

Option	Description	Standard of Protection			Technical		Economic		Environment		Social		Political		Legal		Total	Summary of long list
		Short-term Present day to 2030	Mid-term Present day to 2070	Long-term Present day to 2118	Technical performance and adaptability	Buildability	Capital cost	Maintenance and monitoring	Ecology and environment	NFM and RBMP	Landscape and Heritage	Tourism	Strategic alignment	Stakeholder views	Waste management and contamination	Regulatory consent and approvals		
1	Replace sea wall A new wall could be built of concrete, steel piles or masonry. This option would seek to replace the existing defence or be built seaward of the existing wall. To adapt to climate change, the wall would need to be taller than the current defence, which may require raising the promenade and footpath area behind.				4	3	2	4	3	2	3	4	5	2	3	4	40	Option bought forward to shortlist as it provides flood protection in the long-term by raising the height of the defence. This option also includes extending the existing walls as in SFA option D. Note - Replacing wall does not necessarily require demolition of existing encasement or similar possible.
2	Raise existing sea wall Raising the existing wall would increase the flood protection performance of the defence in the short to mid-term. However, as this option relies on the existing structure it can only practically be raised so far without a complete re-build. In addition, without raising the promenade, sea views could be affected and therefore the wall could only be raised so far. In areas where the existing structures are currently in poor condition a concrete 'brow' would be used to				2	5	4	1	3	3	3	2	3	1	5	5	37	Option discounted as does not address extreme sea levels at southern end of the 'Central' benefit zone. Maintenance of existing defence and beach also required adding to costs.
4	Setback walls with flood gates Flood protection walls could be installed set-back from the existing coastal defences, these would run parallel to the roads and private property boundaries. In some instances, it is envisioned that private properties may require integrating into the defence line to ensure flood wall continuity; this would require waterproofing or shrouding of vulnerable areas. This option would help prevent flooding to the town through a secondary defence line; while it does not help reduce wave overtopping, it would prevent flood water from inundating properties. In the long term this option will be less effective due to the extreme				4	3	4	1	4	3	3	2	3	3	3	4	38	Option discounted as it is understood that during previous events the momentum of water as well as debris carried with it is unlikely to be stopped by setback walls. Also limited space on where these could be located in some areas.
5	Offshore breakwater An offshore breakwater would seek to reduce the flood risk by dissipating wave energy within Stonehaven Bay. The size of the structure (height and width) would determine how much wave energy is dissipated. For this reason, a breakwater could be designed to be submerged such that it is not visible, creating a reef-like structure to break the largest waves offshore. As this option does not increase the height of the existing defences it may only offer limited protection in				4	1	2	2	2	4	3	5	4	5	3	2	37	Discounted as extreme sea levels will still cause flooding in the long term.
7	New stepped or sloping revetment The existing defences could be replaced by a new stepped revetment (as currently seen along the Cowie promenade), or by a similar modular blockwork structure or rock armour structure. All solutions could be designed such that their wave overtopping performance is suitable into the long-term scenario. Given the present-day overtopping risk, a higher crest level than existing will be required. To adapt to climate change, the wall would need to be raised further, which may				5	3	1	4	2	2	2	5	2	3	4	4	35	Option discounted due to the high capital cost and limited difference to sea wall.
8	Beach recharge + control structures The beach within Stonehaven could be recharged increasing the beach crest width and height. To prevent the beach mobilising and moving around within the bay beach control structures would also likely be required. With a large enough beach in both height and width this option could be a solution in the long-term, however it would also require replenishment over time if it is shown that material is lost offshore or the beach migrates shoreward through "roll-over". This option may				3	3	3	2	2	4	4	5	4	5	3	2	41	Option bought forward to short list as larger beach can provide flood protection and increases amenity values. Option is the same as SFA option B; same as option C as beach control structures are not defined at this stage (could be timber or rock groynes).
9	Foreshore recharge Similar to beach replenishment, this would look to have large quantities of beach material dumped near the centre of Stonehaven Bay, effectively making a very large beach / sand bar. Over time this material would move around within the bay, replenishing the existing beaches. This option would reduce the water depths within the bay and thus create a large area in which wave action would be dissipated across. This option would be suitable up until the long-term scenario				2	2	2	2	2	5	4	5	4	5	3	1	36	Option discounted due to the environmental impact on the rocky foreshore and the high capital and maintenance costs.
10	Beach and river realignment Within the central section, the beach could be moved seaward with a view to redirect the Cowie Water south towards the Carron, as it flowed historically. As the beach is moved seaward, it would effectively act as type of breakwater to the hard coastal defences, however this realignment would likely require nourishment along with control structures to make sure the system is stable in extreme events and not breached. This option would be suitable into the mid-term scenario, but extending the toe of the hard defences for the realigned river may require				4	3	2	2	2	2	3	4	2	2	2	2	31	Option discounted due to the environmental impact on the rocky foreshore and the high capital and maintenance costs.
14	River Cowie training wall / groyne extension The existing concrete structure could be extended further out and southward to shelter the river mouth from waves. The structure could be an extension of the concrete structure or be formed of rock armour. As this defence does not increase the height of the existing river banks, it is only effective to the mid-term scenario, however coupled with existing defence improvements would make it a				4	3	2	3	2	2	3	4	2	2	3	3	32	Discounted as stakeholder concerns on impacts of diverting flow southwards on sediment in front of coastal defences.
20	Property relocation Properties at immediate flood risk behind the current coastal defences could be relocated, reducing potential flood risk behind the current coastal defences while also providing additional space for flood protection improvement schemes behind the existing defences. While this option does not seek to reduce wave overtopping it could be coupled with other mid to long-term strategies to reduce flood risk damages.				3	2	2	2	2	3	2	1	1	1	3	3	25	Discounted as not in stakeholder interest or practical.
21	Property Flood Resilience and Resistance (PFR) A short-term option to address flooding in less severe storm events, PFR measures could be a valuable option to incorporate into those properties at risk of flooding. For more severe storms and with increasing sea levels, the level of resilience will be limited and is therefore not considered to be a mid-term option, resilience will be limited and is therefore not considered to be a mid-term option,				2	5	5	2	3	3	3	4	3	5	5	5		Taken through as 'quick win' instead of short list option.
22	Do Nothing				1	5	5	5	2	3	2	1	1	2	5	5	33	Discounted as not inline with HTL policy
23	Do minimum				1	5	5	2	3	3	3	3	3	3	3	3	35	Discounted due as it does not address flood risk issues.
SFAG Option A	Cowie southern training wall																Will be considered as part of control structures within option 8.	
SFAG Option B	Central area groynes																Will be considered as part of control structures within option 8.	
SFAG Option C	Offshore rock armour																Rock armour will be considered as a control structure within option 8.	
SFAG Option D	Sea wall extension																Extending the direct defences into this area would be considered within any of the direct defence options above.	
SFAG Option E	Groynes, Cowie southern training wall, rock armour and recharge																Will be considered within option 8.	