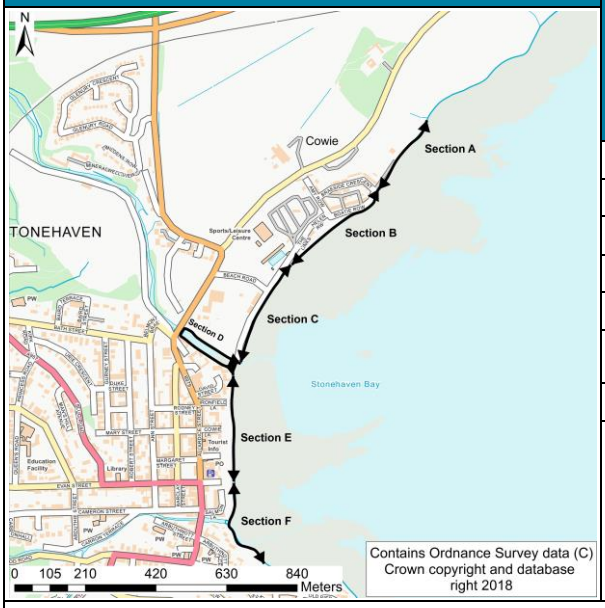
1. General information

Location Plan:



Stonehaven coastal defences
Assessment Date: 14/05/2018

Exam Type:	**Detailed**
Complete Survey:	Yes
Structure Ref:	**1**
OS Ref:	387570 , 786291
Survey Unit:	N/A
Governing SMP2:	N/A
SMP2 Policy Unit:	N/A
SMP2 Policy:	N/A

1.1. Type of structure and general description (to include key components and materials)

Stonehaven coastal defences are located in Stonehaven Bay, Aberdeenshire. The defence has been split into six sections corresponding to a change in defence combination.

- Stonehaven coastal defence A: A masonry/concrete wall with a concrete toe, fronted by a sand/shingle beach.
- Stonehaven coastal defence B: A concrete sea wall, with a sort span of sheet piles connecting it to Section C, fronted by a sand/shingle beach.
- Stonehaven coastal defence C: A concrete stepped revetment with a large recurve splash wall, fronted by a shingle beach.
- Stonehaven coastal defence D: A sheet piles structure with sloping concrete pitching training walls on the mouth of the River Cowie.
- Stonehaven coastal defence E: A concrete sea wall, varying in width, fronted by a shingle beach.
- Stonehaven coastal defence F: A shingle beach with rock armour protection on the mouth of the River Carron.

At the northern end of the asset, Section A ties into the natural cliffline by Cowie village. The southern extent of the defence, Section F ties-into a rock armour revetment forming part of Stonehaven harbour. Access to the beach and foreshore is available via access steps in several locations across the beach and directly from the footpath between Section E and Section F.

1.2. Summary of condition and critical defects

Section A is considered to be in poor condition having several defects which could significantly reduce the performance of the asset and warrants further investigation. Sections B, C, D and E are considered to be in fair condition with defects that could potentially reduce performance of the assets. Section F is considered to be in good condition with only minor defects. The defects that are believed to be significant and require immediate attention are as follows:

Section A:

- The concrete toe of the masonry wall is being undermined in places, providing reduced protection to the sea wall.

- There are signs of voiding behind the blockwork.

- H&S - Access to the structure through the poor condition slipway is considered to be a health and safety hazard.

- The access to the rear of the masonry wall at the north end is in poor condition. Further deterioration may compromise protection to the rear of the wall.

Section B:

- The concrete wall in general is in good condition, however there are numerous outfalls which require flap valves. The exposed sheet piled face is heavily corroded and with some complete loss of section though the piles. Following the survey the local council informed that a sink hole appeared in the crest of the wall, on top of the sheet pile section of the wall due to voiding in the sheet piles. The depression in vegetated crest is believed to be due to wave overtopping and wear from pedestrian and vehicle access.

Section C:

- H&S - The beach access steps have broken or poorly fixed hand railings. In general the steps are in poor condition, most notably one access point is missing 3 tiers of steps and has exposed dowel bars protruding from the concrete providing a severe health and safety hazard. It is recommended that these steps are closed to public access until remedial works are completed.

- Extensive damage to the concrete recurve wall was observed from the reinforcement corrosion.

Section D:

- The river training wall piles are corroded, but the severity of which is unknown. It is known that a section of approximately 5-10m is undermined and there is no piling. Multiple drainage points require maintenance and possibly new flap valves.

Section E:

- No significant defects, but multiple expansion joints require re-sealing for a watertight seal.

Section F:

- The rock armour protecting the river Carron appeared overly steep, along its length, and could be subject to collapse under extreme wave loads.

Note that this is a condition assessment of the existing structures and does not assess the performance of the structures as flood defences, which will be assessed elsewhere.

1.3. Access considerations

Third party/adjacent landowner permissions:	None
Nearest public highway:	B979
Local guidance:	Parking available at the top of the sea wall on Section C on the promenade. Alternatively, in the town centre.
Tide state during survey:	Spring (Low)
Equipment required for access and examinations:	Standard survey equipment.

2. Structure information

Defence Hierarchy	Type	Sub Types	Elements	Material Type
Section A	Defence	Wall	Exposed face	Masonry (open joints, missing blockwork, voiding)
	Defence	Wall	Seaward toe	Concrete (dilapidated repairs, cracks)
	Defence	Wall	Access strip	Concrete (undermined, uneven and damaged surface, health and safety hazard)
Section B	Defence	Wall	Exposed face	Concrete wall (vertical cracks, damaged recurve, exposed reinforcement, loss of concrete cover)
	Defence	Wall	Crest	Vegetated (large depression in earth surface, sinkhole(observed following the visual inspection))
	Defence	Wall	Exposed face	Steel (heavily corroded, localised complete loss of section, damaged capping beam)
Section C	Defence	Embankment	Exposed face	Concrete (abraded concrete surface, some exposed reinforcement)
	Defence	Embankment	Splash wall	Concrete (heavily corroded reinforcement, extensive damage to concrete recurve, cracking)
	Defence	Embankment	Rock armour	Rock armour buried and seems to be in good condition. Unable to survey any defects.
Section D	Defence	Embankment	Channel side	Concrete (some cracking and damage to concrete, vegetation growth, concrete toe undermined and piling missing)
	Defence	Embankment	Piling	Steel (corroded, some anchor plates lost, concrete toe undermined and piling missing (not observed during survey))
	Defence	Embankment	Exposed face	Concrete (cracking, exposed reinforcement, general dilapidation)
Section E	Defence	Wall	Exposed face	Concrete (cracking, exposed reinforcement)
Section F	Defence	Embankment	Exposed face	Beach (shallow, possibly narrow for wave attenuation)
	Defence	Embankment	Rock armour	Rock (undersized at mouth of river Carron, overly steep)
	Defence	Embankment	Splash wall	Masonry (only acting as defence in extreme events)

Approx. defence length (m):	2000		
Approx. co-ordinates from:	387616, 785618	To:	388472, 787211
As built drawing available:	No		
Linked to other Asset Types:	The defence ties into a natural cliff on the northern side and into Stonehaven harbour on the southern side.		
Infrastructure protected:	Asset protects approximately 2000m road infrastructure as well as nearby properties and business immediately at risk of flooding.		
Assets type and ownership that the defence ties into at either end:	The defence ties into the natural cliff to the north and the harbour's rock armour revetment to the south, both under local council ownership.		

2.1 Topographic level information

Section A	Value	Method of calculation
Crest level of primary defence (mAOD)	4.58	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	1.75 (Varies)	N/A
Upper beach level (mAOD)	3.253	Laser scan
Lower beach level (mAOD)	0.844	Laser scan
Approx. total beach height (m)	Varies	N/A
Beach crest width (m)	Varies	N/A
Approx. beach gradient (1 in ...)	Varies	N/A
Beach Cross Sectional Area (m2)	Varies	N/A
Beach composition	N/A	N/A

Section B	Value	Method of calculation
Crest level of primary defence (mAOD)	4.59	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	2.1	N/A
Upper beach level (mAOD)	3.279	Laser scan
Lower beach level (mAOD)	-0.841	Laser scan
Approx. total beach height (m)	Varies	N/A
Beach crest width (m)	Varies	N/A
Approx. beach gradient (1 in ...)	Varies	N/A
Beach Cross Sectional Area (m2)	Varies	N/A
Upper Beach composition	Sand	N/A
Lower Beach composition	N/A	N/A

Section C	Value	Method of calculation
Crest level of primary defence (mAOD)	6.02	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	5.8	Topo Survey
Upper beach level (mAOD)	2.624	Laser scan
Lower beach level (mAOD)	-1.145	Laser scan
Approx. total beach height (m)	Varies	N/A
Beach crest width (m)	Varies	N/A
Approx. beach gradient (1 in ...)	Varies	N/A
Beach Cross Sectional Area (m2)	Varies	N/A
Beach composition	N/A	N/A

Section D	Value	Method of calculation
Crest level of primary defence (mAOD)	5.23	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	5	Topo Survey
Upper beach level (mAOD)	N/A	N/A
Lower beach level (mAOD)	N/A	N/A
Approx. total beach height (m)	N/A	N/A
Beach crest width (m)	N/A	N/A
Approx. beach gradient (1 in ...)	N/A	N/A
Beach Cross Sectional Area (m2)	N/A	N/A
Beach composition	N/A	N/A

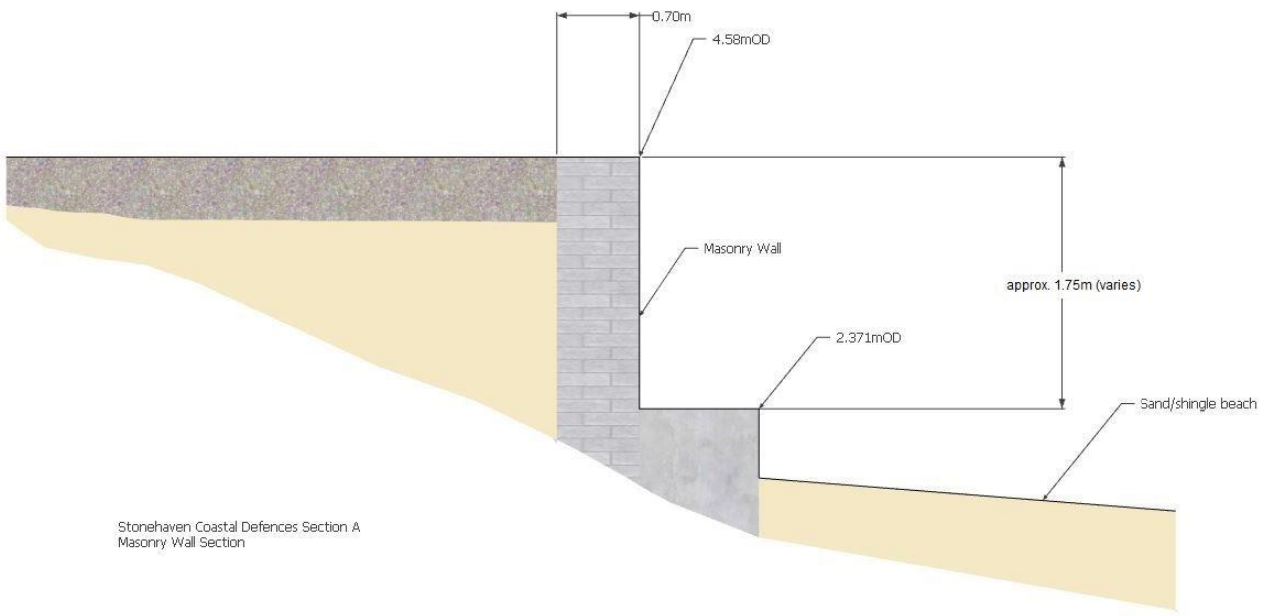
Section E	Value	Method of calculation
Crest level of primary defence (mAOD)	4.78	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	Varies	Topo Survey
Upper beach level (mAOD)	4.613	Laser scan
Lower beach level (mAOD)	-1.359	Laser scan
Approx. total beach height (m)	Varies	N/A
Beach crest width (m)	Varies	N/A
Approx. beach gradient (1 in ...)	Varies	N/A
Beach Cross Sectional Area (m2)	Varies	N/A
Beach composition	Shingle	N/A

Section F	Value	Method of calculation
Crest level of primary defence (mAOD)	4.515	Topo Survey
Toe level of primary defence (mAOD)	N/A	N/A
Approx. defence height above beach (m)	Varies	N/A
Upper beach level (mAOD)	4.118	Laser scan
Lower beach level (mAOD)	-0.951	Laser scan
Approx. total beach height (m)	Varies	N/A
Beach crest width (m)	Varies	N/A
Approx. beach gradient (1 in ...)	Varies	N/A
Beach Cross Sectional Area (m2)	Varies	N/A
Upper Beach composition	Shingle	N/A
Lower Beach composition	N/A	N/A

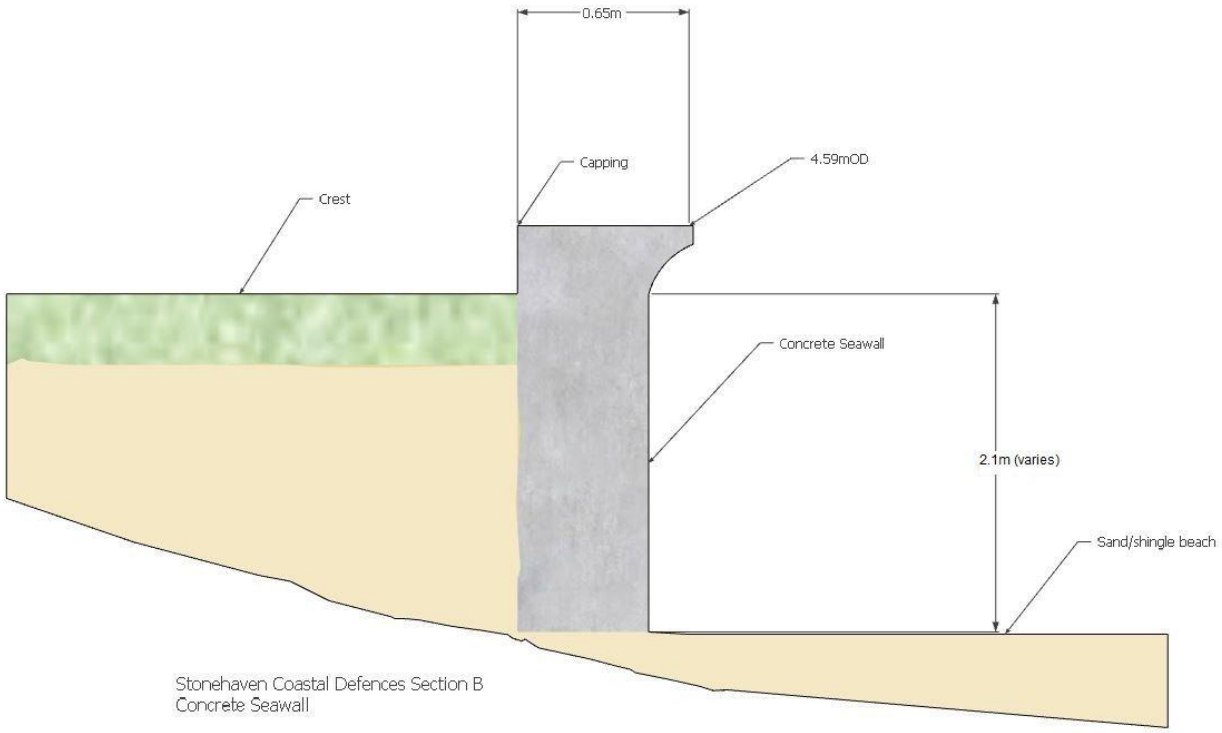
3. Asset site sketch

Plan:

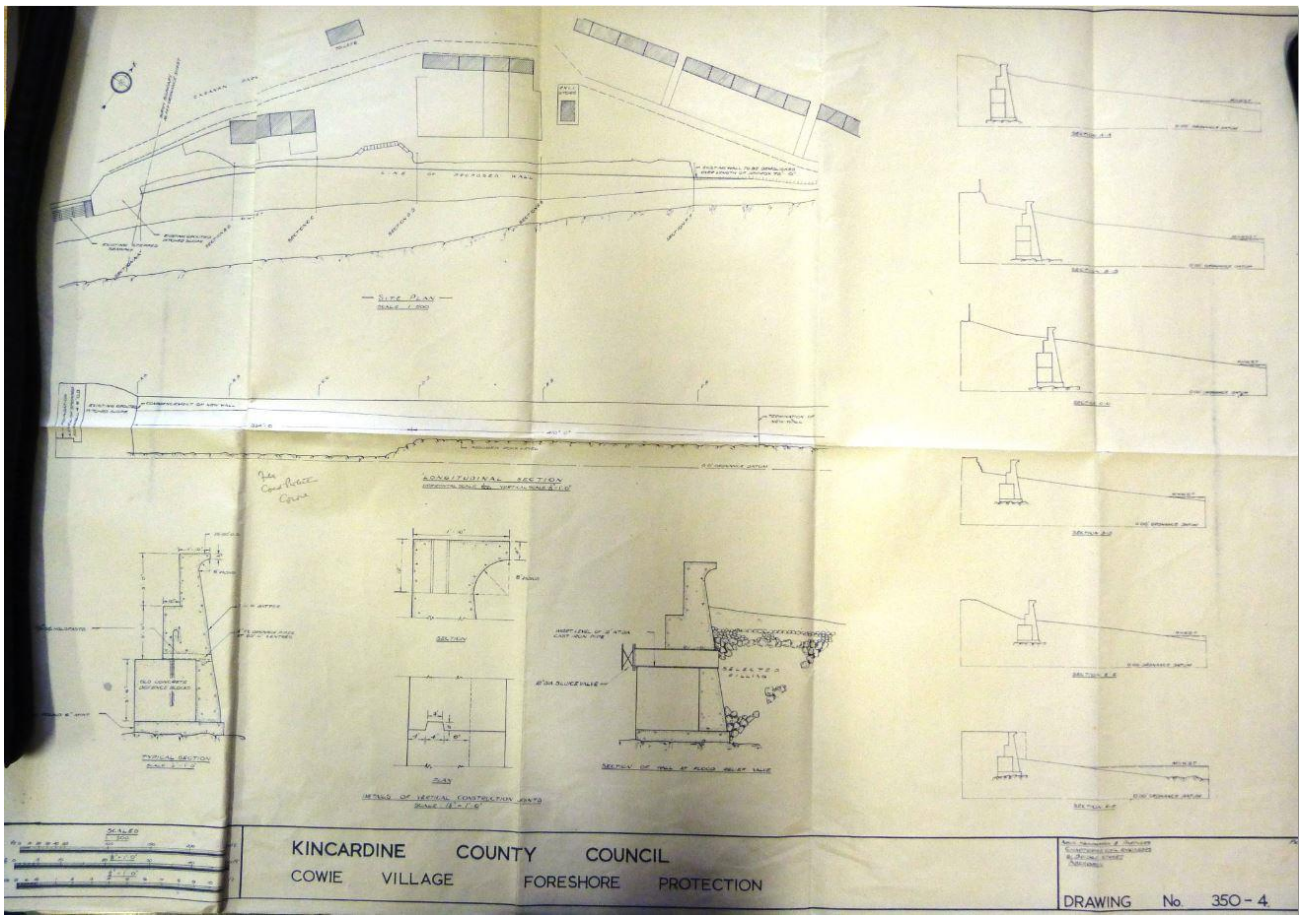
Sketch: Section A



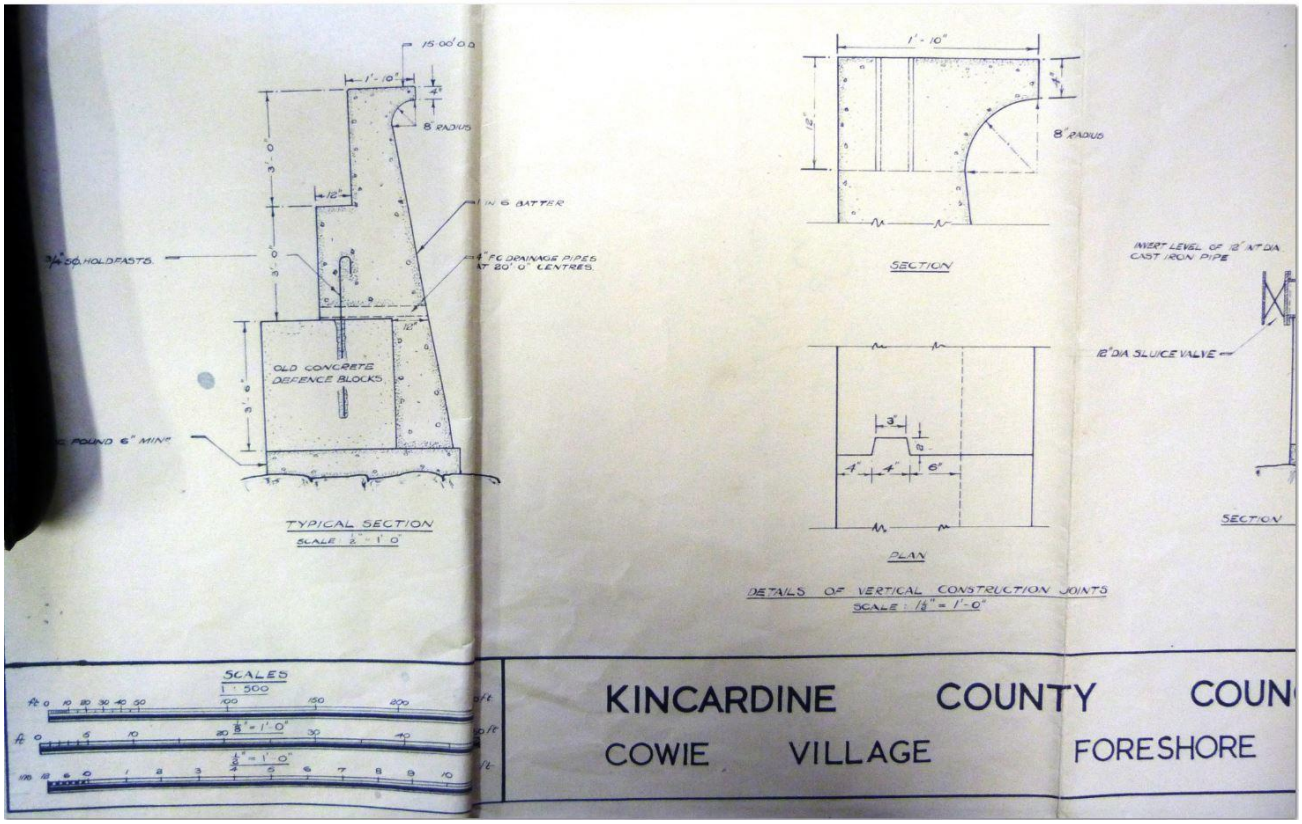
Sketch: Section B



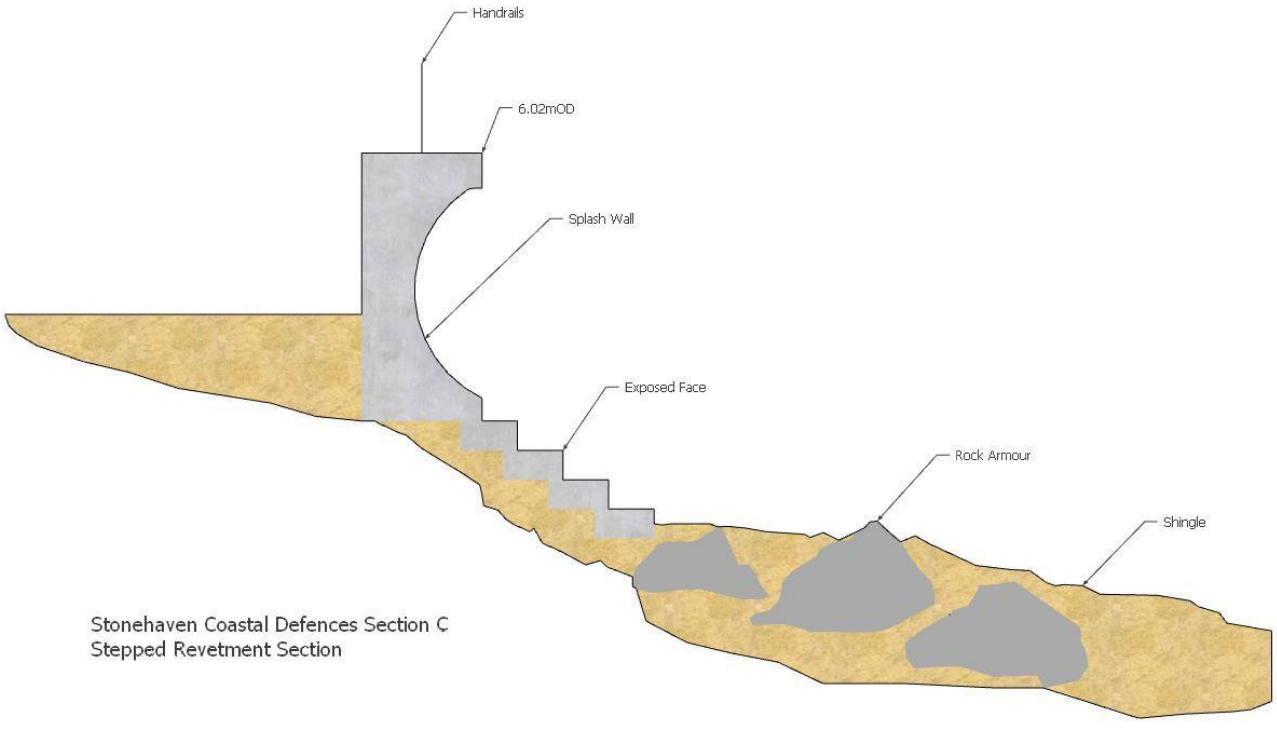
Sketch: Flood Protection Works at Cowie - Seawall Plan and Sections - Section B



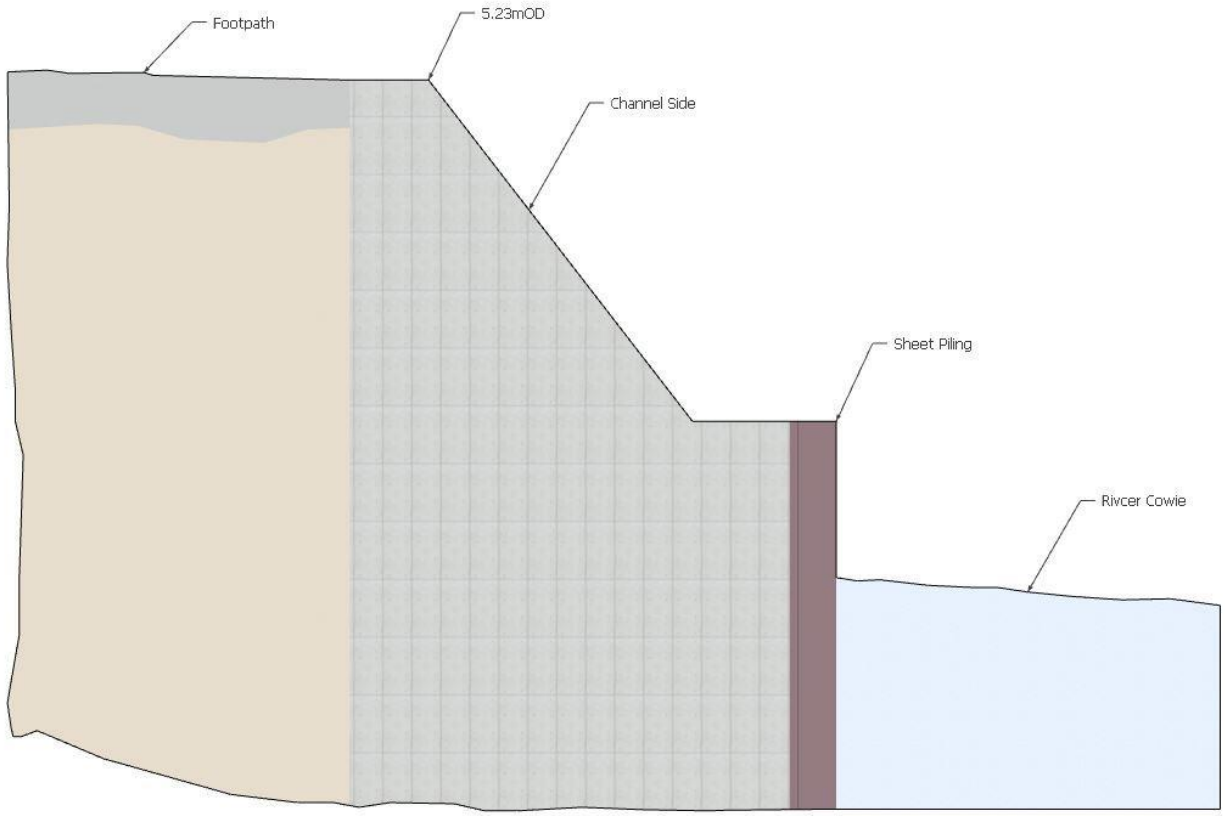
Sketch: Flood Protection Works at Cowie - Seawall Sections - Section B



Sketch: Section C

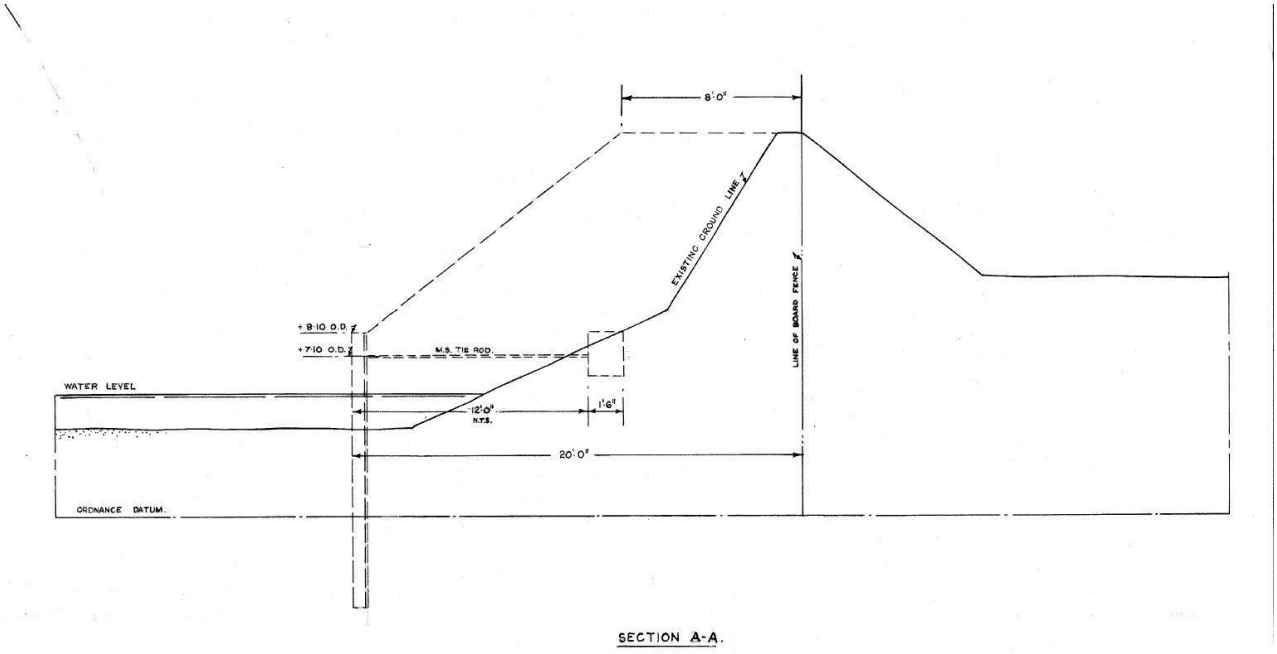


Sketch: Section D

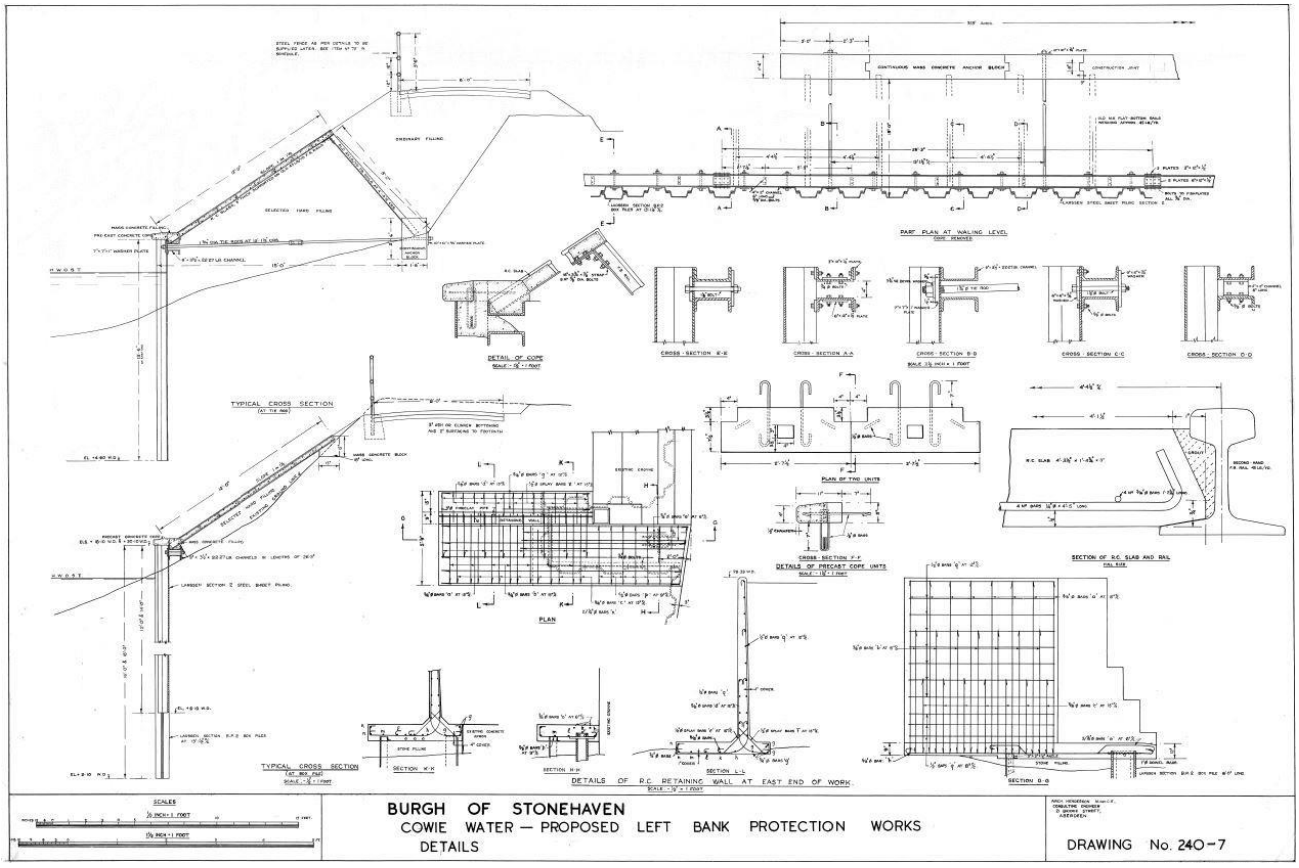


Stonehaven Coastal Defences Section D
River Cowie Training Walls

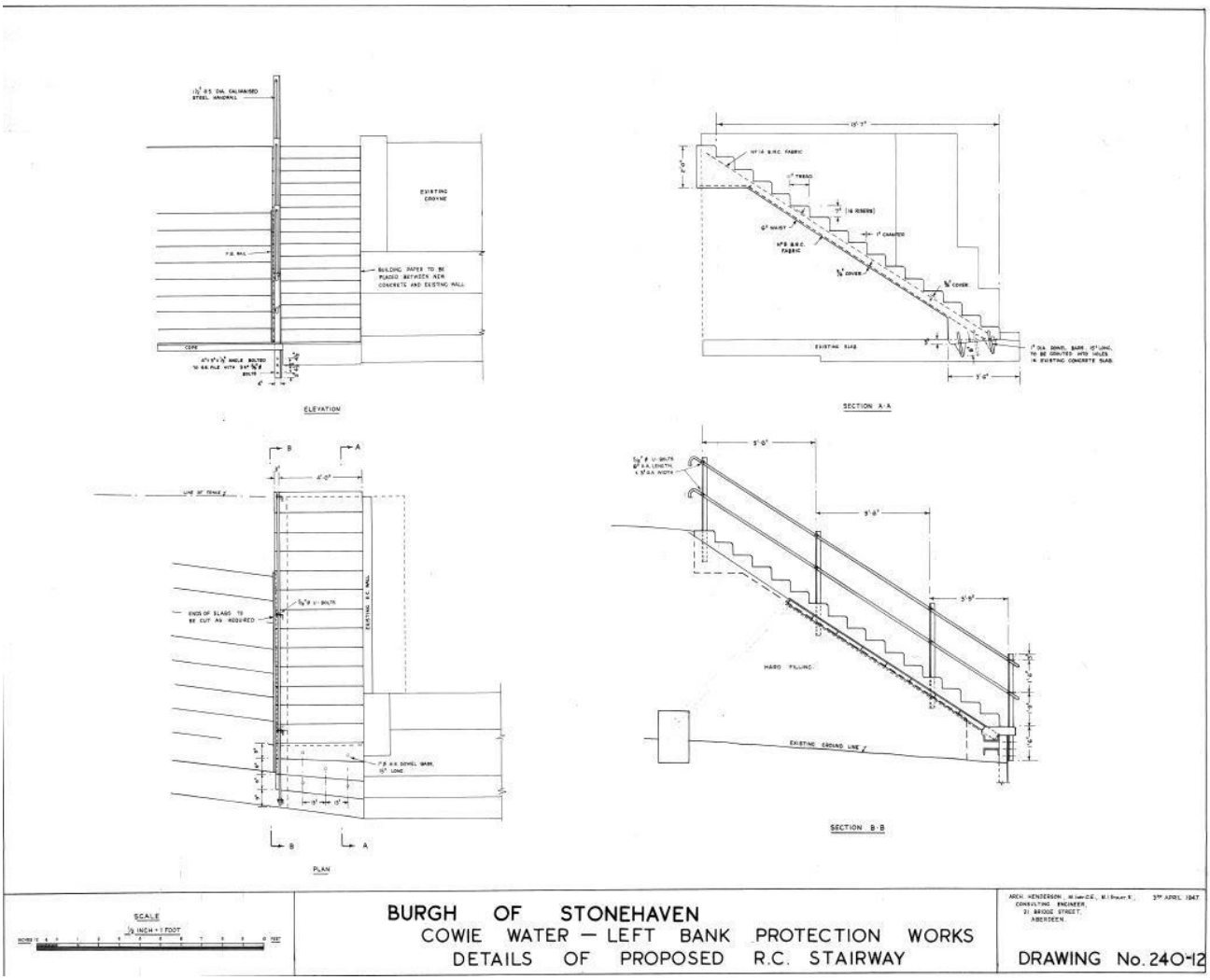
Sketch: Cowie Water - Section D



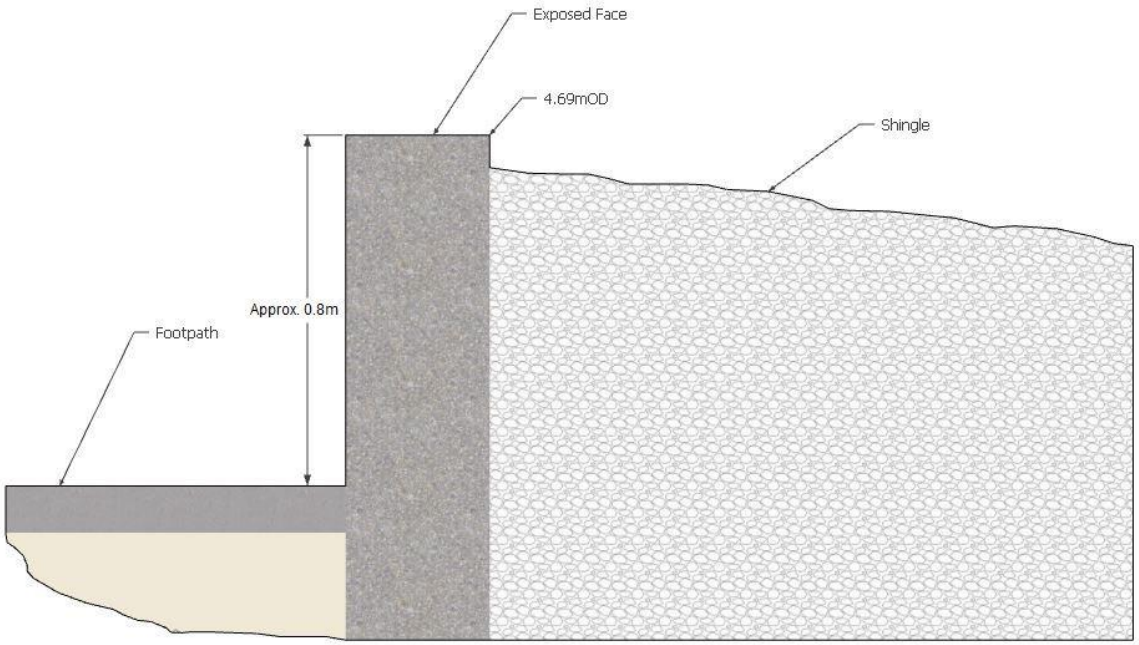
Sketch: Cowie Water Left Bank Protection Works - Section D Details



Sketch: Cowie Water Left Bank Protection Works - Section D Details

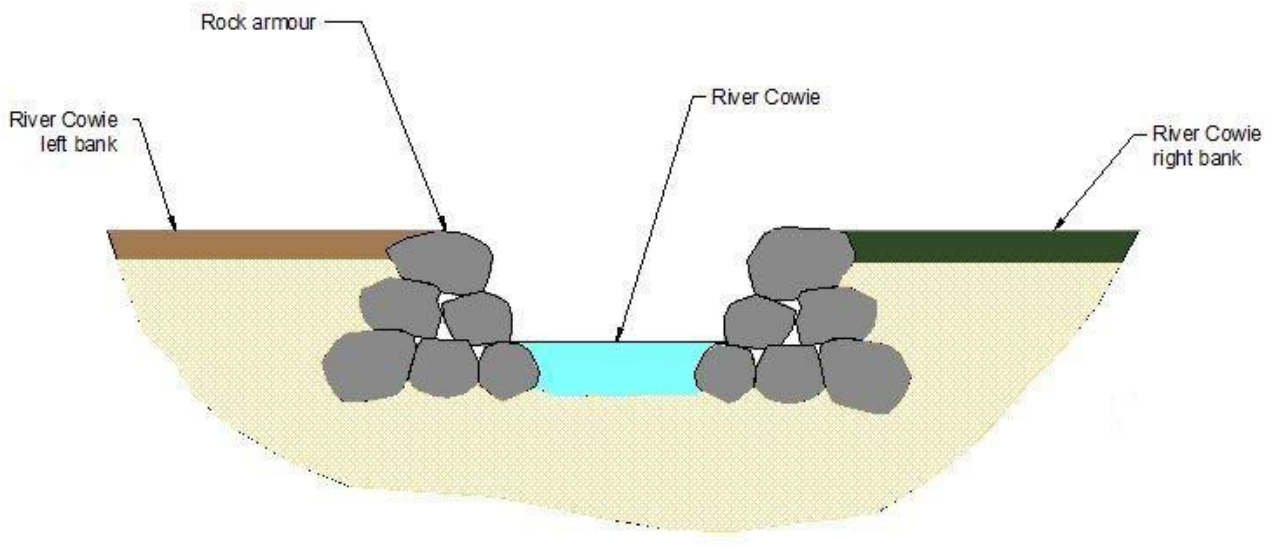


Sketch: Section E



Stonehaven Coastal Defences Section E
Concrete Wall

Sketch: Section F



Stonehaven Coastal Defences Section F
Rock Armour Revetment

4. Visual Condition Survey

4.1 Section A

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Wall	Exposed face	Masonry (open joints, missing blockwork, voiding)	4	9	36
Wall	Seaward toe	Concrete (dilapidated repairs, cracks)	3	8	24
Wall	Access strip	Concrete (undermined, uneven and damaged surface, health and safety hazard)	5	1	5
Sum				18	65
Overall condition score Grade*					**4**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.2 Section B

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Wall	Exposed face	Concrete wall (vertical cracks, damaged recurve, exposed reinforcement, loss of concrete cover)	3	9	27
Wall	Crest	Vegetated (large depression in earth surface, sinkhole(observed following the visual inspection))	3	7	21
Wall	Exposed face	Steel (heavily corroded, localised complete loss of section, damaged capping beam)	4	7	28
Sum				23	76
Overall condition score Grade*					**3**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.3 Section C

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Embankment	Exposed face	Concrete (abraded concrete surface, some exposed reinforcement)	3	7	21
Embankment	Splash wall	Concrete (heavily corroded reinforcement, extensive damage to concrete recurve, cracking)	3	7	21
Embankment	Rock armour	Rock armour buried and seems to be in good condition. Unable to survey any defects.	2	6	12
Sum				20	54
Overall condition score Grade*					**3**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.4 Section D

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Embankment	Channel side	Concrete (some cracking and damage to concrete, vegetation growth, concrete toe undermined and piling missing)	3	7	21
Embankment	Piling	Steel (corroded, some anchor plates lost, concrete toe undermined and piling missing (not observed during survey))	4 (Condition Grade was 3 previously, now classified as Condition Grade 4 after council's information on missing piling for approximately 10m)	8	32
Embankment	Exposed face	Concrete (cracking, exposed reinforcement, general dilapidation)	3	7	21
Sum				22	74
Overall condition score Grade*					**3**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.5 Section E

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Wall	Exposed face	Concrete (cracking, exposed reinforcement)	3	7	21
Sum				7	21
Overall condition score Grade*					**3**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.6 Section F

Main Asset

The main asset is broken down into its constituent parts (elements) and assigned a condition score. This condition score of each element is weighted according to its importance in the functioning of the defence.

Sub-Type	Elements	Attributes and General Notes	Condition Grade	Weighting (1-9)	Overall (CG x W)
Embankment	Exposed face	Beach (shallow, possibly narrow for wave attenuation)	2	7	14
Embankment	Rock armour	Rock (undersized at mouth of river Carron, overly steep)	2	7	14
Embankment	Splash wall	Masonry (only acting as defence in extreme events)	3	4	12
Sum				18	40
Overall condition score Grade*					**2**

*Sum of (Weightings x Condition Grades) / (Sum of Weightings)
Unless a weighting of 9 is given for any element, in which case, the condition of this element should be taken as the overall condition grade.

4.7 Asset condition grade summary

	Section A	Section B	Section C	Section D	Section E	Section F
Target condition grade	2	2	2	2	2	2
Overall surveyed condition grade	4	3	3	3	3	2
Total time taken to reach CG1	0	0	0	0	0	0
Total time taken to reach CG2	0	0	0	0	0	0
Total time taken to reach CG3	0	0	0	0	0	15 years
Total time taken to reach CG4	0	15 years	15 years	25 years	15 years	35 years
Total time taken to reach CG5	15 years	30 years	30 years	35 years	30 years	45 years

4.8 Additional information

General description and effect of any coastal erosion noted:	None noted during asset inspection.
General description and effect of any wave overtopping noted:	Depression in vegetated crest on Section B may be a result of overtopping damage. No observable evidence of damage from wave overtopping was noted during asset inspection.
General description and effect of any longshore / cross-shore sediment transport noted:	Evidence of beach transport into the River Cowie mouth. Variability of beach noted on Section B and to lesser degree to Section C.

5. Identification of defects and recommendations

5.1. Main asset defect register

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D1	387886, 786644	Wall	Crest	63	Poorly vegetated / worn crest.	Resurface vegetated crest.	29
D2	387867, 786632	Wall	Crest	64	Depression of crest.	Resurface vegetated crest.	29
D3	387925, 786664	Wall	Exposed face	48	Cracked and spalling concrete between wall types	Repoint / patch repair damaged concrete.	5
D4	387925, 786663	Wall	Exposed face	49	Spalling concrete approximately 1 x 0.3m.	Consider refacing spalling repairs.	13
D5	387904, 786656	Wall	Exposed face	50	Broken flap valve	Replace flap valve.	21
D6	387903, 786654	Wall	Exposed face	51	Loss of cover exposing corroded steel evenly spaced in the frontage.	Breakout and repair corroded area.	23
D7	387898, 786648	Wall	Exposed face	52	No. 12 missing flap valves.	Consider installing flap valves.	21
D8	387891, 786642	Wall	Exposed face	53	Spalling of concrete along the construction joint.	Reface spalling concrete.	6
D9	387885, 786640	Wall	Exposed face	54	Damaged recurve approximately 0.5m x 0.3m.	Patch repair damaged recurve.	17
D10	387815, 786593	Wall	Exposed face	55	Damaged recurve approximately 0.3m long.	Patch repair damaged recurve.	17
D11	387809, 786587	Wall	Exposed face	56	Minor crack 1m long approx.	Repoint fracture and monitor wall for signs of movement.	18

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D12	387774, 786562	Wall	Exposed face	57	Vertical fracture in wall.	Repoint vertical fracture and monitor wall for signs of movement.	7
D13	387774, 786562	Wall	Exposed face	58	Damaged recurve in two places, approximately 1m long	Patch repair concrete recurve.	7
D14	387767, 786557	Wall	Exposed face	59	Vertical crack in wall.	Repoint cracks and monitor wall for signs of movement.	10
D15	387762, 786550	Wall	Exposed face	60	Vertical crack in wall.	Repoint vertical fracture and monitor wall for signs of movement.	10
D16	387734, 786524	Wall	Exposed face	61	Missing pointing between recurve units.	Repoint open joints.	13
D17	N/A	Wall	Exposed face	62	Blocked drainage pipes.	Unblock pipes and consider installing flap valves.	17
D18	N/A	Wall	Exposed face	65	Corroded sheet piles.	Monitor and undertake further survey to determine pile thickness. Consider replacing sheet piles with an alternative coastal defence solution.	2
D19	387725, 786516	Wall	Exposed face	66	Cracking in the capping beam approximately 0.5m long.	Repoint crack.	18
D20	387719, 786511	Wall	Exposed face	67	Section loss of sheet piles.	Monitor and undertake further survey to determine pile thickness. Consider replacing sheet piles with an alternative coastal defence solution.	1
D21	387714, 786507	Wall	Exposed face	68	Cracking in the capping beam.	Repoint crack.	11
D22	387714, 786501	Embankment	Exposed face	69	Missing handrailing.	Replace timber handrails with a more durable solution.	1
D23	387714, 786503	Embankment	Exposed face	70	Corroded handrailing support.	Replace timber handrails with a more durable solution.	19

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D24	387712, 786500	Embankment	Splash wall	71	Cracking of concrete.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	14
D25	387712, 786501	Embankment	Splash wall	72	Corroded reinforcement	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	16
D26	387708, 786499	Embankment	Splash wall	73	Chipped concrete exposing reinforcement.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	9
D27	387706, 786496	Embankment	Splash wall	74	General abrasion of steps	Monitor and consider replacing rendering to prevent further deterioration.	21
D28	387703, 786492	Embankment	Splash wall	75	Vertical crack.	Repoint vertical crack.	16
D29	387702, 786491	Embankment	Splash wall	79	Exposed corroded reinforcement.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	6
D30	387699, 786491	Embankment	Splash wall	76	Open joints.	Replace missing mastic.	17
D31	387696, 786488	Embankment	Splash wall	77	Cracking in upper radius of recurve throughout defence length.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	12
D32	387692, 786477	Embankment	Splash wall	78	1 x 0.3 m exposed reinforcement and damaged concrete. Crack propagating along by the side of recurve.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	6
D33	387678, 786462	Embankment	Splash wall	80	Open joints.	Replace missing mastic.	17

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D34	387676, 786462	Embankment	Splash wall	81	24No. outfalls missing flap valves. Some outfalls are blocked.	Unblock blocked outfalls. Consider installing flap valves.	20
D35	387669, 786455	Embankment	Splash wall	82	Loss of concrete and exposed reinforcement approx. 0.5 x 0.3m with vertical crack exposing more reinforcement	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	6
D36	387667, 786451	Embankment	Splash wall	83	Long horizontal crack, approximately 5m and crack in buttress wall.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	12
D37	387670, 786447	Embankment	Splash wall	84	Difference in crest level.	None.	11
D38	387657, 786431	Embankment	Splash wall	85	20m long cracks.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	12
D39	387647, 786423	Embankment	Splash wall	86	Timber handrailing missing.	Replace timber handrails with a more durable solution.	1
D40	387647, 786424	Embankment	Splash wall	87	Corroded handrail supports.	Consider replacing corroded supports	23
D41	387646, 786423	Embankment	Splash wall	88	Cracks in concrete on steps.	Repoint fractures.	12
D42	387664, 786450	Embankment	Splash wall	89	Corroded handrailing supports.	Consider replacing corroded supports.	23
D43	387671, 786462	Embankment	Splash wall	90	Loss of concrete cover and corroding reinforcement.	Reface concrete cover.	24

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D44	387642, 786419	Embankment	Splash wall	91	Approximately 20m longitudinal crack along the recurve exposing corroding reinforcement .	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	7
D45	387625, 786391	Embankment	Splash wall	92	Damaged concrete exposing reinforcement approximately 0.3x 0.2m and long crack approximately 10m.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	13
D46	387620, 786386	Embankment	Splash wall	93	Damaged concrete with exposed corroding reinforcement, approx. 2x0.3m	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	5
D47	387618, 786380	Embankment	Splash wall	94	Damaged concrete with exposed corroding reinforcement approximately 1 x 0.3m.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	5
D48	387605, 786361	Embankment	Splash wall	95	Loss of concrete on top of recurve cover exposing reinforcement.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	6
D49	387601, 786351	Embankment	Splash wall	96	Damaged concrete on top of recurve.	Replace damaged concrete.	20
D50	387592, 786332	Embankment	Splash wall	97	Vertical crack on recurve.	Repoint vertical fracture and repair recurve damage.	9
D51	387593, 786323	Embankment	Splash wall	98	Health and Safety - major loss of steps, exposed dowels.	Cordon off step access, replace missing steps and cover exposed dowels.	1
D52	387595, 786325	Embankment	Splash wall	99	Signs of rot on timber handrailing.	Replace timber handrails with a more durable solution.	30
D53	387594, 786329	Embankment	Splash wall	100	Corroded handrail supports.	Replace timber handrails with a more durable solution.	23

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D54	387592, 786326	Embankment	Splash wall	101	Horizontal cracks.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	10
D55	387568, 786260	Embankment	Exposed face	102	Corrosion of handrailing supports.	Replace timber handrails with a more durable solution.	25
D56	387558, 786221	Embankment	Splash wall	103	Health and Safety - Missing handrails.	Replace timber handrails with a more durable solution.	1
D57	387556, 786229	Embankment	Splash wall	104	Distorted handrails.	Replace timber handrails with a more durable solution.	29
D58	387487, 786216	Embankment	Piling	105	Corrosion of piles.	Monitor and consider corrosion protection of piles.	2
D59	387486, 786218	Embankment	Piling	106	Missing flap valve	Replace flap valve.	20
D60	387491, 786215	Embankment	Channel side	107	Drainage points blocked.	Unblock drainage points, consider installing flap valves.	20
D61	387383, 786311	Embankment	Channel side	122	Vegetation growth on top of concrete	Develop vegetation clearance plan.	26
D62	387499, 786208	Embankment	Channel side	108	Broken slab, potential for scour behind protected face	Patch repair damaged slab.	11
D63	387499, 786208	Embankment	Piling	109, 143	Damaged concrete capping beam exposing reinforcement .	Patch repair damaged slab.	11
D64	387514, 786217	Embankment	Piling	110	Anchor missing, possibly more than one	Investigate whether missing anchors require replacing.	3
D65	387532, 786197	Embankment	Exposed face	111	Open joints.	Repoint open joints	17

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D66	387532, 786198	Embankment	Exposed face	112	Cracked and broken concrete approximately 0.5m.	Reface concrete and repoint fracture.	13
D67	387532, 786213	Embankment	Piling	113	Chipped capping beam	Replace damaged concrete.	22
D68	387549, 786214	Embankment	Exposed face	114	Broken parapet.	Fix horizontal guarding.	27
D69	387567, 786212	Embankment	Exposed face	115	Abrasion of concrete exposing reinforcement.	Reface concrete cover.	14
D70	387557, 786206	Embankment	Exposed face	116	Damaged concrete, approximately 1.5m long, exposing reinforcement heavily corroded.	Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	3
D71	387554, 786207	Embankment	Exposed face	117	Chipping concrete and cracks along the river face of the wall.	Reface concrete and repoint fractures.	27
D72	387551, 786208	Embankment	Exposed face	118	Vertical crack on recurve approximately 1m long	Repoint vertical fracture.	28
D73	387544, 786207	Embankment	Exposed face	119	Flap valves missing.	Consider installing flap valves.	23
D74	387405, 786265	Embankment	Channel side	120	Delaminating concrete repairs.	Reface concrete repairs.	18
D75	387403, 786265	Embankment	Channel side	121	Horizontal crack. Poor condition of upper concrete slope.	Repoint fracture.	18
D76	388077, 786860	Wall	Exposed face	123	Improper design/repairs.	Monitor and consider replacing with a more formal coastal protection.	15
D77	388062, 786848	Wall	Exposed face	124	Blocks missing from masonry wall.	Replace missing blockwork.	4

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D78	388057, 786846	Wall	Exposed face	125	Open joints.	Repoint open joints.	4
D79	388028, 786814	Wall	Exposed face	126	Voiding behind blockwork.	Repoint and fill voids.	4
D80	388021, 786802	Wall	Exposed face	127	Dilapidated concrete repairs.	Reface concrete repairs.	8
D81	388014, 786789	Wall	Exposed face	128	Voiding around loose blockwork.	Repoint and fill voids.	4
D82	387970, 786723	Wall	Exposed face	129	5No. missing flap valves.	Consider installing flap valves.	21
D83	387959, 786699	Wall	Access strip	130, 144	Very poor condition of concrete slipway including severe undermining and extensive cracking of slipway surface.	Consider rebuilding slipway if still in use.	8
D84	387948, 786682	Wall	Exposed face	131	Cracking of concrete approximately 2m long.	Repoint vertical cracking. Monitor wall for further deterioration.	12
D88	387534, 786173	Wall	Exposed face	132, 146, 150, 154, 158, 161, 163, 165	Open joints.	Replace missing mastic.	13
D89	387535, 786169	Wall	Exposed face	133, 145, 149, 153, 157, 160, 162, 164, 166, 167, 168, 169, 170, 171, 172, 173, 174	Chipped concrete by expansion joint with exposure of reinforcement.	Reface concrete cover to prevent further damage and repoint fractures.	21
D90	387525, 786097	Wall	Exposed face	134	Flood gate possibly needed.	Consider installing flood gate.	21
D91	387508, 786007	Wall	Exposed face	135	Distortion of parapet	Consider replacing parapet.	29

Defect Ref No.	Defect Location (NGR)	Sub Type	Element	Photo Ref	Defect Description	Recommendations	Defect Priority
D92	387508, 786001	Wall	Exposed face	136	Chipped concrete by the expansion joint approximately 0.4x0.2m.	Reface concrete.	17
D93	387506, 785982	Wall	Exposed face	137, 147, 151, 155	Vertical crack in concrete.	Repoint vertical crack.	14
D94	387509, 785970	Wall	Exposed face	138	Damaged concrete	Reface damaged concrete.	17
D95	387528, 785743	Embankment	Rock armour	139	Overly steep rock armour profile, at risk of collapse under extreme wave loading.	Consider reprofiling rock armour profile.	31
D96	387555, 785675	Embankment	Rock armour	140	Duckbill outfall valves heavily silted.	Clear area surrounding valves.	20
D97	388018, 786803	Wall	Seaward toe	141	Undermining and damage to the concrete toe.	Repair damaged concrete, while extending toe protection further down into the beach .	3
D98	387717, 786512	Wall	Crest	142, 148, 152, 156, 159	Sinkhole in crest (observed following initial inspection).	Fix the sinkhole and fill the depression. Consider replacing the sheet piles in the exposed face to prevent further erosion (Sinkhole observed following initial inspection; Council has undertaken repairworks).	1

6. Health and safety check

Health and Safety Check (Defence - Section A)

	Y or N	Photo No.	Notes
Handrails			No handrails present.
Are handrails necessary?	N		
Are handrails present?	N		
Are handrails secured?	-		
Handrail construction material	-		
Are handrails corroded?	-		
Is handrail paint in good condition?	-		
Ladders / Steps			
Are ladders / steps necessary for access?	N		
Are ladder / steps present?	N		
Steps construction material	-		
Are steps in good condition?	-		
Are steps free of algae growth?	-		
Are ladders secured?	-		
Are ladders corroded?	-		
Is ladder paint in good condition?	-		
Ramps and walkways			The ramp has uneven surface with major holes on the top and undermined on one side.
Are ramps and walkways necessary for access?	Y		
Are ramps and walkways present?	Y		
Ramp construction material			Concrete
Are ramps in good condition?	N		
Are ramps free of algae growth?	Y		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

No summary details entered

Health and Safety Check (Defence - Section B)

	Y or N	Photo No.	Notes
Handrails			Handrails only present on top of the sheet pile wall - 90% of the wall without handrailing.
Are handrails necessary?	N		
Are handrails present?	N		
Are handrails secured?	-		
Handrail construction material	-		
Are handrails corroded?	-		
Is handrail paint in good condition?	-		
Ladders / Steps			
Are ladders / steps necessary for access?	N		
Are ladder / steps present?	N		
Steps construction material	-		
Are steps in good condition?	-		
Are steps free of algae growth?	-		
Are ladders secured?	-		
Are ladders corroded?	-		
Is ladder paint in good condition?	-		
Ramps and walkways			
Are ramps and walkways necessary for access?	N		
Are ramps and walkways present?	N		
Ramp construction material	-		
Are ramps in good condition?	-		
Are ramps free of algae growth?	-		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

Access to Section B is via steps on the south side of the wall and at the beginning of Section C.

Health and Safety Check (Defence - Section C)

	Y or N	Photo No.	Notes
Handrails			Handrails are present throughout Section C, on top of the revetment and the access steps. Some missing elements and corroded supports were found during inspection.
Are handrails necessary?	Y		
Are handrails present?	Y		
Are handrails secured?	Y		
Handrail construction material			Timber
Are handrails corroded?	Y		
Is handrail paint in good condition?	N		
Ladders / Steps			Access to the toe of the defence is available via steps in four different locations. Some dilapidated and hazardous access steps are present to the south side of Section C and exposed dowel bars are causing tripping hazards (removed after initial visual inspection).
Are ladders / steps necessary for access?	Y		
Are ladder / steps present?	Y		
Steps construction material			Concrete
Are steps in good condition?	Y		
Are steps free of algae growth?	N		
Are ladders secured?	N		
Are ladders corroded?	N		
Is ladder paint in good condition?	N		
Ramps and walkways			
Are ramps and walkways necessary for access?	N		
Are ramps and walkways present?	N		
Ramp construction material	-		
Are ramps in good condition?	-		
Are ramps free of algae growth?	-		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

- There are exposed dowels bars on the access steps causing immediate hazard and they should be covered.
- There are access steps missing causing falling hazard.
- Due to the falling hazard at the crest of the sea wall, the missing handrailing section should be repaired.

Health and Safety Check (Defence - Section D)

	Y or N	Photo No.	Notes
Handrails			Handrails generally in good condition. Fixings missing off a parapet panel on top of the exposed face of the structure.
Are handrails necessary?	Y		
Are handrails present?	Y		
Are handrails secured?	Y		
Handrail construction material			Steel
Are handrails corroded?	N		
Is handrail paint in good condition?	Y		
Ladders / Steps			
Are ladders / steps necessary for access?	N		
Are ladder / steps present?	N		
Steps construction material	-		
Are steps in good condition?	-		
Are steps free of algae growth?	-		
Are ladders secured?	-		
Are ladders corroded?	-		
Is ladder paint in good condition?	-		
Ramps and walkways			
Are ramps and walkways necessary for access?	N		
Are ramps and walkways present?	N		
Ramp construction material	-		
Are ramps in good condition?	-		
Are ramps free of algae growth?	-		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

No major health and safety hazards. Parapet suggested to be repaired.

Health and Safety Check (Defence - Section E)

	Y or N	Photo No.	Notes
Handrails			
Are handrails necessary?	N		
Are handrails present?	N		
Are handrails secured?	-		
Handrail construction material	-		
Are handrails corroded?	-		
Is handrail paint in good condition?	-		
Ladders / Steps			
Are ladders / steps necessary for access?	Y		
Are ladder / steps present?	Y		
Steps construction material			Concrete
Are steps in good condition?	Y		
Are steps free of algae growth?	Y		
Are ladders secured?	N		
Are ladders corroded?	N		
Is ladder paint in good condition?	N		
Ramps and walkways			Access to the defence is available via Section E.
Are ramps and walkways necessary for access?	N		
Are ramps and walkways present?	N		
Ramp construction material	-		
Are ramps in good condition?	-		
Are ramps free of algae growth?	-		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

No summary details entered

Health and Safety Check (Defence - Section F)

	Y or N	Photo No.	Notes
Handrails			
Are handrails necessary?	N		
Are handrails present?	N		
Are handrails secured?	-		
Handrail construction material	-		
Are handrails corroded?	-		
Is handrail paint in good condition?	-		
Ladders / Steps			
Are ladders / steps necessary for access?	N		
Are ladder / steps present?	N		
Steps construction material	-		
Are steps in good condition?	-		
Are steps free of algae growth?	-		
Are ladders secured?	-		
Are ladders corroded?	-		
Is ladder paint in good condition?	-		
Ramps and walkways			
Are ramps and walkways necessary for access?	N		
Are ramps and walkways present?	N		
Ramp construction material	-		
Are ramps in good condition?	-		
Are ramps free of algae growth?	-		
Safety Harness Attachments			
Are attachments necessary for inspection?	N		
Are attachments present?	N		
Are attachments in good condition?	-		

Summary of health and safety items

No summary details entered

7. Asset assessment

7.1. Recommended works

Band A: Emergency works
Defect posing an immediate safety hazard. Immediate action required.

Defect Recommendation	Defect #
Unblock pipes and consider installing flap valves.	D17
Monitor and undertake further survey to determine pile thickness. Consider replacing sheet piles with an alternative coastal defence solution.	D20
Replace timber handrails with a more durable solution.	D22
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D35
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D44
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D46
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D47
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D48
Cordon off step access, replace missing steps and cover exposed dowels.	D51
Replace timber handrails with a more durable solution.	D56
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D70
Clear area surrounding valves.	D96
Fix the sinkhole and fill the depression. Consider replacing the sheet piles in the exposed face to prevent further erosion (Sinkhole observed following initial inspection; Council has undertaken repair works).	D98

Band B: Urgent Works
Defect posing a potential safety hazard. Work recommended within 12 month period.

Defect Recommendation	Defect #
Repoint / patch repair damaged concrete.	D3
Consider refacing spalling repairs.	D4
Replace flap valve.	D5
Reface spalling concrete.	D8
Repoint fracture and monitor wall for signs of movement.	D11
Repoint vertical fracture and monitor wall for signs of movement.	D12
Patch repair concrete recurve.	D13
Repoint cracks and monitor wall for signs of movement.	D14
Repoint vertical fracture and monitor wall for signs of movement.	D15
Repoint open joints.	D16
Monitor and undertake further survey to determine pile thickness. Consider replacing sheet piles with an alternative coastal defence solution.	D18
Repoint crack.	D21
Replace timber handrails with a more durable solution.	D23
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D24
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D25
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D26
Repoint vertical crack.	D28
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D29
Replace missing mastic.	D30
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D31
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D32
Replace missing mastic.	D33
Unblock blocked outfalls. Consider installing flap valves.	D34
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D36
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D38

Replace timber handrails with a more durable solution.	D39
Consider replacing corroded supports	D40
Repoint fractures.	D41
Consider replacing corroded supports.	D42
Reface concrete cover.	D43
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D45
Replace damaged concrete.	D49
Repoint vertical fracture and repair recurve damage.	D50
Replace timber handrails with a more durable solution.	D53
Breakout damaged area of concrete, remove and replace corroded reinforcement as required and reform concrete recurve.	D54
Replace timber handrails with a more durable solution.	D55
Monitor and consider corrosion protection of piles.	D58
Replace flap valve.	D59
Unblock drainage points, consider installing flap valves.	D60
Develop vegetation clearance plan.	D61
Patch repair damaged slab.	D62
Patch repair damaged slab.	D63
Investigate whether missing anchors require replacing.	D64
Repoint open joints	D65
Reface concrete and repoint fracture.	D66
Replace damaged concrete.	D67
Fix horizontal guarding.	D68
Reface concrete cover.	D69
Reface concrete and repoint fractures.	D71
Repoint vertical fracture.	D72
Consider installing flap valves.	D73
Reface concrete repairs.	D74
Repoint fracture.	D75
Replace missing blockwork.	D77
Repoint open joints.	D78
Repoint and fill voids.	D79

Reface concrete repairs.	D80
Repoint and fill voids.	D81
Repoint vertical cracking. Monitor wall for further deterioration.	D84
Replace missing mastic.	D88
Reface concrete cover to prevent further damage and repoint fractures.	D89
Consider installing flood gate.	D90
Reface concrete.	D92
Repoint vertical crack.	D93
Reface damaged concrete.	D94
Repair damaged concrete, while extending toe protection further down into the beach .	D97

Band C: Short-term remedial works
Defect posing a potential safety hazard. Work recommended within 12 to 30 month period.

Defect Recommendation	Defect #
Resurface vegetated crest.	D1
Resurface vegetated crest.	D2
Breakout and repair corroded area.	D6
Consider installing flap valves.	D7
Patch repair damaged recurve.	D9
Patch repair damaged recurve.	D10
Repoint crack.	D19
Monitor and consider replacing rendering to prevent further deterioration.	D27
None.	D37
Replace timber handrails with a more durable solution.	D52
Replace timber handrails with a more durable solution.	D57
Monitor and consider replacing with a more formal coastal protection.	D76
Consider installing flap valves.	D82
Consider rebuilding slipway if still in use.	D83
Consider replacing parapet.	D91
Consider reprofiling rock armour profile.	D95

Band D: Long-term maintenance works

Defect resulting in long-term deterioration of structure or affecting performance. Work recommended within 30 to 48 month period.

No defects identified in this band

7.2. Report sign-off

Prepared and Completed by: Signed: Date:	Johan Skanberg-Tippen BSc, MSc (Eng)  02/07/2018
Checked and Approved by: Signed: Date:	Graham Kenn CEng, MICE, C.WEM, CIWEM – Technical Director – Coastal Engineering  02/07/2018

Appendix 1 – Photographs

Section Photos	
Section A **Description:** View of Section A (looking south) Asset Type: Defence Sub Type: Wall Elements: Exposed face, seaward toe and access strip **Photo number: 1**	
Section A **Description:** View of Section A (looking south) Asset Type: Defence Sub Type: Wall Elements: Exposed face, seaward toe and access strip **Photo number: 7**	

Section B **Description:** View of Section B (looking south) Asset Type: Defence Sub Type: Wall Elements: Exposed face (concrete), exposed face (sheet piles) and crest **Photo number: 2**	
Section C **Description:** View of Section C (looking north) Asset Type: Defence Sub Type: Revetment Elements: Exposed face, sea wall and rock armour **Photo number: 6**	

Section D **Description:** View of Section D (looking west) Asset Type: Defence Sub Type: Training Walls Elements: Channel side, exposed face and piling **Photo number: 3**	
Section E **Description:** View of Section E (looking south) Asset Type: Defence Sub Type: Wall Elements: Exposed face **Photo number: 4**	

Section F **Description:** View of Section F (looking south) Asset Type: Defence Sub Type: Embankment Elements: Beach and rock armour **Photo number: 5**	
Section F **Description:** View of Section F (looking south) Asset Type: Defence Sub Type: Embankment Elements: Beach and rock armour **Photo number: 8**	

Defect Photos	
Section B **Crest** **Defect Ref: D1** **Description:** D1 - Poorly vegetated and eroded crest **Photo number: 63**	
Section B **Crest** **Defect Ref: D2** **Description:** D2 - Depression of crest **Photo number: 64**	

Section B **Exposed face** **Defect Ref: D3** **Description:** D3 - Cracked and spalling concrete **Photo number: 48**	
Section B **Exposed face** **Defect Ref: D4** **Description:** D4 - Spalling concrete **Photo number: 49**	

Section B **Exposed face** **Defect Ref: D5** **Description:** D5 - Broken flap valve **Photo number: 50**	
Section B **Exposed face** **Defect Ref: D6** **Description:** D6 - Cover loss exposing corroded reinforcement **Photo number: 51**	

Section B **Exposed face** **Defect Ref: D7** **Description:** D7 - 12 missing flap valves **Photo number: 52**	
Section B **Exposed face** **Defect Ref: D8** **Description:** D8 - Spalling concrete **Photo number: 53**	

Section B **Exposed face** **Defect Ref: D9** **Description:** D9 - Damaged recurve **Photo number: 54**	
Section B **Exposed face** **Defect Ref: D10** **Description:** D10 - Damaged recurve **Photo number: 55**	

Section B **Exposed face** **Defect Ref: D11** **Description:** D11 - Vertical crack **Photo number: 56**	
Section B **Exposed face** **Defect Ref: D12** **Description:** D12 - Vertical fracture **Photo number: 57**	

Section B **Exposed face** **Defect Ref: D13** **Description:** D13 - Damaged recurve **Photo number: 58**	
Section B **Exposed face** **Defect Ref: D14** **Description:** D14 - Vertical crack **Photo number: 59**	

Section B **Exposed face** **Defect Ref: D15** **Description:** D15 - Vertical fracture **Photo number: 60**	
Section B **Exposed face** **Defect Ref: D16** **Description:** D16 - Missing pointing between recurve units **Photo number: 61**	

Section B **Exposed face** **Defect Ref: D17** **Description:** D17 - Blocked drainage pipes **Photo number: 62**	
Section B **Exposed face** **Defect Ref: D18** **Description:** D18 - Corroded sheet piles **Photo number: 65**	

Section B **Exposed face** **Defect Ref: D19** **Description:** D19 - Cracking in the capping beam **Photo number: 66**	
Section B **Exposed face** **Defect Ref: D20** **Description:** D20 - Section loss of sheet piles **Photo number: 67**	

Section B **Exposed face** **Defect Ref: D21** **Description:** D21 - Crack in the capping beam **Photo number: 68**	
Section C **Exposed face** **Defect Ref: D22** **Description:** D22 - Missing handrailing **Photo number: 69**	

Section C **Exposed face** **Defect Ref: D23** **Description:** D23 - Corroded handrailing support. **Photo number: 70**	
Section C **Splash wall** **Defect Ref: D24** **Description:** D24 - Cracking of concrete **Photo number: 71**	

Section C **Splash wall** **Defect Ref: D25** **Description:** D25 - Corroded reinforcement **Photo number: 72**	
Section C **Splash wall** **Defect Ref: D26** **Description:** D26 - Chipped concrete exposing reinforcement **Photo number: 73**	

Section C **Splash wall** **Defect Ref: D27** **Description:** D27 - General abrasion of steps **Photo number: 74**	
Section C **Splash wall** **Defect Ref: D28** **Description:** D28 - Vertical crack **Photo number: 75**	

Section C **Splash wall** **Defect Ref: D29** **Description:** D29 - Exposed corroding reinforcement **Photo number: 79**	
Section C **Splash wall** **Defect Ref: D30** **Description:** D30 - Open joints **Photo number: 76**	

Section C **Splash wall** **Defect Ref: D31** **Description:** D31 - Cracking in upper radius of recurve **Photo number: 77**	
Section C **Splash wall** **Defect Ref: D32** **Description:** D32 - Exposed reinforcement and damaged concrete **Photo number: 78**	

Section C **Splash wall** **Defect Ref: D33** **Description:** D33 - Open joints **Photo number: 80**	
Section C **Splash wall** **Defect Ref: D34** **Description:** D34 - 24 outfalls missing flap valves **Photo number: 81**	

Section C **Splash wall** **Defect Ref: D35** **Description:** D35 - Loss of concrete exposing reinforcement **Photo number: 82**	
Section C **Splash wall** **Defect Ref: D36** **Description:** D36 - Horizontal crack on sea wall and buttress wall **Photo number: 83**	

Section C **Splash wall** **Defect Ref: D37** **Description:** D37 - Difference in crest level **Photo number: 84**	
Section C **Splash wall** **Defect Ref: D38** **Description:** D38 - 20m long cracks **Photo number: 85**	

Section C **Splash wall** **Defect Ref: D39** **Description:** D39 - Handrailing missing **Photo number: 86**	
Section C **Splash wall** **Defect Ref: D40** **Description:** D40 - Corroded handrail supports **Photo number: 87**	

Section C **Splash wall** **Defect Ref: D41** **Description:** D41 - Cracks in concrete on steps **Photo number: 88**	
Section C **Splash wall** **Defect Ref: D42** **Description:** D42 - Corroded handrail supports **Photo number: 89**	

Section C **Splash wall** **Defect Ref: D43** **Description:** D43 - Cover loss and corroding reinforcement **Photo number: 90**	
Section C **Splash wall** **Defect Ref: D44** **Description:** D44 - Crack exposing corroding reinforcement **Photo number: 91**	

Section C **Splash wall** **Defect Ref: D45** **Description:** D45 - Chipped concrete exposing reinforcement **Photo number: 92**	
Section C **Splash wall** **Defect Ref: D46** **Description:** D46 - Chipped concrete exposing reinforcement **Photo number: 93**	

Section C **Splash wall** **Defect Ref: D47** **Description:** D47 - Chipped concrete exposing reinforcement **Photo number: 94**	
Section C **Splash wall** **Defect Ref: D48** **Description:** D48 - Chipped concrete exposing reinforcement **Photo number: 95**	

Section C **Splash wall** **Defect Ref: D49** **Description:** D49 - Damaged concrete on top of recurve **Photo number: 96**	
Section C **Splash wall** **Defect Ref: D50** **Description:** D50 - Vertical crack on recurve **Photo number: 97**	

Section C **Splash wall** **Defect Ref: D51** **Description:** D51 - Loss of steps and exposed dowels **Photo number: 98**	
Section C **Splash wall** **Defect Ref: D52** **Description:** D52 - Signs of rot on timber handrailing **Photo number: 99**	

Section C **Splash wall** **Defect Ref: D53** **Description:** D53 - Corroded handrail supports **Photo number: 100**	
Section C **Splash wall** **Defect Ref: D54** **Description:** D54 - Horizontal crack in sea wall **Photo number: 101**	

Section C **Exposed face** **Defect Ref: D55** **Description:** D55 - Corrosion of handrailing supports **Photo number: 102**	
Section C **Splash wall** **Defect Ref: D56** **Description:** D56 - Missing handrails **Photo number: 103**	

Section C **Splash wall** **Defect Ref: D57** **Description:** D57 - Distorted handrails **Photo number: 104**	
Section D **Piling** **Defect Ref: D58** **Description:** D58 - Corrosion of piles **Photo number: 105**	

Section D **Piling** **Defect Ref: D59** **Description:** D59 - Missing flap valve **Photo number: 106**	
Section D **Channel side** **Defect Ref: D60** **Description:** D60 - Drainage points blocked **Photo number: 107**	

Section D **Channel side** **Defect Ref: D61** **Description:** D61 - Vegetation growth on top of concrete **Photo number: 122**	
Section D **Channel side** **Defect Ref: D62** **Description:** D62 - Broken slab, potential for scour behind protected face **Photo number: 108**	

Section D **Piling** **Defect Ref: D63** **Description:** D63 - Damaged concrete capping beam exposing reinforcement **Photo number: 109**	
Section D **Piling** **Defect Ref: D63** **Description:** D63 - Damaged concrete capping beam exposing reinforcement **Photo number: 143**	

Section D **Piling** **Defect Ref: D64** **Description:** D64 - Anchor missing, potentially more than one **Photo number: 110**	
Section D **Exposed face** **Defect Ref: D65** **Description:** D65 - Open joints **Photo number: 111**	

Section D **Exposed face** **Defect Ref: D66** **Description:** D65 - Cracked and broken concrete approximately 0.5m **Photo number: 112**	
Section D **Piling** **Defect Ref: D67** **Description:** D67 - Chipped capping beam **Photo number: 113**	

Section D **Exposed face** **Defect Ref: D68** **Description:** D68 - Broken parapet **Photo number: 114**	
Section D **Exposed face** **Defect Ref: D69** **Description:** D69 - Abrasion of concrete exposing reinforcement **Photo number: 115**	

Section D **Exposed face** **Defect Ref: D70** **Description:** D70 - Damaged concrete approximately 1.5m long, e posing heavily corroded reinforcement **Photo number: 116**	
Section D **Exposed face** **Defect Ref: D71** **Description:** D71 - Chipping concrete and cracks along the river face of the wall **Photo number: 117**	

Section D **Exposed face** **Defect Ref: D72** **Description:** D72 - Vertical crack on recurve approximately 1m long **Photo number: 118**	
Section D **Exposed face** **Defect Ref: D73** **Description:** D73 -Flap valves missing **Photo number: 119**	

Section D **Channel side** **Defect Ref: D74** **Description:** D74 - Delaminating concrete repairs **Photo number: 120**	
Section D **Channel side** **Defect Ref: D75** **Description:** D75 - Horizontal crack - poor protection of upper concrete slope **Photo number: 121**	

Section A **Exposed face** **Defect Ref: D76** **Description:** D76 - Improper design / repairs **Photo number: 123**	
Section A **Exposed face** **Defect Ref: D77** **Description:** D77 - Missing blockwork **Photo number: 124**	

Section A **Exposed face** **Defect Ref: D78** **Description:** D78 - Open joints **Photo number: 125**	
Section A **Exposed face** **Defect Ref: D79** **Description:** Voiding behind blockwork. **Photo number: 126**	

Section A **Exposed face** **Defect Ref: D80** **Description:** D80 - Dilapidated concrete repairs **Photo number: 127**	
Section A **Exposed face** **Defect Ref: D81** **Description:** D81 - Voiding around blockwork **Photo number: 128**	

Section A **Exposed face** **Defect Ref: D82** **Description:** D82 - Missing flap valves **Photo number: 129**	
Section A **Access strip** **Defect Ref: D83** **Description:** D84 - Undermined slipway **Photo number: 130**	

Section A **Access strip** **Defect Ref: D83** **Description:** D83 - Holes on top of the slipway **Photo number: 144**	
Section A **Exposed face** **Defect Ref: D84** **Description:** D84 - Cracking of concrete **Photo number: 131**	

Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 132**	
Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 146**	

Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 150**	
Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 154**	

Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 158**	
Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 161**	

Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 163**	
Section E **Exposed face** **Defect Ref: D88** **Description:** D88 - Open joints **Photo number: 165**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 133**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 145**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 149**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 153**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 157**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 160**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 162**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 164**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 166**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 167**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 168**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 169**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 170**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 171**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 172**	
Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 173**	

Section E **Exposed face** **Defect Ref: D89** **Description:** D89 - Chipped concrete by expansion joint with exposure of reinforcement **Photo number: 174**	
Section E **Exposed face** **Defect Ref: D90** **Description:** D90 - Flood gate possibly needed **Photo number: 134**	

Section E **Exposed face** **Defect Ref: D91** **Description:** D91 - Distortion of parapet **Photo number: 135**	
Section E **Exposed face** **Defect Ref: D92** **Description:** D92 - Chipped concrete by the expansion joint approximately 0.4x0.2m **Photo number: 136**	

Section E **Exposed face** **Defect Ref: D93** **Description:** D93 - Vertical crack in concrete **Photo number: 137**	
Section E **Exposed face** **Defect Ref: D93** **Description:** D93 - Vertical crack in concrete **Photo number: 147**	

Section E **Exposed face** **Defect Ref: D93** **Description:** D93 - Vertical crack in concrete **Photo number: 151**	
Section E **Exposed face** **Defect Ref: D93** **Description:** D93 - Vertical crack in concrete **Photo number: 155**	

Section E **Exposed face** **Defect Ref: D94** **Description:** D94 - Damaged concrete **Photo number: 138**	
Section F **Rock armour** **Defect Ref: D95** **Description:** D95 - Overly steep rock armour profile **Photo number: 139**	

Section F **Rock armour** **Defect Ref: D96** **Description:** D96 - Duckbill valves blocked up **Photo number: 140**	
Section A **Seaward toe** **Defect Ref: D97** **Description:** D97 - Poor protection of the toe **Photo number: 141**	

Section B **Crest** **Defect Ref: D98** **Description:** Sinkhole in crest (observed following initial inspection) **Photo number: 142**	
Section B **Crest** **Defect Ref: D98** **Description:** Sinkhole in crest (observed following initial inspection) **Photo number: 148**	

Section B **Crest** **Defect Ref: D98** **Description:** Sinkhole in crest (observed following initial inspection) **Photo number: 152**	
Section B **Crest** **Defect Ref: D98** **Description:** Sinkhole in crest (observed following initial inspection) **Photo number: 156**	

Section B **Crest** **Defect Ref: D98** **Description:** Sinkhole in crest (observed following initial inspection) **Photo number: 159**	

Appendix 2 – Asset descriptors

Asset Type	Sub Type	Element
Defence	Wall	Exposed face
		Landward face
		Crest
		Berm
		Channel side
		Landward toe
		Capping wall
		Access strip
		Core
		Drainage ditch
		Seaward toe
		Rock armour
	Embankment	Exposed face
		Landward face
		Crest
		Berm
		Channel side
		Landward toe
		Access strip
		Splash deck
		Splash wall
		Seaward toe
		Rock armour
		Piling
		Gabions
	Quay	Quay face
		Deck
		Capping
		Piling
		Planking
		Stem
		Roundhead
		Sheet piling
		Seaward face
		Face protection
	Dune	Stabilised zone
		Active zone
	Cliff	Seaward face
		Cliff top
		Seaward toe
		Face protection
		Drainage

Asset Type	Sub Type	Element
Beach Structure	Groyne	Crest
		Left face
		Right face
		Piling
		Planking
		Waling
		Roundhead
		Fishtail
		Stem
		Sheet piling
		Capping beam
	Breakwater	Crest
		Seaward face
		Landward face
		Sheet piling
		Bedding layer
		Face protection
		Roundhead
		Fishtail
		Capping beam
		Waling

Appendix 3 – EA Condition Grades

2.0 Visual inspection condition grades

The condition grading and descriptions given below are the standards adopted by the Environment Agency. The five condition grades, ranging from 'very good' to 'very poor', remain as before. However, the descriptions have been redefined, compared to the previous versions of the Condition Assessment Manual, to reflect condition according to flood defence performance.

2.1 General assessment

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

Appendix 4 – Deterioration times – EA Guidance

Table A.1 Deterioration times (years) to different condition grades for different asset types and exposures

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Vertical wall	Fluvial	Concrete	Defence/ wall	N/A	1	0	15	35	50	60	0	5	20	30	40	0	20	50	70	80
					2	0	20	45	70	90	0	10	30	50	60	0	25	60	100	120
					3	0	25	55	90	120	0	15	40	70	80	0	30	70	130	160
		Brick/ masonry		N/A	1	0	15	35	50	60	0	5	20	30	40	0	20	50	70	80
					2	0	20	45	70	90	0	10	30	50	60	0	25	60	100	120
					3	0	25	55	90	120	0	15	40	70	80	0	30	70	130	160
		Timber		N/A	1	0	5	10	12	15	0	3	5	7	10	0	7	15	18	21
					2	0	10	20	25	30	0	5	10	12	15	0	15	30	35	40
					3	0	15	30	35	42	0	7	15	17	20	0	23	45	52	60
		Gabion	Defence/ wall/ gabions	N/A	1	0	5	10	22	26	0	4	8	15	18	0	5	10	25	30
					N/A															
					N/A															
	Coastal/ estuarine	Concrete	Defence/ wall	N/A	1	0	10	30	40	50	0	5	15	25	30	0	15	45	60	80
					2	0	15	40	55	70	0	10	20	30	40	0	20	60	80	100
					3	0	20	50	70	90	0	15	25	35	50	0	25	75	100	120
		Brick/ masonry		N/A	1	0	10	30	40	50	0	5	15	25	30	0	15	45	60	80
					2	0	15	40	55	70	0	10	20	30	40	0	20	60	80	100
					3	0	20	50	70	90	0	15	25	35	50	0	25	75	100	120
		Timber		N/A	1	0	4	8	10	14	0	2	4	6	8	0	5	13	16	20
					2	0	8	18	23	28	0	4	8	10	13	0	14	28	33	38
					3	0	13	28	33	38	0	5	13	15	18	0	21	42	48	55
		Gabion	Defence/ wall/ gabions	N/A	1	0	3	8	15	20	0	1	5	10	13	0	3	8	20	25
					N/A															
					N/A															

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Sheet piles	Fluvial	Cantilevered steel	Defence/ wall/ piling	N/A	1	0	15	20	40	50	0	10	15	20	25	0	20	30	60	70
					2	0	20	30	50	60	0	15	20	30	35	0	25	40	70	80
					3	0	25	40	60	70	0	20	30	40	45	0	30	50	80	90
		Anchored steel		N/A	1	0	15	20	40	50	0	10	15	20	25	0	20	30	60	70
					2	0	20	30	50	60	0	15	20	30	35	0	25	40	70	80
					3	0	25	40	60	70	0	20	30	40	45	0	30	50	80	90
	Coastal/ estuarine	Cantilevered steel		N/A	1	0	10	15	30	40	0	5	10	15	20	0	15	30	50	60
					2	0	15	25	50	60	0	10	15	25	30	0	20	40	60	70
					3	0	20	35	60	70	0	15	20	35	40	0	25	50	70	80
		Anchored steel		N/A	1	0	10	15	30	40	0	5	10	15	20	0	15	30	50	60
					2	0	15	25	50	60	0	10	15	25	30	0	20	40	60	70
					3	0	20	35	60	70	0	15	20	35	40	0	25	50	70	80
Demount-able defences	Fluvial	Metal	Defence/ demount-able	N/A	1	0	1	3	4	5	0	1	2	3	4	0	2	4	5	7
					2	0	5	10	45	55	0	2	5	35	45	0	10	20	60	70
					3	0	8	15	55	65	0	5	10	45	55	0	15	25	70	80
		Wood		N/A	1	0	1	3	4	5	0	1	2	3	4	0	2	4	5	7
					2	0	3	5	23	28	0	1	3	18	23	0	5	10	30	35
					3	0	4	8	28	33	0	3	5	23	28	0	8	13	35	40
Earth dykes or embank-ments	Fluvial	Varying core material	Defence/ embankment	Narrow	1	0	3	6	25	40	0	1	3	5	7	0	5	10	40	60
					2	0	15	30	60	80	0	2	5	7	10	0	20	40	70	110
					3	0	16	33	70	90	0	3	6	8	11	0	22	44	90	130
				Wide	1	0	3	6	25	40	0	2	6	10	14	0	5	10	40	60
					2	0	15	30	60	80	0	4	10	14	20	0	20	40	70	110
					3	0	16	33	70	90	0	5	10	14	20	0	22	44	90	130
	Coastal/ estuarine			Narrow	1	0	3	6	22	30	0	1	2	4	5	0	5	10	40	60
					2	0	14	28	40	50	0	2	4	6	8	0	20	40	60	80

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
					3	0	15	30	45	60	0	3	5	8	10	0	22	45	80	110
				Wide	1	0	4	6	22	30	0	2	5	9	12	0	5	10	40	60
					2	0	14	30	50	60	0	4	9	12	18	0	20	40	70	90
					3	0	20	35	55	70	0	5	10	14	20	0	22	44	85	120
	Fluvial	With slope/toe protection		Narrow	1	0	15	25	35	40	0	3	8	10	12	0	20	40	60	80
					2	0	20	30	70	90	0	3	8	10	15	0	25	50	80	130
					3	0	25	45	80	100	0	15	20	30	40	0	30	60	90	140
				Wide	1	0	15	25	35	40	0	8	15	20	25	0	20	40	60	80
					2	0	20	30	70	90	0	12	20	30	40	0	25	50	100	130
					3	0	25	45	80	110	0	15	30	40	50	0	30	60	110	150
	Coastal/ estuarine			Narrow	1	0	9	19	31	40	0	3	7	10	12	0	10	20	40	60
					2	0	15	30	50	60	0	3	8	10	15	0	20	50	75	100
					3	0	20	40	60	80	0	10	20	25	30	0	30	60	100	130
				Wide	1	0	9	19	31	40	0	8	15	20	25	0	20	40	60	80
					2	0	15	30	50	60	0	12	20	30	40	0	25	50	90	120
					3	0	20	40	60	80	0	15	30	40	50	0	30	60	100	140
Sloping walls with slope protection or revetment	Fluvial	Turf	Defence/ embankment	Narrow	1	0	3	6	25	40	0	1	3	5	7	0	5	10	40	60
					2	0	15	30	60	80	0	2	5	7	10	0	20	40	70	110
					3	0	16	33	70	90	0	3	6	8	11	0	22	44	90	130
				Wide	1	0	3	6	25	40	0	2	6	10	14	0	5	10	40	60
					2	0	15	30	60	80	0	4	10	14	20	0	20	40	70	110
					3	0	16	33	70	90	0	5	10	14	20	0	22	44	90	130
	Coastal/ estuarine			Narrow	1	0	3	6	22	30	0	1	2	4	5	0	5	10	40	60
					2	0	14	28	40	50	0	2	4	6	8	0	20	40	60	80
					3	0	15	30	45	60	0	3	5	8	10	0	22	45	80	110
				Wide	1	0	4	6	22	30	0	2	5	9	12	0	5	10	40	60

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
					2	0	14	30	50	60	0	4	9	12	18	0	20	40	70	90
					3	0	20	35	55	70	0	5	10	14	20	0	22	44	85	120
	Fluvial	Permeable[2]		Narrow	1	0	15	25	35	40	0	3	8	10	12	0	20	40	60	80
					2	0	20	30	70	90	0	3	8	10	15	0	25	50	80	130
					3	0	25	45	80	100	0	15	20	30	40	0	30	60	90	140
				Wide	1	0	15	25	35	40	0	8	15	20	25	0	20	40	60	80
					2	0	20	30	60	90	0	12	20	30	40	0	25	50	100	130
					3	0	25	45	80	110	0	15	30	40	50	0	30	60	110	150
	Coastal/ estuarine			Narrow	1	0	9	19	31	40	0	3	7	10	12	0	10	20	40	60
					2	0	15	30	50	60	0	3	8	10	15	0	20	50	75	100
					3	0	20	40	60	80	0	10	20	25	30	0	30	60	100	130
				Wide	1	0	9	19	31	40	0	8	15	20	25	0	20	40	60	80
					2	0	15	30	50	60	0	12	20	30	40	0	25	50	90	120
					3	0	20	40	60	80	0	15	30	40	50	0	30	60	100	140
	Fluvial	Impermeable[3]		Narrow	1	0	15	25	35	40	0	3	8	10	12	0	20	40	60	80
					2	0	20	30	70	90	0	3	8	10	15	0	25	50	80	130
					3	0	25	45	80	100	0	15	20	30	40	0	30	60	90	140
				Wide	1	0	15	25	35	40	0	8	15	20	25	0	20	40	60	80
					2	0	20	30	60	90	0	12	20	30	40	0	25	50	100	130

[2] Permeable revetments: These are flexible revetments including rip rap, turf, natural stone and concrete blocks.

[3] Impermeable revetments: These are continuous sloping structures of concrete or stone blockwork, asphalt or mass concrete. They tend to be grouted in bitumen or concrete, making them inflexible.

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
					3	0	25	45	80	110	0	15	30	40	50	0	30	60	110	150
	Coastal/ estuarine			Narrow	1	0	9	19	31	40	0	3	7	10	12	0	10	20	40	60
					2	0	15	30	50	60	0	3	8	10	15	0	20	50	75	100
					3	0	20	40	60	80	0	10	20	25	30	0	30	60	100	130
				Wide	1	0	9	19	31	40	0	8	15	20	25	0	20	40	60	80
					2	0	15	30	50	60	0	12	20	30	40	0	25	50	90	120
					3	0	20	40	60	80	0	15	30	40	50	0	30	60	100	140
Pipe culverts	Fluvial	Concrete	Channel/ simple OR complex culvert	N/A	1	0	10	30	45	55	0	5	10	20	30	0	20	50	65	80
					2	0	30	55	80	90	0	20	40	60	70	0	40	70	100	115
					3	0	50	80	115	125	0	35	70	100	110	0	60	90	135	150
		Masonry/ brick		N/A	1	0	10	30	45	55	0	5	10	20	30	0	20	50	65	80
					2	0	20	40	70	80	0	10	20	35	45	0	30	60	90	110
					3	0	30	50	95	115	0	15	30	50	65	0	40	70	115	135
		Steel (corrugated galvanised)		N/A	1	0	10	30	45	55	0	5	10	20	25	0	20	50	65	75
					2	0	20	40	60	75	0	10	20	30	40	0	30	60	85	100
					3	0	30	50	75	95	0	15	30	40	50	0	40	70	105	130
		Plastic		N/A	1	0	10	30	45	55	0	5	10	20	25	0	20	50	65	75
					2	0	30	55	70	80	0	20	40	50	60	0	40	70	90	110
					3	0	50	80	95	105	0	35	70	80	90	0	60	90	115	135
		Clay		N/A	1	0	10	30	45	55	0	5	10	20	25	0	20	50	65	75
					2	0	30	55	80	90	0	20	40	60	70	0	40	70	100	115
					3	0	50	80	115	130	0	35	70	100	115	0	60	90	135	155
Beaches with and without beach control	Coastal	Shingle/sand	Defence/ beach		1	0	9	13	25	35	0	4	7	9	13	0	15	38	75	100
					2	0	16	30	50	75	0	7	10	13	20	0	27	50	150	200
					3	0	20	55	90	120	0	12	20	25	40	0	27	75	200	250

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
structures																				
Control structures	Coastal	Rock groynes	Beach structure/ groyne		1	0	19	57	114	124	0	10	30	59	67	0	44	131	262	273
					2	0	19	114	190	200	0	10	59	99	108	0	44	262	437	450
					3	0	57	190	266	285	0	30	99	139	150	0	131	437	612	635
		Timber groynes			1	0	6	13	17	20	0	2	5	8	10	0	10	20	25	30
					2	0	10	25	30	34	0	5	10	13	15	0	15	40	45	50
					3	0	14	37	43	48	0	8	15	18	20	0	20	60	65	70
		Offshore breakwaters (rock)	Beach structure/ breakwater		1	0	19	57	114	124	0	10	30	59	67	0	44	131	262	273
					2	0	19	114	190	200	0	10	59	99	108	0	44	262	437	450
					3	0	57	190	266	285	0	30	99	139	150	0	131	437	612	635
		Breastwork (timber)			1	0	11	18	22	25	0	7	10	13	15	0	15	25	30	35
					2	0	15	30	35	40	0	10	15	18	20	0	20	45	50	60
					3	0	19	42	48	55	0	13	20	23	25	0	25	65	70	80
		Crib walls (timber)			1	0	11	18	22	25	0	7	10	13	15	0	15	25	30	35
					2	0	15	30	35	40	0	10	15	18	20	0	20	45	50	60
					3	0	19	42	48	55	0	13	20	23	25	0	25	65	70	80
Dunes with or without holding structures	Coastal	All	Defence/ dunes		1	0	10	15	30	40	0	5	8	10	15	0	20	40	110	150
					2	0	15	35	60	80	0	7	10	13	20	0	27	60	150	200
					3	0	20	60	100	130	0	12	20	25	40	0	30	80	190	250
Saltmarsh-es, saltings and warths with or without holding structures	Coastal	All	Land/ saltmarsh		1	0	12	25	40	45	0	8	14	20	25	0	20	40	110	150
					2	0	18	40	75	90	0	10	16	25	30	0	27	60	150	200
					3	0	22	80	130	150	0	14	25	30	50	0	30	80	190	250
Maintained	Fluvial	Earth (e.g.	Channel/		1	0	1	2	5	8	0	1	2	3	6	0	1	2	6	10

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
channels		regraded channels)	open channel		2	0	2	150	250	350	0	1	140	150	200	0	3	180	300	400
					3	0	150	200	300	400	0	120	150	200	300	0	170	220	350	450
Maintained channels	Fluvial	Concrete/ brick		N/A	1	0	15	35	50	60	0	5	20	30	40	0	20	50	70	80
					2	0	20	45	70	90	0	10	30	50	60	0	25	60	100	120
					3	0	25	55	90	120	0	15	40	70	80	0	30	70	130	160
Weirs	Fluvial	All	Structure/ weir	N/A	1	0	15	20	40	60	0	10	15	30	40	0	20	30	50	70
					2	0	30	50	70	90	0	20	30	50	60	0	40	70	90	110
					3	0	45	80	100	120	0	30	45	70	80	0	60	110	130	150
Outfalls	Fluvial	All	Structure/ outfall	N/A	1	0	15	35	50	60	0	5	20	30	40	0	20	50	70	80
					2	0	20	45	70	90	0	10	30	50	60	0	25	60	100	120
					3	0	25	55	90	120	0	15	40	70	80	0	30	70	130	160
	Coastal/ estuarine	All		N/A	1	0	10	15	30	40	0	5	10	15	20	0	15	30	50	60
					2	0	15	25	50	60	0	10	15	25	30	0	20	40	60	70
					3	0	20	35	60	70	0	15	20	35	40	0	25	50	70	80
Flap valves	Fluvial	Cast iron and coplastic	Structure/ control gate	N/A	1	0	8	13	17	20	0	5	9	12	15	0	10	17	21	25
					2	0	10	17	21	25	0	8	13	17	20	0	12	20	25	30
					3	0	12	21	25	30	0	11	17	22	25	0	14	23	29	35
	Coastal/ estuarine	Cast iron and coplastic		N/A	1	0	5	9	12	15	0	3	6	8	10	0	8	13	17	20
					2	0	8	13	17	20	0	5	9	12	15	0	10	17	21	25
					3	0	11	17	22	26	0	7	12	16	20	0	12	21	25	30
Moveable gates (manually operated)	Fluvial	All	Structure/ control gate	N/A	1	0	12	25	32	38	0	5	12	16	20	0	15	32	41	50
					2	0	18	34	42	50	0	10	22	30	35	0	20	40	50	60
					3	0	24	43	52	62	0	15	32	44	50	0	25	48	59	70
	Coastal/ estuarine	All		N/A	1	0	10	14	16	18	0	4	7	9	10	0	13	22	26	30
					2	0	15	23	27	30	0	7	11	13	15	0	18	29	35	40
					3	0	20	32	38	42	0	10	15	17	20	0	23	36	44	50

Asset class	Environment	Material	AIMS asset classification	Narrow/ wide*	Maintenance Regime	Expected deterioration times (years) to specified CG from new														
						Medium deterioration					Fastest deterioration					Slowest deterioration				
						1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Moveable gates (electrically operated)	Fluvial	All	Structure/ control gate	N/A	1	0	12	20	24	28	0	5	10	13	15	0	15	27	33	38
					2	0	18	29	35	40	0	10	17	21	25	0	20	33	39	45
					3	0	24	35	42	49	0	15	24	29	35	0	25	39	45	52
	Coastal/ estuarine	All		N/A	1	0	10	14	16	18	0	4	7	9	10	0	13	16	18	20
					2	0	15	20	23	25	0	7	11	13	15	0	18	24	27	30
					3	0	20	26	30	33	0	10	15	17	20	0	23	32	36	40
Debris screens	Fluvial	All	Structure/ screen	N/A	1	0	5	14	21	25	0	2	10	17	20	0	7	20	25	30
					2	0	7	20	32	40	0	5	15	25	30	0	10	25	40	50
					3	0	9	26	43	55	0	8	20	33	40	0	13	30	55	70
Flood gates and barriers	Fluvial	Metal	Structure/ control gate	N/A	1	0	12	25	32	38	0	5	12	16	20	0	15	32	41	50
					2	0	18	34	42	50	0	10	22	30	35	0	20	40	50	60
					3	0	24	43	52	62	0	15	32	44	50	0	25	48	59	70
	Coastal/ estuarine			N/A	1	0	10	14	16	18	0	4	7	9	10	0	13	22	26	30
					2	0	15	23	27	30	0	7	11	13	15	0	18	29	35	40
					3	0	20	32	38	42	0	10	15	17	20	0	23	36	44	50
	Fluvial	Wood		N/A	1	0	6	13	16	19	0	3	6	8	10	0	8	16	21	25
					2	0	9	17	21	25	0	5	11	15	18	0	10	20	25	30
					3	0	12	22	26	31	0	8	16	22	25	0	13	24	30	35
	Coastal/ estuarine			N/A	1	0	5	7	8	9	0	2	4	5	6	0	7	11	13	15
					2	0	8	12	14	15	0	4	6	7	8	0	8	15	18	20
					3	0	10	16	19	21	0	5	8	9	10	0	12	18	22	25

Narrow assets defined as <4 m crest width, wide assets defined as 4 m or greater crest width