Implementation of the levee regulatory framework

Review report

February 2018
Summary

The Department of Natural Resources, Mines and Energy (DNRME) has conducted a review of the implementation of the levee regulatory framework. This delivers on the Government’s response to an audit of flood resilience in Brisbane River catchments, conducted by the Queensland Audit Office (QAO) in 2016.1 As recommended by the QAO, DNRME engaged with the councils of Ipswich City Council and the Lockyer, Scenic Rim and Somerset Regional Councils in conducting the review, and also consulted the Local Government Association of Queensland (LGAQ), the Council of Mayors, and other relevant State agencies.

The regulatory framework for levees requires approval to be given under the Planning Act 2016 for constructing new levees, or modifying existing levees. Local governments are the assessment manager for levee approvals, and the State Government is a referral agency for levees that have off-property impacts and impact three people or more.

Consultation identified the following issues with implementing the framework:

- Lack of data on the present landform and on levees already existing in May 2014 (when the regulations commenced), which are needed to support compliance, assessment, and flood planning
- High cost of the hydraulic assessments which are required to be conducted by applicants and the assessment manager
- Capacity and capability limits on local governments to meet their responsibilities for assessment and compliance
- Low community awareness of the regulations, which together with the high cost may be leading to a low level of engagement
- Structures regulated by other agencies under other Acts may not undergo the equivalent consideration of their impacts on flooding
- Councils may become liable for impacts caused by approved levees or illegal levees
- Absence of powers under the framework to take action against levees already existing in May 2014 if they are, or become unsafe
- Need for review of the Codes and Guidelines to make them easier to use, encourage the use of suitably qualified engineers, and to take climate change into account.

Other issues identified by the QAO audit include the need for increased use of pre-lodgment discussions, the complaints-driven approach to compliance, fees, and the lack of an assurance process for self-assessable levees.

To address key issues, DNRME has identified a number of actions (summarised in Table 1) developed in consultation with technical officers of the four local governments and the Council of Mayors (SEQ):

4.1 Data needs analysis: In consultation with local governments, conduct a scoping study to identify gaps in data needed to support levee assessment, planning and compliance.

4.2 Support for assessments: Provide appropriate technical support for councils, together with advice and basic training on levee codes and guidelines on a needs basis.

4.3 Community education: Develop appropriate communication materials (e.g. information sheets) suitable for use by local governments to raise community awareness within their areas.

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1 Queensland Audit Office 2016: 'Flood resilience of river catchments (Report 16: 2015-16)'. 
4.4 **Codes and Guidelines**: Update the codes and guidelines applying to levees to improve efficiency and effectiveness in assessments and applications.

4.5 **Monitoring and record-keeping**: Develop and maintain a basic levees recording system for the levee regulation.

As the levee regulation has been in place only since May 2014, experience on its implementation is still somewhat limited. Continued assessment of the regulatory performance in the future may identify further issues and opportunities for improvement.

As required by the QAO, the review examined levee management in the middle and upper Brisbane River catchment only. There may be additional issues affecting implementation of the levee regulation elsewhere in the State.

Taking the actions identified will enable the value to be realised more fully and enhance community resilience to flooding. In addition, the increasing development of flood management planning and its integration into the land use planning framework has the potential, over time, to provide a more efficient and comprehensive approach to improving community resilience.
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1. Background

1.1 History of the levee regulatory framework

Levees – in the general sense of structures that are built to divert or direct the flow of floodwater - play an important role in floodplain management. They can protect vulnerable properties and land uses, reduce flooding risk, and enable land to be used for purposes that would otherwise be at too much risk. However, they also can potentially increase the risk of flooding to neighbouring properties. The over-development of levees in a floodplain, especially close to the watercourse, can increase flow depth and velocity in the channel leading to bank erosion, with the eroded material causing sedimentation and water quality issues downstream. They can also transfer the potential for adverse impacts downstream. In addition, poorly constructed or maintained levees could fail during a flood, allowing flooding to suddenly and unexpectedly affect the land and people they were intended to protect. Further, a levee designed to manage floods up to a certain height, may still be overtopped if a higher flood occurs. It is therefore important that the community in which a levee is built understands the positive and negative impacts, maintenance needs, and limitations of the levee. This understanding is critical to community resilience.

Following Queensland’s 2011 floods, the Queensland Floods Commission of Inquiry investigated a wide range of matters including the regulatory frameworks that affected flood planning, management and resilience. This included a consideration of the regulatory framework applying to levees.

The Queensland Floods Commission of Inquiry Final Report (March 2012) identified that up to that time, there was an inconsistent approach to levee development across Queensland, and that there were differing views as to who should exercise control over this. The Commission concluded that the patchwork of state government and local council approvals, and in some areas a complete absence of regulation, is not conducive to consistent decision making. It recommended that:

- levees should be regulated in a consistent and effective manner across the state.
- the most appropriate regulatory regime under the Sustainable Planning Regulation 2009 should be used.
- in the preparation of the regulation, consultation should be undertaken with local governments.

The State Government committed to implementing all recommendations of the Queensland Floods Commission of Inquiry. The first phase of levee regulation, consisting of the development of a legislative framework for levees under the Water Act, was introduced into Parliament on 5 March 2013 as part of the Land, Water and Other Legislation Amendment Bill 2013 and was subsequently passed on 2 May 2013. The legislative framework included placing a definition of levees in the Water Act 2000, prescribing levees as assessable development under the Sustainable Planning Act 2009, and providing for regulations to specify the requirements for assessing levees.

Prior to its passing by Parliament, the Bill was reviewed by the Agriculture, Resources and Environment Committee (AREC) which reported to Parliament on 23 April 2013. AREC recommended that the Land, Water and Other Legislation Amendment Bill 2013 be passed and that “the Department of Natural Resources and Mines (DNRM) continue to monitor pre-existing levees which will not be affected by the provisions of this Bill to ensure those levees do not endanger landholders and infrastructure.”

DNRM, in consultation with local governments, then developed the codes and guidelines to support assessment of levees. The levees regulatory framework including the codes and guidelines took effect on 16 May 2014.

1.2 Outline of the regulatory framework

The levee regulatory framework applies to the construction of new levees, and the modification of existing levees, that meet the definition of a levee. The definition states that a levee is an artificial embankment or structure which prevents or reduces the flow of overland flow water onto or from land. A number of exclusions are specified to avoid unintentionally capturing other structures and activities that are regulated or managed under other regulation. This includes for example: laser levelling, contouring, and other agricultural activities; irrigation channels and ditches that are not associated with a levee; coastal hazard infrastructure; and structures that are regulated under another Act such as a public road, railway, bridge, ring tank or dam.
The framework requires any proposal to build or modify a levee to be subject to assessment against the applicable development code. Levees are categorised according to the risk they pose to people and property, with each category being assigned a level of assessment corresponding to the level of risk. The three categories of levees and corresponding assessment are:

- Category 1 levees have no off-property impacts and are subject to self-assessment.
- Category 2 levees have off-property impacts and impact less than three people. These are subject to code assessment.
- Category 3 levees have off-property impacts and impact three people or more. These are subject to impact assessment.

Category 1 levees are classified as accepted development under the new Planning Act 2016, meaning they can be built without an approval but must comply with a self-assessable code available on the DNRME website. An approval is needed to build or modify a Category 2 or Category 3 levee. Category 2 levees are approved by the local government, which assesses them against a Code contained in the Water Regulation 2016. Category 3 levees are also assessed and approved by local government using this Code, and in addition the State Assessment Referral Agency (SARA) assesses them against State Code 19, contained in the State Development Assessment Provisions. State Code 19 identifies that the state interest in levees is to maintain community resilience; that is, that the community in which the levee will be located has been consulted, is aware of the impacts, and has considered the levee in its planning for flood emergency responses. Presently, DNRME provides technical advice to SARA on the state level assessment.

The framework does not regulate levees that were in existence when the framework commenced (an “existing levee”). The government decided not to retrospectively apply new standards to levees that were in existence when the new regulatory framework commenced. Hence existing levees do not require an approval unless an application is made to modify them. There is also no legal requirement to maintain or to repair an existing levee.

Between May 2016 and June 2017, three category 3 levees were referred to the state referral agency for state interest assessment:

- A levee in Maryborough which was submitted by the Fraser Coast Regional Council.
- An extension of the Roma Levee which was submitted by the Maranoa Regional Council.
- A levee submitted by Fraser Coast Regional Council.

DNRME offered to assist councils with interpretation of the levees framework and to provide advice on its implementation. A number of councils, including Lockyer Valley Regional Council, Goondiwindi Regional Council, Fraser Coast Regional Council, Banana Shire Council, Bundaberg Regional Council and the Maranoa Regional Council have sought advice from DNRME since the framework commenced.

1.3 Origins of this review

In 2016 the Queensland Audit Office (QAO) undertook an examination of the effectiveness of flood resilience activities in Queensland since 2011, focusing specifically on the catchments of the Bremer River, Lockyer Creek, and the mid and upper Brisbane River. These areas fall under the Ipswich City Council and the Lockyer, Scenic Rim and Somerset Regional Councils.

The final report ‘Flood resilience of river catchments (Report 16: 2015-16)’ was tabled in Parliament in April 2016 and contained 4 recommendations.

Recommendation 4 was that - *We recommend that the Department of Natural Resources and Mines and the four councils: work together to effectively and economically regulate levee banks*

In response to that recommendation DNRM stated in Appendix A of the QAO report that “DNRM will engage with the four councils in relation to the implementation of the framework. This will include identification of training needs and its delivery, compliance matters, data collection requirements and the identification of concerns in relation to the implementation of the levees.
framework. This will also include identification of state and local government follow up actions.”
DNRM committed to complete this by June 2017.
2. Research and sources

DNRME conducted this review in consultation with officers of the Scenic Rim, Lockyer Valley and Somerset Regional Councils and Ipswich City Council. Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP - formerly DILGP, Department of Local Government, Infrastructure and Planning), Department of Premier and Cabinet, the Council of Mayors (SEQ) and the Local Government Association of Queensland (LGAQ) were also consulted.

This review focuses on the implementation of the existing levee regulation. This includes identifying barriers to the effective implementation of the framework by the assessment managers and the state referral agency, and proposing actions to address these barriers. Issues concerning the regulation itself, or issues with the underlying statutory framework provided by the Planning Act, are beyond the scope of this review.

Issues with implementing the existing regulatory framework have been identified from a number of sources, including the following:

- An implementation workshop attended by officers involved in levee regulation in State and local governments, held by DNRME in Toowoomba in November 2013;
- The QAO report;
- Submissions by local governments and other members of the public to the Parliament Agriculture, Resources and Environment Committee, which considered the Bill to introduce the levee regulation;
- Discussions held with officers of the Scenic Rim, Lockyer Valley and Somerset Regional Councils and Ipswich City Council; the Council of Mayors (SEQ) and the Local Government Association of Queensland in December 2016 to March 2017;
- A workshop attended by officers involved in levee regulation in State and local governments, held by DNRME in Toowoomba on 13 April 2017;
- Further consultation with state agencies and the four councils on the draft recommendations and actions.

It is noted that the levees regulatory framework has been in place only since May 2014. As such, State-wide experience on the implementation of the levees regulatory framework has been somewhat limited. It is anticipated that future assessment of the regulatory performance may identify further issues and opportunities for improvement.

As required by the QAO, the review examined the implementation of the levee regulation in the middle and upper Brisbane River catchment only. This means that the issues have been identified and the proposed actions have been developed in the context of levee and flood management in the middle and upper Brisbane River catchment. However, the four councils in this region present a case study of issues (and actions) that are likely to apply more broadly across the State. It is possible that some issues differ or that additional issues occur in other areas.
3. Issues

3.1 Lack of data

All four councils indicated that they are inhibited by an absence of information on levees, and this issue was raised in the QAO audit report. Without information on where levees existed in May 2014, councils cannot determine if a given levee has been constructed since the regulatory framework came into effect. Lack of records of the original dimensions of a levee means they also cannot identify whether work done on an existing levee constitutes maintenance work or a modification.

This paucity of data prevents effective compliance action. It also has implications for planning and assessment of levees and other flood-related studies.

Councils consider that they should have free and regular access to data held by State Government entities where it supports the implementation of responsibilities assigned to them under State legislation, such as levees. For example, Energex holds good quality LIDAR data in the location of its infrastructure, and making this data available to councils as a community service obligation would be useful to compliance, planning and assessment of levees.

While DNRME has LIDAR data in the catchments of the Bremer, Lockyer and Brisbane rivers and makes this available to the councils without charge, the councils are concerned that in some cases the quality of the data or uncertainty in its availability may not support its use in compliance and flood planning.

3.2 High cost of assessment of applications, and council capacity and capability

The regulatory framework uses an impact assessment model, in which each proposed development is required to identify the impacts that it would have against the baseline of the existing situation. This approach may lead to a proponent meeting the costs to manage or avoid any impacts (e.g. by including mitigation measures in their design), but importantly it requires each proponent to also meet the full cost of producing the information on these impacts.

For example, determining whether a levee is Category 1, 2 or 3 requires information on the effects of the levee, which in many cases can only be produced by hydraulic modelling of the levee’s performance under a range of flood events. The high cost of such studies (estimated from $10,000 to $200,000) may exceed several times over the cost of building the levee and the cost of the flood damage it is intended to prevent. This is a disincentive to proponents from engaging with the regulation.

This would be particularly true for rural levees intended to protect crops, which a landholder can build themselves for little capital outlay, and where landholders might consider it unlikely that the council would become aware of the levee. It is likely that in some cases this is leading to landholders building or modifying a levee without the correct assessment or approval.

The framework also requires councils to assess the information provided by an applicant. This may require the council to also conduct hydraulic modelling (often by engaging specialist advice, as the skills are not likely to be available within the Council staff), particularly if there is an appeal by the applicant or a third party. The cost of this is also high with one instance of a Category 3 levee application costing the council over $100,000. This cost is beyond the capacity of many councils, and few councils consider they have the technical capability to undertake the work.

This issue also applies to compliance activity. Prosecution of an unapproved structure generally would require the local government to first establish which Category the levee is, because a Category 1 levee does not need an approval. The council might need to conduct the modelling to establish that the levee is Category 2 or Category 3 and whether it meets the requirements of the Code. Councils are concerned about their funding and technical capacity to undertake this work.

3.3 Complaints-driven approach to compliance and community awareness

The QAO audit report identified that councils use a complaints-driven approach to ensuring compliance with the regulatory framework. In this approach, a council uses complaints or queries by residents to identify levees which require investigation for possible compliance activity.

While the councils agree that this is the situation, they generally regard this as an acceptable and appropriate approach to the level of risks and the level of levee-building activity in their regions, especially given the limits of available resources and data. A complaints-based approach can be an
effective way to identify and prioritise the levees needing attention, provided the community is broadly aware that levees are regulated. Councils agreed that the effectiveness of the complaints-based compliance would be improved by greater community awareness of the levee regulations. This would increase the likelihood that a resident who is concerned about a neighbour’s new levee will contact their council, and this in turn will help increase the rate of applications or notification of levees by allowing compliance actions.

3.4 Evaluating and monitoring existing levees

Government decided in 2013 not to regulate levees that were lawfully constructed at the time they were built. Applying new standards to lawfully built structures is a breach of fundamental legislative principles that is undertaken only where there is clear evidence of a substantial risk, and with consideration of the financial impacts on the owners. For example, the introduction of higher standards for swimming pool fencing and for smoke alarms were done only after substantial evidence of public harm including deaths arising under the previous standards, and in each case owners have been provided with a number of years before being required to comply with the new standards.

A dangerous situation could theoretically arise if a levee was not built to proper engineering standards, or if it has not been properly maintained. In these cases, a levee might fail unexpectedly in a flood, causing sudden flooding to people and properties that were thought to be protected. All four councils and the QAO audit report agree this is a potential issue.

While recognising the theoretical potential for levee failures to cause harm, there is no data to substantiate the number of levees and the level of risk, or to demonstrate actual public harm having occurred from the existence or failure of existing levees.

Few, if any, records exist to indicate where existing levees are located, or whether a given landform is natural or a constructed levee. Even where existing levees can be identified, it would be difficult to determine when they were constructed and therefore what regulation applied at that time. It is therefore difficult to determine whether those levees were legally constructed.

There is presently no regulatory power for either State or local governments to take action against a levee built before the framework came into effect in May 2014. (There is one exception to this: if a local government retains a local law that regulated levees before this date, it may still be able to take action under the local law against a levee that was built contrary to the local law’s requirements before May 2014. However, this situation is rare and does not apply within the four councils involved in this review or over most of Queensland).

AREC recommended that DNRM should monitor pre-existing levees to ensure those levees do not endanger landholders and infrastructure, but such monitoring has not been found to be practicable. Firstly, there are difficulties in establishing where such levees exist. Secondly, monitoring their safety would entail regularly collecting and assessing detailed engineering and geotechnical information, and the cost of this exercise would be extremely high. Finally, it also presents legal difficulties in obtaining access to the privately owned structures and in determining responsibility for any necessary action. At the time the regulatory framework was established, the government determined that this action is not warranted, especially in the absence of any evidence of actual harm caused by failed levees and the absence of regulatory power to require action to be taken.

3.5 Definition of levee

The QAO audit report and the four councils generally agree that there are issues with the scope of the current regulatory framework. For example, some structures that are levees according to the definition – such as detention basins – may not need to be regulated given the lack of risks. However, there is more concern over structures that are not defined as levees but which, it is considered, have similar risks and potential impacts as levees. The examples raised by the four councils include:

- Turkey dams – these structures are not defined as levees because if they are classified as referable dams they are regulated under the Water Supply Act; while otherwise they are classified as irrigation infrastructure and regulated under the Water Act. In some localities with a high density of turkey dams, they could be having a cumulative impact on flood levels;
- Irrigation infrastructure generally, in particular embankments that are created during the construction of drainage channels, either to stockpile the spoil or to increase the capacity of the channel;
- Roads, railway embankments and other similar linear infrastructure.

The definition of “levee” in the Water Act 2000 was designed to exclude these and other structures to prevent regulatory duplication. In each of the examples given above, the items are excluded because they are already regulated under other Acts.

While it remains important to prevent regulatory duplication, there is a question over the degree to which flooding impacts and community resilience are addressed under the approval processes applying under the other Acts. For consistency, the assessment process under the other Acts needs to address the issues that, for levees, are addressed by the relevant codes.

A separate, but related issue lies in the regulation of temporary levees constructed as emergency works. The Planning Act 2016 (Section 166) allows the undertaking of works without approval where an emergency endangers a person’s life or health, a building’s structural safety or the operation or safety of infrastructure or approved tidal works. This is provided they give notice to the local government as soon as reasonably practicable, and comply with any notice to stop the work. Clearly, it would not be practicable or desirable to apply the same standard of assessment (e.g. detailed hydraulic studies and public consultation) to emergency works.

The Act does not require emergency works to be subject to approval after the emergency has passed, unless they are located in a heritage place. While it might well be argued that emergency levees should be subject to an application and approval under the regulation once the emergency has passed, this lies outside the scope of the review as it would require amendment to the Planning Act 2016.

3.6 Scope of the regulation

Some councils suggested that limiting the application of the regulation to urban and peri-urban areas could reduce the cost imposts on councils and individuals. However, such an amendment would not implement the recommendation of the Brisbane River Floods Commission of Inquiry which called for consistent regulation of levees across the state. Action on this issue would be contrary to Government policy to implement the recommendations in full.

Concerns were also raised that cross-boundary issues (i.e. impacts of a levee that extend outside a council boundary) may need to be addressed. However, nothing in the Planning Act, or the levee codes, limits the location of impacts that an assessment manager may consider. Impacts of a levee that occur within or outside the local government area should be identified by the applicant and should be considered by the assessment manager.

3.7 Liability

Councils are concerned that their role as assessment manager may expose them to liability, in the event that an approved levee fails and causes damage to property or people it was intended to protect. Due to the limitations in data and resources for monitoring, they are concerned that liability may also arise in future adverse events caused by an unlawful or existing levee of which they were not aware. However, liability for planning and development control is established under the Planning Act, and action on this issue would lie outside the scope of this review.

3.8 Review of Codes, Guidelines and Categories

The original codes and guidelines were prepared before commencement of the regulatory framework, and a commitment was given to review them after the first 12 months operation to include any learnings from their application. DNRM did commence a review in November 2014, however the revised versions were not implemented at that time. A review was restarted in 2017 to ensure compatibility with terminology and processes under the new Planning Act 2016 and Planning Regulation 2017. The four councils and DNRM agree that it is desirable to complete the review of the codes and guidelines to incorporate learnings from their application, and to improve their ease of use. It is anticipated that the updated codes and guidelines applying to levees to be completed in 2018 will also address other issues in order to improve efficiency and effectiveness in levee assessments and applications.

3.9 Governance

The Local Government Association of Queensland (the LGAQ) and individual local governments have consistently expressed the view that assessment and approval of levees should be a State Government responsibility, citing a lack of resources and technical expertise within many local...
councils. This view was reflected for example in submissions on the Regulatory Impact Statement (RIS) at the time the regulations were developed in 2013.

Following the RIS, State Government determined that local government should be the assessment manager. This is because local government have the responsibilities for approving most land development proposals, that the new levee banks are likely to be associated with. In addition, they are responsible for managing natural hazards as part of land use planning, and they are better placed to integrate levee assessment into flood management and emergency management planning. The RIS included a cost effectiveness analysis which showed a slightly lower cost for local governments being assessment manager than for the state government to take this role. The State Government (like local governments) has limited resources to undertake the assessment manager role, and is not best placed to make decisions on activities that fit more appropriately under local council planning activities.

3.10 Assurance process for self-assessable levees

The QAO audit report identified that Councils have no process in place to gain assurance over Category 1 levees. Councils do not have compliance checks in place to provide assurance that applicants are completing the self-assessments appropriately.

Councils agree that this is the situation, but it must be acknowledged that this is the intention of the regulatory framework established by the Planning Act 2016 (and the previous planning Acts). Councils do not have any regulatory power over accepted (previously termed “self-assessable”) developments. State Government does not intend to require approvals to be obtained for accepted development.

The code and guidelines for Category 1 levees do require a notification to be given to the council, but this does not create any power for the council to assess, approve or reject the notifications.

The four councils consider the notification process is desirable and should continue, because it provides a record that can be used if need arises. For example, if a complaint is made about a new levee, the notification can be used to identify that the structure is lawful. It also ensures proper acceptance of responsibility and provides information to allow investigation in the event of any issues arising in the future.

3.11 Need for increased use of pre-lodgement discussions

The QAO Audit report indicates that DILGP (currently DSDMIP) considers it would be more practical for applicants of Category 3 levees to seek pre-lodgement advice at the design stage. Experience from DNRME officers supports this view, and DSDMIP also encourages applicants generally to seek pre-lodgement advice to ensure applications are approval-ready.

3.12 Fees

The fee for a Category 3 levee referral to the state referral agency was initially set at $12,000, and DILGP indicated in the QAO audit report that this could be revised in the light of experience at the real cost of assessing the referred applications. This action has already been implemented, with the referral fee reduced to $6,000 at the commencement of the new Planning regulation 2017.
4. Recommended actions

The review process has identified a number of actions that address issues raised in Section 3. The relationship between the issues and actions is complex, with some actions addressing multiple issues.

While the review focused on the four council areas in the Brisbane River middle and upper catchments, the actions in general are intended to apply state-wide. This is because, consistent with Government policy to fully implement the recommendations of the Queensland Floods Commission of Inquiry, the regulatory framework for levees applies state-wide. Consequently, any changes to framework or responsibilities (for example a review of the codes and guidelines) must apply generally across the State.

Some actions will clearly achieve greatest benefit and greatest economies of scale if they are made available state wide, however it will be open to each individual Council to decide whether to make use of the measure. These actions will be offered state wide for reasons of equity. This applies, for example, to Action 4.2 (provision of assistance to Councils in conducting assessments) and Action 4.3 (communication materials to be made available for use by Councils to raise awareness of the regulation).

4.1 Data Needs analysis

**Action: In consultation with local governments, conduct a scoping study to identify gaps in data needed to support levee assessment, planning and compliance;**

Improved data has been identified as critical by all stakeholders. Two critical areas of data availability are identified for proper hydraulic assessment and effective regulation of levees: topographic data in floodplains, to support assessment of new levee proposals; and levees existing as at 16 May 2014 when the new regulation of levees commenced, to support compliance activity.

**Topographic data**

Suitable topographic data capturing natural features (such as ridges, valleys, gullies, waterways) and man-made structures (such as levees, roads, railways) across a landscape is essential to inform both hydraulic assessment and regulation of levees.

LiDAR data captured through DNRM projects are available for Queensland coastal areas and some selected inland rural towns. Although quality of these LiDAR data (precision +/- 0.15 to 0.3m, 1 metre grid) is considered to be generally suitable, coverage and currency of data for specific areas of interest can be limited thus resulting in data gaps. Quality of available data may also be problematic in some specific areas or situations. Estimated cost of filling gaps in LiDAR data (+/- 0.3m, 1m grid) is approximately $50/sq km (subject to the survey area being a minimum of 1000sq km). For efficiency, it would be prudent to identify the data gaps for specific areas of interest first and then determine the scope of survey (including specifications for data coverage, quality, format and timing) to address data gaps.

In addition, ground surface shape and elevations below water in rivers and creeks would be required for accurate hydraulic modelling. These data are generally acquired from the industry standard cross-sectional survey and/or bathymetric survey of the river reaches as appropriate. These surveys tend to be expensive and therefore would need to be targeted depending upon the requirements of hydraulic assessment, any such existing data, and critical data gaps in specific areas of interest.

**Existing levees**

Councils currently apply a complaints-driven compliance process to levees. This is appropriate for the level of risk and the number of levees, however some data are still required to support effective compliance investigations where complaints are made. It would be highly desirable to have a baseline of topographic data that will enable a council to quickly determine if a levee was built before or after a reference date (this date should be, ideally, as close as possible after the date the regulation came into effect). Any levee that has appeared after the date of the baseline data should have either an approval (for a category 2 or category 3 levee) or to have been notified to Council (for a category 1 levee). These approvals and notifications should appear in the Council’s records. Absence of such a record would then provide sufficient basis to instigate compliance action, as the levee is likely not to comply with the regulatory requirements.
**Scoping study**

The need for data on levees depends on the objective, scope and approach for regulation, in particular compliance activities. For example, if the current complaints-driven compliance system continues, high quality data may not be required everywhere, especially in rural areas.

On the other hand, good quality data may be required for urban or sensitive areas where potential impacts of levees and associated risks of non-compliance are greater. For compliance action, information is also required on levee location, ownership, year of construction (age), design standards including design flood event, general condition including operation and maintenance, people and community assets at risk, and emergency procedures if and when the levee overtops or fails. It is expected that this information would be readily available for properly made applications which have undergone the required assessments and approval as per the regulatory framework. The initial collection of this information therefore lies outside the scope of the proposed scoping study, however the study may need to consider how to relate this information (where it exists) to the topographic, cross-sectional survey and/or bathymetric survey data.

Data gathering exercises can be significant and expensive projects with potentially limited benefits if the purpose and potential use of the data is not clear. Hence, it would be prudent to undertake a ‘scoping’ study in order to identify related key issues and outline any data collation and collection program to support levee regulation.

The proposed scoping study would involve the following main tasks:

- clarify the objective, approach and information requirements (including assessments or hydraulic modelling requirements) for levee regulation and compliance in different areas;
- identify other areas in Queensland in which flood planning and levee management are considered priority issues;
- assess the data requirements for levee regulation and compliance including the data/information type, quality, format, level of detail and precision;
- review the existing data and information availability in the middle and upper Brisbane River catchments and other identified priority areas of Queensland with regards to their suitability and coverage for levee assessment and regulation;
- identify critical data and information gaps that must be addressed (e.g. LiDAR, QSAT) for efficient and effective regulation;
- identify and consider linkages with floodplain management and flood modelling activities in different areas (e.g. flood studies or management planning), while carrying out the above tasks so that they can be optimized; and
- provide an outline of a preliminary program to fill the identified data collection priorities (including indicative funding requirements, possible funding sources, timeframes and roles and responsibilities of agencies involved).

It is considered that such a scoping study would be based mainly on desk top review and research, and discussions with relevant technical people from pertinent state and local government authorities as needed. It is important that the scoping study identify and consider linkages with floodplain management and flood modelling activities in different areas so that optimum data collection program results can be achieved.

This action has linkages with a number of other actions including codes and guidelines, support for assessments, linkages to flood modelling and flood planning, and consistent assessment of levees and structures.

The main outcome/benefit of this action is:

- Ensures that the basic data requirements for implementation of an efficient and effective regulation of levees across Queensland are met in an optimum manner.

**4.2 Support for assessments**

*Action: In conjunction with other state agencies, provide appropriate technical support for councils, together with advice and basic training on levee codes and guidelines on a needs basis*
Lack of capacity and capability within councils is a key issue in the assessment of levee applications and compliance with the levee regulation. All councils have limited resources, and while some of the four councils involved in this review have the technical expertise needed for proper assessment of levee applications and/or for investigating a potential compliance problem, none of them consider they have the capacity to handle a significant volume of levee assessments or compliance actions. The available expertise and capacity must also be prioritised across a large range of potential planning and development activities. Other councils elsewhere in Queensland may not hold the relevant technical expertise.

In the absence of sufficient in-house technical expertise, councils would need professional advice from a suitable qualified person (e.g. RPEQ) to be able to assess the hydraulic effects and off-property impacts of proposed levees and to prepare technical reports and management plans as required. Such technical assessments (e.g. flood studies, impact assessments) can be expensive depending upon a number of factors (e.g. data availability, complexity of the problem, level and accuracy of assessment required, and availability of expertise). In addition, resources are also needed for associated administration and coordination activities.

Alternatively, councils could rely on RPEQ certification of the levee application and associated assessments. However, this approach tends to impose large costs on applicants/proponents. For example, the cost of a typical assessment for a levee application is estimated to range from a few thousand dollars (e.g. $10,000) up to a few hundred thousand dollars (e.g. $200,000) depending upon a number of factors such as data availability, category of the levee, complexity of the problem, level and accuracy of assessment required, and availability of expertise. This cost is a disincentive to levee applicants who may be trying to protect an asset (e.g. crop or private property) of only moderate value.

The Office of Chief Engineer in DSDMIP can provide high level guidance and advice to local governments on technical aspects of flood mitigation matters. This could include, for example:

- The type and extent of numerical modelling that may be required;
- Critical technical issues e.g. geotechnical, route location;
- Review of Scope of Work for any proposed consultancy to undertake the assessment.

As such, the State Government is able to provide support to councils to support the effectiveness of the levee regulation. Support can happen as follows:

- free access to basic data required for application and assessment of levees;
- technical support for councils from the State government (e.g. through the Office of Chief Engineer DSDMIP, advice and basic training on levee codes and guidelines); and
- community education and awareness, leading to high quality applications by levee proponents.

This action has linkages with a number of other actions including codes and guidelines, flood modelling and flood planning, data needs analysis, community education and consistent assessment of levees and structures.

The main outcome/benefit of this action is:

- access to necessary basic data and support services (within State and local government authorities) is available for efficient and effective regulation of levees.

### 4.3 Community education

**Action:** Develop appropriate communication materials (e.g. information sheets) suitable for use by local governments to raise community awareness and provide advice to landholders, contractors and professional consultants.

Community awareness is necessary to the efficient functioning of the levee regulatory framework. Firstly, landholders need to be aware of the existence of the regulation and where to find the detailed requirements, to ensure that they know when they need to make an application, and how to prepare approval-ready applications.

As levees may often be constructed by earthmoving contractors, it may be useful to also target this industry for awareness of the regulation.
Further, a general awareness of the existence the levee regulatory framework would support the complaints-based compliance process. In this case, a simple awareness that levees are managed by the local government would be sufficient, so that a resident concerned about a new levee would alert the council who can then take appropriate investigations.

The above groups would be most effectively reached by a campaign delivered by the local government, as this is the agency which will generally deal with levee-related enquiries and implementation matters. Consultants should have a higher level of knowledge of the codes and guidelines in order to provide effective advice to landholders and provide an appropriate level of service.

Communication materials with standard messaging and appearance, able to be applied by each council in its area, has several benefits:

- Cost efficiency
- Reinforcing of messages for landholders living near local government boundaries or moving between local government areas

It is proposed that DNRME develops standard information sheet/s for community education about levees and the levee regulation. These would be designed to be suitable for use by local governments to raise general awareness of landholders, residents and earthmoving contractors, and for professional consultants such as RPEQs living and working within their areas. Common messaging and branding would amplify the program’s effectiveness especially for landholders and contractors working across adjacent local government areas.

Fact sheets could be included in local government websites or used as the basis for holding information sessions as required.

This action has linkages with a number of other actions including support for assessments.

The main outcome/benefit of this action is:

- More effective functioning of the regulation through higher awareness and engagement and effective compliance action.

### 4.4 Codes and Guidelines

**Action: Update the levee codes and guidelines to improve efficiency and effectiveness in assessments and applications.**

The current codes and guidelines for construction or modification of levees were developed to support the new regulations when they came into effect on 16 May 2014. Whereas the codes specify criteria that should be met for each type or category of levee, the guidelines provide information to help meet the regulatory requirements. Although the guidelines are not meant to provide design standards or detailed methodologies, they do provide general information to help understand the related issues involving planning, design, construction and management of levees.

The guidelines are intended to be used by landholders or levee proponents, local government authorities or assessment managers, consultants engaged by either proponents or local councils, and other interested parties or individuals.

The codes should be revised to make them consistent with the new *Planning Act 2016*, *Planning Regulation 2017* and the *State Development Assessment Provisions SDAP 2017*. It is desirable to update the guidelines to reflect the changes to the planning legislation and to update *Schedule 10 of the Water Regulation 2016*. In addition, the guidelines could be streamlined to improve efficiency and effectiveness in assessments and applications. This is based on implementation learnings since the release of the previous guidelines, issues identified in reviews and further consultation with local government authorities.

Key ideas that could be included in the updated codes and guidelines are the recommendation to appropriately engage a suitably qualified person (e.g. RPEQ) for all types of levees, the recommendation for a two-step application and assessment approach, and the inclusion of appropriate links to existing flood management plans or planning schemes.

A suitably qualified person is expected to be familiar with the levee design standards (e.g. design event AEPs and residual risks, structural and geotechnical engineering considerations, and operation...
and maintenance requirements) and/or best practice methodologies (e.g. hydrologic and hydraulic modelling, impact assessment, engineering designs). At present, whilst the guidelines for all levees include a general recommendation to engage a suitably qualified person, the codes do not refer to engaging RPEQ as a recommendation or as a mandatory requirement. Hence the updated codes and guidelines should include specific recommendations about how a RPEQ can conduct necessary assessment works and/or provide technical advice to levee proponents or assessment managers in order to meet specific performance outcomes.

The updated guidelines should also recommend a two-step application and assessment approach which would consist of (1) a ‘rapid appraisal’ or ‘preliminary advice or discussion’ step followed by (2) a risk-based ‘fit-for-purpose’ or ‘detailed advice or discussion’ step. The first step would involve a relatively inexpensive appraisal of the flooding situation and relevant issues (including potential risks) based on a simple (mainly desk-top) assessment. The main purpose is to discuss (i) likely category of the proposed levee, and (ii) scope and approach for a ‘fit-for-purpose’ assessment (including approximate cost). This discussion could form the basis of pre-lodgement meetings.

The second step, which would proceed only if the outcomes of the first step are satisfactory, would involve undertaking the ‘fit-for-purpose’ assessment for specific problems. It is recommended that a suitably qualified person (e.g. RPEQ) be involved as appropriate in both steps. Suggested step-wise approach can be adopted for all levee types and could potentially reduce assessment and compliance costs.

Appropriate links to existing flood management plans or planning schemes should also be included in the guidelines. It has long been recognized that well-engineered levees provide flood protection for flood-prone properties and communities. However, levees are just one of several floodplain management measures. Floodplain risk management should not only consider structural flood protection measures (e.g. levees, dams) but also non-structural measures such as land use, community education, building design, flood warning systems, proper dam operation and maintenance, flood insurance and so on.

Current best practice to floodplain risk management requires a holistic catchment approach, underpinned by scientific risk assessment, to minimise flood risk and maximise flood resilience. Levee proposals should be considered in a broader context of floodplain risk management and planning. To facilitate and encourage this approach, the Codes should provide linkages to approved local flood management plans or approved planning schemes where such instruments exist, so that assessment is streamlined where a proposed levee is consistent with an approved plan or planning scheme. This should be subject to ‘conditions’ or situations where local flood management plans or planning schemes are based on adequate hydraulic modelling and have explicitly considered levees.

Where a local flood management plan has not been approved by the council, or a local planning scheme does not specify requirements for levees, full assessment against the existing Code provisions would still be required. However, where a council has approved a local flood management plan that addresses levees and their impacts, or a planning scheme that contains requirements for levees, it should be adequate for the RPEQ to investigate and certify that the proposed levee is in accordance with the plan or the planning scheme.

It is recognised that this approach is not suitable for all areas. It would be most applicable in a floodplain where there are significant flood risks and a green field area proposed for conversion to urban development. In this case, the cost of flood management planning could be readily justified, and the use of levees can be examined along with the range of other options for flood management, such as setbacks, land use zoning, floor level regulation, detention basins, and catchment management, in a comprehensive approach. The most desirable approach can then be applied through the Strategic Plan. This could both limit the need for levees and provide the basis for assessing them where they are permitted. The approach may also be justified in a rural floodplain area where significant numbers of levee developments are proposed or likely to occur.

This action links with other actions including support for assessments, monitoring the effect of regulation, and consistent assessment of levees and structures.

Structures such as irrigation embankments, railway embankments and bridge works can act in the same way as a levee in excluding or diverting flood water. Where these structures are regulated under another Act, they were excluded from the definition of a levee in order to prevent regulatory duplication. This remains an appropriate goal. However, it relies on the matters that are considered under the levee code and guidelines being considered in the assessment and approval processes.
applying under these other Acts. It is recommended that the agencies responsible for these levee-like structures be encouraged to consider the potential flood impacts of future proposals, and ensure consistency of assessment and appropriate integration with local government flood management planning.

The main outcomes/benefits of this action are:

- Ensures that the related requirements of the new Planning Regulation (2017) are met;
- Ensures the guidelines apply an efficient and risk-based approach to the planning and design of levees that minimises assessment costs; and
- Ensures the regulation of levees is considered in the broader context of floodplain risk management.

4.5 Monitoring and record-keeping

Action: Develop and maintain a basic levees recording system for the levee regulation.

At the heart of the QAO Audit and this review, lie questions about the effect of the regulation. To allow this to be assessed, meaningful objectives or criteria against which to measure effect, and data that allow the effect to be analysed, are needed.

The State Government does not collate data on the number of notifications, applications, or approvals of levees. Instead, each local government is responsible for keeping records of applications within its area. Obtaining data on the effect of the Assessment Code would require a records search by every local government to identify the levee approvals given, and whether each approved structure complies with the code. Further, there is no standardised approach to this record keeping and councils may rely on a manual search to identify applications for a particular type of development such as a levee. This can make data collection to measure the effect of the Assessment Code difficult and expensive. Future reviews of the regulation would be easier if councils could readily identify the number, location, and outcome of levee applications and notifications.

The State Code 19 for Category 3 levees states that its purpose is to ensure the community’s resilience to the impacts of flood events, levee failure, or levee overtopping is maintained or enhanced by the category 3 levee. Resilience means the ability to adapt to changing conditions and prepare for, withstand and rapidly recover from disruption.

It is possible to collect data on the number of referrals of Category 3 levee applications, to identify the number, location, and outcome of levee applications and notifications. This is practicable as the myDAS referral system allows for extraction of levee referrals and their outcome. However, it is only an indirect measure of achievement of the Code’s purpose.

It is proposed that DNRME works with local governments to obtain basic data to help assess the effect of the regulation. This could entail, for example, encouraging councils to provide annual returns of the number of levee applications.

The main outcome/benefit of this action is:

- Ensures that the basic data for monitoring the effect of the regulation are established to better inform future reviews.

5. Conclusions

The recommended actions identified by this review are summarised in Table 1, together with the agencies likely to be involved. Some actions fall within existing budgets and activities and this is indicated. However, other follow-up actions may require consideration by government to determine their priority and funding.

The QAO report ‘Flood resilience of river catchments (Report 16: 2015-16)’ identified that there were clear benefits in establishing a consistent regulatory framework for levees. Despite the difficulties in implementation that were identified in the QAO report and confirmed in this review, the four councils and DNRME agree there is value in the framework. Taking the actions identified in this review will enable the value to be realised more fully and contribute to the improvement of community resilience to flooding.
As required by the QAO, the review examined the implementation of the levee regulation in the middle and upper Brisbane River catchment only. The four councils in this region present a case studies of issues that are likely to apply more broadly across the State. However it is possible that issues differ or that additional issues occur in other areas, and further consultation in other regions may identify any other issues affecting implementation of the levee regulation.

Arguably, many of the difficulties experienced in implementing the levee regulatory framework arise from its use of an impact assessment model, isolated from flood planning approaches.

Through the work of QRA and the Council of Mayors (SEQ), the Councils of south east Queensland and other areas are making significant advances in flood management planning. If flood models are able to be completed for priority catchments and their outcomes are translated into strategic land use plans and flood management plans, it can be expected that this will reduce the cost of levee applications and assessments. Ideally, this will occur to the point that there is no longer a significant disincentive to proponents to engage with the regulatory framework.

The effectiveness of implementing the regulation of levees will be improved by the adoption of the actions identified in this report. In addition, the increasing development of flood management planning and its integration into the land use planning framework has the potential, over time, to provide a more efficient and comprehensive approach to ensuring community resilience.
Table 1 – Recommended actions

<table>
<thead>
<tr>
<th>No.</th>
<th>Action</th>
<th>Responsibility</th>
<th>Resourcing</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>In consultation with local governments, conduct a scoping study to identify gaps in data needed to support levee assessment, planning and compliance.</td>
<td>DNRME</td>
<td>Within existing budget and resources</td>
<td>2018</td>
</tr>
<tr>
<td>4.2</td>
<td>In conjunction with other state agencies, provide appropriate technical support for councils. Provide advice and basic training on levee codes and guidelines on a needs basis.</td>
<td>Chief Engineer, DSDMIP, DNRME</td>
<td>Within existing budget and resources</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4.3</td>
<td>Develop communication materials (e.g. information sheets) suitable for use by local governments to raise community awareness within their areas. Deliver the communication materials to landholders and contractors.</td>
<td>DNRME</td>
<td>Within existing budget and resources</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Councils</td>
<td>At Councils’ discretion</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Update the Codes and guidelines applying to levees to improve efficiency and effectiveness in assessments and applications.</td>
<td>DNRME</td>
<td>Within existing budget and resources</td>
<td>2018</td>
</tr>
<tr>
<td>4.5</td>
<td>Develop and maintain a basic levees recording system for the levee regulation.</td>
<td>DNRME</td>
<td>Within existing budget and resources</td>
<td>2018</td>
</tr>
</tbody>
</table>