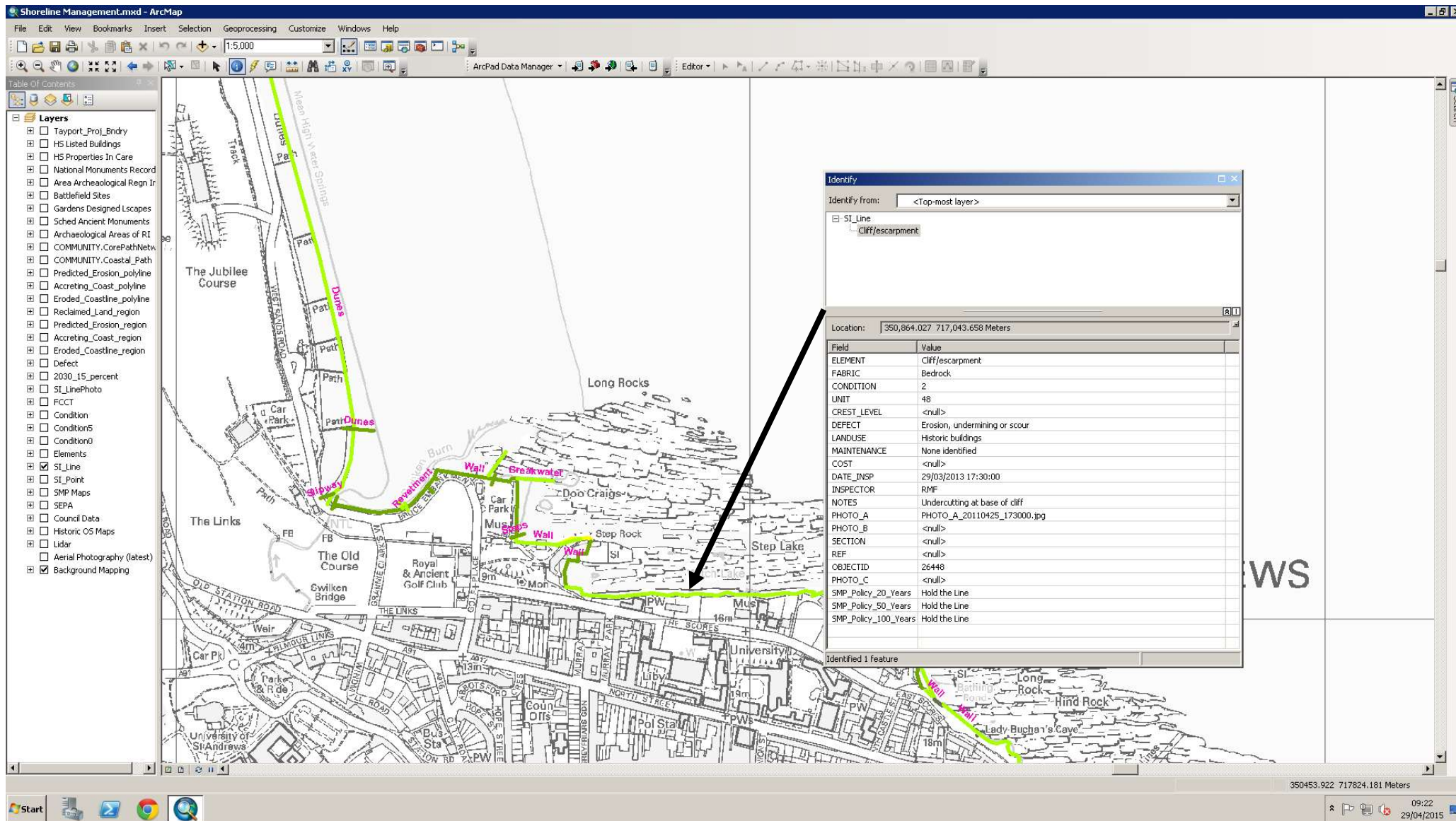
Note that not all Local Authorities have such a comprehensive data set on their built and natural coast protection assets.



# Scotland's National Coastal Change Assessment



# Scotland's National Coastal Change Assessment



# Scotland's National Coastal Change Assessment

The screenshot displays the ArcMap interface for a project titled 'Shoreline Management.mxd'. The map shows a coastal area with various features labeled, including 'The Jubilee Course', 'The Links', 'The Old Course', 'Royal & Ancient Golf Club', 'University of St Andrews', and 'Step Lake'. A green line highlights a 'Revetment' structure along the coast. An 'Identify' window is open, showing details for the selected feature.

**Identify Window Details:**

- Identify from: <Top-most layer>
- SI\_Line
  - Revetment
- Location: 350,352.057 717,185.211 Meters

Field	Value
ELEMENT	Revetment
FABRIC	Stone masonry (pointed)
CONDITION	1
UNIT	49
CREST_LEVEL	3
DEFECT	No significant defects
LANDUSE	Roads/car parking
MAINTENANCE	None identified
COST	0
DATE_INSP	23/04/2015 09:00:03
INSPECTOR	rnf
NOTES	repairs carried out 2014
PHOTO_A	PHOTO_A_20100526_090003.jpg
PHOTO_B	PHOTO_B_20150423_111425.jpg
SECTION	<null>
REF	<null>
OBJECTID	26468
PHOTO_C	<null>
SMP_Policy_20_Years	Hold the Line
SMP_Policy_50_Years	Hold the Line
SMP_Policy_100_Years	Hold the Line

Identified 1 feature

**Appendix B: Potential influences on visual assessments (from Environment Agency 2006)**

<b>Foreign objects</b> Foreign objects include trees, outfalls, pipes and any other fixed structure that is placed on top of or behind the defence asset.	Minor	Examples include small trees or authorised outfalls.
	Severe	Examples include large trees or an unauthorised outfall.
<b>Loading</b> Could be residential development, industrial storage etc.	Minor	Some additional loading occurring behind or on top of structure.
	Severe	Heavy loading causing deformation and/or cracking of ground.
<b>Weight of foreign objects</b>	Light	A light object is unlikely to significantly affect the performance of the structure should it collapse or move.
	Heavy	A heavy object would cause significant damage to the structure if it was to collapse and likely to affect the performance of the structure.

<b>Erosion and evidence of overtopping</b>	Minor	Small sections of outer slope slightly eroded.
	Severe	Large section(s) of slope eroded possibly leading to further slippage of material.
<b>Low points on crest</b>	Minor	Partial erosion/rutting of some crest width.
	Severe	Erosion/rutting across entire crest width and of a significant depth.
<b>Cracking (earth embankment)</b>	Significance	The definition of crack significance has to be based on the inspectors judgement on site. Significant cracks or fissures are likely to be of considerable depth or length in relation to the embankment. If the inspector is unsure as to the significance of any cracking found then this should be reflected in their assessment of confidence in the condition assigned.

Cracking (Earth embankment)	Extent	The extent of cracking should reflect the quantity and depth of the cracks/fissures. Cracks of high quantity but little depth, such as those caused by the drying out of clay, should be classed as minor. A small number of deep cracks or fissures extending well into the embankment body should be classed as severe.
Cracking (Masonry/concrete)	Minor	Cracking present, often diagonal, but localised.
	Severe	Large, often diagonal cracks running from the bottom almost to the top of the structure.
Movement (Gabion)	Minor	Small gaps appearing between gabions. Signs of misaligned gabions.
	Severe	Gabions displaced or slipped creating gaps between gabions.
Horizontal sliding (Gravity walls)	Minor	Only observable on close inspection.
	Severe	Obvious on cursory inspection.

Condition of wall material (Gravity walls)	Missing material - Minor	Some reduction in material thickness due to general deterioration. No signs of holes completely through structure.
	Missing material - Severe	Major and extensive loss of material due to deterioration. Some holes or gaps in material could be present exposing backfill.
	Damage	Examples of signs of damage included cracking of masonry or concrete, spalling of concrete and corrosion or damage to gabion baskets.
State of joints (Gravity walls)	Joint misalignment - Minor	Some evidence of movement at the joints under close inspection and loss of joint material.
	Joint misalignment - Severe	Obvious total loss of joint material leading to movement of wall material at joints.
State of joints (Sheet piles)	None	Sheets are in perfect alignment. No gaps visible even under close inspection.
	Minor	Small gaps evident at the clutches under close inspection.
	Severe	Obvious gaps evident at the clutches. Indications of movement of sheets.

## References

Environment Agency (2006) Managing Flood Risk, Condition Assessment Manual. Document Reference 166\_03\_SD01. 203pp.



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