



Department  
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# Evidence Review: International non- governmental funding of FCERM projects Final Report

May 2018



Llywodraeth Cymru  
Welsh Government



Joint Flood and Coastal Erosion Risk Management  
Research and Development Programme

## **FCERM Funding Investment**

**Final report WT1562 Evidence review number 11**

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This is a report of research carried out by Centre for Ecology & Hydrology and HR Wallingford, on behalf of the Department for Environment, Food and Rural Affairs.

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## Executive Summary

DEFRA commissioned CEH and HR Wallingford to undertake a Quick Scoping Review (QSR) on the question 'What international examples are there of private funding and/or financing for flood defence?' This final report outlines the results of the QSR, covering the evidence found, summaries of direct contacts with flooding professionals, a synthesis and grouping of that evidence, and conclusions on what the evidence shows.

The evidence for the QSR has been gathered from four primary sources; Google Scholar, Web of Science, SCOPUS and personal contacts/interviews. Starting with the web and literature database searches, we used the following search strings.

| Population  | Intervention  | Comparator                   | Outcomes |
|---|---|------------------------------|----------|
| (Flood* OR Coast*)<br>AND (defences<br>schemes OR "risk<br>management") | Private AND<br>(Funding OR<br>Investment)   | International                | N/A      |
| Flood* AND<br>defences OR<br>Infrastructure                             | Private AND<br>(Financing OR<br>finance)  | Public/Government<br>funding | N/A      |
| Coast* AND<br>Infrastructure AND<br>Flood*                              | Private AND Public<br>AND Partner* AND<br>(Funding OR<br>Financing OR<br>Finance) | Europe*                      | N/A      |
| Coast* AND Erosion<br>AND (defence* OR<br>"risk management")            | Private AND Public<br>AND Partner* AND<br>(Funding OR<br>Financing OR<br>Finance) |                              |          |

Source: CEH / HR Wallingford

With these search terms, we obtained the following hits from each search engine, from which a sample screening of the top 'hits' delivered a series of documents for detailed review. In total, 58 documents were found worthy of analysis and these are listed in Appendix A, along with additional documents that were found through references in the

found documents and additional documents that were referred to us through the interview process.

| <b>Search engine</b> | <b>Hits</b> | <b>Excluded in screening</b> | <b>Included in screening</b> |
|----------------------|-------------|------------------------------|------------------------------|
| SCOPUS               | 250         | 5                            | 1                            |
| Web of Science       | 1327        | 38                           | 6                            |
| Google Scholar 1     | 40300       | 70                           | 30                           |
| Google Scholar 2     | 87900       | 79                           | 21                           |

*Source: CEH / HR Wallingford*

In addition to the literature and web searches, we also contacted 14 individuals from key organisations or groups via email or telephone interview. These individuals were identified initially from our existing professional links, as well as ones identified from the information collation exercise. These contacts included representatives from the following countries/organisations:

- Nation states of Belgium, Netherlands (Rijkswaterstaat), Sweden, Spain, Austria, Canada, Australia, Japan, Malaysia, Ireland, United States;
- US organisations of FEMA, USACE, American Beach and Shoreline Preservation Association (ASBPA).

These individual contacts identified 9 case studies that were deemed relevant to this review, and overall provided the most useful information for this study.

Based on all of the collated information, our findings suggest that there is only limited evidence of private financing and funding of flood defences. This is typically due to the presupposition that flood defences are a public good and therefore within the remit of central, regional and local governments. However there is some evidence of how flood works can be funded through private means through approaches such as multi-use defences, corporate social responsibility contributions and where developers are building on specific sites.

The most widespread involvement of private funding in FRM schemes has been found in the USA, where schemes have typically been developed at the county or coastal zone scale. This localisation helps to link those who are contributing to the scheme with the benefits that will be realised from the works. In many cases, private funding was

associated with community contributions, with the local population having voted to accept the additional payment.

The positive examples we have found of 'partnership' funding have several attributes:

- The scheme or funding arrangement needs to be promoted by dedicated and enthusiastic people or groups, who are 'in it for the long term'. They can pass on the baton once the key decisions have been taken and agreed;
- The long-term viability of schemes needs to be recognised, which needs any funding or financing to consider long-term maintenance or operation;
- Getting everyone to contribute to a scheme seems to work best, as this engenders shared ownership, vision and commitment. If a neighbour contributes and you don't then this puts you in a bad light, which applies equally to businesses. However there will always potentially be a problem with 'freeloaders';
- Promoting new funding mechanisms seems to work best where the costs and benefits can be isolated to specific, local areas where people and businesses can see what is being paid for and who will benefit. In each case some form of tax reduction or exemption will encourage businesses to get more involved.

Consideration of these key components of such jointly-funded schemes, may provide a basis for considering their future usefulness in the UK.



# Background

Defra is assessing the long term investment needs and funding options required for flood and coastal erosion management after 2021. This assessment will build on existing studies carried out in the Flood Resilience Review and will involve the Environment Agency, HM Treasury and the National Infrastructure Commission. Funding and investment options include both the role of government and the potential for funding contributions from private sources, particularly where those private contributions benefit either directly or indirectly from the investment. In order to evaluate the funding options Defra is looking for evidence of successful private funding/investment in the international context. This evidence will be used to develop policy thinking within Defra and to assist the department in understanding which, if any, of the options are applicable to the United Kingdom. The evidence is to be gathered from a quick scoping review and targeted interviews supported by a common questionnaire.

## Objective of the Quick Scoping Review

A Quick Scoping Review (QSR) aims to provide “an informed conclusion of the size and type of evidence available and a summary of what that evidence indicates with respect to the question/s posed” but does not extend to a critical appraisal of the evidence (Collins et al., 2014).

In order to aid Defra in considering long term funding and investment needs for flood and coastal erosion management there is a need to understand if there are any suitable examples in an international setting. Therefore the objective of this QSR is to find, collate and synthesise evidence that addresses the following **primary question**:

**What international examples are there of private funding and/or financing for flood defence?**

In addition this QSR uses the following secondary questions to provide context to the primary question:

- Where private funding/finance was secured how this was done and how successful was this?
- Who were the key organisations involved in the funding or finance and what was the government’s role, if any, in facilitating this?
- How long did it take to set up these schemes?
- Are there lessons that could be transferable to the UK or are there reasons why such schemes could not be applied here?

Table 1 summarises the main elements of the primary question.

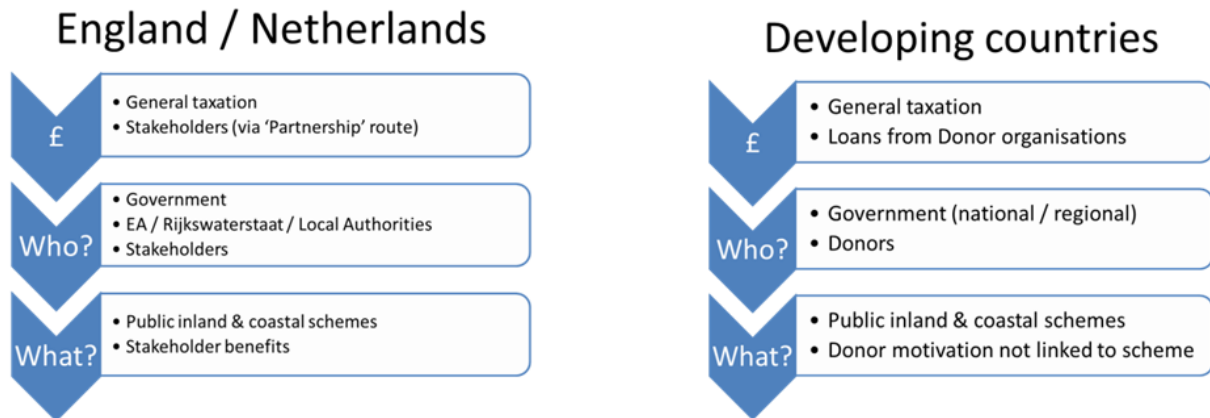
**Table 1: PICO considerations for the primary question**

| <b>PICO element</b> | <b>PICO element within this QSR</b>                                  |
|---------------------|--|
| <b>Population</b>   | <b>Flood defences, coastal erosion, flood/coastal infrastructure</b> |
| <b>Intervention</b> | <b>Private funding, private investment, private financing</b>        |
| <b>Comparator</b>   | <b>International examples</b>  |
| <b>Outcome</b>      | <b>N/A</b>   |

Source: CEH/HR Wallingford

## Conceptual / logical framework

What this study looks at is only international examples of where private funding and/or financing have been used to implement flood schemes. These funding sources may include examples where intra-national non-governmental organisations have provided finance/funding. The study does not look at examples where private funding has been used on very small scale private deployments or where a private entity has funded flood defences for an asset it is solely responsible for and where that flood defence has limited or no external ‘public’ benefit. International funding organisations (IFOs), such as the World Bank, ADB etc., do provide governmental financing for the delivery of flood alleviation schemes, but this is not the type of funding arrangement that could be adopted in the UK, given this is targeted at developing countries. Figure 1 summarises the delivery routes for the existing situation and the IFO model.



**Figure 1: Existing delivery routes for the UK, Netherlands and developing countries**

Source: *HR Wallingford*

## Scope of the QSR

Defra has identified that for the purposes of this QSR the following definitions are to be used:

- **Funding** is defined as funds provided free of charge, whereas
- **Financing** is defined as money provided with the expectation that it will be repaid, usually with interest.

In addition to the above definitions this QSR is limited to the following criteria:

Relevant subjects: Flood defences, coastal erosion, flood/coastal infrastructure;

Geographical Reference: Any international example;

Climatic conditions: Any climate conditions are valid;

Language: Any;

Date: Any.

Information sources: Government websites, Web of Science, general web searches using Google and Bing. Searches will be primarily in English, however additional searches have been undertaken in Italian, Spanish, French, Slovenian and Dutch sources (making use of native speakers at HR Wallingford).

# Evidence collation

## Collation method

Evidence collation was essentially desk-based, with the majority of the data collected via web searches, emails and telephone calls. The basic method of evidence collation was a three stage process:

1. Searches/direct contact;
2. Where a web search or direct contact resulted in useful information a questionnaire was sent to explore the delivery of FCERM for the country/organisation in question;
3. Where the questionnaire resulted in the need for additional information a telephone call was arranged to elicit more information on the delivery of the item.

In order to ensure that all interviews followed a structured format, the same simple questionnaire formed part of these interviews. The questionnaire provided, along with the covering email used, is attached as Appendix 2 of this report.

## Sources of evidence

To address the primary question evidence has been collated from a range of sources, including academic and grey literature, searches of government and institute websites, and professional contacts in industry, government and academia. For clarity we have defined the various literature sources as follows:

- Academic literature: Academic literature is published material in book, journal or other academic form.
- Grey literature: grey literature is defined as material that has not been published in traditional channels. This will often include government reports, policy statements, conference proceedings, and corporate websites but also includes material on government, institute and corporate websites. Grey literature can often be a valuable source of information as projects of this nature are not always documented in academic literature.

The evidence sources attempt to address the primary question and provide a summary of what is known to answer the review questions and the associated key issues of interest. Evidence has been collated from the following sources:

- A review of the FRM legislation and policies in operation in a wide selection of countries that would be relevant to the UK, and hence to the review question. This review has been done through both searches of government websites and through direct contacts in government. Note that the review has been done at both central

and regional/local government level as countries have differing approaches as to the responsibilities for FCERM.

- The academic databases Web of Science and SCOPUS.
- A Google Scholar search of published literature on this topic using keywords relevant to the review question.
- Direct consultation with international professionals working in the area of flood risk management and coastal erosion management. This consultation has included representatives from the following countries/organisations:
  - Nation states of Belgium, Netherlands (Rijkswaterstaat), Sweden, Spain, Austria, Canada, Australia, Japan, Malaysia, Ireland, United States,
  - US organisations of FEMA, USACE, American Beach and Shoreline Preservation Association (ASBPA).

The countries selected above were chosen based on a mixture of criteria, which included the following:

- Established professional contacts;
- Suggested contacts based on established contacts;
- Results from web and academic searches;
- Country suitability (i.e. developed nations with similar governance to the UK, evolved approaches to FCERM); and
- English language literature.

As well as the web searches and direct contacts, we sought permission from the European Commission to submit a short questionnaire relating to FCERM funding arrangements to the 27 member state representatives on Working Group F. This permission was not, however, obtained as the EC, along with the OECD, will be conducting similar research in the near future and the EC did not wish to increase the burden on its members. Nevertheless we have obtained some European evidence from our existing professional networks.

## **Grey literature searches**

Where searches took place on specific governmental or organisation websites the searches were essentially ad hoc rather than following a structured approach. The ad hoc approach was used as not all websites used the same search engines and searches varied wildly in their output. As a result site maps were typically used along with simple searches like “FLOOD POLICY” and “FLOOD FUNDING”.

## Search keywords and strings

Table 2 lists search terms that were used for web and database searches. A wildcard (\*) was used where possible to pick up multiple word endings. As the primary question is not in the form of an ‘impact’ question, there is no outcome element to the PICO information in Table 2.

**Table 2: Search strings and tables used in the web and database searches**

| <b>Population</b>   | <b>Intervention</b>  | <b>Comparat<br/>or</b>                    | <b>Outcome<br/>s</b> |
|---|--|---|----------------------|
| <b>(Flood* OR Coast*) AND (defences schemes OR “risk management”)</b> | <b>Private AND (Funding OR Investment)</b>                                   | <b>Internatio<br/>nal</b>                 | <b>N/A</b>           |
| <b>Flood* AND defences OR Infrastructure</b>                          | <b>Private AND (Financing OR finance)</b>                                    | <b>Public/Go<br/>vernment<br/>funding</b> | <b>N/A</b>           |
| <b>Coast* AND Infrastructure AND Flood*</b>                           | <b>Private AND Public AND Partner* AND (Funding OR Financing OR Finance)</b> | <b>Europe*</b>                            | <b>N/A</b>           |
| <b>Coast* AND Erosion AND (defence* OR “risk management”)</b>         | <b>Private AND Public AND Partner* AND (Funding OR Financing OR Finance)</b> |   |                      |

## Web and search portal search results

Searches were undertaken using standard web searches using the following sources:

- Google Scholar
- The search portals Web of Science and SCOPUS.

## Study screening and extraction

A record of all relevant information collected and refined for assessment in this review is provided in Appendix 1. The literature has been refined using inclusion criteria to identify the most relevant evidence; this forms the basis of the QSR.

The initial screening of web searches was refined further using the following steps:

1. Title screening (TS) based on key words. For example if the title of the article indicated that the article is primarily about the technical details of the defence then it was excluded. Where this screening provided material of interest then:
2. The material was then screened at abstract/contents page level to determine if the material is indeed of further interest. The screening looks for sections that relate to funding/financing etc.
3. If any uncertainty remains after these two screening stages then remaining articles were read in full to identify that the document is of relevance to the question being addressed, i.e. *is this article evidence of an **international** example of **private funding/financing of FCERM** and therefore of value to this study.*

Articles that were captured at stage three of the screening process and therefore likely to have material of interest are outlined in the data synthesis below.

The extraction statistics for the screened articles are shown in Table 3, Table 4 and Table 5. The extraction statistics are defined as follows:

Hits: this is the number of documents found using the search terms. For the Google Scholar searches only the first 100 hits were analysed.

Excluded in screening: of the documents identified in the hits, these documents were excluded on the first pass (document title) as they clearly showed no relevance to the study.

Included in screening: of the documents identified in the hits, these documents were referred to further screening. Note that the various searches resulted in the same documents occurring. In total, 58 unique documents were found worthy of analysis and these are listed in Appendix A, along with additional documents that were found through references in the found documents and additional documents that were referred to us through the interview process.

**Table 3: SCOPUS search results**

| Search  | Hits     | Excluded in screening | Included in screening |
|---|----------|-----------------------|-----------------------|
| <b>S1: TS=(Flood* OR Coast*) AND TS=(defence schemes OR “risk management”) AND TS=(Private AND Funding OR Investment)</b> | <b>2</b> | <b>1</b>              | <b>1</b>              |

| Search  | Hits       | Excluded in screening | Included in screening |
|---|------------|-----------------------|-----------------------|
| S2: TS=(Private OR public OR partner* OR alternative) AND TS=(Fund* OR Investment OR finance* OR business model*) AND TS=(flood* or Coast* OR "coastal erosion") AND TS=(risk OR defence* OR defence* infrastructure OR management OR protect*) | 250        | 4                     | 0                     |
| <b>Total</b>  | <b>250</b> | <b>5</b>              | <b>1</b>              |

Source: HR Wallingford

Table 4: Web of Science search results

| Search  | Hits                 | Excluded in screening | Included in screening |
|---|----------------------|-----------------------|-----------------------|
| S1: TS=(Flood* OR Coast*) AND TS=(defence schemes OR "risk management") AND TS=(Private AND Funding OR Investment)  | 141 (included below) | 14 (included below)   | 5 (included below)    |
| S2: TS=(Private OR public OR partner* OR alternative) AND TS=(Fund* OR Investment OR finance* OR business model*) AND TS=(flood* or Coast* OR "coastal erosion") AND TS=(risk OR defence* OR defence* infrastructure OR management OR protect*) | 1327                 | 38                    | 6                     |
| <b>Total</b>  | <b>1327</b>          | <b>38</b>             | <b>6</b>              |

Source: James Miller (CEH)



**Table 5: Google Scholar search results**

| Search   | Hits         | Excluded in screening | Included in screening |
|--|--------------|-----------------------|-----------------------|
| <b>S1: (Flood* OR Coast*) AND (defence schemes OR “risk management”) AND (Private AND Funding OR Investment)</b>   | <b>40300</b> | <b>70</b>             | <b>30</b>             |
| <b>S2: (Private OR public OR partner* OR alternative) AND (Fund* OR Investment OR finance* OR business model*) AND (flood* or Coast* OR "coastal erosion") AND (risk OR defence* OR defence* infrastructure OR management OR protect*)</b> | <b>87900</b> | <b>79</b>             | <b>21</b>             |
| <b>Total</b>   |              |                       |                       |

*Source: Searches done on 15<sup>th</sup> December 2017, first 100 hits evaluated*

The three sources of searches we used gave differing results; the Web of Science and Google Scholar results were sympathetic, if not equivalent in numbers of hits, but the SCOPUS results gave very little output of value to the study.

## Evidence synthesis

The evidence synthesis is divided up into sections reflecting the collection of evidence relating to how FCERM governance is practiced in a range of countries, and then for individual countries a discussion of either individual cases, where they were found, or a discussion of why private/partnership funding mechanisms were not applicable or have not been used.

## Governance practices

### Europe

Our investigations into how FCERM governance varies across Europe identified the EU STAR-FLOOD project as a key source of material; this was reinforced in a discussion with a representative of the Swedish Civil Contingencies Agency.

The EU STAR-FLOOD project ran from 2012 to 2016 and looked at how European flood risk practices are carried out and how these could be strengthened and redesigned. The project focussed on 18 vulnerable urban regions in the countries of Belgium, England, France, the Netherlands, Poland and Sweden. A key finding identified that throughout Europe funding was typically the role of governmental (central and regional) actors:

*“Flood defences, water retention and adapted building can be costly measures. Therefore, in all countries analysed, a lack of financial resources was reported as a factor hindering the implementation of flood risk management. This is in particular the case for flood defence measures. In the analysed countries, financial resources from various actors are invested. Mostly, measures are funded by public authorities using taxes as in the Netherlands; in England private parties (co)finance flood measures; in France the Barnier fund finances measures from a supplement to the insurance premiums; and Poland relies equally on both World Bank or EU investments and on public funds in structural measures.”*

[\(http://www.starflood.eu/guidebook/before-a-flood-event/how-to-ensure-sufficient-money-for-physical-measures/\)](http://www.starflood.eu/guidebook/before-a-flood-event/how-to-ensure-sufficient-money-for-physical-measures/)

In addition to the countries listed above we also looked at Ireland where FCERM is primarily the responsibility of the Office of Public Works (OPW).

*“OPW Flood Defence Schemes are generally carried out under the Arterial Drainage Act 1945 and the Arterial Drainage Amendment Act 1995, although in recent years some phases of schemes have been carried out by the Local Authorities under the Planning and Development Regulations. The OPW either works in association with the relevant Local Authorities or funds Local Authorities directly to undertake flood defence works.*

*The OPW Minor Flood Mitigation Works & Coastal Protection Scheme provides funding to Local Authorities to undertake minor flood mitigation works or studies, costing less than €0.75 million each, to address localised flooding and coastal protection problems within their administrative areas.”*

<https://www.opw.ie/en/flood-risk-management/operations/> retrieved 01/02/2018

## **New Zealand**

In New Zealand the country is administered at a central and regional level. The country is divided up into a number of regional councils, where the regional councils are responsible for the delivery of FCERM. However it is noted that due to the inequality in the funding levels of the various regional councils some parts of the country are unable to afford an acceptable level of flood risk management.

*“Flood risk management in New Zealand has evolved over time, from ad hoc to centralised approaches last century, to the current devolved approach of management by local government. This devolved system is consistent with the Government’s policy in relation to civil defence and emergency management policy:*

*local risks are the responsibility of local authorities. Managing flood risk takes place within the wider context of emergency management and sustainability for central government, local government and communities.”*

*“Individuals and communities that benefit from flood risk management are generally paying for that benefit, but there are inconsistencies and gaps. A wider mix of funding tools could be used by local government. Beneficiaries that do not currently pay include some central government and local government owned lands and activities. Rating exemptions mean that education and health facilities, in particular, do not contribute to the full cost of flood risk management. When beneficiaries do not pay, other funding is needed to cover the shortfall. Generally this falls on ratepayers, which results in inequity. Some communities may also settle for a higher level of flood risk than if all potential beneficiaries paid their share.*

*Lower-income areas and areas with a smaller rating base also experience difficulties in affording good flood risk management. Councils with better resources, including better information and funding, are more likely to achieve more robust flood risk management. This results in an equity issue, as some communities may not be able to afford an acceptable level of flood risk management. Reducing flood risk across the country requires that all councils are able to manage the flood risk effectively.”*

<http://www.mfe.govt.nz/publications/land/meeting-challenges-future-flooding-new-zealand/2-flood-risk-management-new-zealand> retrieved 01/02/2018

## **Australia**

Flood risk management is the responsibility of the state and local governments. FCERM varies at a state level, with local authorities within each state empowered to manage the local flood risk.

*“Flood risk management should be based on up to date State/Territory and Local Government policies, which are supported by legislation. The responsibility for flood risk management varies within jurisdictions but is primarily the responsibility of the local flood management authorities. However effective flood risk management requires the active participation of governments at all levels, industry and the community. Where catchments cross boundaries of responsibility, flood management authorities need to put in place appropriate arrangements to facilitate cooperation on issues that may have cross boundary implications on flood behaviour and/or hazard.”*

<https://ajem.infoservices.com.au/downloads/AJEM-23-04-06> retrieved 01/02/2018

## **Canada**

Funding and delivering FCERM is largely the responsibility of the provinces and territories. Where federal projects or funding is involved then the National Flood Damage Reduction Program and the Disaster Financial Assistance Arrangement can be coupled with the provincial/territory sources of funding. [https://www.kwl.ca/sites/default/files/Final%](https://www.kwl.ca/sites/default/files/Final%20)

[2020170528%20Flood%20Risk%20Management%20Matrix.pdf](#) provides a useful table outlining the approaches from the individual provinces and territories. A brief summary of the findings by Kerr Wood Leidal Associates Ltd (KWL) are included in Table 6.

**Table 6: Funding routes in Canada**

| <b>Jurisdiction</b>     | <b>Legislation/Policy</b>   | <b>Funding</b>  |
|-------------------------|---|---|
| <b>Federal</b>          |   | <b>National Flood Damage Reduction Program/Cost Share with Provinces and/Territories Disaster Financial Assistance Arrangement (DFAA)</b> |
| <b>First Nations</b>    | <b>No specific legislation (Indian Act silent), defaults to provincial legislation and bi-lateral agreements between Federal and Provincial Governments</b> | <b>Provincial Governments through agreements with Indigenous and Northern Affairs Canada (INAC)</b>                                       |
| <b>British Columbia</b> | <b>Emergency Program Act<br/>Flood Hazard Statutes Amendment Act</b>  | <b>Emergency Management BC/Local Authorities</b>  |
| <b>Alberta</b>          | <b>Flood Recovery and Reconstruction Act</b>  | <b>Alberta Environment and Parks/Local Authority funding through taxation</b>   |
| <b>Saskatchewan</b>     | <b>Water Security Agency Act</b>  | <b>Provincial Disaster Assistance Program</b>   |
| <b>Manitoba</b>         | <b>Water Resources Administration Act<br/>Manitoba Water Strategy</b>   | <b>Unknown</b>  |
| <b>Ontario</b>          | <b>Conservation Authorities Act<br/>Lakes and Rivers</b>  | <b>Ministry of Natural Resources and Flooding</b>   |

| Jurisdiction               | Legislation/Policy  | Funding  |
|----------------------------|---|--|
|                            | Improvement<br>Act  |  |
| Quebec                     | Floodplain Protection Policy<br>Environment Quality Act                 | Unknown  |
| New Brunswick              | Clean Environment Act<br>Provincial Flood Risk<br>Reduction<br>Strategy | National Disaster Mitigation<br>Program/Provincial Disaster<br>Financial Framework |
| Nova Scotia                | Nova Scotia Flood<br>Mitigation Framework                               | Flood Assessment<br>Fund/Flood Risk Investment<br>Program                          |
| Prince Edward Island       | Water Act   | National Disaster Mitigation<br>Program  |
| Newfoundland &<br>Labrador | Water Resources Act   | Unknown  |
| Yukon                      | Waters Act  | Provincial, City   |
| Northwest Territories      | Unknown   | Unknown  |
| Nunavut                    | Unknown   | Unknown  |

Source: <https://www.kwl.ca/>

### United States

This comprises a combination of Federal, State and city governments, with the Federal Emergency Management Agency (FEMA) and the US Army Corps of Engineers (USACE) being primary stakeholders. A USACE report of 2011 acknowledged that federal and state budgets are being squeezed, with public-private partnerships (PPPs) being potential sources of funding.

*“Particularly with its inherent nature of shared responsibility in the United States, flood risk management offers potential for PPPs. PPPs could substitute for the Federal role from studies to construction, operations, maintenance, and financing. Sharing risks is an important consideration. Some experts believe PPPs must be*

*engaged to assist in national levee protection because the needs are too great for just the government to meet, although any continuing governmental liability must be considered. However, PPPs must be appropriate to the circumstances, and potential negative aspects must be taken into account. For example, smaller and/or poorer communities may have more difficulty in making cost-sharing arrangements, and this must also be taken into consideration. In addition, certain aspects are inherently governmental.”*

<http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/2011-R-08.pdf> (page 85), retrieved 01/02/2018.

## **South Korea**

South Korean FCERM is managed at the central government level.

*“The “Natural Disaster Counter-measure Act” was enacted in December 1995 to manage all kinds of natural disasters in Korea. The Natural Disaster Countermeasure Act was based on two previous acts on natural disaster- the “Flood Disaster and Relief Act” and “Flood with Typhoon Counter-measure Act.” The Flood Disaster and Relief Act, 1961 is the first act pertaining to natural disaster management. In 1967, the Flood with Typhoon Counter-measure Act was passed which included the management of earthquakes, droughts, and flood with typhoons”*

[http://nidm.gov.in/easindia2014/err/pdf/country\\_profile/south\\_korea.pdf](http://nidm.gov.in/easindia2014/err/pdf/country_profile/south_korea.pdf) retrieved 01/02/2018

## **Japan**

Japanese flood risk management is the domain of the Ministry of Land, Infrastructure, Transport and Tourism (MILT).

*“The legal framework for flood risk management has also evolved over the years, with implementation and revision of two major laws, the River Law (1896 and two major revisions) and the Flood Control Act (1949). The River Law focuses on river management (comprising flood risk reduction, water resources management, and environment creation and preservation). The flood management aspect of the River Law includes planning and implementation of flood risk reduction along with a regulatory framework that prevents an increase in flood risk.”*

<http://pubdocs.worldbank.org/en/432021487900546309/Integrated-Urban-Flood-Risk-Management-Technical-Deep-Dive-Summary-Report.pdf> retrieved 01/02/2018

## **Country specific evidence**

The following sections detail the findings from specific countries. These have been divided up into geographic regions. As an overall summary we would conclude that there is evidence of private funding of FCERM measures and these measures can be found across the globe; however we observe that the examples are typically isolated and not

indicative of a general strategy or policy framework. The exception to this would be the funding of coastal nourishment and management projects in the United States.

## Asia/Pacific

### Malaysia

The SMART (Stormwater Management And Road Tunnel) is a 9.7km long dual function tunnel in Kuala Lumpur. The purpose of the tunnel is to solve both traffic congestion problems and to act as a conduit for flash flooding in the city. The tunnel was originally conceived as a stormwater tunnel but was identified as being empty for most of the year (unlike the east coast of Malaysia the climate in Kuala Lumpur does not have a rainy season; it is prone to short duration and violent convective storms that cause flash flooding). In order to maximise the utility of the structure an alternative use was sought. The tunnel was completed in 2007 and is comprised of 4km length of dual function and a further 5.7km of stormwater conduit. The project was a joint project between the Malaysian Highway Authority, the Department of Irrigation and Drainage, and a joint venture between Gamuda Berhad and Malaysian Mining Corporation Berhad (MMC). Khairuddin (2014) reports that the SMART is an example of a successful public-private partnership in Malaysia. Under the agreement the government financed \$342m and the remaining \$163m being funded by the joint venture. The SMART is then operated by the joint venture under a 40-year concession where the concession charges a toll for vehicle movements. The current toll is RM3/vehicle (approximately £0.50) and there are an estimated 10,000 vehicle movements each day (<https://www.roadtraffic-technology.com/projects/smart/>).

When asked whether the project was successful we were told that as far as traffic and flood management was concerned the answer was yes in that the flood risk at the confluence of the Kelang and Gombok rivers (in the city centre) was reduced. However the largest problem with the system is reverting the tunnel back into traffic use once it has been used for flood control. Typically the system has been set up so that it is ready for traffic use with 3-4 days of being used for flood control, but the observation from our contact in Malaysia is that this is very much the ideal scenario and does not happen in practice. As a result the dual function of the tunnel has drawbacks.

### Philippines

The APEC on Public-Private Partnerships and Disaster Resilience workshop in Bangkok, 2010 reported on the contribution of the mobile communications company Smart Communications to a reforestation project.

*“An example of corporate involvement in this project is Smart Communications, a CNDR-member corporation who supported a mangrove reforestation project in the typhoon and flood prone “Barangay Cagsao” community in an effort to contribute to natural resource management and disaster mitigation. Soil erosion at riverbanks and shorelines was identified to be a key risk factor in the community. The company provided necessary funds and employee volunteers participated in the planting together with communities. Based on the success of the first planting initiative*

*Smart is committed to support another mangrove reforestation project in the same community. Smart Communications considers this initiative as a win-win situation contributing both to community disaster mitigation efforts as well as to meeting the company's tree planting target under its corporate social responsibility (CSR) program.” (APEC, 2010)*

## **New Zealand**

In New Zealand the responsibility for flood defences is almost exclusively the remit of the regional and city councils. The regional/local authorities have the power to raise levies to pay for schemes. The Hawkes Bay Regional Council is responsible for twelve schemes where landowners who directly and indirectly benefit from the defences pay targeted rates as contributions for the schemes. (<http://www.hbrc.govt.nz/services/flood-control/individual-schemes> accessed 13 April 2018)

Without identifying specific cases Auckland City Council (Chandrasekhar, 2007) targeted development contributions as a source for funding for managing future growth:

*“Development contributions should be used as the main funding tool for growth related infrastructure provided by the council, with financial contributions used as set out in Schedule 6.”*

## **Australia**

In Australia there is limited evidence of private funding of flood defences:

*“I am not aware of records of private financing. It would be up to the beneficiary to fund in full. There are some systems that allow for a group of beneficiaries to be rated by an organisation to maintain flood mitigation / drainage works that benefit them. One example is the Loch Garry Flood Protection District, managed by Goulburn-Murray Water. Another example is the Koo Wee Rup-Longwarry flood protection district, managed by Melbourne Water.”*

In terms of coastal protection works there are some examples that can be referenced. Ware and Banhalmi-zakar identified the increasing involvement of non-governmental actors:

*Consideration of funding coastal protection must also recognise a number of significant non-government actors involved, in addition to government entities. These non-government actors include; the owners of foreshore properties exposed to coastal hazards as well as local residents, tourists and businesses as the users and beneficiaries of coastal assets such as beaches, estuaries and surf zones. These non-government actors can have a significant role in many coastal protection projects. There are examples of private property owners pooling resources to self-fund the construction of coastal protection works such as seawalls to protect their properties from erosion. For example, private property owners at the Belongil Spit in Byron Bay (NSW) have taken legal action against governments to establish their rights to undertake coastal protection works.*



They identified that due to the potentially enormous costs involved, along with potential tensions relating to perceived bias towards beachfront property owners, that fully funding beach protection works is beyond the capacity of local governments. Two case studies were identified where non-governmental actors were involved; these are summarised below.

### **Tweed River Entrance Sand Bypass Project**

The mouth of Tweed River is at the boundary between the states of New South Wales and Queensland. In 1964 the government of New South Wales built training walls at the mouth to stabilise the river entrance; a consequence of this work was that the longshore drift of sand northwards into Queensland was inhibited resulting in degradation of the beaches and increased beach erosion. To replenish the beaches north of the river mouth a sand pump system was built in 2001 where the financing was provided by the ANZ bank. The ongoing operation of the project is managed by the Tweed River Entrance Sand Bypassing Company, a subsidiary of McConnell Dowell, who designed and built the system. The project was set up under a 24 year contract with the states of NSW and Queensland, ending in 2025.

*“As the project was innovative, and the technology uncertain, it was thought that it would be desirable for the sand bypassing system to be run by the private sector to limit the need for day to day involvement of the two Governments. The involvement of the private sector was a difficult task for the size of the project because of the large variability in the coastal processes, and hence the risks associated with the undertaking. It was decided that the risk could best be shared by involving a private sector partner in a long-term agreement in which payment would be related to the performance of the system.” (Dyson, Victory and Connor, 2001)*

To the end of 2015 the total cost of the operation was \$AU121.7 million, where the cost is split between the New South Wales (62%) and Queensland (38%) state governments. The annual cost of the project is directly related to the volume of the sand pumped.

### **Toogoom Seawall**

Toogoom is a coastal community in Queensland adjacent to Fraser Island and is a part of the Fraser Coast Regional Council (FCRC). A small stretch of the coastline has a history of erosion and in response to this a 370m length of seawall was built to defend 15 properties. The seawall was completed in 2014. The seawall was constructed according to a 2013 policy on coastal protection that allows FCRC to design and construct coastal protection works where multiple property owners are required to act together. The policy was designed to avoid existing issues where uncoordinated coastal defences had been constructed. A key part of the policy allowed FCRC to be compensated for the construction costs by charging the protected owners a levy. In the case of Toogoom the costs of construction were passed to the 15 benefiting properties based on the length of the property frontage and the levy was payable over ten years. The total project cost was \$AU1.1 million resulting in payments of approximately \$AU700/month/property.

## Europe

A conclusion can be made that suggests that at national level there is limited evidence of private funding/financing of flood defences. However we have found individual private contributions that suggest possible approaches.

### The Netherlands

In the Netherlands we were told the following:

“In general, in the Netherlands there is no private funding involved in the measures taken in flood prevention works. This holds for:

- The Primary flood defences - laid down in the *national* law (3400 km). These have been given such status as they play a dominant role in guaranteeing the *national* flood risk management level. Consequences of failure are loss of life (up to thousands) and economic damage (billions). Financing improvement works is realised through a fixed budget of some € 350 million annually, of which 50% comes from the State and 50% from the Water Boards (who have own tax system). Financing maintenance is through the State (for its objects, like storm surge barriers and the large dams) and through the Water Boards (all other dikes and dunes etc.).
- The Regional flood defences - laid down in the *provincial* law (14.000 km). These play a role in guaranteeing the *regional* flood risk management level. Consequences of failure are less dramatic: nuisance (regional financial damage level - in the order of a few million max; no fatalities). Financing improvement and maintenance works is arranged per province. The budget comes from the Water Boards within those provinces.
- The smaller, lesser significant defences - mostly a *very local and temporary functioning* (our italics) for e.g. agriculture along the rivers – the ‘summer’ dikes. These are not considered to be of importance for playing a role in the flood risk management. Here, private funding may come in but also funding through the Water Board is possible.

### Belgium

In Belgium, the Flanders Environment Ministry reported:

“Here in Flanders everyone is still only looking to Government to fund for all kind of investments on flooding. We know we can’t solve flooding alone by Government and we do communicate that it has to be a shared responsibility (water and spatial management, emergency and insurance services plus citizens) but this recent message for now a couple of years has certainly NOT yet shifted minds towards some private funding. So what happens is the risks increase and hence insurance cover too.”

### Sweden

Representatives of the Swedish Civil Contingencies Agency (SME) reported that in Sweden the provision and funding of flood defenses is the responsibility of the municipalities. Municipalities can apply for up to 60% of the funds and must obtain the balance from other sources; this could be from municipality funds, raising specific taxes or by sourcing monies from private residents. This explanation is reinforced by the findings of the STAR-FLOOD country report for Sweden:

*Municipalities finance their operations, e.g. emergency services, planning and building and sewerage, mostly through local taxes and charges. The local level receives some financial support from the central level, mainly for investigative or defensive measures, crisis preparedness and recovery, but these funds are perceived as insufficient. Thus, as for distributional effects between the different levels of government, costs for flood risk management seem to be borne largely by those who enjoy its benefits considering the local nature of the risks.*

<http://www.starflood.eu/documents/2016/03/wp3-sw-final-webversion.pdf> (retrieved 15 March 2018)

The SME also reported that the acquisition of land for flood defences is not compulsory but that if a private actor does contribute then they will benefit from the flood defence. They also commented that the consultation process is not a significant hurdle in delivering flood schemes; however the scheme going to the Environment Court can result in significant delays. Typically the SME receives around 20 applications for contributions each year. Finally they reported that the process of shared funding is under review; they did not comment on how long the process would take.

The most high profile case of shared funding in Sweden is that of Kristianstad.

*The project, which by 2014 is halfway done, is expected to be finalised in 2025 to a cost of almost 290 million SEK (corresponding to about € 32 million) (National centrum for climate adaptation, 2015). Delays can, however, be expected as the project advances and affects infrastructure and land which does not belong to the municipality (National centrum for climate adaptation, 2015). About 60% of costs will be financed with state resources, namely through the fund for preventive measures administered by the Swedish Civil Contingencies Agency.*

<http://www.starflood.eu/documents/2016/03/wp3-sw-final-webversion.pdf> (retrieved 15 March 2018)

## **Austria**

Through a contact we were introduced to Thomas Thaler of the University of Natural Resources and Life Science in Vienna. Thaler has co-authored a number of papers on public-private partnerships. We provided him with the questionnaire and he was able to respond with the following information.

Thaler identified three case studies in Austria where public-private partnerships have been used to varying degrees:

*“When looking at the relationship with non-communal actors, we observed a wide range of different situations among the case studies. First, the Triesting-Tal case study shows no partnership approach with non-communal actors, neither informally or formally. Second, in the Aist case study we observe an informal partnership with the Regional Road Authority. The key objective is the financial contribution to the total project costs. The Regional Road Authority is less involved in the strategy planning process. Third, the Ill-Walgau case study, in contrast to the other two case studies, is various steps ahead. First, eight of the involved members are non-communal actors. Second, two of them are members of the steering group. Their involvement is not only based on financial support, but also in the strategic-development planning process. Moreover, the Ill-Walgau region has a long tradition of co-operation with private actors relating to flood risk management. Finally, the involvement of private actors increased the willingness of local authorities to participate.”*

*Thaler, Priest and Fuchs (2016)*

Table 7 and Table 8 show that in Austria the water engineering and torrent/avalanche control look for 10 to 20% of contributions from private actors and other government organisations. They do not differentiate between these contributions so here further evidence would be required.

**Table 7: Funding overview for water engineering administration**

| <b>Task</b>  | <b>National Government: Water Engineering Administration</b>                | <b>Regional Government: Federal Water Engineering Administration</b>        | <b>Local Authority</b>   | <b>Private actors and other Governmental organisations, such as citizens, companies, OEBC, Asfinag, Regional Road Association</b> |
|--|---|---|--|---|
| <b>Planning of flood alleviation schemes</b>       | <b>Between 40% to 50%</b>   | <b>Between 30% to 40%</b>   | <b>Both together 20%</b>   |   |
| <b>Implementation of flood alleviation schemes</b> | <b>Between 40% to 50% (rivers with heavy bed load transport: up to 50%)</b> | <b>Between 30% to 40% (rivers with heavy bed load transport: up to 40%)</b> | <b>Both together 20% (rivers with heavy bed load transport: up to 10%)</b> |   |

| <b>Task</b>                                  | <b>National Government:<br/>Water Engineering Administration</b> | <b>Regional Government:<br/>Federal Water Engineering Administration</b> | <b>Local Authority</b> | <b>Private actors and other Governmental organisations, such as citizens, companies, OEBC, Asfinag, Regional Road Association</b> |
|--|--|--|------------------------|---|
|  | to 60%)  | to 30%)  |                        |   |
| <b>Maintenance flood alleviation schemes</b> | <b>Max. 33%</b>  | <b>Max. 33%</b>  | <b>33% to 100%</b>     |   |

Source: Thomas Thaler

**Table 8: Funding overview for water engineering administration for torrent and avalanche control**

| <b>Task</b>                                  | <b>National Government:<br/>Water Engineering Administration</b> | <b>Regional Government:<br/>Federal Water Engineering Administration</b> | <b>Local Authority</b> | <b>Private actors and other Governmental organisations, such as citizens, companies, OEBC, Asfinag, Regional Road Association</b> |
|--|--|--|------------------------|---|
| <b>Planning of flood alleviation schemes</b> | <b>Up to 75%</b>   | <b>Up to 15%</b>   | <b>Up to 10%</b>       |   |
| <b>Implementation of flood alleviation</b>   | <b>Up to 75%</b>   | <b>Up to 15%</b>   | <b>Up to 10%</b>       |   |

| Task                                  | National Government:<br>Water Engineering Administration | Regional Government:<br>Federal Water Engineering Administration | Local Authority | Private actors and other Governmental organisations, such as citizens, companies, OEBC, Asfinag, Regional Road Association |
|---------------------------------------|--|--|-----------------|--|
| <b>schemes</b>                        |  |  |                 |  |
| Maintenance flood alleviation schemes | 100%   | None   | None            | None   |

Source: Thomas Thaler

## Spain

The Zorrotzaurre district in Bilbao is sited on a peninsula in the Estuary of Bilbao. The peninsula is currently a brownfield flood-prone industrial site. The district is being regenerated under an urban renewal project where the project will convert the peninsula into an island, developing a flood protection wall, elevating the ground level by 1.5m, constructing stormwater tanks and creating green space for the public. The European Environment Agency (2016) reported the following:

*“To realise this urban regeneration project, a public-private partnership was established for financing and managing the plan. The costs for the redevelopment works will be covered by the public-private partnership, i.e. the owners of the land, according to their share of ownership.”*

The contributions to flood defence are as follows (EEA, 2016):

- Elevation of the ground level. During the first phase of the project the surface in the east and west of the Zorrotzaurre peninsula/island will be elevated by 1.5 metres so that new buildings can be constructed on a higher level. This should protect the new buildings from T=500 rainfall events.
- Construction of a flood protection wall. To protect the 47 existing buildings (including 352 apartments) on the peninsula, mostly located next to the river, a 1 meter high flood protection barrier will be constructed. This barrier should ensure that existing buildings are protected from flooding from T=100 rainfall events.

- Provision of storm water tanks. In addition to the measures above, 3 storm water tanks will be provided to store excess water, one in San Ignacio (620 cubic meters) and two in Ribera de Duesto (2.100 cubic meters each) (two neighbourhoods on the other side of the canal).

Note that the storm tanks and the flood barrier are explicitly paid for by the municipality, while the changes to ground elevation are paid for by the PPP.

## North America

### Canada

Similar to many European countries our investigations into flood management in Canada resulted in the conclusion that FCERM is essentially a state funded program:

*“FCERM is mostly state funded in Canada. Some municipalities/provinces are deploying green bonds as a means of financing climate change mitigation/renewable energy, but nothing on the flood management side. Some insurers provide minor funding for corporate social responsibility related activities on flood management/climate change adaptation, such as awareness raising, but this is marginal.”*

### United States

In terms of FCERM the United States is a complex nation with there being a number of actors from the Federal government down through the individual State governments and then to city/county/borough local authorities. At a federal level flood defences are essentially the remit the US Army Corps of Engineers (USACE), with FEMA also playing a role under the National Flood Insurance Program. At a local government level the principal actors are state and local authorities.

Developers of land are required to provide flood storage to compensate for increase in impermeable surfaces. The expense is borne by them but is due to government requirements.

Cities such as Norfolk and others have focused on locating new infrastructure (water, electric) and critical services (police) in less flood prone areas. They are also working with private firms to position nursing homes, schools, i.e., vulnerable populations, in areas unlikely to be flooded in order promote sheltering in place.

The Corps of Engineers builds projects which are then transferred to the local sponsor for operation. An operations manual is provided but the lack of proper maintenance is a primary reason that flood defences do not prevent damages as projected.

A representative of the USACE highlighted the importance of operations and maintenance for the viability of these schemes.

Typically large scale FCERM projects are managed and funded by either the USACE or by FEMA. However it is possible for smaller scale projects to be managed by either State or

local authorities with funding coming from a mix of local and state governments and private contributors. An example of the combined funding model is shown below.

### **Charlotte County**

Charlotte County is located on the west coast of the state of Florida. Manasota Key is on the north western edge of the county and has suffered from coastal erosion problems. Manasota Key is essentially comprised of a retirement community. To remedy the coastal erosion problems it was estimated that the cost of a solution would be approximately \$24 million, where this amount included eight years of operation and maintenance. In the state of Florida the funding rules limit the amount the state is willing to contribute; in this case the funding was capped at 39%, leaving the county to find the remaining 61%. The county was willing to fund 50% of the balance, with the balance (\$7 million) to be found from the local community.

The county engaged PAR Consultants to manage the process of finding the \$7 million balance. After a year-long consultation process the community came to the agreement that they would contribute to the provision of the works. In essence the community had to, in the words of Peter Ravella of PAR Consultants, 'ask the county to be taxed more.'

The final report for the Charlotte County Program can be found here:

<http://apps.charlottecountyfl.gov/NovusAgenda/AttachmentViewer.ashx?AttachmentID=30229&ItemID=18925>.

In addition to the Charlotte County example PAR Consultants have worked on over twelve other cases. The lessons learnt from these processes include the following:

- When designing the strategy for the beach nourishment it is very important to consider the long term nature of the problem; it is not enough to simply build the structure and walk away as long term operation and maintenance needs to be included.
- In the US the local electoral cycle can inhibit the provision of both the funds for development and maintenance, hence the relatively short operation maintenance period.
- In addition to the electoral cycle the solution can be limited by the demographics of the contributing community. In the case of Manasota the community is comprised of essentially elderly residents who may only live in the area for a short time.
- In almost every case in the US where state and local government funding is insufficient the local community will need to fill the gap. Inevitably this means that this favours those communities that have sufficient wealth, and willingness, to contribute.
- Persuading residents to pay is problematic; what will drive people to pay is damage to their personal property.



- Having an external actor, such as PAR Consultants, as a mediator is important in the success of such projects. The external actor can be seen as neutral, even though they typically are engaged by the local authority. The external actor should not be seen to have arrived in the community with a pre-conceived solution; rather any solution should be developed using community input.
- Explaining how any contributions are 'fair' can be very difficult. An argument, often made by residents who live more than four streets back from the beach, is that they 'do not live at the beach'. Therefore persuading these residents/business owners of the wider benefit of the work can be complex.
- Both ad velorem and fee based approaches to contributions have been applied successfully in these projects.

PAR Consultants have only applied these approaches in coastal environments; when asked whether these approaches would work in inland locations they observed that the advantages of using them in coastal environments is that the ocean is the only 'upstream' actor, and there are no downstream actors (the flood or erosion risk tending to be in a well-defined area). For a river example the potential for changes to the upstream and downstream boundaries may result in complex legal and political conditions, resulting in much longer consultation and development cycles. When asked whether the approach would work in the UK they suggested that it would as the political environment is simpler (there are less layers of government). However there are still questions of developing a culture of being willing to pay as well as the ability to pay.

### **Waikiki Beach**

Waikiki Beach in Hawaii is a similar, but simpler example to the Charlotte County case. Waikiki Beach is a valuable tourist destination but has been suffering from neglect. The Waikiki Beach Special Improvement District Association (WBSIDA) manages public-private funds to manage and improve the beach. The University of Hawai'i Sea Grant project provides the public funding and local businesses provide the private contributions. The private contributions are only collected from businesses within 150m of the shoreline. The annual budget is of the order of \$600,000. In conversation with Derek Brockbank of the American Shore and Beach Preservation Association (ASBPA) he observed that the level of funding is at 'band-aid' level, i.e. the funding is only sufficient to manage the status quo and not to provide long-term managed solutions to the beach. This, then, presents a counterpoint to the Charlotte County example where the long term management and operation is inherently part of the design of both the nourishment program and the funding regime.

### **Levee districts**

A Levee Improvement District (LID) is a flood management governance approach in use in Texas. For example there are 17 major LID systems in Fort Bend County that provide flood and storm water management resources to those who reside or conduct business in the geographic area protected by the LIDs. In addition to the more than 60 miles of levees

managed by all of the Fort Bend County LID systems, the multiple districts also provide protection with other related flood control works that include:

- More than 20 miles of internal drainage ditches and channels that collect and convey storm water run-off;
- Outfall structures where internal storm water drainage is discharged outside of the levee;
- Pumping stations (with electrical power that is completely independent of the public power grid);
- Flap gates and sluice gates;
- Detention and retention ponds.

The Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers set standards that guide the construction, maintenance and operations of LIDs. Levee Districts in Fort Bend County are funded by local ad valorem property taxes. Property taxes pay for the bonds that are used to finance the design and construction of the levee systems and other related flood control works. Levee Districts in Fort Bend County spend more than \$12,000,000 annually to operate and maintain the levee systems and other related flood control works, as well as to carry out their other regular business. Fort Bend County levee systems have not previously received and do not currently receive any federal money to construct, operate and maintain their levees or other flood control works. It is important to note that the levee system was generally designed and built at the same time that the initial housing in the geographic area of the LID was created, with powers from Fort Bend County to tax the residents. So there was a clear acceptance that housing was being constructed in the floodplain area, and that some sustainable funding mechanism was needed to provide the long-term protection of the communities' livelihoods and businesses.

### **Findlay, Ohio**

Findlay is a city in NW Ohio and the county seat of Hancock County, with a population of approximately 41,500. It sits on the Blanchard River and experienced a major flood in 2007 which caused significant damage, including \$10 million to Marathon Petroleum who are one of the two largest employers in the city. A telecom was held with Tony Iriti, ex-Mayor of Findlay, who had been instrumental in progressing a flood scheme for the city and the funding arrangements that underpinned it. A private foundation was set up as a charity, which provided tax benefits to the 10 large companies and other private interests who were involved. They also convinced the county authority to impose an additional sales tax of 0.25% that would be levied on all goods sold in the county, so that everyone living or passing through the area would contribute to the scheme fund. The local population voted to accept this tax increase. Once the arrangements had been agreed then Hancock County administered the fund and collected the sales tax contribution.

In addition to the sales tax and contributions from companies, a user fee was also levied on businesses based on their impervious area (so providing a link between the runoff and the scheme needs). Also, Marathon Petroleum made a valuable in-kind contribution of marketing and graphical services to support the project dissemination. 2019 will be the last year of the 10 year period for collecting the sales tax, but they are looking to extend this.

In terms of the scheme, then structural works along the river front were assessed as too costly, and so the solution was a diversion channel, some 7 miles long, which aids in changing the timing of the flood peak at various places across the city. Tony Iriti agreed that the scheme was only possible by having a group of 'driven', like-minded people to build a successful and sustainable coalition. A key part of 'selling' the scheme to the local community was how everyone would benefit from reducing the flood risk, and not just the major companies.

Since the telecom we have found additional information which indicates that the progress of the flood alleviation scheme is not as 'rosy' as painted by Iriti, although this may be partly due to the fact that he now lives in a different state and has no formal links, as far as we know, with the scheme. It appears that the USACE-proposed diversion channel did not achieve a high cost : benefit ratio, and therefore a consultant has been brought in to look at alternatives. There is also some disquiet from agriculturists who consider they were not as well engaged as other stakeholders. Nevertheless, the fund has been used to buy up property and land that was most at risk and which could be used for any flood works.

## Evidence from direct contacts

The consistent message we received when we made direct approaches to fellow flood professionals, government officials and academics suggested a constant theme: that widespread and established partnership and private funding largely remains an aspirational approach and while there is some evidence of private funding/financing the vast majority of spending on flood defences is done by combinations of central, regional (state/county/province/prefecture...) and local/municipal governments. As noted above, there are examples where those benefitting from a scheme do agree to contribute on an individual basis (whether companies or families), although this is more prevalent for coastal schemes than for rivers.

## Other potential sources/models of funding

The following two potential models do not have any direct evidence and are more theoretical but we considered them to be worthy of further investigation.

### **Multi-functional defences**

Aguilar-López, Juan Pablo; Anvarifar, Flora et al., 2017 identified that flood defences could be utilised as multi-functional assets, where the 'downstream' side could be utilised as a commercial proposition, such as a car park.

*Another advantage of a multi-functional flood defence is that it potentially broadens the financial basis of the project. For example, if a parking garage is combined with a flood defence, then the parking garage can help to finance the flood defence, and vice versa.*

### **Corporate safeguarding**

APEC (2010) reported the following:

*Businesses are vital actors in the societies in which they operate. They act as employers, producers of goods and services, operators of critical infrastructure, consumers of public and other private sector services, taxpayers, and many more. In every community, companies both small and large, are key to community development. Disruption in business activity can lead to major economic losses and can significantly impact the long-term growth of national economies. Safeguarding companies from business disruptions is therefore a public interest. Similarly, community disaster resilience is in the interest of the private sector as a business needs a functioning community (within which) to operate.*

## **Conclusions**

We have reviewed a wide range of publications identified from agreed search protocols. The information gleaned from these sources has been further backed-up by additional web searches and email questionnaires and direct conversations with practitioners in several countries.

A conclusion that we have made relating to the search process is that the academic literature is limited in how much evidence it provides. Our searches identified a number of papers that address the concept of private-public partnerships but in terms of evidence there was little to draw from. The majority of the evidence contained in this report is taken from the interviews and correspondence we had with individuals who were able to direct us towards reports and other online material relating to specific case studies; therefore it can be concluded that grey literature is a much better source of evidence.

Overall, it is clear that the topic of funding of flood and coastal erosion schemes is an ever-present concern of FRM professionals, and particularly where the funding sources should come from, given that there is never enough central funding to cover all of the potential FRM interventions.

There are several examples outlined in this report (Zorrotzaurre, Hancock County, Malaysia and the Philippines) where private companies have contributed funds or finance to bespoke engineering and development schemes. Generally, such contributions are forthcoming either because of some financial benefit from the development, or simply to contribute to the companies' CSR (corporate social responsibility) credentials. Trying to expand the use of CSR funds for FRM funding may be difficult because of the wide variety of company structures and drivers, and could be viewed as an extra 'tax' if it became universal across certain types of organisation. Therefore, in terms of providing a model for

more widespread involvement of private funding, neither of the above examples appears that useful.

The evidence suggests that there is a clear difference between flood defence schemes and coastal erosion schemes. Most of the evidence of successful partnership funding is related to coastal schemes. From our conversations with people involved with the various projects we have concluded that this is because:

- Coastal erosion and associated flooding problems have, at their root cause, the ocean. Therefore there is no 'upstream catchment' at play, which ensures that there is no upstream actor that can affect the scheme;
- Similarly to the absence of upstream actors there are typically no downstream actors, i.e. the scheme is unlikely to have an effect on other communities. The exception to this is where the scheme interrupts the longshore flow of sediment, leading to potential and wider erosion issues;
- Typically coastal schemes have defined beneficiaries (businesses, residents etc.) Therefore it is possible to identify a group of people who may be willing to contribute to the scheme as they will directly benefit from it.

A key factor, therefore, seems to be the need to link any proposed FRM scheme with those who would benefit from it, whether this be local businesses or the resident community. A dissemination/education programme is needed to bring about this acceptance of the benefits of a scheme and its costs (economic, social and environmental). This then allows the affected groups to take decisions as to how and whether they will contribute to the works, so enabling them to come into existence. The best examples we have found of this approach are in the USA, where mechanisms exist at state and county level for changes in local taxation, which affects all residents and transient consumers, as well as funding routes that provide tax benefits to companies, in addition to any flood damages they will avoid from the scheme operation. Such schemes appear to be more prevalent for coastal areas, where the 'source-pathway-receptor' chain is clear, rather than for river schemes, where the upstream and downstream interactions complicate the cost-benefit assessment. The positive examples we have found of 'partnership' funding have several attributes:

- The scheme or funding arrangement needs to be promoted by dedicated and enthusiastic people or groups, who are 'in it for the long term'. They can pass on the baton once the key decisions have been taken and agreed;
- The long-term viability of schemes needs to be recognised, which needs any funding or financing to consider long-term maintenance or operation;
- Getting everyone to contribute to a scheme seems to work best, as this engenders shared ownership, vision and commitment. If a neighbour contributes and you don't then this puts you in a bad light, which applies equally to businesses. However there will always potentially be a problem with 'freeloaders';

- Promoting new funding mechanisms seems to work best where the costs and benefits can be isolated to specific, local areas where people and businesses can see what is being paid for and who will benefit. In each case some form of tax reduction or exemption will encourage businesses to get more involved.

A final conclusion that we have drawn is that most of the schemes we have looked at are unique and this has led to bespoke solutions. An exception to this is the scheme at Toogoom in Queensland. To date this remains the only scheme that Fraser Coast Regional Council has implemented, however there is potential for this scheme to be used as a template as the council has put in place a policy that, should there be the need, allows for further schemes to be developed.

# Appendices

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## 2 Questionnaire and covering email

### Introductory text for questionnaire email

HR Wallingford and CEH Wallingford are undertaking a systematic review of funding mechanisms for flood defence and coastal erosion schemes on behalf of Defra in the UK. In particular, the review is concerned with identifying examples from around the world where private funding or financing has been used to deliver defence schemes that provide public benefits.

Based on our web searches and professional links, we believe that you may be able to provide valuable information on this topic, and for this reason we enclose a short survey that we would ask you to complete and return to us.

We should note that the absence of any private funding of national or regional flood schemes is still a valuable conclusion, and therefore please do confirm this in the questionnaire. It may be that we would like to hold a short follow-up teleconference, to expand some of your responses, and we ask that you confirm you are happy to take part in this. Please feel free to add as much text as you need to answer each question.

### Questionnaire

#### FCRM funding & financing routes – Quick Scoping Review

|   |  |
|---|--|
| <b>Name of respondent:<sup>1</sup></b>  |  |
| <b>Country / region:</b>  |  |
| <b>Organisation and role:<sup>2</sup></b>   |  |
| <b>Briefly outline how flood &amp; coastal defence schemes are normally delivered and who is involved</b> |  |

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<sup>1</sup> You can omit this if you wish the response to be anonymous

<sup>2</sup> Please provide some details of the type of organisation so that this can be related to the responses, but you may omit your role

**For the normal situation, how are flood schemes funded or financed?**

**Is there any history of private financing or funding, in part or full? Please provide brief details**

**Who are the organisations who provide such private funding/financing?**

**How long have such funding schemes been in existence?**

**How long did they take to set up?**

**Provide a brief summary of how these schemes operate – links to any reports will be very useful**



**What do you see are the benefits or disadvantages of such schemes?**

**Do you consider that such a funding scheme could be transferred to the UK?**

**Would you be happy to take part in a follow-up telecom?**

Thank you for completing this questionnaire

HR Wallingford & CEH Wallingford

November 2017

