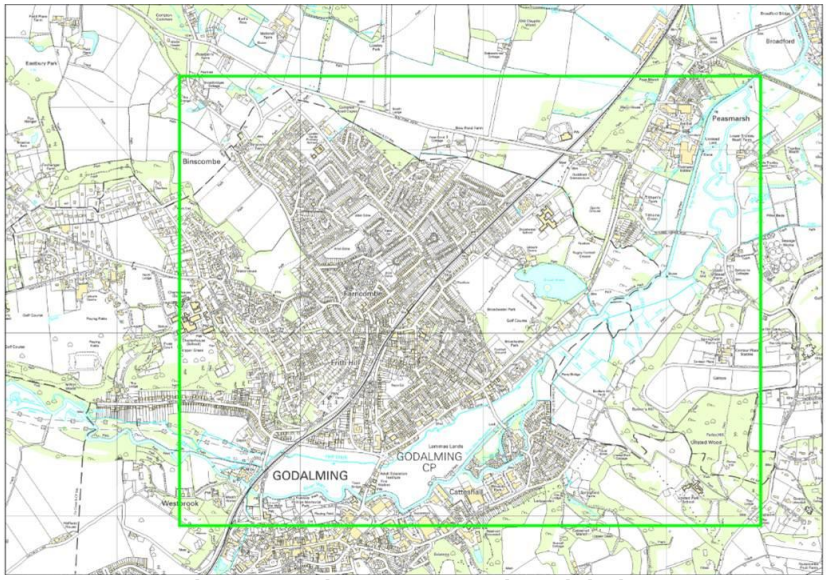
Godalming Flood Alleviation Scheme

Outline Business Case

Aerial Photograph of Godalming - Catteshall Road (centre) and Meadrow (left), Christmas 2013



Primary Study Area around Godalming

Version No: Final

***Date*: 10/02/17**

FINANCIAL SCHEME OF DELEGATION (FSoD) APPROVALS

1.

Project name	***Godalming FAS***				
Project ref.		**Project Code**	IMSE500193	**Start date**	2013/14
Programme	River Wey Packaged Flood Alleviation Schemes			**End date**	April 2019
Hub or Head Office	**ncpms – HO**		For FSOD use only		
Area name	**SE West Thames**		**FSoD reference**		
Function	**FCERM**		**FSoD Date**		

2.

Role	**Name**	**Post Title**	**% time allocated to project**
Project Sponsor	David Bedlington	West Thames Flood Risk Manager – Project Sponsor	5%
Project Executive	Tim Chinn	ncpms Project Team Manager-Project Executive	10%
Project Manager	Steve Archer	ncpms Project Manager 2	25%

3.

Risk Potential Assessment (RPA) Category	Low	x	Medium	☐	High	☐

4.

FSoD schedule		**Description**	Delegation	
			National – up to	**Area – up to**
A1	☐	Projects (includes FCRM revenue)	£5m	£5m
A2	☐	FCRM capital project within approved strategy	£100m WLC Defra	£10m
A3	☒	FCRM capital project outside of approved strategy	£100m WLC Defra	£5m
A5	☐	Consultancy project	£500k	£500k
T2	☐	Corporate Property Projects /acquisitions	£5m	£5m

5.

FSoD value			**£k**
Strategic Outline Case (SOC)	**FSoD reference**		
Full Business Case (FBC)	**FSoD reference**		
Whole Life Costs (WLC) of Project (if applicable)			
Financial benefits			n/a
Non-financial benefits			**Yes**

6.

Required level of Environmental Impact Assessment (EIA)	**N/A** ☐	**Low** ☐	**Medium** ☒	**High** ☐

7.

NPAB/LPRG chair	**Post title**	Assurance confirmation			**Date**
		RED ☐	AMBER ☐	GREEN ☐	

8.

FSoD approver(s) name	**Post title**	Emailed approval	**Date**

9.

Form G	**Form G value (£k)**	**FsoD ref.**	**Latest FsoD authorised cost (£k)**
1			
2			
3			

10.	**For FsoD Coordinator use only:**

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1. Executive Summary

1.1 Introduction

The Godalming Flood Alleviation Scheme (FAS) is a partnership project between the Environment Agency, Surrey County Council, Waverley Borough Council, Godalming Town Council, Thames Water, Scottish and Southern Electricity and the Godalming Flood Group which seeks to address the unacceptably high level of flood risk to Godalming in Surrey. Without intervention the levels of flood risk within these communities will remain high (at greater than 1 in 100 chance of flooding in any given year).

In 2015/16 the Environment Agency completed an initial assessment that confirmed that if the current approach to flood risk management is maintained, 87 residential and 45 commercial properties are at a 1 in 100 chance of flooding in any given year within the target area of Meadrow and Catteshall Road. Initial estimates indicated that up to £8,450k in Present Value (PV) whole life benefits may be achieved by implementing a scheme.

This Outline Business Case (OBC) enhances the information supplied in the Strategic Outline Case (SOC), which was recommended for approved in September 2016.

1.2 Strategic Case

1.2.1 Strategic Context

The Godalming Flood Alleviation Scheme has been included in the Thames RFCC 6 year programme. It was recognised that the development of the scheme was subject to securing local partnership funding. This funding is now agreed in principle, enabling the scheme to progress.

1.2.2 Objectives

The objectives of the Godalming FAS developed by the Environment Agency are:

- Promote a jointly funded scheme and work with our partners to reduce fluvial and other sources of flood risk to people and property;
- Promote a scheme which provides the economically optimal standard of protection that is resilient and adaptive to climate change;
- Deliver an option which helps create a better place, maximise environmental outcomes for people and wildlife, and contribute to WFD objectives where practicable;
- Minimise and mitigate for adverse impacts and safety and environmental risks that may result from the Scheme.
- Involve the local community and stakeholders in the development of the scheme and document this.

1.2.3 The case for change

Following the December 2013 flood the Waverley Infrastructure Resilience Group (WIRG) was set up by Jeremy Hunt MP for South West Surrey which consists of representatives from key stakeholders and partners including the Godalming Flood Group. It was agreed that WIRG would form the Sponsor Group for the Godalming FAS. The latest hydraulic model of the Middle River Wey (2015) suggests that if the current approach to flood risk management (Do Minimum) is continued, 87 residential and 45 commercial properties are at risk of fluvial flooding within the study area. Without intervention the levels of flood risk within these communities will remain high (at greater than 1 in 100 year event).

The Godalming FAS project appraisal has concluded that there are viable cost-beneficial options to alleviate flooding within the Godalming area. The Godalming FAS is included within the River Wey Flood Alleviation Schemes Package which has been allocated FDGIA funding within the

Environment Agency's six year programme. The identification of technically and economically viable options that meet the key objectives of the Environment Agency and local partners together with the support of the Project Sponsor Group and the allocation of funding provides a robust case for change.

1.3 Economic case

As part of this OBC a full economic appraisal for Godalming FAS options has been carried out using the methodology defined in Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) and in accordance with HM Treasury's Green Book.

1.3.1 Options considered:

Initial Long list options:

A long-list of options were identified as part of Strategic Outline Case (SOC) and can be found in Appendix G of this OBC.

Short list options:

Table 1 provides details of the shortlist options considered and summarises the results from the economic appraisal.

The 'Do Nothing' scenario has been used as the baseline scenario for the economic appraisal

Option	Total PV costs	Total PV benefits	Net Present value (NPV)	Average benefit cost ratio (BCR)	Incremental benefit cost ratio (iBCR) compared to Do Minimum	Non monetised benefits
Option 1- Do Minimum	£753k	£6,544k	£5,791k	8.7	-	Infrastructure Education and Health Services
Option 2 - Two-Stage Swale	£4,854k	£6,544k	£1,690k	1.4	-	
Option 3 - Two-Stage Swale & Drainage channels	£5,036k	£6,544k	£1,508k	1.3	-	
Option 4a - Meadrow Defence with CSA	£5,627k	£11,884k	£6,300k	2.1	1.10	
Option 4b - Meadrow Defence without CSA	£3,986k	£11,733k	£7,747k	2.9	1.60	
Option 5 – Combination of Options 3 & 4a	£10,047k	£11,884k	£1,880k	1.2	0.58	
Option 6 - Structural Defence – Bridge Road	£1,641k	£5,834k	£4,193k	3.6	-	

Table 1: Economic Appraisal of Shortlist options summary

1.3.2 Key findings

The economic appraisal of the shortlist options has concluded that:

- Option 1: (Do Minimum) - Has the highest ABCR but does not fulfil the project objectives or provide a long term sustainable flood risk management solution. **Option rejected**.

- Option 2: (Two-Stage Swale) – Detailed hydraulic modelling has identified that this option provides a negligible impact on water levels or conveyance within the watercourse and does not reduce flood risk within the Godalming vicinity. Option 2 provides no economic benefit. **Option rejected.**

- Option 3: (Two-Stage Swale & Drainage channels) - Detailed hydraulic modelling has identified that this option provides a negligible impact on reducing water levels or conveyance within the watercourse and does not reduce flood risk in the Godalming vicinity. Option 2 provides no economic benefit. **Option rejected.**

- Option 4a: (Meadrow Structural Defence & CSA) – Detailed hydraulic modelling has identified that this option reduces flood risk to properties and assets in the vicinity of Meadrow, Catteshall road and Wey court and fulfils the project objectives. The inclusion of the CSA results in additional ecosystems benefits being achieved but also attracts significant PV costs and programme risks when compared to option 4b. Option 4a is a technically viable option but is not the option which best optimises value for money (VFM). **Option rejected**

- Option 4b: (Meadrow Structural Defence without CSA) - Detailed hydraulic modelling has identified that this option reduces flood risk to properties in the vicinity of Meadrow, Catteshall road and Wey court and does not result in the transfer of flood risk to downstream communities. Option 4b fulfils the project objectives. The removal of a CSA results in the loss of additional ecosystems benefits being achieved but also results in PV costs being reduced significantly when compared to option 4a. Option 4b is a technically viable option and is the option which best optimises value for money (VFM). **Preferred Option**

- Option 5: (Two-Stage Swale, Drainage channels & Meadow Structural Defence) - Detailed hydraulic modelling has identified that this option reduces flood risk to properties and assets in the vicinity of Meadrow, Catteshall road and Wey court and fulfils the project objectives. The inclusion of a 2 stage swale and drainage channels results in no additional flood risk benefits whilst creating significant PV costs and programme risks when compared to option 4a. Option 4a is a technically viable but is not the option which best optimises value for money (VFM). **Option rejected**

- Option 6: (Structural Defence, Bridge Road) – Detailed hydraulic modelling has identified that this option causes higher water levels upstream of Bridge Road. Downstream of Bridge Road, within Lammas Land, there are small reductions in water level. Properties just downstream of Bridge Road (such as the Adult Education Institute and the Fire Station) are removed from flooding for the 1% AEP plus climate change event. However, there is an increase in flood extent and depth along Chalk Road and at the properties roughly opposite Hallam Road. There is also an increase in flood extent around The Burys, to the south of Bridge Road. The transfer of increased flood risk to properties and critical infrastructure upstream render this option unviable. Option rejected.

1.3.3 Preferred way forward

The economic analysis for the Godalming FAS has concluded that:

- Options 4a and Option 4b, the Meadrow Structural Defence with and without CSA, are options that satisfies the wider project objectives to a greater extent than a Do Minimum scenario;
- There are no benefits from damages avoided through the inclusion of CSA, and only relatively minor Ecosystems Services benefits are attained;
- Option 4b without CSA is preferred Option as the BCR is greater than Option 4a and the iBCR for inclusion of CSA is insufficient to justify its inclusion;
- A 1 in 200-year (0.5% AEP) is the preferred Standard of Protection for the Preferred Option 4b;
- PV Cost for Approval (Appraisal, Design, Construction) of Preferred Option 4b is £3,950k
- Contributions of £3,113k are required to progress Preferred Option 4b with an adjusted PF score of 100%;
- FDGiA of £837k towards the upfront costs of the scheme would be recommended if these contributions are secured;

It is recommended that:

- Contributions are sought to ensure the viability of the scheme;
- The Meadrow Defence Wall alignment is optimised further during the detailed design stage to establish an alignment which best meets the needs of landowners, partners and stakeholders.
- Assuming the above points are taken into consideration, the scheme is taken forward to Detailed Design and Full Business Case.

1.4 Commercial case

1.4.1 Procurement strategy

1.4.2 Key contractual terms and risk allocation

1.4.3 Efficiencies and Commercial arrangements

1.5 Financial case

1.5.1 Summary of financial appraisal

The projected project financial summary is presented below.

Project Summary £k	Prior (sunk)	Yr 0 '16-17	Yr 1 '17-18	Yr 2 '18-19	Yr 3+	Total
Staff	TBC	TBC	TBC			
Initial investment:-						
➢ Capital cost						
➢ Revenue cost						
Future costs						
Project Total						

*Sunk cost not included in total.

Table 2: Summary of Financial Appraisal

1.5.2 Funding sources

Funding sources have been agreed in principle to cover all costs for the lifetime of the scheme and at this stage of development are summarised below:

Annualised funding profile (£k)	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4+	Total
Grant in Aid						
Thames Region FD Levy Funding						
Partnership funding:- Surrey County Council Waverley Borough Council Godalming Town Council						
Other Contributions: Local Business etc						
Project Total						

Table 3: Summary of Funding Sources

1.5.3 Overall affordability

The current overall costs and impact of the project over its expected lifespan is summarised below.

Year	Stage	Economic appraisal £k	Whole-life cash cost £k	Approval £k
0	**Costs up to SOC (outline design)**	n/a sunk costs	40.9	
	Costs after SOC			
0	Existing staff costs (EA)			TBC

Year	Stage	Economic appraisal £k	Whole-life cash cost £k	Approval £k
0	Further staff costs (EA)			83
0	Consultants' fees (WEM Lot 3, Land Agent & ECC)			
0 / 1	ECI Contractors' fees (WEM Lot 4)			
0 / 1	Cost consultants' fees (NCMF & ECC PM)			
0	Site investigation and survey			3950.5
0 / 1	Construction			1653
0 / 1	Environmental mitigation (			150
0 / 1	Environmental enhancement			
0 / 1	Site supervision			
0, 1, 2	Lands Compensation Budget			219
0	Initial Risk contingency			
1 / 2	95%ile Risk			323
1 / 2	50%ile Risk			
2 / 3	Inflation			
3 to 99	Future costs (construction + maintenance)		125	
3	Other (Post Construction)			
0, 1 to 99	Contributions over the project lifecycle (not in the total)			3113
	Total			

Table 4: Summary of Costs over the Project Lifecycle

River Wey: Godalming Construction Option Cost Summary - to 1:200+CC SoP

Item	**Preferred Option 4b 1:200Central**
Name	Meadrow Wall + No Compensatory Storage
Detail	1000mm Wall (incl. 150mm Freeboard)
Base Construction Cost	**£1,704,000.00**
Fees (Design & Supervision) @ 20%	£340,800.00
Fees (NCF) @ 6%	£102,240.00
Fees (EA Staff) @ 5%	£85,200.00
Lands and Compensation @ 15% (* EA Land Agent Provided Costs)	£219,000.00
Geotechnical Investigation @ 2%	£34,080.00
Environmental Investigation @ 3%	£51,120.00
Environmental Enhancement	£150,000.00
Sub Total	**£2,686,440.00**
Risk Allowance (See Register)	£323,415.00
Total Capital Costs	**£3,009,855.00**
Total PV Costs (Excl. Contributions & Inclusive of Operation and Maintenance)	**£125,793.37**

Optimism Bias = £940,694.51

PV Whole life cost = £4,076,342.89

1.6 Management case

1.6.1 Project Management

The Godalming Flood Alleviation Scheme forms part of the River Wey Flood Alleviation Schemes package and is an integral part of the indicative Thames RFCC 6 year programme. A management structure with the Area Portfolio Board, Project Board and Project Team has been identified with stated roles and responsibilities. A project plan has also been outlined. The project will be managed in accordance with the Prince 2 accredited principles.

The Project Board retains accountability for project delivery and operates by exception within tolerances set by the Area Portfolio Board (APB). Any deviation will be first agreed by the APB. Representatives of the Senior Users representing the Partnership and Strategic Overview Team (PSO) and Asset Performance Team (APT) are embedded in the project to ensure that the scheme meets and is focussed on end-user needs and reflects change within the business. Guidance will also be given by a Sponsor Group made up of stakeholders and partners. The project communication will reflect a communications and engagement plan developed using 'Working with Others' best practice.

1.6.2 Benefits realisation

A Benefits Realisation Plan covering what benefits are to be measured will be developed in the next stage of the project. This will state who is accountable for the expected benefits, how and when achievement of expected benefits will be measured and what resources are needed to carry out the work closely with the Project Board to profile anticipated benefits and report efficiencies using the CERT reporting tool.

1.6.3 Risk management

A Monte Carlo derived register for project risks going forward is contained in Appendix E. Risks which apply to the OBC stage are highlighted and the Mean Effective Value included.

No	Key Project Risk	Adopted Mitigation Measure
1	**Business** – **Partnership funding** is not available to progress a scheme	Formalise the MoU funding agreements for the OBC.
2	**Business** – Flood alleviation options may cause disruption to the protected habitats/areas, public open spaces, and affect the reputation of the Environment Agency.	Continue consultation with stakeholders. Landowners and partners and discuss options to manage expectations and minimise disruption.
3	**Modelling:** The Middle Wey hydraulic model has been improved in early appraisal, giving a more robust model, but could be open to challenge if options affect flood risk elsewhere, changing the business case.	Liaise with modelling consultant to understand changes. Hydraulic modelling of options shall be finalised for the OBC to demonstrate the impacts and viability. Modelling of final design option to be undertaken.
4	**Assessment** of **Whole life costs / benefits of options** changes resulting in options being unviable.	Undertake regular c/b review of options, utilising Early Supplier Engagement (ESE). Mitigate key construction risks early with detailed SI / GI to confirm desk-top study findings.
5	**Approvals withheld**, e.g. Natural England, Flood risk permit or Highways, Planning Approval etc.	Continuing stakeholder engagement with the local authorities using developed engagement plans and

		engagement to show a consistent message of the benefits. Continued consultation including with Local Authorities on planning.
6	**Planning** – Insufficient Compensatory storage available within the study area.	Undertake a review of locations using a technical, environmental and lands screening exercise whilst developing short list options.
7	**Compensatory storage** investigations cost increase or risk register cost sum is too low	Progress candidate sites from the Modelling Plan. Consult with landowners/organisations Complete outline design investigations and include costs in SOC.

Table 5: Summary of Key Project Risks

1.6.4 Assurance, approval & post project evaluation

In accordance with Environment Agency guidance on Assurance & Approval Stages for FCERM Capital on the 5 Case Business Model, the table below outlines the current arrangements for reviewing the project's business case. As best practice, a post project appraisal and evaluation will be carried out on completion of each package component project.

Review Stage	Assurance	Date
Strategic Outline Case (draft)	Project Board	Sep 16
Strategic Outline Case	NPAB	Sep 16
Outline Business Case (draft)	Project Board	Jan 17
Outline Business Case	Project Board	Feb 17
Full Business Case (draft)	Project Board	Dec 17
Full Business Case	NPAB	Dec 17
Contract Review leading to Construction	Project Board and Procurement	Est. Dec '17 to March 18

Table 6: Summary of Assurance & Approval Stages

1.7 Recommendations

The Godalming Flood Alleviation Scheme (FAS) seeks to address the unacceptably high level of flood risk on the River Wey at Godalming. Without intervention the level of flood risk will remain very significant (at risk from a 1 in 20 year event and above).

This OBC report has appraised a number of Flood Risk Management options and has concluded that Option 4b: Meadrow Structural Defence (without CSA) is the preferred option.

It is recommended that:

- Contributions are sought to ensure the viability of the scheme;
- The Meadrow Defence Wall alignment is optimised further during the detailed design stage to establish an alignment which best meets the needs of landowners, partners and stakeholders.
- It is recommended that this OBC be approved to enable the project to progress to the delivery stage, complete a detailed design of the preferred option and produce an FBC.

2. The Strategic Case

During production of this OBC the content of the Strategic Case has been reviewed, in line with the 'Green Book Supplementary Guidance on Delivering Public Value from Spending Proposals'.

2.1 Introduction

The River Wey is situated primarily in Surrey. The catchment area is approximately 900km^2 and is mostly rural in nature associated with a typical lowland river that is slow flowing with a wide well defined floodplain. Alton, Haslemere, Farnham, Godalming, Guildford, Old Woking, Byfleet and Weybridge make up the major urban areas with varying levels of flood risk. The town of Godalming on the River Wey has a history of flooding with a number of floods in recent years: September 1968, February 1990, autumn 2000, and December/January 2013. During Christmas 2013, the River Wey experienced some of the heaviest rainfall and highest flows in recent history. The resultant flooding has initiated a review of flood risk reduction options in a number of urban areas, particularly in the lower catchment of the River Wey. Areas of primary interest are Godalming, Guildford, Old Woking, Byfleet and Weybridge and locations in the upper catchment.

Flooding in Godalming consists of both fluvial flooding, where high-river levels result from intense rainfall events, and surface water run-off from nearby impermeable urban surfaces supplemented by groundwater flows. Flooding primarily results from the River Wey and its tributary (Hell Ditch) coming out of bank and occupying the extended floodplain around which Godalming is centred. The December 2013/14 flooding resulted in internal flooding to at least 54 properties in Catteshall Road and Meadrow. The latest hydraulic model of the River Wey (2015) suggests that at present day, 87 residential properties and 45 non –residential properties are between a 1in 20 and a 1 in 100 chance of flooding in any given year. The current approach to flood risk management (Do-Minimum) includes an annual programme of maintenance by the Environment Agency's Asset Performance Team.

An Initial Assessment was undertaken in May 2014, which involved a basic assessment of properties at risk of flooding and options to reduce the fluvial risk. Further information can be found in the Initial Assessment in Appendix G, including a detailed description of the area, review of previous studies/literature and potential flood alleviation options. The SOC concluded that there are a number of cost-beneficial options to alleviate flooding within the study area which have been developed further for OBC.

Since the approval of the Initial Assessment in 2014 a review of the existing hydraulic models was undertaken. A new hydraulic model was built for the Middle River Wey (2015) using the new Flood Modeller Pro interface which is the latest (rebranded) version of ISIS. The overall purpose of the Middle River Wey model 2015 was to provide certainty in regards the mechanisms of flooding on the Middle River Wey and to develop enhanced flood extents maps which can then be used to identify viable options for reducing flood risk. The new model has been used to produce new flood extent maps to re-evaluate the options identified within the Initial Assessment. Additional options have also been evaluated using the new fluvial model, as part of this OBC. The Godalming Flood Alleviation Scheme (FAS) seeks to address the unacceptably high level of flood risk on the River Wey at Godalming, Surrey. Without intervention the level of flood risk within these communities will remain very significant (at risk greater than a 1 in 20 chance of flooding in any given year).

2.2 Business strategies

River Wey Strategy (Withdrawn)

The Environment Agency's River Wey Strategy (Draft) submitted to Large Projects Review Group (LPRG) in 2010 undertook a high level re-assessment of the previous study options and concluded at that time that any 'structural' flood mitigation options were not suitable in Godalming due to low benefit to cost ratios and detrimental impacts upon the environment. The Strategy recommended that non-structural measures were preferred alongside refurbishment of the River Wey

Improvement Scheme flood capacity improvement weirs. However, the options needed to be revisited in the light of the recent flooding to properties in Godalming in Catteshall Road, south Godalming and Meadrow and newly developed options for flood risk management.

The Godalming FAS has been included within the Environment Agency's River Wey FAS Package and funding for developing viable schemes is identified within the six year FCERM programme. The Godalming FAS project will evolve to ensure that it aligns with other internal projects in the catchment and also aligns with future business strategies of the organisations involved and all relevant national and functional strategies where possible.

2.2.1 Project Partners

The Godalming FAS is a partnership project between the Environment Agency, Surrey County Council, Waverley Borough Council, Godalming Town Council, Thames Water, Scottish & Southern Electric and the Godalming Flood Group. Significant support and commitments have already been given from these parties evidenced by a Memorandum of Understanding (MOU) a signed copy of which is contained in Appendix G. This project will deliver joint benefits to the community and project partners. Details of and responsibilities of the project partners are provided in the MOU.

2.2.2 National or Functional Strategies

DEFRA Policy
Many of DEFRA's high level policies are relevant to this Scheme including reducing the threats of flooding, measures for the Water Framework Directive, adapting to climate change and improving water quality. These are integral to the scheme's objectives.

Environment Agency Corporate Plan
The Environment Agency's Corporate Plan (2014-16) is structured around 3 main business areas: flood and coastal risk management; water, land and biodiversity; and regulated business. This Scheme will help towards achieving the objectives of the Corporate Plan.

Thames River Basin Management Plan (RBMP)
The RBMP has been prepared under the EU's Water Framework Directive, 2000, which requires all countries throughout the European Union to manage water environments to consistent standards. This Scheme will support local delivery of the plan.

Waterbody Reference	Weirs	Current Overall Potential	Status Objective	Protected Area Designation	Hydro-morphological Designation
GB106039017820 **Wey (Tilford to Shalford)**	Unstead Weir, Catteshall, Broadoaks, Elstead Mill	Moderate	Good Ecological Status by 2027 Good Chemical Status by 2015	Freshwater Fish Directive Nitrates Directive	Not HMWB

Table 7: Wey River Waterbody Designation

Thames Catchment Flood Management Plan (CFMP)
The scheme has been developed to respond to the CFMP policy in using resources to reduce risk where there are more people at higher risk.

2.3 Environmental and other considerations

Building on the Initial Assessment, subsequent work included a desk study in 2014 to review environmental risks and constraints associated with delivering the short list options. This referred to publicly available material from 'MAGIC' (Multi-agency Geographic Information for the Countryside), the National Biodiversity Network, the Environment Agency and the Waverley Borough Council website. Environmental issues have been summarised in Table 8 below:

No	Key Environmental Issues	Recommended Mitigation Measure
1	From a landscape perspective, the proposed Meadrow Defence is located within a sensitive area. Lammas Lands, located immediately south of Hell's Ditch comprises the River Wey and Godalming Navigations Conservation Area. This area, as well as the allotment land to the north of Hell's Ditch is also covered by an Area of Strategic Visual Importance (ASVI).The proposed flood defence wall has the potential to impact upon the landscape character of the area.	An Indicative Landscape Plan (ILP) and a plan showing Indicative Landscape Details (ILD) have been produced for the OBC. These show an 'optimised' alignment to minimise potential landscape effects resulting from the scheme. This includes minimising removal of trees as well as minimising land take from allotments and private gardens. As some tree loss is unavoidable, mitigation measures also include replacement planting of native tree and shrub species. It has also been recommended that the wall is concealed within a grass bund, where possible, or otherwise clad with an appropriate material to be in keeping with the character of the area. This would minimise potential effects of the scheme on the surrounding landscape.
2	The inclusion of CSA was outside the original scope of the project and as such a landscape assessment, including the production of ILDs and ILPs has not been completed. The landscape character in this area is sensitive to potential impacts from the scheme as the proposed CSA is located within the Surrey Hills AONB. In addition, a number of listed buildings are located in close proximity to the works and therefore views from listed buildings and their setting must be considered.	It is recommended that a landscape assessment, including the production of and ILD and ILP, is completed for the CSA. In addition, due to the scale of the proposed CSA and its sensitive location a Landscape and Visual Impact Assessment is recommended. It is recommended that the proposed CSA is designed sensitively to be in keeping with the character of the area and should include replacement planting of appropriate native species.
3	Numerous trees are present along Hell's Ditch, one of which has been identified as being protected under a Tree Preservation Order (TPO), The remaining trees are largely immature and semi-mature specimens. A number of trees will require removal to facilitate the works.	The alignment of the wall has been optimised to minimise the number of trees to be removed and to avoid the TPO tree and its root protection zone. An arboricultural survey was carried for the site and subsequently an Arboricultural Method Statement was completed detailing recommended mitigation measures to minimise impacts to retained trees. These include installation of protective fencing; and installation of temporary ground protection. To mitigate for removal of trees as part of the works, replacement planting of native species is recommended.
4	Numerous trees are present within the proposed CSA, which may require removal as part of the scheme. A number of these trees are mature specimens although none are protected under TPOs. An arboricultural survey and assessment was not completed to inform the OBC and therefore potential adverse effects on arboriculture for the CSA have not yet been quantified	It is recommended that an arboricultural survey, assessment and method statement is completed for the CSA to inform potential adverse effects and to inform mitigation and enhancement measures. It is recommended that trees are retained where possible and that retained trees are protected using fencing and temporary ground protection. To mitigate for removal of trees as part of the works, replacement planting of native species is recommended.
5	Areas of floodplain both upstream and downstream of the proposed Meadrow Defence comprise the Wey Valley Meadows and Charerhouse to Eashing Sites of Special Scientific Interest (SSSI). The latter is located in close proximity to the proposed CSA. These sites are designated due to the presence of wetland habitats. Providing appropriate pollution prevention measures are in place, adverse effects on SSSIs are not anticipated during the construction phase.	A Letter of Support would be required from Natural England.
6	Lammas Lands, immediately to the south of the proposed Meadrow Defence as well as Hell's Ditch comprise a series of locally designated Sites of Nature Conservation Importance (SNCI), due to the presence of wetland habitats, which support a range of species. There is potential for these sites to be adversely affected during the construction phase due to habitat loss along the banks of Hell's Ditch; potential vehicular access and	Mitigation measures during the construction phase should include: • Locating the construction compound away from SNCIs; • Construction of any required vehicular access bridges across Hell's Ditch to be completed in accordance with a method statement in order to prevent potential

No	Key Environmental Issues	Recommended Mitigation Measure
	location of the construction compound in this area. During the operational phase of the scheme there is potential for the scheme to result in changes in water levels within the SNCIs, which could adversely affect habitats. In addition, where the proposed Meadrow Defence is located close to Hell's Ditch, such as at the eastern extent, there is potential for adverse effects to the hydrogeomorphology of the watercourse during the operational phase as it could inhibit the natural processes of the watercourse.	adverse effects to the watercourse and bankside habitat; • Working areas should be clearly defined and movement of vehicles within these areas should be restricted; and • Directing site access away from sensitive habitats and installing track mats to ensure topsoil/landscape is not disturbed as a result of the proposed construction works. Hydraulic modelling has confirmed that there would be no changes to water levels within Lammas Lands during normal conditions and an increase in water levels of 3– 20mm during 1:100 year flood events (less for lower return periods). It is not anticipated that this will result in adverse effects to habitats within SNCIs. It is recommended that the wall is located as far from the watercourse as possible in order to minimise impacts to bankside habitat and allow the watercourse's natural processes to continue. Where this is not possible, recommended mitigation measures would include introducing meanders along Hell's Ditch to modify the flow characteristics that would in turn encourage in channel macrophyte establishment and habitat diversity. It is recommended that the Local Planning Authority Biodiversity Officer is consulted regarding the mitigation strategy for SNCIs.
7	There is potential for there to be locally designated wildlife sites (SNCIs) within close proximity of the CSAs. Data on local wildlife sites within proximity to CSAs was not obtained to inform the OBC. If the proposed works for the CSA are likely to impact upon SNCIs, mitigation measures would be required.	It is recommended that a data search, including details of SNCIs is obtained from the Local Environmental Record Centre, following which an assessment of the likely impact of the scheme on SNCIs should be completed. If an impact on SNCIs is likely to occur, mitigation measures would be required, to be agreed with the Local Planning Authority Biodiversity Officer.
8	A matrix of habitats including scrub, scattered trees, semi-improved grassland, waterbodies, tall ruderal and marginal vegetation is located along the Hell's Ditch river corridor and within the area proposed for CSA, which offers potential for a range of protected species, including otters, water voles, reptiles, nesting birds and roosting, foraging and commuting bats. Invasive species, including Himalayan balsam and bamboo have been identified along Hell's Ditch.	Further ecological surveys and mitigation is likely to be required. Recommended mitigation and enhancement measures will be informed by further surveys to be completed but could include: • Timing works to avoid impacting on species; • Ecologically sensitive construction practices; • Supervision of works by an Ecological Clerk of Works (ECoW) • Planting of native trees and shrubs as part of the landscaping of the scheme. • Log piles and dead wood to be retained on site; • Swales or scrapes to be dug within Lammas Lands to improve the structural diversity of habitats within this area; • Removal or management of invasive species from the site and the surrounding area; • Creation of wetland habitat within the CSA to include planting of appropriate species.
9	There are numerous heritage features in the area including the following Grade II listed buildings: St Andrew's Vicarage, St Andrew's Church Hall (Front Wall, Fence and Gates) and Circular drinking trough in the North of Norbury Park, Harefield Road. The proposed	Recommended mitigation measures could include the use of materials in keeping with the character of the area and planting along the base of the wall to blend the proposed scheme into the surroundings and break up the hard

No	Key Environmental Issues	Recommended Mitigation Measure
	Meadrow Defence will be aligned through the gardens of two listed buildings. The site is also located adjacent to an AHAP and Conservation Area and therefore the works could impact upon the character of the area as well as causing potential adverse effects to buried archaeology.	edge of the wall. This would minimise the potential effect of the scheme upon the setting of the heritage assets. Listed building consent may be required where the wall is aligned through the gardens of listed properties. It is recommended that Historic England and the Waverley Borough Heritage Officer are consulted to agree a mitigation strategy. Further archaeological evaluation and investigation is recommended. The level of further work is to be agreed with the NEAS archaeologist and Local Planning Authority but could include: • Archaeological trial trenching; • Geophysical survey • Analysis of material from future ground investigations • Archaeological watching brief of any excavation or topsoil strip
10	The proposed CSA has been assessed as offering moderate archaeological/ heritage value due to the presence of Scheduled Monuments (SMs); listed buildings and undesignated heritage assets in the surrounding area. There is potential for construction works to impact upon buried archaeology as also for the proposed CSA to adversely affect the character of the area, which could impact upon the setting of nearby listed buildings.	It is recommended that a heritage desk based assessment is completed for the CSA to inform further archaeological evaluation or investigation and mitigation measures that may be required. It is recommended that the proposed storage area is designed sensitively to be in keeping with the heritage setting of nearby features of interest, such as SMs and listed buildings as well as the landscape character of the area.
11	The River Wey at Godalming is within the Wey (Tilford to Shalford) GB106039017820 Waterbody and is not classified as a Heavily Modified Water Body. A Preliminary WFD screening assessment was completed to support the OBC. The assessment concluded that the potential effects of the proposed Meadrow Defence on the identified environmental sensitive receptors, alone and in combination, are anticipated to be minor/negligible and that there would be no adverse/deteriorating affects to existing or future WFD status of the waterbody.	Recommended mitigation/ enhancement measures for WFD include introducing meanders along Hell's Ditch to modify the flow characteristics that would in turn encourage in channel macrophyte establishment and habitat diversity. Further opportunities include: • Creation of swales or backwater habitats in the Lammas Land, or on the left bank downstream of the TPO where a wide buffer strip of bramble and scrub habitat exists between Hell's Ditch and property boundaries. • Selective channel re-profiling or installation of engineered log jams to deflect flows. Deflectors are designed to encourage substrate deposition behind the features that subsequently creates shallow berms, diversifying flow and vegetation establishment. • Introduction of gravels to the system, or/and creation of pool and riffle sections through simple bed manipulation. • Creation of berms alongside the edge of the wall to effectively create a larger buffer between the wall and margins of Hell's Ditch. • Creation of online flood storage areas for the CSA, to include the creation of wetland habitats. • Proposals to lower the land at Tilthams Corner to change the flow dynamics across the flood plain. This would prevent or delay the spill of the Wey at the low point on the opposite bank, which would remove sediment from the flood plain. • Implement fish passage measures at Unstead Lock, using either a bypass channel, technical fish pass or removal of

No	Key Environmental Issues	Recommended Mitigation Measure
		the structure.
11	The Meadrow wall option alignment is located within an area of statutory allotments. These are protected under the Small Holdings and Allotments Act 1908, and the Allotments Act 1925 and cannot be sold or used for other purposes without the Local Planning Authority obtaining consent from Defra. The proposed wall alignment will result in the permanent loss of areas of statutory allotment as well as significant disruption to further allotment areas during the construction phase.	As areas of statutory allotment land will be disrupted and lost as a result of the scheme, provision of alternative allotment land will be required in order to gain consent from Defra. The Environment Agency are in consultation with Godalming Town Council to secure alternative land upstream that has been identified as suitable for use as alternative allotment land. It will be necessary to demonstrate that allotment holders have been consulted and that their views have been taken into account.
9	The Meadrow Defence is aligned within a number of private gardens and therefore damage to gardens is likely to occur during the construction phase.	It is recommended that residents to be affected are consulted throughout the design process and agree a method statement for the works, which will minimise potential adverse effects. This will include ensuring that plant accessing the site are confined to designated routes and track mats are used where possible. Once the works have been completed, planting and landscaping will be required to restore the gardens to their original appearance as far as possible. This will be agreed with residents during consultation.

Table 8: Godalming FAS Environmental Constraints and Opportunities

A scoping request was submitted to Waverley Borough Council (WBC) in May 2016. At the time that the request was submitted, Compensatory Storage Areas were to be included within the scheme. As such, WBC agreed with the recommendation within the Preliminary Environmental Information (PEI) report that a statutory Environmental Impact Assessment (EIA) would be required and agreed with the key issues to be 'scoped in'. These comprised Flora and Fauna; Arboriculture; Landscape/ Townscape; Architecture and Archaeological Heritage; Water; Population; Waste; Use of natural Resources; Soils; Noise and Vibration; Air Quality; Climate Change; Landscape and visual; Transport and Movement; and Socio-Economic Effects. However, if it is determined that the compensatory flood storage is not required, it is considered unlikely that a statutory EIA would be required. However, it is recommended that a screening request is submitted to WBC to confirm this.

Appendix E contains the Preliminary Environmental Information Report, which documents the environmental scoping exercise completed on the scheme. The PEI has assessed the Meadrow Wall option, and recommended mitigation to reduce the impact of the optimised wall alignment and the construction works area and compound. Future construction impacts such as those to designated land, allotments, noise, vibration and access disturbance would need to be avoided or mitigated through implementation of an appropriate Environmental Impact Assessment at the detailed design stage and an Environmental Action Plan.

2.4 Investment objectives

The objectives of the Godalming FAS are discussed in Section 1.2.

2.5 Current arrangements

At a catchment level, the current approach is to have targeted sustainable flood risk management activities reducing the need for maintenance and where possible re-establish the river corridor allowing the river to naturally flood and making use of the floodplain where available. This can

involve de-culverting watercourses where possible, safeguarding areas of open space to use as flood storage areas and reducing fly-tipping to reduce the likelihood of blockages.

The planned maintenance for the River Wey and Hell Ditch in the vicinity of Godalming by the Environment Agency's Asset Performance Team is targeted on known flood risk areas and assets. This includes; River Wey Improvement Scheme weir maintenance and improvements, clearances of debris at known restrictions or trash screens, annual channel maintenance for conveyance, and desilting works to respond to sand deposition at RWIS Statutory and other sites which affect flood risk or navigation.

In 2015 the Environment Agency carried out routine maintenance activities which cost approximately £19.4k per year and these operations were funded by the Environment Agency's FDGIA revenue budget. The current estimate for the River Wey in Godalming is £579k in Present Value (PV) whole life costs for undertaking annual operation and maintenance (100 year duration).

The Environment Agency provides a free flood warning service in Godalming through their Floodline Warnings Direct Service. The town is covered by the River Wey at Godalming, Peasmarsh and Shalford flood warning area. This has 582 properties within it, of which 510 are registered to receive warnings. The aim is to provide a minimum of 2 hours lead time between the flood warning being issued and flooding to property occurring. The Environment Agency also provides a limited groundwater alert service for the Godalming, Shackleford and Hambledon areas.

During flood incidents a Multi-agency incident response is coordinated by the Surrey Local Resilience Forum (SLRF). This comprises of Category 1 and Category 2 responders under the Civils Contingency Act. The group has an agreed Multi Agency Flood Plan (MAFP). During a major incident, responders co-ordinate their actions through the Strategic Coordination Group (SCG) and Tactical Coordination Group (TCG). These may also be known as Gold and Silver respectively. These groups were activated in the 2013/14 floods and the SLRF has carried out a review this.

2.6 Main benefits

The Initial Assessment completed in 2014 and the completion of a new more robust hydraulic model for the Middle Wey in 2015 has identified that a number of flood risk management options are currently viable.

The shortlisted options were assessed in terms of their propensity to reduce flood risk (Appendix A&C). The Meadrow flood wall was concluded as the option that would reduce flood risk the most, when compared to the other shortlisted options. By designing it to the 1 in 200 plus climate change (in line with the 50th percentile in the EA 2016 guidance), the estimated Present Value whole life benefits (PVb) of £11,733k can be achieved by implementing a scheme within Godalming.

There are also a number of additional benefits that could be obtained by implementing options that integrate or support environmental enhancements, habitat creation, WFD improvements and chemical water quality improvements. There is also potential to generate ecological enhancements or deliver these through mitigation within the study area.

2.7 Main risks

A risk review meeting was completed in July 2016 which identifies the key risk of delivering the project between SOC and FBC stage. Table 9 provides details of the key risks at OBC stage

No	Key Project Risk	Adopted Mitigation Measure
1	**Business** – **Partnership funding** is not available to progress a scheme	Formalise the MoU and funding agreements for the OBC.
2	**Business** – Flood alleviation options may cause disruption to the protected habitats/areas, public open spaces, and affect the reputation of the Environment Agency.	Continue consultation with stakeholders and discuss options to manage expectations and minimise disruption.
3	**Modelling:** The Middle Wey hydraulic model has been improved in early appraisal, giving a more robust model, but could be open to challenge if options affect flood risk elsewhere, changing the business case.	Liaise with modelling consultant to understand changes. Hydraulic modelling of options has been finalised for the OBC to demonstrate the impacts and viability. - Undertake modelling of the preferred option at design stage to confirm benefits
4	**Assessment** of **Whole life costs / benefits of options** changes resulting in options being unviable.	Undertake regular c/b review of options, utilising Early Supplier Engagement (ESE). Mitigate key construction risks early with detailed SI / GI to confirm desk-top study findings.
5	**Approvals withheld**, e.g. Natural England, Flood risk permit or Highways, Planning Approval etc.	Continuing stakeholder engagement with the local authorities using developed engagement plans and engagement to show a consistent message of the benefits. Continued consultation including with Local Authorities on planning.
6	**Planning** – Planning application not approved	Undertake regular consultation with landowners, partners and GTC throughout detailed planning stage. Provide detailed modelling analysis of preferred option downstream impacts assessments to sustainable places and LA's.
7	**Programme delays -** increase or risk register programme cost sum is too low	Consult with landowners/organisations Complete detailed design investigations and include costs and planning decision in FBC.

Table 9: Godalming FAS Key Risks and Recommended Mitigation

2.8 Constraints

The key constraints to implementing the Godalming FAS are as follows:

- **Securing external funding** – Full funding for the scheme has been agreed in principle. Initial Assessment and subsequent work has identified this need and scheme viability. Details of the level of partnership funding required for each of the short listed options can be found within this OBC. Agreements to secure this funding from the Sponsor Group partners are being progressed by the PSO team. A MOU has been signed and Collaborative Agreements will be formalised in the next stage for the FBC.
- **Funding allocation (six year programme) -** the scheme is currently identified within the Environment Agency's six year funding plan. Failure to deliver the benefits of the scheme within the specified time constraints may lead to funding being withdrawn.
- **Partner objectives** – objectives of partner organisations may need their outcomes to be achieved alongside delivering scheme objectives. The need to address surface water flooding and any improvements in foul water management is likely to form part of the partnership working arrangement with Thames Water. The National Trust is protective of the navigation and heritage interests through the catchment. Surrey Wildlife Trust/EA are part of the Wey Forward project looking to carry out environmental enhancements.

- **Partner and stakeholder work programmes** – in addition to the above, partner organisations and other stakeholders, such as Thames Water and Scottish and Southern Electric and other utility companies have their own investment programmes, which may constrain the scheme programme.
- **High groundwater levels** – Advice has been obtained from the Environment Agency groundwater specialist. There are two groundwater aquifers in central Godalming, the Hythe significant aquifer and the less significant lower terrace aquifer. This could impact on the effectiveness of technical options being proposed. Additional groundwater investigation, modelling or assessment may be needed.
- **Highways Approvals** – approvals may be required from Highway Authorities for some options. The Environment Agency does not have the powers to obstruct highways. A Compulsory Works Order (CWO) building on the precedent Mimmshall Brook FAS Order may be needed.
- **Protected Habitats and the WFD** – approvals may be required from Natural England for any options that could affect protected habitats. WFD constraints and objective could influence option selection especially if compensatory storage areas are required.

2.9 Dependencies

The key project dependencies are:

- **Planning permission** – it is likely that many of the environmental and technical options will need planning permission, potentially with more than one Local Council (Waverley and Guildford Borough Councils), needing careful and ongoing consultation;
- **Stakeholder / Partner / Public agreement** – in order to secure partnership funding, the Sponsor Group, Flood Group and stakeholders will need to be satisfied that the preferred option delivers the agreed benefits as detailed in later collaborative agreements with the partners /stakeholders. Public consultees will need to be generally in agreement and satisfied that any option has no significant impacts downstream.
- **Environmental Permit** – Environment Agency staff will need adequate time to review the proposals and agree the methodology, so that it does not impact flood risk in line with the new permitting regulations.

3. The Economic Case

3.1 Introduction

The purpose of the Outline Business Case (OBC) is to:

- Identify the spending option which optimises value for money (VFM)
- Prepare the scheme for procurement; &
- Put in place the necessary funding and management arrangements for the successful delivery of the scheme.

The purpose of the Godalming FAS OBC (Economic Case chapter) is to identify the spending option which optimises Value for Money (VfM), in accordance with: Public Sector Business Cases: Using the 5 Case Model Supplementary Guidance, as is outlined below:

Stage 2	Planning the scheme and preparing the Outline Business Case (OBC)	Deliverables
Step 4	Determining potential VFM	Economic case – part 2
Action 9	Revisit SOC and determine short list, including the Reference Project (outline PSC)	
Action 10	Prepare the economic appraisals for short-listed options	
Action 11	Undertake benefits appraisal	
Action 12	Undertake risk assessment/appraisal	
Action 13	Select preferred option and undertake sensitivity analysis	

The economic appraisal for Godalming FAS has been carried out using the methodology defined in Flood and Coastal Erosion Risk Management Appraisal Guidance1 (FCERM-AG) and in accordance with HM Treasury's Green Book.

Depth Damage data for each receptor in the study area has been taken from the Multi Coloured Manual (Flood Hazard Research Centre, 2013), and used to estimate damages in modelled flood events. All receptors in the study area for which the scheme will have a positive or negative impact on flood risk have been considered.

3.2 Critical success factors

The critical success factors (CSF) for the Godalming FAS project have been identified at SOC stage and are identified Table 10:

Item	CSF	Measurement Criteria	Importance (1-5 rank)
A	Strategic fit & business needs	• Meets our partners strategic objectives	2
		• Continues to deliver benefits over the next 100 years, allowing for climate change;	1
		• Is compatible with future schemes to adapt to climate change	2
		• Demonstrates that it does not increase flood risk downstream or elsewhere	1
		• Helps to meet Water Framework Directive targets	3
		• Delivers wider benefits to the local economy	4
B	Potential value for money (VFM)	• Achieves a viable cost benefit ratio and incremental benefit cost ratio, when compared with the other available options	1
		• Delivers efficiencies	3
		• Minimises future maintenance / operational requirements	2
C	Potential achievability	• Fits with the study area's constraints	2
		• Mitigates for adverse effects on water levels and flows elsewhere	1
		• Meets and exceeds requirements under the relevant legislation to secure necessary consents	2

Item	CSF	Measurement Criteria	Importance (1-5 rank)
		• Generates and maintains political and stakeholder support • Follows a clear, timely and deliverable approval route and delivery timeframe • Is integrated with related schemes in the area	1 1 2
D	Supply-side capacity and capability	• A clear delivery model is agreed • The option allows for the establishment of an integrated project team in accordance with the stage of the project • Future maintenance and management is agreed and clearly understood	2 3 2
E	Potential affordability	• Delivers 'Outcome Measures' according to DEFRA's Partnership Funding rules • Employs a joined-up funding strategy • Designs in benefits to potential funding partners	2 1 3

Table 10: Godalming FAS Critical Success Factors

3.3 Long list of options

The long-list of options contained within the Strategic Outline Case (SOC) can be found in Appendix G of this OBC.

As part of this OBC the early work undertaken at SOC stage to determine the long list and preferred way forward has been reviewed and refined.

3.4 Short List Options (Refined)

The short-list of options presented within the Strategic Outline Case (SOC) have been taken forward for full appraisal in the OBC and are presented below:

Short List Option No	Description	Benefits delivered / Risks involved	Comments on viability of option (SOC stage)
0	Do Nothing – Walk away from existing assets; no maintenance	Deterioration of assets results in additional properties becoming inundated.	**For assessment** as economic baseline from which to compare options only
1	Do Minimum – Continue current maintenance regime.	Current level of protection maintained	**For assessment** to compare options against the current condition.
2	Do Something – Two-Stage Swale	Increase conveyance	**For assessment**: Take forward into detailed options appraisal stage
3	Do Something – Two-Stage Swale & Drainage channels	Increase conveyance	**For assessment**: Take forward into detailed options appraisal stage
4a	Do Something – Meadrow Structural Defence & CSA	Increases level of protection to Meadrow, Catteshall Lane, and Wey Court properties.	**For assessment**: Take forward into detailed options appraisal stage
4b	Do Something – Meadrow Structural Defence without CSA	Increases level of protection to Meadrow, Catteshall Lane, and Wey Court properties.	**For assessment**: Take forward into detailed options appraisal stage
5	Do Something – Two-Stage Swale, Drainage channels & Meadow Structural Defence	Increase conveyance and increases level of protection to Meadrow, Catteshall Lane, and Wey Court properties.	**For assessment**: Take forward into detailed options appraisal stage
6	Do Something – Structural Defence – Bridge Road	Increases level of protection to properties on Bridge road, Meadow, Catteshall Lane, and Wey Court.	**For assessment**: Take forward into detailed options appraisal stage

Table 11: OBC – Shortlist options (Refined)

3.4.1 Technical Assessment

Table 12 provides a technical descriptions of each short list option and identifies how any technical risks are to be addressed.

No.	Option Name	Technical Description
0	Do Nothing – Walk away from existing assets; no maintenance	The 'Do Nothing' model scenario simulates the expected flood depth and extent if the Environment Agency were to cease all existing maintenance. This will include failure of assets, through structural collapse, or blockage, and is likely to increase existing flood risk impacts over time.
1	Do Minimum – Continue current maintenance regime.	The 'Do Minimum' is considered to be the scenario which maintains the existing watercourse and asset condition, with no anticipated interventions required.
2	Do Something – Two-Stage Swale	This option is the creation of a 2 staged swale and spillway, by widening existing channel cross sections to improve channel conveyance and flow, and are added to the existing 'Do Minimum' scenario requirements.
3	Do Something – Two-Stage Swale & Drainage channels	In addition to the swales and spillway, the flow conveyance was further increased through the expansion of the channel cross section, through lowering of the Hells Ditch right bank
4a	Do Something – Meadrow Structural Defence & CSA	This option comprises a structural flood wall (i.e. concrete, sheet piles, etc.) to protect the Meadrow properties and will reduce flood risk in an area of property concentration. This option also includes provision of a small compensatory storage area upstream of the Meadrow defence.
4a	Do Something – Meadrow Structural Defence without CSA	This option comprises a structural flood wall (i.e. concrete, sheet piles, etc.) to protect the Meadrow properties and will reduce flood risk in an area of property concentration. This option does not include provision of compensatory storage within the vicinity of the Meadrow defence.
5	Do Something – Two-Stage Swale, Drainage channels & Meadow Structural Defence	This option combines the swales, spillway, expanded channel cross section and structural flood wall.
6	Do Something – Structural Defence – Bridge Road	This option comprises of a structural flood wall (i.e. concrete, sheet piles, etc.) to protect the properties upstream of Bridge Road.

Table 12 – OBC Shortlist options: Technical Assessment

3.4.2 Environmental assessment

As part of the OBC stage a Preliminary Environmental Information (PEI) report has been completed. The PEI which includes the undertaking of a Phase 1 Habitat Survey and environmental screening exercise was undertaken to establish the environmental impact and benefits of each of the shortlist options. The results of this are contained within Appendix E and the results are summarised in Table 13.

No.	Description	Environmental Risks	Environmental Benefits
0	Do Nothing – Walk away from existing assets; no maintenance	Potential adverse effects to ecology, WFD, heritage and landscape.	N/R
1	Do Minimum – Continue current maintenance regime.	Limited benefit to ecology, heritage and landscape	None
2	Do Something – Two-Stage Swale	Potential adverse effects to ecology, heritage and landscape.	Potential for in channel habitat creation.
3	Do Something – Two-Stage Swale & Drainage channels	Potential adverse effects to ecology, heritage and landscape.	Potential for in channel habitat creation.
4a	Do Something – Meadrow Structural Defence & CSA	Potential adverse effects to ecology, heritage and landscape, if wall is close to watercourse banks.	Potential for large area of habitat creation at CSA. Potential for in channel habitat creation.
4b	Do Something – Meadrow Structural Defence without CSA	Potential adverse effects to ecology, heritage and landscape, if wall is close to watercourse banks.	Potential for in channel habitat creation.
5	Do Something – Two-Stage Swale, Drainage channels & Meadow Structural Defence	Potential adverse effects to ecology, heritage and landscape, if wall is close to watercourse banks.	Potential for large area of habitat creation at CSA. Potential for in channel habitat creation.
6	Do Something – Structural Defence – Bridge Road	Potential adverse effects to ecology, WFD, heritage and landscape.	None

Table 13 – Shortlist options: Environmental Assessment

3.4.3 Long list to short list criteria assessment

In accordance with "Public Sector Business Cases: Using the 5 Case Model Supplementary Guidance", the refined shortlist identified has been tested against the following 'long list to short list' criteria:

- Do any of the options fail to deliver the spending objectives and CSFs for the project?
- Do any of the options appear unlikely to deliver sufficient benefits, bearing in mind that the intention is 'to invest to save' and to deliver a positive net present value (NPV)?
- Are any options clearly impractical or unfeasible – for example, the technology or land is not available?
- Is any option clearly inferior to another, because it has greater costs and lower benefits?
- Do any of the options violate any of the constraints – for example, are any clearly unaffordable or increase risk.
- Are any of the options sufficiently similar to allow a single representative option to be selected for detailed analysis?
- Are any of the options clearly too risky?

The assessment of the refined short list options concluded that all options should be taken forward into detailed appraisal in accordance with the methodology defined in Flood and Coastal Erosion Risk Management Appraisal Guidance1 (FCERM-AG) and in accordance with HM Treasury's Green Book. The results of the economic appraisal are presented within Appendix B of this OBC.

3.5 Economic appraisal Approach

For the OBC a full economic assessment of the refined short list options has been undertaken. Flood Risk Benefits for each of the short list options have been derived using the updated Middle River Wey (2015) hydraulic model.

The 'Do Nothing' scenario has been used as the baseline scenario for the Economic appraisal. A 100 year appraisal period has been selected based on the typical life of an Environment Agency structural asset. To enable comparison of options, a typical duration of 100 years has also been used for all short list options.

The approach to estimating damages follows the Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG) whilst Depth Damage data for each receptor in the study area has been taken from the Multi Coloured Manual (Flood Hazard Research Centre, 2013).

Data Sources:

This study has made use of property data from the National Receptor Dataset version 3 (2011), and Depth Damage data for residential and non-residential properties from the Multi Coloured Manual (2015).

LiDAR data has been used to determine ground levels at properties. Threshold Levels for the study have been estimated as 0.1m, and applied as building stubs in the model. As such, no threshold value has been applied in the economics; this may result in a slightly conservative estimate of total damages with any damage occurring below threshold level to gardens and the structure of buildings will not be included.

Model
A new hydraulic model was produced; in order to provide efficiency in the appraisal process this model has been utilised for this study.
The following events were simulated in the Godalming model:
Fluvial Return Periods in years are 1 in 5 (20% AEP), 20 (5% AEP), 50 (2% AEP), 75 (1.3% AEP), 100 (1% AEP) and 200 (0.5% AEP)

Climate change runs have been undertaken for the 100 year (1% AEP) event for Do Nothing and Do Minimum scenarios, and the 75 (1.3% AEP), 100 (1% AEP) and 200 (0.5% AEP) events for optimisation of the preferred option.

3.5.1 Climate change

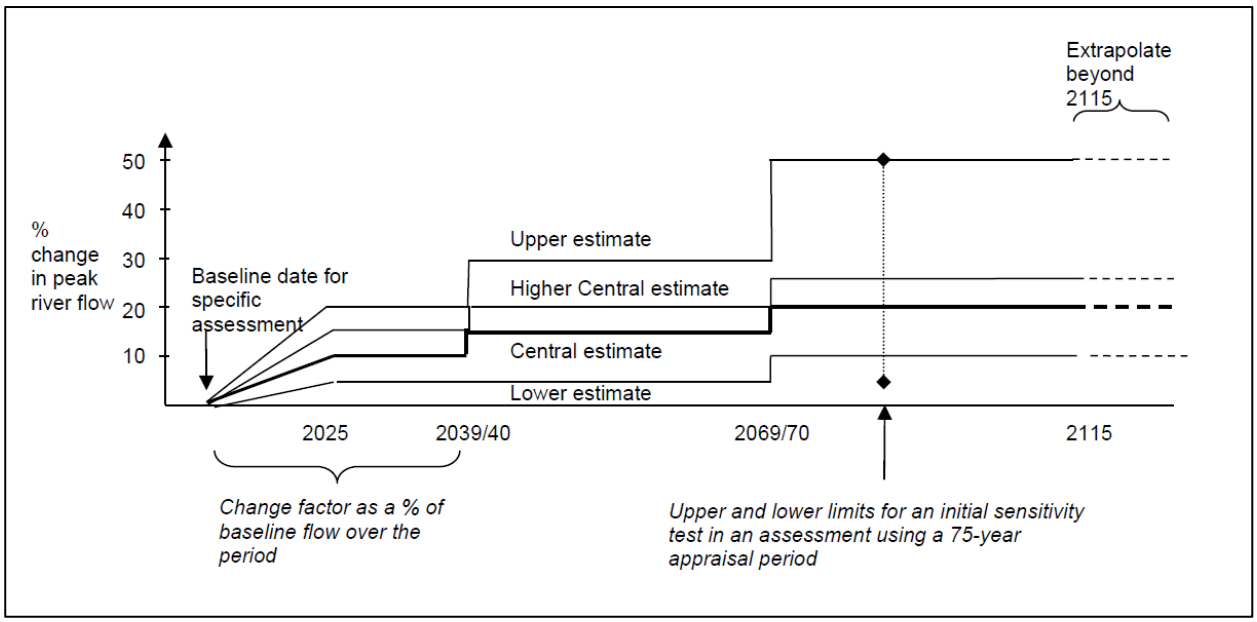
In accordance with the Adapting to Climate Change: Advice to Flood & Coastal Risk Management Authorities1 document, climate change allowances from February 2016 as an increase in peak river flows have been considered. The increases for three climate change epochs are compared to a 1990 baseline. The guidance recommends that the central estimate (50th percentile) is applied to account for the effect of climate change, with additional assessment of the higher central and upper estimates used to determine potential "cliff edge" effects due to larger climate change impacts on peak flows, and an understanding of when the impacts of climate change would result in a significantly reduced Standard of Protection across each estimate.

Thames	2020s (2025)	2050s (2040)	2080s (2070)
Upper estimate (90th percentile)	25%	35%	70%
Higher central estimate (70th percentile)	15%	25%	35%
Central estimate (50th	10%	15%	25%

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

percentile)			

Table 14: Peak River Flow increases in each climate change epoch relative to 1990



3.6 Benefits

Appendix A provides a detailed analysis of how the benefits for each of the shortlist options have been calculated as part of an approximation of the annual damages avoided, discounted over the defined study period, derived from average damage values in the Multi-Coloured Manual (2005 & 2013).

The additional benefits have been calculated using financial damages obtained from the Multi-Coloured Manual (2005 & 2013) and include, but are not limited to:

- Non-residential property damages;
- Road damages;
- Emergency Services costs; &
- Evacuation and temporary accommodation costs

It should be noted that details of the 'Non-Monetary Benefits' (i.e. Ecosystems Services, etc.), can also be found in Section 6.1 of appendix A.

Option	PV Damages (£k)	PV Damages Avoided (£k)	Ecosystem Services Benefits (£k)	PV Benefits (£k)
Do Nothing	21,051	-	-	-
Do Minimum	14,508	6,544	-	6,544
Option 2 - Two-Stage Swale	14,508	6,544	-	6,544
Option 3 - Two-Stage Swale & Drainage channels	14,508	6,544	-	6,544
Option 4a - Structural Defence – Meadrow with CSA	9,318	11,733	150	11,884
Option 4b – Structural Defence – Meadrow without CSA	9,318	11,733	-	11,733
Option 5 – Combination of Options 3 & 4	9,318	11,733	150	11,884
Option 6 - Structural Defence – Bridge Road	15,217	5,834	-	5,834

Table 15: Summary of Short Listed Options PV Benefits

3.7 Costs

The capital costs of each of the options are included in Table 16. These are cash costs and not discounted to Present Value. Costs are assumed to occur in year 1 and will be discounted to Present Value in Section 3.8. The assumptions made in building up these estimates follow.

Table 16: Capital Cash Costs for Options (£k)

	Option 2	Option 3	Option 4a	Option 4b	Option 5	Option 6
	Two-Stage Swale	Two-Stage Swale & Drainage Runs	Meadrow Wall with Compensatory Storage	Meadrow Wall without Compensatory Storage	Combination of Options 3 & 4	Bridge Road Structural Defence
Base Construction Cost	1,776	1,868	2,439	1,653	4,308	439
Fees (Design & Supervision) 20%	355	374	488	331	862	88
Fees (NCF) 6%	107	112	146	99	258	26
Fees (EA Staff) 5%	89	93	122	83	215	22
Lands and Compensation 15%	266	280	412*	219*	692	66
Geotechnical Investigation 2%	36	37	49	33	86	9
Environmental Investigation 3%	53	56	73	50	129	13
Environmental Enhancement & Mitigation	150	150	150	150	150	150
Sub Total	2,831	2,971	3,879	2,467	6,700	813
Risk Allowance (95%ile)	323	323	323	323	323	323
Total Capital Costs	**3,155**	**3,295**	**4,203**	**2,940**	**7,023**	**1,136**

** EA Land Agent Provided Costs*

Construction Costs:
A detailed build-up of construction costs has been completed for each of the options using data from TVO ESE. This means the estimate used in the appraisal is robust.

Fees:
The Fees applicable to each option have been estimated using a percentage of the construction cost; these percentages are assumed based on experience of recent and similar schemes and engineering judgement, and were agreed between the project team.

Surveys and Investigations:
The Geotechnical and Environmental Investigation costs applicable to each option have been estimated using a percentage of the construction cost; these percentages are assumed based on experience of recent and similar schemes and engineering judgement, and were agreed between the project team.

Land Costs:
The baseline costs for the CSA have been estimated based on CSA9 as detailed in the Compensatory Storage Area Technical Report appended to the OBC.

The EA Land Agent (Dalcour Mclauren) has provided lands costs for the Meadrow Defence Wall and CSA9. A conservative approach has been taking to cost estimates in this appraisal, and therefore the upper 'worst case' estimations are used. The lands costs are estimated as follows:

- DS4b Lands Costs (Meadrow Defence Wall only) = £219k
- DS4a Lands Costs including CSA9 = £412k

Remaining 'Do Something' option land costs are assumed at 15% of construction cost.

Environmental Enhancement and Mitigation:
A cost of £150k has been allowed to cover environmental enhancement and mitigation across all options.

Risk Allowance:
A risk allowance has been made based on the outcomes of a risk review and Monte Carlo analysis. The 95%ile value was used to determine the risk allowance for the options costing. Risks were costed and likelihood assessed during a risk workshop between members of the project team. A value of £323k was used as the 95%ile.

Maintenance Costs of Options:
An allowance for O&M costs of £3.4k annually and £9.4k at 5 yearly intervals has been allowed, for all options plus the Do Minimum scenario.

Annual Costs (totalling £3.4k)
Annual costs of £3.4k have been allowed for the following:

- Visual asset inspection – annual condition assessment inspections;
- Operational inspection – annual general inspection and minor maintenance aspects including:
  - operation of drainage flap valves and drainage pump
  - checking flood gate operation and seal condition
- Public Safety inspection – annual safety inspection due to public access to Lammas lands;
- Post storm inspections – pre and post storm inspections and gate closure prior to flood events;
- Annual maintenance – general vegetation management and clearance of land drainage;
- Compensatory storage – inspection, general vegetation management (£1.0k).

Five yearly costs (totalling £9.4k)
Five yearly costs of £9.4k have been allowed for the following:

- Intermittent maintenance activities (assumed to be every 5 years) including:
  - Replacement of gate seals;
  - Cleaning of Brickwork/Coping; &
  - Full service of drainage pump to manufacturers' specifications.

Existing maintenance costs for Reach 2 (Godalming)
Annual costs for the existing maintenance regime are estimated at £19.4k, as identified in the Strategic Appraisal Report (StAR) for Reach 2 (Godalming). This includes:

a) Targeted channel maintenance - vegetation, tree and channel clearance by the EA;
b) Dredging at selected Statutory sites in the Godalming Reach 2; &
c) Maintenance on EA Flood Defence structures.

It is assumed existing maintenance costs would be continued for Do Minimum, Options 3 and 4; for Options 5 and 6 these costs would no longer occur as the new assets would negate the need for this maintenance.

Costs for Thames Water, Waverley Council and other non EA activities are not included.

No additional costs are anticipated in relation to the construction of the CSA. The EA would transfer land maintenance requirements to the landowner, following the completion of the works.

The location is expected to be farmed, through livestock grazing to ensure that the grass at the site is maintained on a regular basis and thus no costs are included.

3.7.1 Cost Summary

The Present Value whole life cost including a Risk Contingency from a Risk Review Meeting (17/02/16) and a 30% Optimism Bias (in line with HM Treasury Greenbook guidance), in addition to scheme construction and maintenance costs is outlined below.

Table 17: PV Capital Costs for Options (£k)

	Do minimum	Option 2	Option 3	Option 4a	Option 4b	Option 5	Option 6
PV Capital Costs	-	3,155	3,295	4,203	2,940	7,023	1,136
PV Maintenance Costs	579	579	579	126	126	705	126
Optimism Bias at 30%	174	1,120	1,162	1,299	920	2,319	379
PV Whole Life Cost	**753**	**4,854**	**5,035**	**5,627**	**3,986**	**10,047**	**1,641**

3.8 Present Values

3.8.1 Stage 1 – Testing for benefits exceeding costs

The average Benefit Cost Ratio (BCR) gives the ratio between PV benefits and PV costs for each option relative to the Do Nothing Scenario. The BCR has been calculated for each short-listed option and is greater than 1 for Do Minimum and all Do Something options; options 2, 3 and 5 are found to be only marginally above 1.

The Net Present Value (NPV) shows the difference between the PV benefits and PV costs of the options.

Option	Total PV costs	Total PV benefits	Net Present value (NPV)	Average benefit cost ratio (BCR)	Incremental benefit cost ratio (iBCR) compared to Do Minimum	Non monetised benefits
Do Minimum	£753k	£6,544k	£5,791k	8.7	-	Infrastructure Education and Health Services
Option 2 - Two-Stage Swale	£4,854k	£6,544k	£1,690k	1.4	-	
Option 3 - Two-Stage Swale & Drainage channels	£5,036k	£6,544k	£1,508k	1.3	-	
Option 4a - Meadrow Defence with CSA	£5,627k	£11,884k	£6,300k	2.1	1.10	
Option 4b - Meadrow Defence without CSA	£3,986k	£11,733k	£7,747k	2.9	1.60	
Option 5 – Combination of Options 3 & 4	£10,047k	£11,884k	£1,880k	1.2	0.58	
Option 6 - Structural Defence – Bridge Road	£1,641k	£5,834k	£4,193k	3.6	-	

Table 18: Summary of the BCRs excluding contributions for the Godalming FAS options

3.8.2 Stage 2 – Identify the leading FCERM option

The BCR of Do Minimum is 8.7; this is the highest BCR and as such following the decision rule in FCERM appraisal guidance (Environment Agency, 2010) this becomes the leading option. The Appraisal Guidance recognises that there can be merit in investing marginally more to achieve greater benefits. Therefore, the incremental Benefit Cost Ratio (iBCR), which is the ratio between PV benefits and PV costs for each option relative to the option with the highest BCR, is used to understand whether it would be cost beneficial to invest in the Do Something options when compared to Do Minimum.

Options 4a, 4b and 5 all have greater PV Benefits than a Do Minimum scenario and the iBCR for these options is therefore considered. Options 2, 3 and 6 are discounted at this stage. The iBCR for Option 5 is less than 1 and it is therefore not considered; furthermore, given that this option also

provides the same PV Benefits as Option 4a but for a greater cost, we can see by inspection that this option will never become the preferred option.

Both Options 4a and 4b have iBCR greater than 1. Therefore, optimisation of these options for a range of Standards of Protection (SoP) is considered to determine what the economic optimum is and whether the iBCR for this justifies promotion of a scheme.

Table 19: Optimisation for Option 4a

Option	Total PV costs	Total PV benefits	Net Present value (NPV)	Average benefit cost ratio (BCR)	Incremental benefit cost ratio (iBCR) from Do Minimum	Incremental benefit cost ratio (iBCR) from Previous Option
Do Minimum	£753k	£6,544k	£5,791k	8.7	-	-
Option 4a – 75 Year SoP	£5,613k	£10,251k	£4,638k	1.8	0.76	0.76
Option 4a – 100 Year SoP	£5,627k	£11,884k	£6,257k	2.1	1.10	115.47
Option 4a – 200 Year SoP	£5,717k	£12,448k	£6,731k	2.2	1.19	6.26

The Meadrow Structural Defence with CSA (Option 4a) and a 75 Year SoP has an incremental Benefit Cost Ratio (iBCR) of 0.76 compared to Do Minimum. In accordance with the decision rule, an iBCR of 1 or greater must be achieved to promote an option with a SoP of up to 1 in 75 years (1.3%AEP). Therefore, Do Minimum remains the leading option in this case. Whilst 1 in 100 (1% AEP) and 200-year (0.5% AEP) SoPs have also been considered, the decision rule states that the iBCR to promote these options would need to be greater than 3 for SoPs greater than 75 up to 200 years, and greater than 5 for SoPs of 200 years and greater. These criteria are not met and thus Option 4a is discounted.

Table 20: Optimisation for Option 4b

Option	Total PV costs	Total PV benefits	Net Present value (NPV)	Average benefit cost ratio (BCR)	Incremental benefit cost ratio (iBCR) from Do Minimum	Incremental benefit cost ratio (iBCR) from Previous Option
Do Minimum	£753k	£6,544k	£5,791k	8.7	-	-
Option 4b – 75 Year SoP	£3,972k	£10,100k	£6,128k	2.5	1.10	1.10
Option 4b – 100 Year SoP	£3,986k	£11,733k	£7,747k	2.9	1.60	115.47
Option 4b – 200 Year SoP	£4,076k	£12,298k	£8,222k	3.0	1.73	6.26

The Meadrow Structural Defence without CSA (Option 4b) for a 75-Year (1.3% AEP) SoP has an incremental Benefit Cost Ratio (iBCR) of 1.10 compared to Do Minimum. Therefore, this option becomes the leading option in accordance with the decision rule; we now consider whether this is the optimum SoP by considering a 1 in 100-year (1% AEP) in comparison with the 75 year (1.3% AEP) SoP. The decision rule states that the iBCR here must be greater than 3; the iBCR for the 100-year (1% AEP) SoP compared to 75-year (1.3% AEP) SoP is 115.47 reflecting the large increase in benefits for relatively minor increase in costs. Therefore, the 100-year SoP (1% AEP)

becomes the leading option. Next we consider the 200-year (0.5% AEP) compared to the 100-year (1% AEP) where we have an iBCR of 6.26. The decision rule states that an iBCR greater than 5 is required to promote a 1 in 200-year (0.5% AEP) SoP; therefore, the 200-year SoP scheme becomes the preferred option.

Following the Appraisal Guidance, the impact of contributions will next be assessed in order to see whether this will impact upon the preferred option.

3.8.3 Stage 3 - Contributions

The BCR results can be influenced by including contributions. The Appraisal Guidance states that 'to take account of contributions, you should subtract any contributions from sources other than FCERM funding from the project costs'. The reduction in costs to the Treasury will see a more favourable BCR and therefore 'considering costs to FCERM funding only could change the order of [the] options' (FCERM-AG, Environment Agency, 2010).

Contributions are only considered for Option 4b, and based on the assumption that sufficient will be found to give an adjusted score of 100% in the Partnership Funding (PF) Calculator for each SoP.

Table 21: Summary of BCR Including Contributions

Option	PV Contributions	PV Costs to EA	PV Costs for Approval (FDGiA upfront)	Total PV benefits	NPV	BCR	iBCR (from DM)
Do Minimum	-	£753k	-	£6,544k	£5,791k	8.7	-
Option 4a – 75 Year SoP	£3,161k	£811k	£685k	£10,100k	£9,289k	12.5	-
Option 4a – 100 Year SoP	£3,056k	£930k	£804k	£11,733k	£10,803k	12.6	-
Option 4a – 200 Year SoP	£3,113k	£963k	£837k	£12,298k	£11,335k	12.8	-

Table 21 shows that for Option 4b, a scheme with sufficient contributions to give an adjusted PF score of 100% would become the leading option based on BCR, with BCR for each SoP being greater than Do Minimum. The 200-year (0.5% AEP) SoP remains the preferred option but requires more contributions that the 100-year (1% AEP) scheme.

3.8.4 Stage 4 - Uncertainty

There is a high level of confidence in the results of modelling and in the costing of options by the ECI partner; as such these elements of work are considered robust.

The Risk Value of £323,415 has been included in addition to the baseline costs and is in line with the submitted SOC Risk Register (95th percentile risk value), which is included within the OBC Appendices for reference. The 95th percentile Risk Value has been included within the economic assessment in order to ensure a robust and conservative appraisal has been undertaken. It is anticipated that should the project progress to Detailed Design and Construction uncertainty should reduce, which will be reflected in a revised Risk Register. Furthermore, a general uplift on all costs is included as a 30% optimism bias at this stage in line with appraisal guidance.

3.8.5 Stage 5 – Wider objectives/outcomes

Table 22: Analysis of the success of Option 4 at meeting wider objectives

Option 4 – Meadrow Defence Option		
Objective	**Description**	**Evaluation**
Objective 1	Promote a jointly funded scheme and work with our partners to reduce fluvial and other sources of flood risk to people and property	**Achieved** – The defence wall for Meadrow properties has been designed to maximise the flood protection to properties based on fluvial modelling assessment.
Objective 2	Promote a scheme which provides the economically optimal standard of protection that is resilient and adaptive to climate change	**Ongoing**– as demonstrated by this economic analysis, there is an economically viable scheme if sufficient third-party contributions are secured. The wall height has been calculated to include uncertainty for climate change and a 1:100CC scenario has been considered in this economic analysis. A sensitivity analysis has also been undertaken for the wall height for the 90th percentile CC event, this will inform the decision on adaptive climate change for future events.
Objective 3	Deliver an option which helps create a better place, maximise environmental outcomes for people and wildlife, and contribute to WFD objectives where practicable	**Achieved** – As detailed within the Preliminary Environmental Investigation (PEI). Costs have been included for WFD improvements – *Assumed within landscaping costs for the compensatory storage area construction.*
Objective 4	Minimise and mitigate for adverse impacts and safety and environmental risks that may result from the scheme	**Achieved** – Costs have been provided for a sheet pile wall; this is less detrimental in terms of land take compared to a bund or RC T-Wall. The decisions made to achieve this objective are included in a separate preferred option technical report
Objective 5	Consult with the wider community and stakeholders using working with others principles and demonstrate that their response has been considered and shaped the scheme	**Ongoing** – consultation is ongoing with riparian owners regarding optimised alignment. Consultation with local landowners has been positive at Outline Design stage and there is support from the local population for the scheme, evidence for this is provided within the PEI

3.9 Preferred option

The leading FCERM option is Option 4b with a SoP of 1 in 200-years (0.5% AEP). Table shows that Option 4b fulfils a number of wider objectives to an extent much greater in terms of flood risk reduction and social benefits compared with continuing with the Do Minimum scenario.

Table 22 provides evidence which satisfies the statement in the FCERM-AG Table 8.3 - 'Does the extent to which wider objectives are achieved affect the choice of the leading option', and therefore suggests that the 'Do Something' option can be considered as the preferred option, as it achieves a wider range of objectives compared to the 'Do Minimum' option.

3.10 Sensitivity analysis

3.10.1 Sensitivity to changes in costs and benefits

A sensitivity has been undertaken to understand whether the preferred option will change due to any unforeseen increase or decrease in costs or benefits.

Table 23: BCR with Adjusted Costs

	Change in Costs (assumed FDGiA funded)				
	Existing	+10%	+20%	-10%	-20%
Do Minimum	8.69	7.90	7.24	9.66	10.87
Option 2	1.35	1.23	1.12	1.50	1.69
Option 3	1.30	1.18	1.08	1.44	1.62
Option 4a	2.11	1.92	1.76	2.35	2.64
Option 4b	2.94	2.68	2.45	3.27	3.68
Option 5	1.19	1.08	0.99	1.32	1.48
Option 6	3.56	3.23	2.96	3.95	4.44

Table 24: iBCR with Adjusted Costs

	Change in Costs (assumed FDGiA funded)				
	Existing	+10%	+20%	-10%	-20%
Do Minimum	-	-	-	-	-
Option 2	0.00	0.00	0.00	0.00	0.00
Option 3	0.00	0.00	0.00	0.00	0.00
Option 4a	1.10	0.98	0.89	1.24	1.42
Option 4b	1.60	1.43	1.29	1.83	2.13
Option 5	0.58	0.52	0.48	0.65	0.74
Option 6	-0.80	-0.67	-0.58	-0.98	-1.27

Table 25: BCR with Adjusted Benefits

	Change in Benefits				
	Existing	+10%	+20%	-10%	-20%
Do Minimum	8.69	9.56	10.43	7.82	6.95
Option 2	1.35	1.48	1.62	1.21	1.08
Option 3	1.30	1.43	1.56	1.17	1.04
Option 4a	2.11	2.32	2.53	1.90	1.69
Option 4b	2.94	3.24	3.53	2.65	2.35
Option 5	1.19	1.31	1.42	1.07	0.95
Option 6	3.56	3.91	4.27	3.20	2.84

Table 26: iBCR with Adjusted Benefits

	Change in Benefits				
	Existing	+10%	+20%	-10%	-20%
Do Minimum	-	-	-	-	-
Option 2	0.00	0.16	0.32	-0.16	-0.32
Option 3	0.00	0.15	0.31	-0.15	-0.31

Option 4a	1.10	1.34	1.58	0.85	0.61
Option 4b	1.60	1.97	2.33	1.24	0.88
Option 5	0.58	0.71	0.84	0.45	0.32
Option 6	-0.80	-0.14	0.51	-1.46	-2.11

It was assumed any change in costs would be to costs incurred to FDGiA. The results show that the changes would not impact on the leading option which would remain Do Minimum without contributions and would become Option 4b through the decision process and iBCR except in the scenario were benefits decrease by 20%. This is not considered likely given the conservative approach taken to estimating benefits from a scheme. Given the detailed costing exercise undertaken, risk and optimism bias applied, the costs for the schemes are considered robust.

3.10.2 Sensitivity to climate change

The climate change higher central (70th percentile) and upper (90th percentile) estimates are recommended for use in sensitivity testing and to help build resiliency into the option if required.

The increased Baseline Construction Cost for option 4b using a higher central and an upper climate change estimate have been calculated. The increase in wall height has been determined in the Meadrow Defence Technical Report. This sensitivity analysis accounts for climate change as a result of increased wall height and selecting a steel sheet pile of length 6.5m on average compared to 6.0m used for a central estimate. The whole life costs increase as a result; Table 27 and Table 28 show the associated BCR's and iBCR's.

No contributions have been assumed.

Table 27: BCR summary for Option 4b using Higher Central Climate Change

Option	Total PV costs	Total PV benefits	NPV	BCR	iBCR (from previous SoP)
Do Minimum	£753k	£7,144k	£6,391	9.5	-
Option 4b – 75 Year SoP	£4,031k	£11,142k	£7,111k	2.8	1.22
Option 4b – 100 Year SoP	£4,074k	£13,342k	£9,268k	3.3	50.79
Option 4b – 200 Year SoP	£4,125k	£13,806k	£9,681k	3.3	9.06

Table 28: BCR summary for Option 4b using Upper Climate Change

Option	Total PV costs	Total PV benefits	NPV	BCR	iBCR (from previous SoP)
Do Minimum	£753k	£7,295k	£6,543k	9.7	-
Option 4b – 75 Year SoP	£4,089k	£11,641k	£7,552k	2.9	1.30
Option 4b – 100 Year SoP	£4,161k	£15,305k	£11,144k	3.7	50.54
Option 4b – 200 Year SoP	£4,174k	£15,682k	£11,508k	3.8	30.45

The impact of an increase in climate change is to increase the BCR and iBCR for option 4b. Whilst the iBCR for a 100-year (1% AEP) SoP scheme reduces, it is still significantly above the decision rule value of 3. This is due to the low increase in a costs in comparison with a higher increase in damages avoided and thus the scheme is more robust to larger estimations of climate change. Therefore, the overall decision remains consistent, with a 200-year SoP scheme the preferred option.

3.10.3 Sensitivity Analysis Summary

As a result of the sensitivity analysis of the economic assessment undertaken in this report the following conclusions are drawn about the preferred option:

- Option 4b is the preferred scheme and is economically viable with a BCR greater than 1 despite changes in uncertainties demonstrated by the sensitivity analyses;
- Increases or decreases in costs or benefits do not impact upon the preferred option;
- The impact of increases in estimated climate change are relatively low but strengthen the case for Option 4b.

3.10.4 Availability of Contributions & Partnership Funding Calculators

The results of the economic appraisal have been used to assess funding arrangements and determine the eligible FDGiA funding for any scheme.

With contributions secured, Option 4b for a 200-year (0.5% AEP) SoP is the preferred option; the Partnership Funding Calculator for this option has been used to determine the level of funding required to achieve an adjusted score of 100%. This will allow for the project team to understand the level of external contributions required.

Table 29: PF Calculator Results

	Raw Score	Contributions Required	Adjusted Score	Eligible Up Front FDGiA
Option 4b – 200 Year (0.5% AEP) SoP	24%	£3,113,192	100%	£837,357

3.11 Conclusions

The economic analysis for the Godalming scheme has concluded that:

- Options 4a and Option 4b, the Meadrow Structural Defence with and without CSA, are options that satisfies the wider project objectives to a greater extent than a Do Minimum scenario;
- There are no benefits from damages avoided through the inclusion of CSA, and only relatively minor Ecosystems Services benefits are attained;
- Option 4b without CSA is preferred as the BCR is greater than Option 4a and the iBCR for inclusion of CSA is insufficient to justify its inclusion;
- A 1 in 200-year (0.5% AEP) is the preferred Standard of Protection.
- Contributions of £3,113k are required to progress Option 4b as the preferred option with an adjusted PF score of 100%;
- FDGiA of £837k towards the upfront costs of the scheme would be recommended if these contributions are secured;

It is recommended that:

- Contributions are sought to ensure the viability of the scheme;
- The Meadrow Defence Wall alignment is optimised further to establish whether ancillary contributions can be made to enhance the economic case;
- A decision is made by the project team, following agreement with Sustainable Places regarding the inclusion of the Compensatory Storage Area within the scheme, as the construction of the CSA significantly affects the amount of contributions required to achieve a viable scheme and there are no benefits from damages avoided by its inclusion.
- Assuming the above points are taken into consideration, the scheme is taken forward to Detailed Design and Full Business Case.

4 The Commercial Case

4.1 Introduction and Procurement Strategy

The Godalming FAS project will follow a traditional approach to delivery. The stages in delivery and anticipated dates for these stages are in Table 15 in Section 5.1.3. The following services are required to be procured between are this OBC stage:

1. WEM Lot 3 supplier to undertake detailed design and ground investigation surveys
2. WEM Lot 4 supplier to undertake ESE
3. NCMF2 supplier to deliver cost consultancy services
4. NEF designated supplier to deliver land agent services

A Procurement Strategy for the appraisal stage was signed off in December 2014 and is contained within Appendix G This confirmed the approach which is Section 1.4.

4.2 Key contractual terms & risk allocation

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- Detailed Design Consultant: This has been let under a WEM Lot 3 PSC Option C Target Cost on the individual contract.
- Principal Contractor role: Directly allocation using a PSC Option E.
- Cost Consultancy services will be re-tendered under the new NCMF2 framework as a packed commission for the Wey FAS, Wey Weirs Refurbishment project and Marlow FAS.

The new procurement strategy will agree contract forms and approach going forward.

4.3 Procurement route, strategy and timescales

The strategy and routes are discussed above. The procurement activities and timescales are shown in the project programme in Appendix F.

4.4 Efficiencies and commercial issues

During the development of this project, an efficiencies register (CERT) will be kept, and reviewed on a monthly basis, with the outcomes feeding into quarterly reports and submissions to PPMT. At each subsequent stage of the project an examination of achievable efficiencies targets will be set out, in line with the EA aspirations to deliver 16% efficiencies across their six year programme. Areas of innovation will be identified as the project develops.

5 The Financial case

5.1 Financial summary

As part of this OBC the project programme presented in the SOC has been updated in line with the delivery requirements of the recommended preferred Option (Option 4b).

Milestone Description	Est. Start date	Est. End date	Asset to be created?	Budget Required £k	Staff (FTE)
OBC approval by Project Board (Gateway 2)	Feb 17	Feb 17	N		-
Appoint Suppliers (Detailed Planning)	Feb 17	Feb 17	N		-
Detailed Design	Feb 17	Oct 17	N		2.5
Detailed Design Sign Off	Nov 17	Nov 17	N		1.2
Submission of Planning	Aug 17	Nov 17	N		2.5
Panning approval	Nov 17	-	N		
FBC submission	Nov 17	-	N		1.2
FBC approval (Gateway 3)	-	Dec 17	Y		2.5
WEM Lot 4 contract award	-	Dec 17	Y		1.4
Construction	March 18	March 19	Y		0.2
Readiness for service (Gateway 4)	March 19	N/A	Y		0.1
Defects period (Gateway 5)	March 19	March 20	N		0.1
Project Closure (Gateway 6)	May 20	N/A	N		0.1
Total	-	-	-		

Table 30: OBC programme milestones

Appendix F contains a detailed project programme for the delivery phase of the project.

The planned profile of costs for the preferred option over the lifetime of the project is presented below.

Project Summary £k	Prior (sunk)	Yr 0 '16-17	Yr 1 '17-18	Yr 2 '18-19	Yr 3+	Total
Staff	TBC	TBC	TBC	TBC	-	
Initial investment:-	-			-	-	
➢ Capital cost	TBC	TBC	TBC	TBC		
➢ Revenue cost	-	-	-	-		
Future costs	-	-	-		125.7	125.7
Project Total	**n/a**					

Table 31: Total Cost profile over lifetime of asset

The project programme and cost profile will be updated as part of the FBC once planning permission and construction costs have been confirmed.

5.2 Funding sources

To date the project has received FDGIA and levy funding for the appraisal stage. This funding has been used to develop the project up until the current OBC stage.

As part of this OBC a full appraisal of options has been undertaken with Option 4b – Meadrow Structural Defence (without CSA) being selected as the preferred option.

A partnership funding calculator for the preferred option has been completed which identifies the level of funding require to deliver the scheme and maintain the asset over its life time. A copy of the partnership funding calculator for the preferred option is included within Appendix A.

Based on the economic analysis undertaken the FCRM partnership funding calculator has confirmed:

- Total capital cost of delivering the scheme (Excluding future maintenance) = £3,950,550
- Total PV FCRM GIA = £837,357

In order to deliver the scheme £3,113,192 of external contributions would be required. Funding partners have been identified and have agreed to contribute towards the capital costs of the scheme. Table 30 below identifies an annualised funding profile for the scheme going forward:

Annualised funding profile (£k)	**Yr 0 16-17**	**Yr 1 17-18**	**Yr 2 18-19**	**Yr 3 19-20**	**Yr 4+**	**Total (k)**
Grant in Aid			-	-		
Thames Region FD Levy Funding						
Partnership funding:- Surrey County Council Waverley Borough Council Godalming Town Council						
Other Contributions: Local Business etc						
Project Total						

* **Table 32: Annualised funding profile**

5.3 Impact on revenue and balance sheet

The impact on revenue and capital budgets as a result of the project and over subsequent years is presented in Table 30 above.

Following the completion of the project a Flood defence asset in the vicinity of Meadrow, Godalming will be created. The new asset is planned to be constructed and operational in spring 2019. Technical details of the new Flood Defence asset are contained within Appendix B.

5.4 Overall affordability

The current overall costs and impact of the project over its lifespan are summarised in Table 32 below.

Annualised spend profile (£k)	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4+	Total
Staff costs						
External Consultant fees (who and for what)						
Purchased goods /services or construction costs (list)						
Other: (list)						
Other: (list)						
Risk contingency						
Inflation (2.5%)						
Initial Investment (appraisal , design & construction)						
Future costs:						
- revenue (PV post construction & Maintenance)						125.7
- capital (Intervention not required)						0
Project Whole Life Costs						**3950**

Table 31: Summary of Costs over the Project Lifecycle

6 The Management Case

6.1 Project Management

The Godalming Flood Alleviation Scheme forms part of the River Wey Flood Alleviation Schemes package, and is both an integral part of the indicative Thames RFCC 6 year programme. A management structure with the Area Portfolio Board, Project Board and Project Team has been identified with stated roles and responsibilities. A project plan has also been outlined. The project will be managed in accordance with the PRINCE2 accredited methodology against key milestones in Section 5.1.3.

6.1.1 Project structure and governance

The project will be managed in accordance with PRINCE2 methodology. PRINCE2 is an approach already well embedded within the Environment Agency and is used throughout our supply chain. The governance structure for the production of this OBC is illustrated below (see Figure 2). This governance and assurance relies on a Sponsor Group, Project Board and Project team as detailed below:

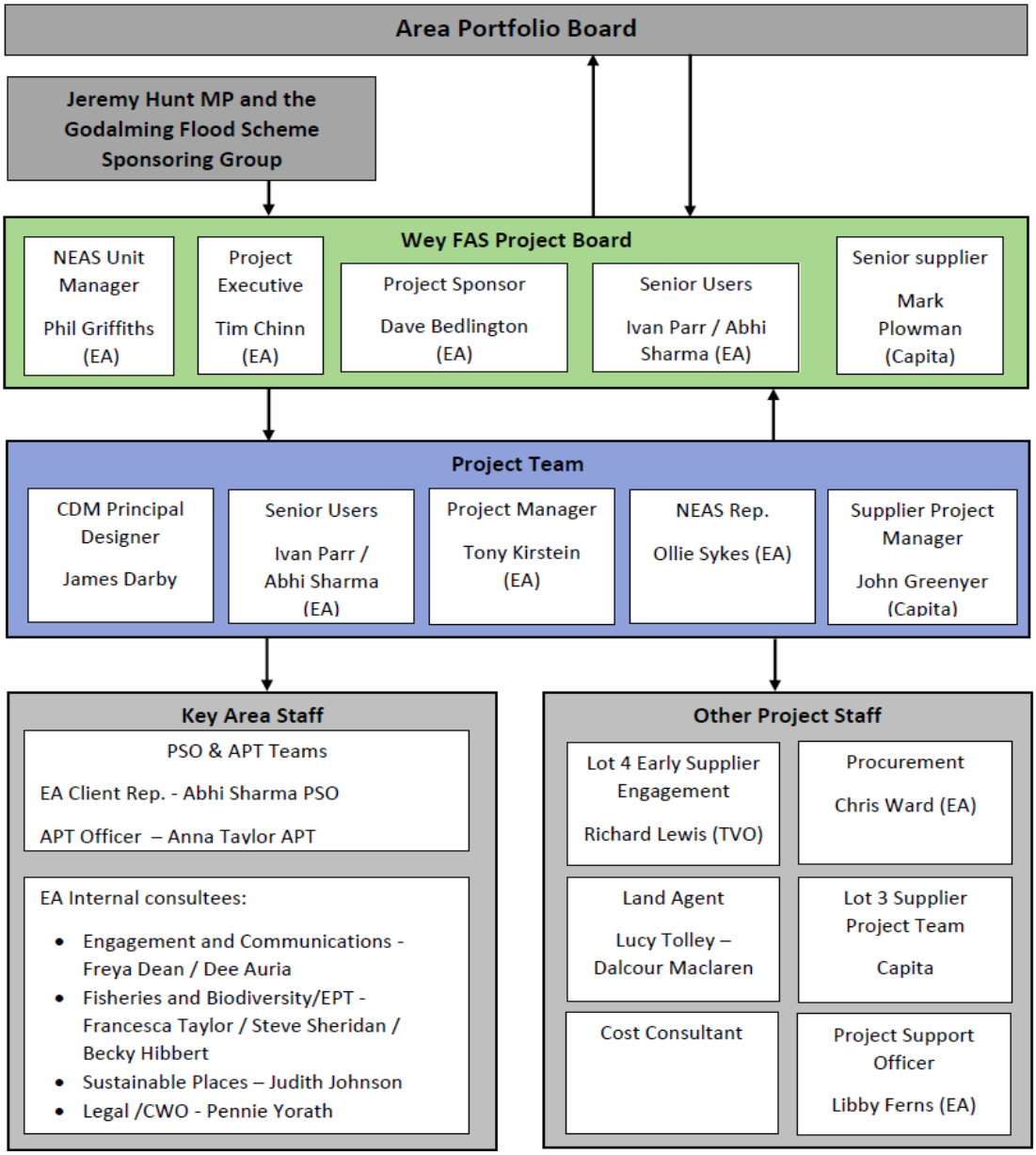

Figure 2: Project structure and organisation

6.1.2 Outline project roles and responsibilities

The governance below is noted in the Memorandum of Understanding:

The Environment Agency, on behalf of the Parties, will manage the overall programme for the Scheme and appoint a Project Sponsor. The Project Sponsor will be accountable to the Sponsoring Group for delivery of the programme, including stakeholder engagement, assurance reviews and approvals.

The Sponsoring Group is responsible for the investment decision, defining the direction of the business and ensuring the ongoing overall alignment of the project to the strategic direction of the organisations.

The Project Board that will deliver the Scheme will support the Project Sponsor in driving forward the programme to deliver the outcomes and benefits. The representatives on the Sponsoring Group and Programme Board will ensure effective liaison between the parties.

The governance organisation structure will be regularly reviewed and amended as required to reflect changes in the programme and the parties. See also, the MOU Annex 2 for Sponsoring Group Terms of Reference.

David Bedlington, Area FCRM Manager West Thames, is the Project Sponsor. He has the following responsibilities:

- Confirming the strategic direction against which the project is to deliver;
- Resolving strategic and directional issues;
- Securing and approving (internal and external) partnership funding for the project.
- Aligning the strategic direction of the project with that of the organisations corporate plan and political environment;
- Engaging local support and political will to drive and progress the project;
- Endorsing partnership and collaborative working to deliver the project;
- Endorsing and supporting the project through the approval gateways;
- Championing the project: leading by example' communicating the benefits to all stakeholders and gaining wider political support;
- Providing continued commitment and endorsement in support of the project objectives at executive and community events; &
- Confirming successful delivery and sign-off of the project.

The Project Board is the main decision making board and its purpose is to drive the project forward and deliver the outcomes and benefits within the tolerances set by the Project Sponsor. The Project Board will have the following responsibilities:

- Resolving strategic and directional issues, which need the input and agreement of senior stakeholders to ensure progress on the project;
- Ensuring the project delivers within the agreed parameter (cost; organisational impact; expected/actual benefits realisation etc.);
- Defining an acceptable risk profile and risk thresholds for the project; &
- Providing assurance through the project lifecycle.

The Project Team comprises the Project Manager, Principal Designer, Senior User(s), NEAS representative and external Supplier Project Manager. The project team will work with key staff and other project team members to deliver the work within tolerances set by the project board.

6.1.3 Project plan

The project plan or programme is a living document. The OBC programme, which includes projected dates up to and including the FBC and construction has been included within Appendix F The programme will be re-visited as the project progresses. Key current milestones are listed in Table 12, below.

Milestone Description	Est. Start date	Est. End date	Asset to be created?	Budget Required £k	Staff (FTE)
Appoint appraisal consultant, ESE supplier and NCMF cost consultant	Feb 15	Apr 15	N	21.0	-
SOC approval (Gw1)	Mar 16	May 16	N	39	-
Appraisal and OBC	Feb 15	Aug 16	N	184	2.5
OBC approval (Gw2)	Sept 16	Oct 16	N	10	1.2
Detailed design and detailed planning	Nov 16	Mar 17	N	546	2.5
Lot 4 Tender	May 17	June17	N	10	
FBC Approval (Gw3)	June 17	July17	N	10	1.2
Construction	June 17	Mar 18	Y	1,691	2.5
Readiness for service – defence in place (Gw4)	-	Nov 18	Y	6	1.4
Defect period	Mar 18	Mar 19	Y	10	0.2
Project closure (Gw5)	-	June 19	N	10	0.1
Total	-	-	-	**2,537**	-

Table 32: Project Plan

6.2 Communications and Stakeholder engagement

A Stakeholder Engagement Plan has been produced detailing the project stakeholders and the approach to consultation with each group of stakeholders. This uses use the Environment Agency's "Working with others" approach to analyse stakeholders. A consultation letter will be produced early in the project and used to introduce the project to consultees, obtain baseline data and views on the project and ultimately set the scene for future consultation and further environmental assessment.

To date, the Godalming FAS has had a number of key consultation meetings, most notably:

January 2016 – Public Meeting at Godalming Town Hall. This was an opportunity to review and discuss the shortlisted options with local residents and business owners. The meeting was attended by local MP, Jeremy Hunt, the EA project board, PSO, NEAS and the supply chain consultant. Over 80 people attended the four hour event, with the Godalming FAS receiving overwhelming support.

April/May 2016 – Meadrow Residents meeting. A number of face to face meetings were held with each of the Meadrow residents to discuss and agree the preferred option alignment and finishes. Each of the residents supported the scheme, but requested the project team explore an alignment closer to the rivers edge, in order to reduce disruption to their own property gardens.

April 2016 – Godalming Town Council meeting. This was held, during the same time as the residents meetings, in order to maintain the positive close working partnership between GBC and the EA. The preferred option alignment and finishes were reviewed, and the propensity of using the existing allotments as a site compound and works access area. It was agreed that the proposals would be beneficial and that GBC would assist the EA in negotiations with the Godalming Allotment Association.

April 2016 – Godalming Allotment Association meeting. Towards the end of the residents meetings, the EA NCPMS, supply chain PM and EA lands agent, along with GBC representatives

met with the GAA to discuss and agree the principles behind the Meadrow flood defence. In addition the use of the existing allotments land as a site compound and works area was discussed. The GAA broadly agreed with the necessity of the preferred option, and with the use of the allotments during the construction period. However, like the Meadrow residents they asked the project team to explore an alignment closer to the rivers edge, in order to reduce disruption to their allotments, once reinstated.

For the FBC, the project's Environmental Project Manager (NEAS representative) will lead on consultation with all statutory consultees. The PSO team will take ownership of communications and media for this. The Project Manager shall lead on consultation with all other (public and non-statutory) consultees. Feedback from regular Sponsor and Flood Group Meetings and initial consultation on the options has been positive with strong support for the preferred way forward.

6.3 Change management

The Project Board retains accountability for project delivery and operates within agreed tolerances set by the Area Portfolio Board (APB). Any deviation from agreed tolerances will be first agreed by the APB. The representation of the Senior User(s), representing the PSO Team and (Area) Asset Performance Team on the Project Team throughout the project will help to ensure that the Scheme meets the needs of the End User. Their involvement will help to implement change within the business and keep the project focused on their requirements.

6.4 Benefits realisation

A Benefits Realisation Plan covering what benefits can be realised, has been completed as part of this OBC. Benefits will continue to be measured throughout the next stages of the project (i.e. Full Business Case). This will state who is accountable for the expected benefits, how and when achievement of expected benefits will be measured and what resources are needed to carry out the work. Consideration will also be given to whether dis-benefits should be measured and reviewed. It is anticipated that benefits will be split into three categories:

- Financial – cashable (cash releasing);
- Financial – non cashable (cost avoidance); &
- Non-financial.

The Project Manager will work closely with the Project Board to profile anticipated benefits and report efficiencies using the CERT reporting tool.

6.5 Risk management

The NCMF2 consultant with input from the project team has produced an initial project risk register for the SOC and this will be developed and reviewed in subsequent phases. The NCMF2 and WEM supplier shall take the lead in project risk management throughout the appraisal process. The process will follow the requirements of the *Employer's* Operational instruction 152_10 Manual of technical guidance for risk management in ncpms projects. The risk management process will have the following objectives:

- Identify and manage risks to the delivery of the appraisal package contract such that the outcomes are achieved as efficiently as possible;
- Identify and actively manage potential show stoppers as early as possible such that abortive work is avoided;
- Identify and take steps to manage significant risks to the future implementation of the preferred way forward. This may include undertaking site investigations to gain an understanding of the risks, the mitigation required and the costs associated with different aspects
- Calculate risk budgets using a Monte Carlo analysis, or appropriate risk analysis methods;
- Clearly document residual risks to support the business plan submissions; &
- Set a risk budget for approval that is realistic for the levels of project risk involved.

6.6 Contract management

Contract management will be the responsibility of the Project Manager who will liaise throughout the project with Procurement and commercial teams on a regular basis to manage suppliers against the contracts.

6.7 Assurance and post project evaluation

See Section 1.6.

6.8 Contingency plans

The four projects contained the River Wey Flood Alleviation Package will be treated separately for business case approval purposes. The WEM Lot 3 tendering process has been completed prior to the completion of this OBC. If one of the project OBCs does not get (or is delayed) approval, the project team will review the situation and assess the merits of delaying approval of the appraisal package PSC until all OBCs are approved; or award a PSC for the approved project and award the additional work as a CE when both OBCs are approved.

6.9 Gateway review

A further Gateway Review are planned following the submission of the preceding business plans. This will be: Full Business case (FBC).

I confirm that the documentation is ready for submission to NPAB. I, as Project Executive, have ensured that relevant parties have been consulted in the development of this project and the production of this submission in particular the Project Sponsor and Senior Users.	
Name	Tim Chinn
Job Title	ncpms Projects Team Manager
e-mailed approval & date	??????

APPENDICES

Appendix A: Godalming FAS Economic Report

Appendix B: Godalming FAS Options Technical Report

Appendix C: Godalming FAS Options Modelling Report

Appendix D: Godalming FAS Compensatory Storage Report

Appendix E: Godalming FAS Preliminary Environmental Investigation

Appendix F: Godalming FAS Programme

Appendix G: Previously Approved Godalming FAS SOC