

OVERLAND FLOWPATH MAPPING – TECHNICAL CONSIDERATIONS AND USE WITHIN THE CONTEXT OF LAND USE PLANNING

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Abstract

The final report of the Queensland Flood Commission of Inquiry (QFCI) was released in March 2012 (Qld Government, 2012). The QFCI report included a number of wide ranging recommendations, many of which are applicable to Local Government. This paper considers specific recommendations of the QFCI report relating to the mapping of overland flowpaths and the subsequent land use planning and legislative requirements for Local Government.

Current practices employed by the Moreton Bay Regional Council (MBRC) in respect to the technical analysis of overland flowpaths and the associated treatment within the planning scheme are presented as a case study. Works completed by MBRC as part of the Regional Floodplain Database Project (RFD) aimed to provide high quality flood information and included overland flowpath mapping.

The paper also considers the technical aspects relating to the definition of overland flowpaths and the subsequent use and treatment in respect to land use planning and development. The paper concludes by posing a range of approaches and techniques that could be used to better inform flood risk to the greater community while also considering approaches that could be used within the context of effective land use planning and enhanced development outcomes.

Keywords

Queensland Flood Commission of Inquiry; Overland Flow Path; Flood; Flood Risk; Development; Planning Scheme; Building Work; Overlay.

Introduction

Overland flow paths are typically associated with gullies and depressions where surface water flows and collect. Overland flow paths pose considerable flood risk to the greater community. Flooding associated with overland flow paths has the potential to damage property and possessions, as well as posing a risk to life. This is especially true within the urban context given the highly developed urbanised areas and dense population.

Overland flow paths are known to be problematic. Overland flow paths: -

- Can be difficult to accurately define;
- Are influenced by human intervention (including building and development work);
- Cover vast spatial scales that extend to the greater urbanised area;
- Are not easily modelled, with related technical and practical complexities impacting overall accuracy;

- Are subject to rapid response times and flash flooding leading to difficulties in accurately forecasting flood severity in timeframes adequate to provide warning.

Not all Local Governments have transitioned to mapping of overland flow paths, nor have included these as part of flood hazard overlay mapping in the Planning Scheme. This may be due to many of the issues outlined above. Moreton Bay Regional Council (MBRC) is one Council that has transitioned to including overland flow paths in the scheme, and this paper explores both the mapping and scheme treatment in respect to building and development work.

It is considered that there remains an opportunity to more effectively administer building work and dwelling approvals under the planning scheme and without otherwise compromising the core objectives of effective flood risk management and associated planning and development outcomes.

A suggested approach has been presented as part of this paper to improve the current arrangements relating to assessment of building work located in overland flow paths.

Legislative Context

Local Government Planning Schemes

Queensland Councils are responsible for preparing local planning instruments to outline local planning controls for their local area. This requirement is mandated via the Sustainable Planning Act, 2009 (SPA, 2009). Planning schemes prepared under the act must also be consistent with the Queensland Planning Provisions (QPP) (QPP, 2009). The QPP are the standard planning scheme provisions made by the Minister for Planning under the Sustainable Planning Act 2009. It is a requirement for Local Government to ensure that the local planning scheme instruments are consistent with the QPP.

The QPP includes the concept of an overlay, which is a mechanism by which areas in the scheme that are subject to a particular constraint can be identified. A range of standard overlays are included in Part 8 – Overlays - Section 8.1 – Standard Suite of Overlays, for which a “flood hazard” overlay is included under the development constraint category. The QPP defines the purpose of the flood hazard overlay as (QPP, 2009): -

“The flood hazard overlay deals with areas of land identified as a flood hazard area as defined in the State Planning Policy. It may include the following area of land identified in the local government area as:

- areas of land with flooding and inundation potential
- overland flow paths identified locally”.

The onus is placed on Queensland Local Governments to ensure that the planning scheme appropriately integrates the state interest by incorporating flooding considerations in the scheme. This requirement is outlined in State Planning Policy 2014 which essentially requires that: -

- Natural hazard areas for flood be identified.
- Provisions are set which seek to achieve an acceptable or tolerable level of risk.
- Flood hazards are appropriately managed via provisions applying to development.

Discussion

Not all Local Government planning schemes in Queensland include flood hazard mapping or a flood hazard overlay. With the SPA 2009 requirements and related QPP 2009, the making and amendment of all new schemes are obligated to include flood hazard overlays. It is noted that a historical planning scheme pre-dates these requirements.

In respect to overland flow path mapping, the following summarises the key considerations under the Local Government Planning Scheme framework: -

- Any amendment of a previous scheme, or the creation of a new planning scheme in Queensland is obligated to include a flood hazard overlay as part of the scheme; and
- The QPP provides a mechanism through the flood hazard overlay to specifically include overland flow path mapping.

Queensland Flood Commission of Inquiry

Overland flow paths were subject to critical consideration as part of the Queensland Flood Commission of Inquiry (Qld Government, 2012). Several key recommendations were made in respect to overland flow paths that specifically apply to Local Government. Table 1 provides a summary of these key recommendations.

Table 1 – Queensland Flood Commission of Inquiry - Key Recommendations Summary (Qld Government, 2012)

Number	Recommendation
2.16	Councils and the Queensland Government should display on their websites all flood mapping they have commissioned or adopted.
2.17	Flood maps, and property specific flooding information intended for use by the general public, should be readily interpretable and should, where necessary, be accompanied by a comprehensible explanatory note.
8.1	Councils should, resources allowing, maintain flood maps and overland flow path maps for use in development assessment. For urban areas these maps should be based on hydraulic modelling; the model should be designed to allow it to be easily updated as new information (such as information about further development) becomes available.
8.2	Councils should make their flood and overland flow maps and models available to applicants for development approvals, and to consultants engaged by the applicant.
10.9	All Councils should, resources allowing, map the overland flow paths of their urban area.

Discussion

There are significant implications from the QFCI recommendations for Local Government relating to overland flow paths. Specifically, Local Government is obligated to: -

- Undertake hydraulic modelling to assess overland flow paths in urban areas.
- Specifically map and display overland flow paths in urban areas.
- Update overland flow path mapping as new information becomes available.
- Make available overland flow path mapping available to applicants for development assessment.

Mapping of overland flow paths is a significant undertaking and not all Local Governments have transitioned to mapping of overland flow paths, nor have included these as part of flood hazard overlay mapping in the Planning Scheme. Selected examples illustrating this are presented in this paper.

Summary of Legislative Requirements

Given the current legislative framework in Queensland, the following summary is provided in respect to Local Government requirements relating to overland flow paths: -

- Local Governments are required to include flood hazard overlay mapping in any new planning scheme or amendments to a former planning scheme.
- In drafting the new planning scheme, Local Governments have the ability to include overland flow path mapping as part of the flood hazard overlay mapping.
- The degree to which overland flow paths need to be included and considered as part of the flood hazard overlay mapping appears inconsistent, with some schemes developed post SPA 2009 not including overland flow path mapping as part of the flood hazard overlay. Selected examples illustrating this point are presented in this paper.
- Local Government is obligated to map and display overland flow path mapping, as well as having overland flow path maps available for development assessment based on the QFCI recommendations.

It would seem appropriate that, in the absence of other approaches, Local Government include overland flow path mapping as a component in the flood hazard overlay map as part of the planning scheme.

Current Overland Flow Path Mapping by SE Queensland Councils

As discussed previously, not all Local Governments have transitioned to mapping of overland flow paths, nor are these included as part of the flood hazard overlays in the scheme. Possible reasons include: -

- Historical scheme pre-dating SPA 2009 requirements.
- Insufficient internal resources, financial or budgetary constraints.
- Overland flow paths not presenting a major concern (i.e. regional Council, non-urbanised).
- Concerns on the reliability and accuracy of the technical assessments and associated limitations. This is discussed further in this paper.
- Administrative arrangements including treatment of overland flow paths in the planning scheme.
- Concern that such mapping is overly restricting or limiting development potential.

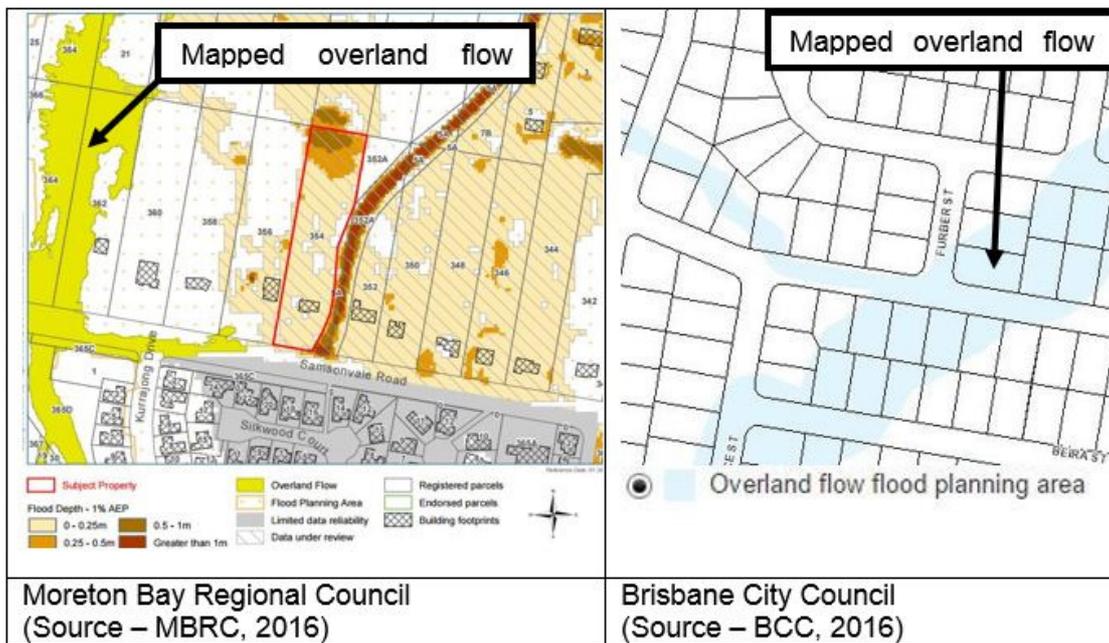
Several Local Governments have completed overland flow path assessments and associated mapping. One example includes the Toowoomba Regional Council overland flow path mapping project, which is included in the conference program. Many of these assessments have involved similar methodologies to the MBRC overland flow path mapping project (MBRC, 2012), which is discussed separately in this paper. It is anticipated that Council's will gradually transition to include overland flow path as part of the planning scheme.

While many Local Governments have updated their planning schemes, not all Councils readily display overland flow path mapping. To further illustrate, available flood mapping from online interactive mapping for several South East (SE) Queensland Council's has been considered, and includes: -

- Moreton Bay Regional Council (MBRC).
- Brisbane City Council (BCC).
- Ipswich City Council (ICC).
- Gold Coast City Council (GCCC).
- Sunshine Coast Council (SCC).
- Logan City Council (LCC).

Table 2 illustrates examples from MBRC and BCC, both of which include mapping for overland flow paths and additionally include this as part of the flood hazard overlay under the respective schemes. Figure 1 illustrates a selected example taken from a SE Queensland Council that does not currently display overland flow path mapping as part of the flood hazard overlay within the scheme.

Table 2 – Examples of MBRC and BCC Overland Flow Path Mapping



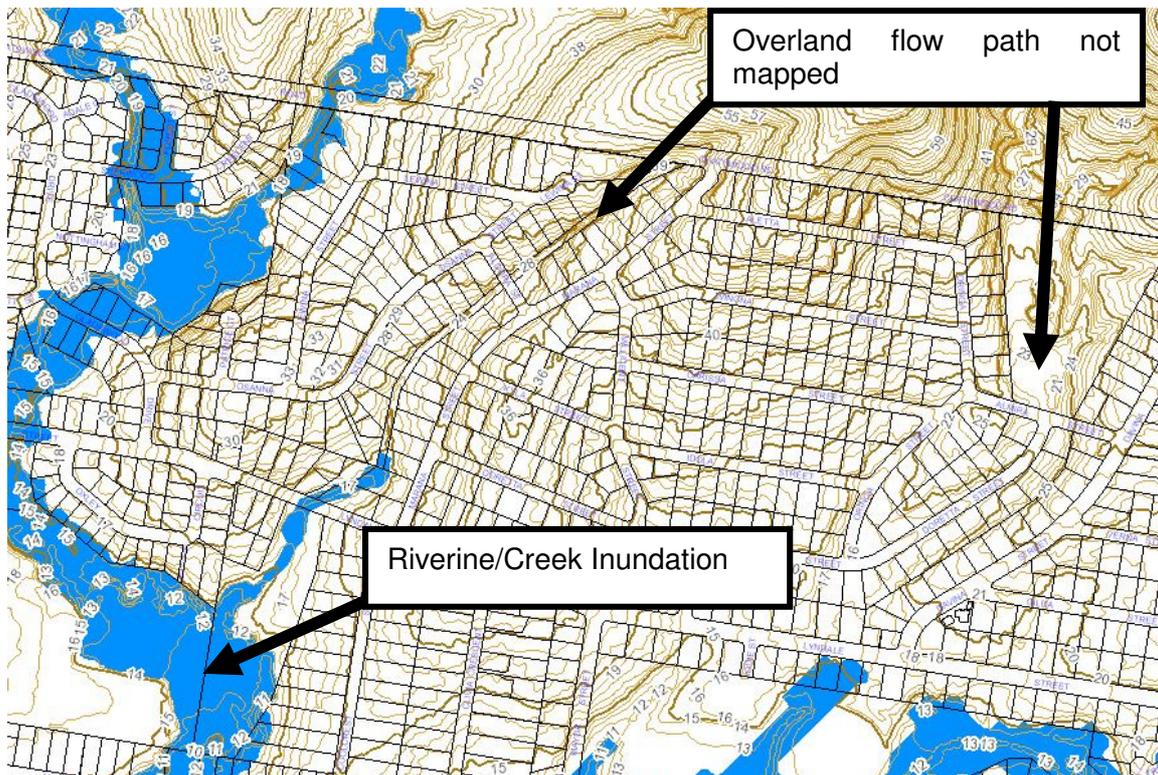


Figure 1 – Example where Overland Flow Paths are not Mapped in the Flood Hazard Overlay

The mapping in Figure 1 does not extend to include areas that would otherwise be considered as overland flow paths based on the definition outlined in this paper. The mapping that is included is limited to regional flooding associated with larger creek and river systems.

Overland Flow Path Assessment

Definition

Overland flow is typically associated with gullies and depressions where surface water flows and collect. Overland flow: -

- May or may not be associated with constructed stormwater drainage systems;
- Is often generally shallow, fast moving and can carry debris;
- Is typically associated with local drainage areas prior to discharge to a larger defined waterway such as a river or creek;
- Typically has quick response time (i.e. generally less than 1 hour) and rapid water level rise and subsequent drawdown.
- Often results in local and nuisance flooding.
- Is generally associated with flows that originate from upslope catchment areas and an absence of any defined channel.

In the MBRC context, overland flow paths are defined in the following way: -

“Overland flow describes the valleys and depressions where storm water is expected to flow or collect. Overland flow is generally shallow, fast moving and can carry debris” (MBRC, 2016).

Flooding which occurs from rivers, creeks and other waterway systems that are typically well defined with bed and banks are not defined as overland flow paths. These larger systems are usually defined and mapped separately, and are typically included within the flood hazard overlay mapping included in the planning scheme.

Assessment and Technical Considerations

Overview

The assessment of overland flow paths can include a wide range of approaches and techniques. Methods can range from spatial analysis to indirectly infer overland flow path flooding through to more accurate analytical hydraulic modelling methods. The more accurate methods usually employ broad scale Light Detection And Ranging (LiDAR) topographic data and analysis using 2-dimensional (2D) hydraulic models.

General Limitations in Analytical Assessments

The QFCI identifies the assessment of overland flow paths as “...a difficult and highly detailed process”, (Section 10.2.3, Page 233, QFCI, 2012). Despite the complexities involved in overland flow path assessment, it is critical that a better and proactive understanding is sought.

Whilst overland flow path analytical methods are prepared typically using reliable data sources and analytical tools, there are limitations that influence the assessment accuracy. A summary of some of the limitations is presented in Table 3.

Table 3 – Limitations in Overland Flow Path Assessments

Issue	Comments
Small flowpaths	The mapping does not always include very small flowpaths at the top of catchments. These are generally characterised as ill-defined flow path areas, and even if available, are often not included in the analysis.
Stormwater Network	There may be limited data available on the stormwater drainage network to adequately define hydraulic characteristics (i.e. extents, data accuracy, missing data, etc).
Major Obstructions	In some circumstances, the modelled flow path disregards major obstructions such as building footprints. Detailed assessments of actual building susceptibility to overland flow is not always undertaken.
Property Fences	The modelling is generally unable to specifically identify local floodplain effects such as fences or fences that are impermeable. The actual flood estimate and associated levels could be greater than predicted.
LiDAR – Representation	Local changes in topography levels may not necessarily be reflected in the model or the associated LiDAR data used (n.b. represents the topography at a specific point in time only).
LiDAR – Resolution	The resolution of the LiDAR data (i.e. forming the basis of the model), as well as the LiDAR data itself, may not be sufficient in detail to represent local conditions.
LiDAR – Accuracy	The general accuracy of the LiDAR data itself. Typical accuracy limits for LiDAR is ± 150 mm on hardstand surfaces only. Depth of flooding associated with the overland flow path is typically much lower than this.
Catchment Conditions	Urban landscapes vary significantly over small spatial areas and can change quickly on a lot scale. Mapping can become outdated very quickly in a rapidly developing catchment.

Hydraulic Model Resolution	Unless a significant effort is made to represent small scale features (i.e. pipes, channels, etc), hydraulic model resolution (i.e. 1 m x 1 m grid) may still be too coarse to accurately define low flow capacities.
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For all of the above reasons as well as others, overland flow path mapping is primarily used to identify the extent, along with the areas subject to potential inundation only. Depending on the detailed modelling approaches applied, overland flow path mapping is generally not appropriate or suitable to specifically inform flood level information.

Moreton Bay Overland Flow Path Mapping Project

The MBRC overland flow path mapping project was conceived in late 2008 following a significant flood event which resulted from a severe storm affected many of the southern suburb areas of the Council. In 2009, Council commenced an overland flow path assessment which covered the entire local Government Area (LGA) of approximately 2070 km². This project was one of the first overland flow path assessments undertaken at a regional scale across Queensland. Importantly, the overland flow path mapping was also incorporated into the planning scheme.

The methodology was devised having consideration of a range of factors: -

- Large scale, being the entire Council region.
- Highly detailed mapping output requirement.
- Consistency, repeatability as well as provision for future upgrades.
- Highly cost effective approach.
- Timely completion.

The methodology used included: -

- Development of some 895 separate overland flow path models employing a 2D TUFLOW hydraulic approach.
- 2009 LiDAR topographic data sets re-sampled based on a 2m model grid size for the 2D model (n.b. this has since been updated using 2014 LiDAR data in the recent 2016 overland flow path model updates).
- No inclusion of the stormwater drainage network in the model.
- A nested design rainfall burst storm pattern to prevent the need for consideration of traditional multiple storm duration events to identify the critical storm duration.
- Analysis of the 2% AEP event to infer the 1% AEP event and to otherwise indirectly account for the capacity of the excluded stormwater drainage network.
- A rain-on-grid hydrological approach (i.e. precludes the need for a separate rainfall-runoff model).
- A simplified floodplain roughness approach which included only three (3) spatial zones of roughness (i.e. buildings, roads and general roughness zone).
- Post-processing techniques involving Geographic Information Systems (GIS): -
 - Refinement of raw mapping outputs via thresholds on depth, velocity and unit flow; and
 - Removing flood extent “puddles” and “island” features. An example is presented in Figure 2.



**Figure 2 – Pre and Post Overland Flow Path Map Extents using GIS Processes
(Source – MBRC, 2012)**

The identified limitations included in the MBRC overland flow path mapping project include: -

- No inclusion of stormwater pipe network.
- Simplified zones of roughness.
- A 250mm mapping depth cut-off threshold.
- Not sufficiently accurate to provide flood level information to the public.

The identified benefits of the MBRC overland flow path mapping project include: -

- Very large scale (entire Council area).
- Highly detailed mapping outputs.
- Consistent approach.
- Upgradable in the future.
- Highly cost effective.

Overall, the MBRC overland flow path mapping project is considered to be highly effective and has allowed Council to meet it's obligations under the Queensland Flood Commission of Inquiry for the following reasons: -

- Delivers highly detailed overland flow path mapping over the entire Council area.
- Mapping is available to the greater community to better inform flood risks.
- Can be readily updated with new information.
- Informs planning and development outcomes.

Overland Flow Path Treatment – MBRC Scheme

Introduction

The previous sections of this report have identified the legislative context for Councils to map overland flow paths and has also presented and discussed the MBRC overland flow path mapping project. Despite the limitations associated with overland flow path mapping generally, MBRC in particular has included overland flow path mapping as part of the flood hazard overlay within the planning scheme.

This section of the report considers the treatment and administrative requirements of overland flow path mapping as part of the MBRC planning scheme. Specifically, the context for this discussion is focused on smaller scale development relating to single lots and new residential dwellings and building works.

Building Works

Introduction

Building works associated with private dwellings are mandated and assessed under the provisions of the Building Code of Australia 2015 (BCA, 2015). The BCA is given legal effect through the **Building Act 1975**. Private certifiers are responsible for approvals relating to building works that are defined as assessable development to ensure compliance with the planning scheme, building permit and the BCA provisions. In Queensland, private certifiers also have to assess compliance under the Queensland Development Code (QDC, 2012) which extends the scope of the BCA.

Building Code Requirements in MBRC Planning Scheme

The Building Act 1975 permits Local Government planning schemes to regulate, for the BCA or the QDC, matters prescribed under a regulation under the Building Act 1975. This include other matters, such as designating land liable to flooding. In the context of the MBRC scheme, Council regulates some elements of the BCA provisions through the planning scheme and identifies building assessment matters. Specifically, this includes designation of flood hazard areas which are managed and assessed through the flood hazard overlay code.

Flood Hazard Overlay Code

The flood hazard overlay code includes provisions for both self-assessable developments along with assessable development. Development that is compliant with the self-assessable acceptable outcomes remains self-assessable and there is no requirement for a development permit from Council. Assessable development must apply and be given a development permit by Council as either a code or impact assessable application.

The levels of assessment and associated assessment criteria for the flood hazard overlay is outlined in Section 5 – Tables of Assessment, Section 5.10.2 – Flood Hazard Overlay. A summary of the assessment criteria in respect to building work is illustrated in Figure 3.

Building Work		
Building work not associated with a material change of use.	No change	
	If in the Balance flood planning area	If self-assessment – the relevant self-assessment outcomes in Table 8.2.1.1 of the 8.2.2 'Flood hazard overlay code'. If code assessment - the 8.2.2 'Flood hazard overlay code'. If impact assessment – the planning scheme.
	Code assessment	
	If in the following: a. High risk area not included in the Limited development zone; or b. Medium risk area; or c. Drainage investigation area identified on Figure 8.2.2.1 to 8.2.2.9 of the 8.2.2 'Flood hazard overlay code' Note - If the building work is impact assessment in the zone or local plan, then the level of assessment is not lowered to code assessment.	8.2.2 'Flood hazard overlay code'
Impact assessment		
Development	Level of assessment	Assessment criteria
	If in the High risk flood hazard area included in the Limited development zone.	The planning scheme.

Figure 3 – Flood Hazard Overlay – Levels of Assessment (Part) (Source - Section 5 – Tables of Assessment, Section 5.10.2, MBRC, 2016)

A code or impact assessable development is triggered for all development types that do not meet self-assessable development outcomes as outlined in Figure 3. In the instance of a new dwelling or building work, the relevant provisions of the dwelling code apply for the determination of self-assessable development types and are discussed further below.

Dwelling Code

The stated purpose under Section 9 – Dwelling Codes – Section 9.3.1.2 – Purpose (MBRC, 2016) applying in the situation for a private dwelling residence (or related building works) that is located in an overland flow path: -

- aims to minimise flood risks.
- not impact on flood conveyance.
- cumulatively avoid any adverse impacts.

Development that is compliant with the self-assessable acceptable outcomes outlined in Section 9 – Dwelling Codes - Part A, Table 9.3.1.1 remains self-assessable. For dwellings or building work located in an overland flow path, development must achieve

the Self-Assessable Outcomes (SAO) presented in Table 4 to remain self-assessable development.

Table 4 – Overland Flow Path Self-Assessable Outcomes (Source – MBRC 2016)

Overland flow path (refer Overlay map - Overland flow path to determine if the following assessment criteria apply)	
SAO35	Development for a material change of use or building work does not involve the construction of a building or structure in an Overland flow path area.
SAO36	Development for a material change of use or operational work does not impede the flow of flood waters through the premises or worsen flood flows to other premises. Note - A report from a suitably qualified Registered Professional Engineer Queensland is required certifying that the development does not increase the potential for significant adverse impacts on an upstream, downstream or surrounding premises. Note - Reporting to be prepared in accordance with Planning scheme policy – Flood hazard, Coastal hazard and Overland flow
SAO37	Development for a material change of use or building work ensures that fencing in an overland flow path area is at least 50% permeable.
SAO38	Development for a material change of use or building work that involves a hazardous chemical ensures the hazardous chemicals is not located within an overland flow path area.
SAO39	Development for a material change of use or building work for a Park ⁽⁵⁷⁾ ensures that work is provided in accordance with the requirements set out in Appendix B of the Planning scheme policy - Integrated design.

In demonstrating compliance to the SAO's, and particularly SAO36, a flood assessment report certified by a Registered Professional Engineer in Queensland (RPEQ) is required. Assuming that this is not met, assessment is against the corresponding performance outcomes (PO) identified in Part B – Criteria for Assessable Development, Table 9.3.1.2. PO56 also additionally requires the provision of a certified flood report. This requirement is maintained regardless of the specific building works that are proposed.

Discussion

Overland flow path mapping specifically impacts private property owners that are looking to build a new dwelling or undertake building work on an existing residential lot. Considering the discussion previously, a RPEQ certified flood report is required where the lot is impacted by overland flow path mapping, regardless of the specific building works or development that is proposed.

In respect to a private dwelling located within an overland flow path, it is understood that a private certifier in Queensland is able to make an assessment of development compliance against performance outcomes in the scheme. This assessment is almost always undertaken in conjunction with the certified flood report. The building approval would revert to a code (or impact) assessable application in the event that the private certifier is either unwilling to make a satisfactory determination or if performance outcomes are able to be met. As a further note, in regard to the Queensland Development Code 2012 - MP3.5 - Construction of buildings in flood hazard areas (Department of Housing and Public Works, 2012), there is no specific requirement to consider flood impacts and loss of flood conveyance, rather the mandatory requirements relate to floor level control and maximum velocity criteria (where applicable). As such, private certifiers may not always consider flood impacts and worsening in the compliance assessment.

MBRC maintains overland flow path modelling and flood level data. However, it is understood that external access to the data is restricted as: -

- No flood level information is currently provided on overland flow path flooding.

- MBRC does not release a digital copy of the model to third parties.

The decision for MBRC not to provide overland flow path model data is understood to reside with the accuracy and limitations as outlined in this paper. This MBRC decision not to release data on overland flow path mapping is also supported given the original purpose and intent for which the data has been prepared. However, in order to complete a flood assessment report and associated RPEQ certified flood report as required by the scheme, site specific modelling will be required (i.e. both hydrology and hydraulics). This has time and cost implications and owing to the complexities, these assessments are not necessarily easily completed.

Alternative Approaches

Current Issues in Assessment Process

The costs in addressing overland flow path flooding aspects through the provision of a certified flood report can represent a significant and disproportional cost to the overall building cost. In some instances, the requirement for a certified flood report may also not be necessary. Selected examples to further illustrate this point are presented in Figure 4.

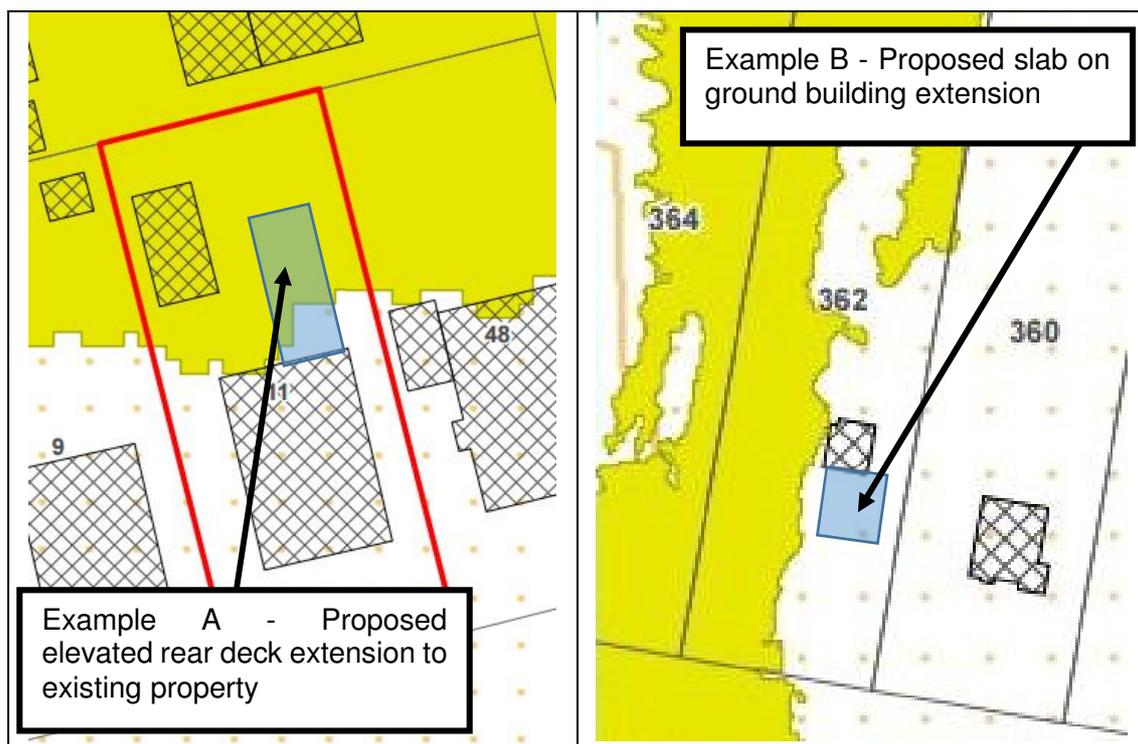


Figure 4 – Lot Scale Examples of Building Works (Base Map Source - MBRC, 2016)

The following discussion is provided in respect to Figure 4: -

- Example A - Although the deck extends into the mapped overland flow path, there is minimal impact in respect to loss of flood conveyance or associated adverse impacts given the deck is raised to above flood level and in the absence of build-in underneath. This example could potentially be supported without a certified flood report assuming that adequate floor level control and conditioning for no build-in underneath is imposed. Council could utilise the overland flow path data to establish and set appropriate building floor levels, even if conservatively determined.
- Example B – While the proposed building extension is outside of the mapped overland flow path, the overlay provisions in the scheme will not be triggered and no requirement for an assessment under the scheme. However, under the Queensland Development Code (QDC, 2012) and associated private certification requirements, a certified flood study may still be required for building floor level control. This example could also potentially be supported by Council utilising overland flow path data to establish and set an appropriate building floor level and in the absence of a certified flood report.

Considering the above examples, there remains an opportunity to more effectively administer building work and dwelling approvals and without otherwise compromising the core objectives of effective flood risk management and associated planning and development outcomes. The MBRC scheme is progressive in respect to better aligning flood risk with development outcomes, with the use of the limited development zone to restrict development occurring in areas of significant and extreme flood risk being one such example. There remain further opportunities to streamline current assessment arrangements in the scheme, and particularly for smaller scale development proposals located in overland flow paths.

Consideration of Alternative Approach

One approach that could be considered is for Council to take an active role in providing an assessment and advice service outside the current development assessment process. This approach could be similar to the siting variation process, which is assessed by Council and represents an additional component to the building approval. Where acceptable, approval is issued outside of the planning scheme provisions and dealt with through the building approval process via private certifier. Where the proposal is unsatisfactory, the applicant has the opportunity to apply for development approval under the normal scheme provisions (i.e. either code or impact assessable).

The potential benefits in this approach could include: -

- Fee paying service to Council that would ideally be full cost recovery.
- Assessment of overland flow paths is better administered by Council (n.b. poses both the technical knowledge as well as the data).
- Benefits in respect to time and cost to a range of professionals involved in the process.
- More certainty in development outcomes for all parties.
- Streamlined approach with timely decisions.
- Minimises opportunity for private certifiers to overlook aspects of the development (i.e. such as flood impacts, etc).
- Specific flood levels need not be specified by Council, rather a “minimum” compliance level to be achieved for building floor levels. Level is determined by Council having regard to the veracity of the overland flow path model.

The potential dis-advantageous in this approach may include: -

- Potential higher workloads for Council (or consideration of out-sourcing to external provider).
- Possible need for additional resources.
- Potential risk and liability in the assessment. This could however be offset by Council not providing an assessment rather requesting a certified flood report.

Conclusion

Overland flow paths pose considerable flood risk to the greater community and have the potential to damage property and possessions, as well as present a risk to life. This is especially true within the urban context given the highly developed urbanised areas and dense population.

Overland flow paths are known to be problematic and difficult to assess. Regardless of the complexities involved, technical issues and associated limitations affecting accuracy, this should not preclude use of the data in an informative way to assess flood risk and enable development outcomes.

Local Governments are obliged under the requirements of both the QFCI and State Planning Policy 2014 to map overland flow paths. Not all Local Governments have transitioned to mapping of overland flow paths, nor have included these in the planning scheme.

The MBRC overland flow path mapping project has been considered as part of this paper. The project was found to be highly effective and has enabled Council to meet their obligations under the Queensland Flood Commission of Inquiry in respect to mapping of overland flow paths.

Planning schemes represent a mechanism by which a balance is maintained between effective flood risk management and land use planning and development outcomes. The MBRC planning scheme is a progressive scheme that has considered flood risks as a fundamental pillar underpinning the scheme. The scheme includes mapped overland flow paths.

Overland flow paths are considered to impact to a greater degree on private property owners that are looking to build a new dwelling or undertake building work. The costs associated with satisfying overland flow path flooding requirements can represent a significant and disproportional cost imposition to individuals.

A suggested approach has been presented as part of this paper to improve the current arrangements relating to assessment of building work located in overland flow paths. This approach aims to improve outcomes and without otherwise compromising the core objectives of effective flood risk management and associated planning and development principals. It is considered that the approach provides considerable benefits to Council, as well as all professionals associated with certification of private building works.

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References

Brisbane City Council (2014), *Brisbane City Plan 2014*. Available from: <http://eplan.brisbane.qld.gov.au/>. [20 March 2016]

Department of Infrastructure, Local Government and Planning (2016), *Queensland Planning Provisions – Version 4*. Available from: <http://www.statedevelopment.qld.gov.au/resources/policy/state-planning/qpp-4-0.pdf>. [19 March 2016].

Department of State Development, Infrastructure and Planning (2014), *State Planning Policy, July 2014*. Available from: <http://www.dilgp.qld.gov.au/resources/policy/state-planning/state-planning-policy-jul-2014.pdf> [19 March 2016].

Department of Housing and Public Works, *Queensland Development Code (2012)*. Available from: <http://www.hpw.qld.gov.au/construction/BuildingPlumbing/Building/BuildingLawsCodes/QueenslandDevelopmentCode/Pages/default.aspx> [20 March 2016].

Department of Housing and Public Works (2012) *Queensland Development Code 2012 – MP3.5 - Construction of buildings in flood hazard areas*. Available from: <http://www.hpw.qld.gov.au/SiteCollectionDocuments/Mandatory3.5ConstructionOfBuildingsInFloodHazardAreas.pdf> [20 March 2016].

Gold Coast City Council (2015) *City Plan Version 2, 2015*. Available from <http://cityplan.goldcoast.qld.gov.au/pages/plan/viewer.aspx?vid=10129>. [20 March 2016]

Ipswich City Council (2005) *Ipswich Planning Scheme, 2005*. Available from: <http://www.ipswichplanning.com.au/>. [20 March 2016]

McConaghy, E, (2012) “*Out with the old, in with the new – a flood risk management approach to preparing a planning scheme*”, Stormwater Queensland Conference, 2014.

Moreton Bay Regional Council (2015), *Regional Floodplain Database Project, 2015*.

MBRC, (2016), Moreton Bay Regional Council, *Flood Publications and Digital Data – Overland Flow 2016*. Available from: <https://www.moretonbay.qld.gov.au/general.aspx?ekfrm=114179>. [20 March 2016]

Moreton Bay Regional Council (2012) *MBRC Planning Scheme, 2015*. Available from: <https://www.moretonbay.qld.gov.au/subsite.aspx?id=143424>. [20 March 2016].

Qld Government (2012), *Queensland Government, Queensland Floods Commission of Inquiry – Final Report, 2012*, Available from: http://www.floodcommission.qld.gov.au/__data/assets/pdf_file/0007/11698/QFCI-Final-Report-March-2012.pdf. [19 March 2016]

Queensland Reconstruction Authority (2012) *Planning for stronger, more resilient floodplains*, Part 2 – Measures to support floodplain management in future planning schemes. Available from: <http://qldreconstruction.org.au/publications-guides/land-use-planning/planning-for-stronger-more-resilient-flood-plains>. [20 March 2016]

Sunshine Coast Council (2016) Sunshine Coast Planning Scheme 2014. Available from: <https://www.sunshinecoast.qld.gov.au/Development/Planning-Documents/Sunshine-Coast-Planning-Scheme-2014/View-the-Sunshine-Coast-Planning-Scheme-2014-Text>. [20 March 2016].