## AUSTRALIAN DISASTER RESILIENCE

## HANDBOOK COLLECTION

Technical Project Brief Template

Template 7-4

*This template is for use with Australian Disaster Resilience Guideline 7-1 Using the National Generic Brief for Flood Investigations to Develop Project Specific Specifications*

Preface

This generic brief template has been designed to be used in conjunction with its associated guideline, Australian Disaster Resilience *Guideline 7-1 Using the National Generic Brief for Flood Investigations to Develop Project Specific Specifications* (ADR Guideline 7-1) (AIDR 2017).

When used together, the brief and the guide provide a consistent basis for the development of technical specifications for flood investigations in consideration of best practice as documented in Australian Disaster Resilience *Handbook 7 Managing the Floodplain: A guide to best practice in flood risk management in Australia* (ADR Handbook 7) (AIDR 2017).

The Handbook 7 Collection can be found at [www.knowledge.aidr.org.au](http://www.knowledge.aidr.org.au).

**For copyright and acknowledgements see ADR Guideline 7-1**

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FINAL VERSION OF BRIEF



Technical project brief template

[project title – generally river/town]

Commissioned by [generally floodplain management entity]

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# Introduction

|Alternative text: using ADR Handbook 7|

[The principal] in partnership with [partner floodplain management entities and agencies] is undertaking a flood investigation of the [location and/or catchment name]. [The project has received financial support from [government program(s)] managed by [agencies]].

*Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR 2017) outlines the following key objectives that are relevant to studies into managing flood risk to communities:

make information on flood risk readily available so that government, risk managers and community can make informed risk management and investment decisions

understand flood behaviour and risk to recognise the impacts of floods on the community and enable effective decisions to be made on flood management

understand and maintain the natural flood functions of flow conveyance and storage of the floodplain to enable effective flood risk management and minimise environmental impacts

manage flood risk to improve community resilience to flooding, and to handle the potential growth of this risk through development and redevelopment, and future changes to floodplain topography and climate.

The Flood Risk Management Framework outlined in Diagram 1 is designed to promote a risk management approach that facilitates the effective understanding of flood risk and decisions on options on a floodplain or catchment basis. It also promotes the management of flood risk more broadly across a floodplain management entity’s (FME’s) service area and within larger catchment boundaries.



[Alternative text: Depending upon jurisdiction, refer to Guideline 7-1 Section 4.1]

# Objectives of the Study

The objective of this study is to improve understanding of flood behaviour and impacts, and better inform management of flood risk in the study area in consideration of the available information, and relevant standards and guidelines as outlined in sections 4 and 5, respectively. The study will also provide a sound technical basis for any further flood risk management investigation in the area.

The study will be overseen and guided by [the principal and its steering committee], which may include representatives from key stakeholder and end user groups. The study will be guided technically by [the principal and a technical committee], which may include representatives from the principal and other organisations (such as state government). The [principal] will be the day-to-day contact for the study.

[Alternative text 1: FS/COMBINED see Guideline 7-1 Section 4.2]

This project involves conducting a flood study, which is a comprehensive technical investigation of flood behaviour that provides the main technical foundation for the development of a robust floodplain management plan. It aims to provide a better understanding of the full range of flood behaviour and consequences in the study area. It involves consideration of the local flood history, available collected flood data, and the development of hydrologic and hydraulic models that are calibrated and verified, where possible, against historic flood events and extended, where appropriate to determine the full range of flood behaviour.]

[Alternative text 2a: Floodplain management study and plan/combined (e.g. a flood study combined with a floodplain management study) see Guideline 7-1 Section 4.2]

[Alternative text 3a: Floodplain management plan/combined (e.g. a floodplain management study combined with a floodplain management plan) see Guideline 7-1 Section 4.2]

[Alternative text 4a: Floodplain management study and plan review see Guideline 7-1 Section 4.2]

The overall project provides an understanding of, and information on, flood behaviour and associated risk to inform:

* relevant government information systems
* government and strategic decision makers on flood risk
* the community and key stakeholders on flood risk
* flood risk management planning for existing and future development
* emergency management planning for existing and future development, and strategic and development scale land-use planning to manage growth in flood risk decisions on insurance pricing.
* [Alternative text 2b: FRMS/COMBINED see Guideline 7-1 Section 4.2]
* [Alternative text 3b: Floodplain management plan/combined see Guideline 7-1   
  Section 4.2

The degree of sophistication of the study should be commensurate with the scope of the study and the outcomes and outputs required from the study and the complexity of the flood situation.

Depending upon the degree of sophistication of the study the outputs of the study outlined in Section 7 may be able to assist this by:

* providing a better understanding of the
* variation in flood behaviour, flood function, flood hazard and flood risk in the study area
* impacts and costs for a range of flood events or risks on the existing and future community
* impacts of changes in development and climate on flood risk
* emergency response situation and limitations
* effectiveness of current management measures
* facilitating information sharing on flood risk across government and with the community.

The study outputs will also inform decision making for investing in the floodplain; managing flood risk through prevention, preparedness, response and recovery activities; pricing insurance, and informing and educating the community on flood risk and response to floods. Each of these areas has different user groups, whose needs vary. The key end-user groups that this study aims to support are identified in   
Table 1.

Table 1: Project end users

|  |
| --- |
| **Potential end user groups** |
| High-level strategic decision makers |
| Community |
| Flood risk management professionals |
| Engineers involved in designing, constructing and maintaining mitigation works |
| Emergency management planners |
| Land-use planners (strategic planning and planning controls) |
| Hydrologists and meteorologists involved in flood prediction and forecasting |
| Insurers |
| [Others] |

Meeting the requirements of the identified end user groups, which have been tailored to the context of the flood situation, is a key objective of this study.

# Background and Study Area

[Paragraph 0: Summary of key drivers for undertaking the study] see Guideline 7-1 Section 4.3

[Paragraph 1: Study area overview] see Guideline 7-1 Section 4.3

[Paragraph 2: Catchment description] see Guideline 7-1 Section 4.3

[Paragraph 3: Study area political context] see Guideline 7-1 Section 4.3

[Paragraph 4: Description of flood behaviour] see Guideline 7-1 Section 4.3

[Paragraph 5: Description of flood history] see Guideline 7-1 Section 4.3

[Paragraph 6: Description of flood emergency management situation] see Guideline 7-1 Section 4.3

|Optional [Paragraph 7: Preferred Modelling Software] see Guideline 7-1 Section 4.3 |

[Paragraph 8: How the outcomes of the study are going to be used] see Guideline 7-1 Section 4.3

[Figure 2: Study area] see Guideline 7-1 Section 4.3

**(Insert Figure 2 here)**

Figure 2: Study Area (see Guideline 7-1 Section 4.3)

# Available Information

The study is to draw upon:

* existing flood investigations in the area (Table 2)
* relevant local land-use planning policies, flood emergency management plans and local design standards (Table 3).

The study should use relevant existing data that is available from the principal for use by the consultant during the study (Table 4) and other organisations that may have other relevant information – for example, road or rail authorities, and the Bureau of Meteorology (Table 5). The data listed in Table 4 will be provided or arrangements for access made at the start of the study.

Table 2: Summary of previous studies [see Guideline 7-1 Section 4.4]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study name** | **Description (one paragraph summary)** | **Author** | **Year** |  | **Accessible for tendering and project** |
| [e.g. Study Area Flood Study] |  |  |  |  | [yes/no/electronic/hardcopy/in-house at office of principal (include timeframe etc.)] |

Table 3: Summary of local policies and emergency management plans [see Guideline 7-1 Section 4.4]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Document** | **Description (one paragraph summary)** | **Author** | **Year** | **Accessible for tendering and project** |
| **Land-use planning policies** |  |  |  | [yes/no/electronic/hardcopy/source /in-house at office of principal (include timeframe etc.)] |
| **Emergency management plan** |  |  |  |  |
| **Local design standards** |  |  |  |  |

Table 4: Available and compiled existing data [see Guideline 7-1 Section 4.4]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data type** | **Description** | **Source/agency** | **Year** | **Accessible** |
| **Historic flood information** |  |  |  | [yes/no/ electronic/hardcopy/in-house at office of principal (include timeframe etc.)] |
| **Hydrologic data**  **Stream water level gauges (station number and record length (years))** |  |  |  |  |
| **Survey data (ALS/topographic DEMs)** |  |  |  |  |
| **GIS layers** |  |  |  |  |
| **Hydrologic models** |  |  |  |  |
| **Hydraulic models** |  |  |  |  |

Table 5: Organisations with relevant existing data [see Guideline 7-1 Section 4.4]

|  |  |  |
| --- | --- | --- |
| **Agency/office** | **Relevant contacts – name, email, phone** | **Comments** |
| **[list]** |  |  |

# 5. Current Guidelines and References

The consultant should use current guidelines, manuals and technical reference documents during the study. These documents detail best practice in regards to management of flood risk. They cover both best practice about the technical assessment of flood behaviour and flood risk, and, more generally, who has responsibility for managing flood risk and how this management is best achieved in the area. Sources are outlined in Table 6.

Table 6: Guidelines and reference documents [see Guideline 7-1 Section 4.5]

|  |  |  |  |
| --- | --- | --- | --- |
| **Reference** | **Source/link** | **Topic** | **Comment** |
| **National** | | | |
| Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia | www.knowledge.aidr.org.au | Best Practice in Flood Risk Management | Adhere to /consider |
| Guideline 7-2 Flood Emergency Response Classification of the Floodplain | www.knowledge.aidr.org.au | Emergency Response |  |
| Guideline 7-3 Flood Hazard | www.knowledge.aidr.org.au | Flood Hazard |  |
| Guideline 7-5 Flood Information to Support Land-use Planning | www.knowledge.aidr.org.au | Land-use Planning |  |
| Guideline 7-6 Assessing Options and Service Levels for Treating Existing Risk | www.knowledge.aidr.org.au | Mitigation options and service levels |  |
| Australian Rainfall & Runoff (ARR) | http://www.arr-software.org/project-reports.html | Best Practice in Hydrological and hydraulic modelling |  |
| This includes the current version of ARR and specific advice published on the ARR website, such as: |  |
| Project 18 – Interaction of coastal processes and severe weather events | http://arr.ga.gov.au/arr-guideline |
| Project 11 – Blockage of hydraulic structures |  |
| Best practice floodplain risk management (FRM) guidelines |  |
| Australian Disaster Resilience Handbook Collection - Manual 27 Disaster Loss Assessment Guidelines | www.knowledge.aidr.org.au |  |  |
| Australian Disaster Resilience Handbook Collection - Manual 28 Economic and Financial Aspects of Disaster Recovery | www.knowledge.aidr.org.au |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Other national documents or guidelines that provide best practice advice for issue specific support, such as the technical flood risk management guidelines on flood hazard and flood emergency response classification of the floodplain and ANCOLD guidelines for dam break assessments |  |  |  |
| **Jurisdictional** | | | |
| Relevant jurisdictional specific standards or requirements |  |  |  |
| Relevant documents or guidelines that provide jurisdictional specific advice or support |  |  |  |
| Relevant jurisdictional guidelines for the acquisition of aerial survey methods |  |  |  |

# 6. Scope of Work

The proposal is to outline a methodology that will achieve the objectives of the study, listed in Section 2 for the identified key end users (Table 1). The proposed methodology is to be developed to meet the scope of work and produce the deliverables detailed in Section 7 in the formats outlined, and comply with the guidelines and best practices listed in Section 5 in consideration of the available information (Section 4).

It is to follow the general structure of a hydrologic model and hydraulic model being used to estimate the behaviour of design flood events, while being aided by available data, data collection and community consultation, to estimate flood risk to the community.

It concludes with a handover of deliverables at the completion of the study in the formats outlined in Table 14.

The tenderer’s proposal is to have a section on limitations to specifically indicate the ability to comply with the full requirements of the brief or to specifically identify any limitations of their proposed approach in meeting the full requirements of this brief, including the defined deliverables for all end users.

### 6.1 Data collection and review

Data collection should gather and collate all data necessary for the completion of the study. It is typically begun at the outset of the study, when the majority of data is collected (or commissioned to be collected). The remaining data will be collected during the study, either as it is required or as it becomes available – for example, for a recent flood event.

This data will be supplied at the start of the study. All available and collected data should be reviewed and considered in the development of the study. Reporting on data collection should consider the findings and any recommendations of this review.

|Optional text: Data collection study already completed and is listed in Table 2| refer to Guideline 7-1 Section 4.6.1

Where the need for and availability of data additional to that listed in Section 4 could have reasonably been anticipated before the close of tenders, the consultant shall obtain the data as part of the project. The cost of obtaining these data is to be included in the proposal fee.

If additional data become necessary during the study, and it can be shown the need or availability could not have been reasonably anticipated during the tender process, the consultant is to submit a brief to the principal that outlines what data are required, and the cost and timing of acquiring them.

Following the principal’s approval, the consultant will undertake the additional data collection.

#### 6.1.1 Topographic survey

Proposals are to include a realistic estimate of the cost of the required survey that reflects the recommended hydraulic modelling approach, and provisional model configuration and any available survey information, as listed in Table 4. The modelling approach and provisional hydraulic model configuration should be based on the information reasonably available to consultants at the time of tendering following reasonable enquiry.

If alternative modelling approaches with different survey requirements are proposed for consideration, then realistic survey costs associated with each option must be provided as part of the project. Where alternative modelling approaches are proposed, costs associated with collection of detailed data on control structures such as bridges, culvert and roads across the floodplain must be included.

Topographic data obtained using aerial survey methods are to comply with any relevant guidance outlined in Table 6. Consultants are advised that any subcontractor under this consultancy for the acquisition of topographic information will be required to include provisions relating to intellectual property and use by government.

Deliverables should meet the requirements and be consistent with the format specified in Table 14.

|Optional text: Study requires topographic survey collection| refer to Guideline 7-1 Section 4.6.1

|Optional text: LiDAR acquisition| refer to Guideline 7-1 Section 4.6.1

#### 6.1.2 Digital elevation model development

|Optional text – DEM development| refer to Guideline 7-1 Section 4.6.1

#### 6.1.3 Survey for flood damages assessment

|Optional text – Study requires floor level survey| refer to Guideline 7-1 Section 4.6.1

|Alternative text 1 – Detailed floor level survey| refer to Guideline 7-1 Section 4.6.1

|Alternative text 2 – Estimated floor level survey| refer to Guideline 7-1 Section 4.6.1

### 6.2 Site Visit

During the initial stages of the project, the project team should undertake a comprehensive familiarisation field inspection of the study area. This should be conducted to enable an understanding of key features within the catchment and floodplain that may influence flood behaviour. Ideally, this would be undertaken with representative(s) from the principal organisation and would be used to inform development of the survey brief.

### 6.3 Consultation

Community consultation has an important role in all flood-related studies. The outcome goals for community consultation can be to:

* inform the community about the study
* identify community concerns
* gather information from the community by participation
* develop and maintain community confidence and collaboration with the study results
* seek input from the community on management options.

These principles are in line with those detailed in the relevant community engagement guideline listed in Table 6.

The consultant is to propose a consultation program considering the relevant guidance outlined in Table 6 that is suitable for the study, achieves each consultation point identified in Table 7 and, at a minimum, uses the tools identified in the same table. The consultant’s proposal is to form the basis of a program community consultation with further discussion at the inception meeting for the project.

Table 7: Consultation points and tools [see Guideline 7-1 Section 4.6.3]

|  |  |  |
| --- | --- | --- |
| **Consultation point** | **Consultation tools** | **Comment/aim** |
| [e.g. Stage 1] | [e.g. newsletter, media release] | [e.g. inform] |
| [e.g. public exhibition] | [e.g. information session] | [e.g. gather feedback] |

|Optional text: Consultation tools description| refer to Guideline 7-1 Section 4.6.3

Consultation with key stakeholders is an important aspect of the consultation process. Key stakeholder groups are identified in Table 8. This list is not exhaustive and other stakeholder may be identified throughout the study. The consultant is to demonstrate how they will engage with the identified and potential future stakeholders.

Table 8: Key stakeholders for consultation [see Guideline 7-1 Section 4.6.3]

|  |  |
| --- | --- |
| **Stakeholder group** | **Comment** |
| [e.g. technical officers at principal organisation] |  |

### 

### 6.4 Hydrologic analysis

The purpose of the hydrologic analysis is to calculate all flows entering the hydraulic model, either as upstream or point inflows, rainfall, or as an oceanic boundary. The consultant is to provide details of how this is to be undertaken including recommended methods of analyses that are fit for purpose for the study area and project scope, and align with industry best practice in ARR. Possible methods of analyses may include flood frequency analysis and rainfall-runoff routing models. Features of the catchment that have a distinct influence on the catchment’s hydrology are listed in Table 9.

Table 9: Catchment features affecting hydrology [see Guideline 7-1 Section 4.6.4]

|  |
| --- |
| **Catchment feature** |
| [e.g. gauge no. 1234567 was moved 1 km downstream in 1990] |
| [e.g. extensive vegetation clearing along the creek bank occurred in 1970s] |

|Optional text – Previous hydrologic analysis exists and should be adopted| refer to Guideline 7-1 Section 4.6.4

|Optional text 1a – Previous hydrologic analysis will require update| refer to Guideline 7-1 Section 4.6.4

|Optional text 1b – Included for any case where an existing hydrologic analysis exists| refer to Guideline 7-1 Section 4.6.4

|Optional text – Comparison of 2016 IFD data to at site gauge data| refer to Guideline 7-1 Section 4.6.4

#### 6.4.1 Model selection

|Alternative text 1 – Rainfall-runoff routing| refer to Guideline 7-1 Section 4.6.4

Given the scope of the study and the likely hydraulic modelling and outputs required, an appropriate computer-based rainfall-runoff routing model is suitable for this study. The chosen modelling software should be detailed, including a description of its capability to represent all significant features of the catchment. The extent of the rainfall-runoff routing model shall be sufficient to establish reliable boundary conditions for input to the hydraulic model covering the study area.

|Alternative text 2 – Regional methods| refer to Guideline 7-1 Section 4.6.4

|Alternative text 3 – Explanatory text to be included if principal believes a flood frequency analysis is viable | refer to Guideline 7-1 Section 4.6.4

|Alternative text 4 – Direct rainfall method | refer to Guideline 7-1 Section 4.6.4

|Optional text 1a – Combined regional method and runoff routing | refer to Guideline 7-1 Section 4.6.4

|Option text 1b – Combined flood frequency analysis and runoff routing| refer to Guideline 7-1 Section 4.6.4

|Alternative text 1 – Simple hydrologic approaches| refer to Guideline 7-1 Section 4.6.4

|Alternative text 2 – Ensemble hydrologic approaches – best balance for most studies| refer to Guideline 7-1 Section 4.6.4

[The hydrologic analysis is to use the ensemble hydrologic modelling approach outlined in Australian Rainfall and Runoff 2016. This approach relies on selecting an ensemble of 10 and in some cases 20 temporal patterns for each event duration. The design flow at key locations should be calculated by the averaging the flow from the ensemble for each duration. These key locations should be areas within the catchment where the hydraulic model is to be set up including inflow locations to the hydraulic model and those locations further downstream within the hydraulic model where tributaries combine]

|Alternative text 3 – Complex hydrologic approaches – used in limited circumstances where advanced techniques are required| refer to Guideline 7-1 Section 4.6.4

### 6.5 Hydraulic model

The purpose of the hydraulic model is to simulate the behaviour of flood waters in the study area, including their depth, level and velocity as they vary across the study area. The model is to be able to represent all topographic features of the study area that significantly affect flood behaviour, including waterways, overland flow paths, subsurface drainage, and structures such as bridges, culverts, levees, detention basins, entrance berms and oceanic inundation. The study area for modelling including specific waterways to be modelled is included in Figure 1.

The proposal is to nominate a software model and configuration that is suitable to achieve the required outcomes of this study, including the assessment of flood risk management measures as part of this or subsequent studies in a cost effective manner. The proposal should detail how it will achieve these outcomes, and identify any limitations or shortcomings of the proposed approach. Features of the catchment that have a distinct influence on the hydraulic behaviour of the flooding are listed in Table 10.

Table 10: Catchment features affecting hydraulic behaviour [see Guideline 7-1 Section 4.6.5]

|  |
| --- |
| **Catchment feature** |
| [e.g. bridge at Main Street was upgraded (including raising) in 1984] |
| [e.g. levee built at low point at end of Flood Street in 2001] |

The selection of hydraulic modelling technique is primarily governed by the complexity of the flood situation and flood risk present.

|Optional text – Previous hydraulic analysis exists and should be adopted| refer to Guideline 7-1 Section 4.6.5

|Optional text – Previous hydraulic analysis will require update| refer to Guideline 7-1 Section 4.6.5

|Optional text – Included for any case where an existing hydraulic analysis exists| refer to Guideline 7-1 Section 4.6.5

#### 

#### 6.5.1 Model selection

|Alternative text 1 – Historical information| refer to Guideline 7-1 Section 4.6.5

|Alternative text 2 – 1D steady state| refer to Guideline 7-1 Section 4.6.5

|Alternative text 3 – Dynamic 1D or course 2D| refer to Guideline 7-1 Section 4.6.5

|Alternative text 4 – Dynamic 2D rural| refer to Guideline 7-1 Section 4.6.5

|Alternative 5 – Dynamic 1D/2D riverine| refer to Guideline 7-1 Section 4.6.5

|Alternative 6 – Dynamic 1D/2D overland| refer to Guideline 7-1 Section 4.6.5

|Alternative 6a – All pipes in| refer to Guideline 7-1 Section 4.6.5

|Alternative 6b – Greater than minimum-sized pipes in| refer to Guideline 7-1 Section 4.6.5

|Alternative 6c – No pipes in| refer to Guideline 7-1 Section 4.6.5

|Alternative text 1 – Simple hydrologic approaches – best balance for most studies| refer to Guideline 7-1 Section 4.6.5

|Optional text 1a – sensitivity of design flood estimate to temporal patterns| refer to Guideline 7-1 Section 4.6.5

|Optional text 1b – To be added for Direct Rainfall methods|

|Alternative text 2 – Ensemble hydraulic approaches| refer to Guideline 7-1 Section 4.6.5

|Optional text 2a – To be added for Direct Rainfall methods|

|Alternative text 3 – Complex hydraulic approaches| refer to Guideline 7-1 Section 4.6.5

If a tenderer supports using a different model type, reasoning should be given as to how this model is suitable, including how it will meet the objectives of the study and produce the deliverables as outlined in Section 7 for the full range of end users’ needs, as well as any shortcomings the model type will have. The project schedule should be amended to clearly identify a specific item to include all the associated costs. This cost should be considered as part of the lump sum proposal.

### 6.6 Model calibration and validation

The models are to be calibrated and validated to a standard consistent with both the principal’s expectations and with the guidelines on model calibration that form parts of the material listed in Table 6, before any work on simulation of design flood levels.

The consultant shall review the available data and information, and provide guidance on the possibility of undertaking a reasonable calibration and validation process.

A report and supporting data files are to be provided to outline calibration and validation for consideration and review by the principal. The consultant shall not undertake any aspect of the design flood modelling until the principal has reviewed and provided written approval of the model calibration and validation. This report and the supporting data files provided should meet the requirements of the relevant guideline as outlined in Table 6.

|Alternative text 1: No calibration data| refer to Guideline 7-1 Section 4.6.7

|Alternative text 2: Calibration data (either hydrologic or hydraulic)| refer to Guideline 7-1 Section 4.6.7

|Optional text 2a: Explicitly quantified calibration| refer to Guideline 7-1 Section 4.6.7

|Alternative text 3: Model has already been calibrated| refer to Guideline 7-1 Section 4.6.7

|Optional text 1– Ground truthing – desktop review| refer to Guideline 7-1 Section 4.6.7

|Optional text 2 – Ground truthing – field| refer to Guideline 7-1 Section 4.6.7

### 6.7 Rating curve review

|Optional text – rating curve review| refer to Guideline 7-1 Section 4.6.7

### 6.8 Model parameter sensitivity

Sensitivity analyses shall be carried out to assess how much influence model parameter values have on the results of the calibration and validation. The main parameters are those simulating rainfall (spatial and temporal variation), rainfall losses, catchment storage and lag, friction, energy losses, and blockage at culverts, bridges and other structures. The sensitivity of the model results to downstream boundary conditions shall also be tested.

Sensitivity analyses shall also be carried out to assess the relative uncertainty associated with the design results. The consultant is to clearly state the proposed approach and methodology, along with nature and extent of sensitivity testing that will be undertaken.

|Optional text – Model sensitivity has already been assessed|

|Optional text 1 or 2 – Model sensitivity ARR2016| refer to Guideline 7-1 Section 4.6.7

### 

### 6.9 Modelling events

The study should consider flood behaviour for a range of events. Table 11 outlines the events that should be considered for this study. The events and scenarios included will depend upon the end use of this information.

For the design event runs outlined in Table 11, the calibrated model is to be modified as necessary to accurately represent the relevant conditions for the scenario, with model and modelling parameter changes clearly documented.

|Optional text – Catchment flooding and coastal inundation| refer to Guideline 7-1 Section 4.6.8

|Optional text –Alternate 1– Blockage- ARR| refer to Guideline 7-1 Section 4.6.8

|Optional text –Alternate 2– Blockage- Alternate| refer to Guideline 7-1 Section 4.6.8

|Optional text – Waterway timing coincidence| refer to Guideline 7-1 Section 4.6.8

The models are to be run for all the relevant scenarios and the results discussed in reporting and used to developed relevant deliverables.

Table 11: Flood events or floodplain conditions to be assessed [see Guideline 7-1 Section 4.6.6, Table 2]

|  |  |  |
| --- | --- | --- |
| **Scenario ID** | **Event** | **Description/Information** |
| 1(A) | Historical calibration/validation flood events – historic conditions | [Month, year] |
| 2(B) | Design flood events existing conditions | [Events] |
| 3 | Design flood events | [Events] |
| 4(D) | Design flood event to test sensitivity to climate change | [Events] |
| 5 | Design events for assessing levee failure and overtopping and modelling flooding without levee | [Events] |
| 6 | Design events for assessing the impacts of proposed works in the floodplain (e.g.) road upgrade | [Events] |
| 7(C) | Design events for model parameter sensitivity analysis | [Events] |
| 8 | Design events for assessment of flood hazard | [Events] |
| 9 | Design events for assessment of flood function | [Events] |
| 10 | Design events for assessment of individual floodplain management options and treatment packages | [Events] |
| 11 | Design events for assessment of flood warning and emergency management | [Events] |
| 12 | Design events for developing information to support land use planning activities | [Events] |

The use of an extreme event instead of the probable maximum flood (PMF) is to be approved by the principal, unless stated in Table 11.

### 6.10 Consequences of flooding to the community

|Optional text – Consequences of flooding on the community| Refer to Guideline 7-1 Section 4.6.10

|Optional text – Flood damages assessment| refer to Guideline 7-1 Section 4.6.10

|Optional text: Levee failure and overtopping analysis| refer to Guideline 7-1 Section 4.6.10

|Alternative 1 – Simple Scenario|

|Alternative 2 – Complex Scenario|

|Optional text – Impacts of dams on flood behaviour| refer to Guideline 7-1 Section 4.6.10

|Optional text – Assessment of the impacts of climate change on flood behaviour| refer to Guideline 7-1 Section 4.6.10

### 6.11 Post processing of results

|Optional section: Flood hazard assessment| refer to Guideline 7-1 Section 4.6.11

|Optional text 1: Simple|

| Optional text 2: Complex|

|Optional section – Flood emergency response classification of the floodplain| refer to Guideline 7-1 Section 4.6.11

### 6.12 Information to support decisions on activities in the floodplain and managing flood risk

|Optional section – Flood planning area| refer to Guideline 7-1 Section 4.6.12

|Optional section – Information to support emergency management activities | refer to Guideline 7-1 Section 4.6.12

|Alternative text 1 – Simple: Advice on land-use planning considering flooding|

|Alternative text 2 – Complex: typically based upon the information from a flood study|

|Alternative text 3 – More complex: typically using products of a floodplain management study|

|Optional section – Advice on land-use planning considering overland flooding| refer to Guideline 7-1 Section 4.6.12

|Optional section – Assessment of cumulative impacts of development| refer to Guideline 7-1 Section 4.6.12

|Optional section – Impact of floodplain works assessment| refer to Guideline 7-1 Section 4.6.12

### 6.13 Option assessment

|Optional section – Assessment of management options| refer to Guideline 7-1 Section 4.6.13

|Option 1 – Preliminary identification of management options|

|Alternative 1a – Simple|

|Alternative 1b – Complex|

|Option 2 – Detailed assessment of floodplain management options| refer to Guideline 7-1 Section 4.6.13

|Optional text 3 – Detailed assessment including a multi criteria assessment| refer to Guideline 7-1 Section 4.6.13

### 6.14 Floodplain management plan

|Optional section – Floodplain management plan| refer to Guideline 7-1 Section 4.6.14

### 6.15 Peer review

|Alternative text 1 - internal| refer to Guideline 7-1 Section 4.6.15

|Alternative text 2 – technical review panel| refer to Guideline 7-1 Section 4.6.15

|Alternative text 3 – independent review| refer to Guideline 7-1 Section 4.6.15

### 6.16 Reporting

The draft and final report is to cover the issues identified in the scope of work in sufficient detail to be fit for the intended purpose. As a minimum it is to contain the following information:

|Option line items – based on scope items included| refer to Guideline 7-1 Section 4.6.16

**Executive Summary**

* Outlining the purpose of the study as well as its methodology, results and conclusions

**Introduction**

* Outlining the purpose of the study, the intended end users and the client

**Background**

* Study Area - description of the study area, its catchment(s) and the history of flooding in the area
* Previous Studies - a summary of the previous studies completed in the area and their relevance to the   
  current study
* Discussion of relevant policies, legislation and guidance
* Flood Behaviour - Written description of design and historical flood behaviour for a range of events for locations across the study area

**Available Data**

Provided and collected – description of all data collected (data and survey) and used for the study and their limitations and final ownership. This includes:

* Historic Data – including summary of historic events and available data
* Guidelines used
* Data collection
* Information from Site Visit
* Topographic and Aerial Survey and imagery
* DEM Development
* Survey for Flood damage assessment

**Community Consultation**

* Methodology
* Materials developed
* Discussion on inclusive consultation undertaken and results for different stages

**Hydrological analysis**

Description of the hydrologic analyses, including any review of existing models and studies, and calibration and validation, and assumed catchment conditions.

* Hydrologic controls in catchment and changes overtime
* Model Review
* Description of model
* Review Model parameter selection and assumed catchment conditions
* Assessment of fitness for purpose
* Recommended modification or alternative approaches
* Model Selection
* Model Setup
* Model parameter selection
* Model results – reporting and presentation of results for all design runs identified in Table 11 including design flood hydrographs at gauges and key locations.
* Compare at-site data to BOM 2016 IFD

**Hydraulic Analysis**

Description of the hydraulic analyses, including any review of existing models and studies.

* Identification of hydraulic controls in the floodplain and any key changes overtime
* Model Review
* Description of model
* Review Model parameter selection and assumed catchment conditions
* Assessment of fitness for purpose
* Recommended modification or alternative approaches
* Model Selection
* Model Setup

**Model Calibration and Validation**

Description of model calibration and validation. Presentation of results showing model fit to calibration and validation flood events, if applicable

* Model parameter selection and assumed catchment conditions
* Model results - reporting and presentation of results for all design runs identified in Table 11 including design flood hydrographs at gauges and key locations.

**Model sensitivity**

Description of the results of sensitivity analysis and model checks.

**Overall Model results**

* written description of likely model accuracy and limitations such as domain extent compared with suitable study area for result use

**Consequences of Flooding on the Community**

* Identification of existing flood problem areas
* Flood Impacts - A preliminary assessment of flood impacts and risk in the study area.
* Written description (aided by figures if needed) to describe flood levels at which roads are cut and other relevant information
* Flood damages. Assessment and reporting on flood damages
* Levee failure and overtopping
* Dam Break Assessment
* Impacts of climate change

**Post Processing of Results**

Reporting on and providing the following post processed model outputs.

* Flood Extents
* Flood function
* Flood hazard
* Flood Emergency Response Classification

**Information to inform decisions on activities in the floodplain and managing flood risk**

* Emergency Response
* Land use planning
* Cumulative Impacts
* Impacts of works on the floodplain.

**Option Assessment**

* Identification and preliminary assessment of options.
* Detailed option assessment.

**Peer Review**

**Conclusions**

**Recommendations**

**Data Handover**

* The report is to summarise the intellectual property of all study material (including outputs, models and input data), in consideration of the requirements of the brief.
* It is also to document the information handed over as part of the study, including all relevant model files and versions used in the study as outlined in Section 7.

**Figures**

**Acknowledgements**

**References**

**Appendices**

* **Floodplain Management Plan report**
* Executive summary
* Introduction
* Discussion of inclusive consultation undertaken
* Recommended Actions
* Implementation plan
* Presentation of base information to support funding applications
* Discussion of how monitoring of plan should be undertaken

Printing of the final report(s) shall not proceed without the written direction of the principal. The cost of all work associated with preparing the approved final report shall be included in the consultant’s fee estimate.

### 6.17 Meetings

Meetings are to be held regularly throughout the duration of the study. The meetings shall be attended by representatives from the principal (typically land-use planning, engineering, disaster management, community engagement, etc.) as well as, occasionally, the management committee. Meetings will generally take place at the project inception and when progress milestones are reached. The meeting location and number of meetings, their purpose and expectations of the consultant are shown in Table 12.

Table 12: Meeting requirements [see Guideline 7-1 Section 4.6.17]

|  |  |  |  |
| --- | --- | --- | --- |
| **Meeting Type/Purpose** | **Location** | **Number of Visits Required** | **Expectation of Consultant** |
| [e.g. Inception meeting with Principal representatives] | [e.g. Principal/consultant offices] | [1] | [finalising conditions of commission, handover of data, etc] |
| [e.g. Principal’s project technical committee and steering committee] | [e.g. Principal/consultant offices/as above] | [2] | [Reporting and presenting to technical committee, receiving and discussing feedback, clarifying technical matters, etc] |

### 

### 6.18 Timing and hold points

The end of each stage represents a milestone. The study will also include significant hold points where a principal review period should be allowed for. The consultant is not to commence works on any new stage beyond a hold point without written approval of acceptance of the previous stage from the principal’s representative. Acceptance of the final report and handover of all relevant materials will mark the completion of the study. Key project stages for reporting and managing progress payments are shown in Table 13.

Table 13: Project stages [see Guideline 7-1 Section 4.6.18]

|  |  |  |
| --- | --- | --- |
| **Phase/stage** | **Description** | **Hold points** |
| Phase 1 | Data collection |  |
|  | [Add additional entries as required See Guideline 7-1 Section 4.6.18] |  |

# 7 Deliverables

Deliverables are to be produced in the formats specified in this section and provided to the Principal in accordance with the milestones of the study as outlined in Table 13. They include progress, draft and final reports, survey data, model set-up files, model files and model results, and mapping products. Outputs will be used by a number of end users for a variety of purposes and, therefore, all deliverables should adhere to the formats specified in the following section, in accordance with any relevant guideline detailed in Section 5 and provided in GIS format, where possible.

Output deliverables are to be provided for the events listed in Table 11. Table 14 lists required deliverables and indicates whether a hard copy figure is required as part of the final report. All mapping should be clear and legible. All deliverables are to be provided electronically (where applicable) to assist in provision of information to all study end users. Some deliverables are also required in hardcopy in the report.

Table 14 provides a listing of the majority of deliverables required from this study, it aims to provide an indication of the scope and scale of deliverable requirements for this study.

Table 14: Output Deliverables [see Guideline 7-1 Section 4.7]

|  |  |  |
| --- | --- | --- |
| **Deliverable** | **Specifics** | **Notes, Formats and Preferences** |
| Data | Survey data | Raw and Processed. Spatial Layer of locations  [e.g. MGA 56]  [e.g. mAHD or local datum and any correlation] |
| LiDAR | [e.g. MGA 56]  [e.g. mAHD and BOM gauge] |
| Aerial Imagery | Catalogue of imagery |
| Digital Elevation Model | [e.g. MGA 56]  [e.g. mAHD or local datum] |
| Flood data | Collected historical information, gauge/rain  [e.g. mAHD and BOM gauge] |
| Survey for flood damages assessment | [Number of properties to be surveyed/estimated]  Provided as part of a cadastral GIS layer or as a .csv excel file in tabular form. Floor, ground and levels are to be tabulated with the properties’ property number or address, coordinates. |
| Hydrologic controls | Survey or description |
| Hydraulic controls | Survey or description |
| Model Outputs | [Simple/Complex, Refer Guideline 7-1 Section G4.7] | [Details] |
|  | Maximum water levels |  |
| Study Area Wide | [e.g. time series water level] |  |
|  | [e.g. impacts on flooding of future conditions] | Development or climate change |
| Mapping/processed outputs | [e.g. flood planning area/levels] | Indicative, preliminary or detailed |
|  | [e.g. flood function] |  |
|  | [e.g. impact on flood behaviour maps] | May be included as part of assessment of floodplain management options |
| Specific Locations | [e.g. time series flow] | Point locations |
|  | [e.g. results at specific locations] | Level, depth, flow velocity, rate of rise, inundation time locations shown in Figure 1 |
|  | Model DEM | Consistent with model results |
|  | Modelling output for post processor viewer | Steady state/dynamic [e.g. Water ride] |
|  | Visualisation/animation | [e.g. key location/whole study area] |
| Reports | Monthly Progress Reports | [e.g. 1 electronic copy] [e.g. MS Word/PDF] |
|  | Survey Brief, where required | [e.g. 1 electronic copy] [e.g. MS Word/PDF] |
|  | Calibration and Validation Report | [e.g. 1 electronic copy] [e.g. MS Word/PDF] |
|  | Progress Reports | [Stages 1, 2, 3, 4, etc.] [e.g. 1 electronic copy] [e.g. MS Word/PDF] |
|  | Draft report | e.g. 2 copies, 1 electronic] [e.g. MS Word/PDF] |
|  | Final report | [e.g. 5 copies, 1 electronic] [e.g. MS Word/PDF] |
|  | Handover report | [e.g. 1 electronic copy] [e.g. MS Word/PDF] |
|  | Figures | [Figures of flood layers to be A3 unless otherwise stated. Flood layers to be overlaid on cadastral map or aerial photography, including a legend. Other figures.] |