REPORT

Bay of Plenty Regional Council

Hazard Research in the Bay of Plenty

Gap Analysis

Prepared for:

Bay of Plenty Regional Council

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1 Introduction and background

The Bay of Plenty Civil Defence Emergency Management Group (BOPCDEM) are responsible for managing and reducing the risk of hazards through measures such as community preparedness, increasing hazard awareness and understanding, and evacuation planning.

In order to effectively identify, assess and manage relevant hazards BOPCDEM require a complete understanding of the hazards relevant to the Bay of Plenty region (BOP). Research is often the first step undertaken in terms of the identification of hazards.

To date hazard research conducted within the BOP has been undertaken by consultants, crown research institutes (such as GNS, NIWA), tertiary institutions and local authorities[1]. Further, we understand from discussions with BOPCDEM that the Bay of Plenty Lifelines Group is currently researching hazards. The local authorities include:

- Bay of Plenty Regional Council (BOPRC);
- Kawerau District Council (KDC);
- Opotiki District Council (ODC);
- Rotorua District Council (RDC);
- Tauranga City Council (TCC);
- Western Bay of Plenty District Council (WBOPDC); and
- Whakatane District Council (WDC).

At present the BOPCDEM have no central repository or catalogue to list and regularly update all the hazard research undertaken relevant to the BOP. In our opinion this results in:

- Difficulty in assessing the specific hazards or spatial areas where either more focus or fresh focus is required;
- Missed opportunities for organisations to collaborate on projects, share information and tailor new research to build on a body of existing knowledge; and
- Challenges to ensuring that hazard research is responsive to changing legislative requirements, best practice and new scientific knowledge.

A spreadsheet has been created by the BOPRC to act as a catalogue for hazard research conducted to date and relevant to the BOP. The BOPRC have named their spreadsheet the "Natural Hazards Research Database". For the purposes of this report the BOPRC's Natural Hazards Research Database will be referred to as "the database" hereafter.

2 Project scope

The BOPCDEM engaged Tonkin and Taylor Limited ("T&T") to:

1. Review the BOPRC's database referred to above;
2. Review T&T's repositories of technical reports relating to hazards within the BOP and commissioned by the local authorities and tertiary institutes;
3. Contact key personnel at the local authorities to request access to technical reports relating to hazards in the BOP;
4. Review and collate all information sourced from the tasks undertaken above and prepare a catalogue of the various information sourced setting out: title; scope; date of production; and location where the information is held; and

[1] As defined in the Local Government Act 2002.

5. Prepare a summary report summarising the extent and type of information available, as well as a gap analysis and critical review of the research or studies undertaken to date.

This report serves as the completion of item 5 above. This report contains a conclusion identifying the types of hazards which are considered by T&T to be well researched and understood, and conversely where it is considered more effort or focus is required, including within each specific hazard. The catalogue required under item 4 has been supplied to the BOPRC in an electronic form due to its size.

The BOPCDEM instructed T&T to consider the hazards relevant to this project as being those identified in Table 2-6 of the 2014 Hazard Risk Profile report[2] prepared by BOPCDEM. Those hazards are:

- Tsunami – local source;
- Human pandemic;
- Tsunami – distal source;
- Volcanic- local source;
- Dam failure;
- Major marine/port accident;
- Earthquake – severe;
- Plant and animal pest diseases;
- Drought;
- Wind storm (including tornado);
- Storm surge;
- Flooding – river/stream;
- Coastal erosion;
- Lifeline utility failure;
- Hazardous substance release;
- Slope instability (landslide, debris flow, slumping);
- Civil unrest/terrorism;
- Major air, road or rail accident;
- Flooding – urban/rural ponding;
- Volcanic – distal source;
- Rural fire;
- Volcanic – caldera unrest;
- Geothermal;
- Urban Fire; and
- Regional deformation (long term).

[2] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

3 Methodology

The database complied by the BOPRC was last updated in April 2015. The BOPRC has advised that during the development of the database all relevant territorial authorities[3] (TAs) were asked to provide any information they held that was relevant to hazards. A number of documents over and above those listed in the database were found by T&T following an internal library search and a search for relevant publications produced by tertiary institutions.

3.1 Gap analysis

Following consultation with s 7(2)(a) - Privacy of the BOPCDEM it was decided that some of the hazards listed in Section 2 of this report were not actively managed by the BOPCDEM, and were managed by local or national external agencies.

Consequently, the list of hazards contained in Section 2 of this report was further refined by categorising them into "primary" and "secondary" hazards. That is, those hazards that were within the "higher priority", as determined by the BOPCDEM in Table 2-6 of the 2014 Hazard Risk Profile report[4], were further split into primary and secondary hazards. The same process was followed for "medium priority" and "low priority" hazards. Table 3-1 below presents the result of the refinement process.

This refinement provided for more attention and focus to be placed on primary hazards, which represent those hazards that BOPCDEM has a direct mandate to manage. Secondary hazards are typically managed by other agencies with the BOPCDEM at time retaining some involvement. An example of this is human pandemic, which is managed by the Ministry of Health, however the BOPDCEM do need to be aware of the hazard and ensure they are informed of the relevant plans and available risk assessments.

Table 3-1: Hazards relevant to the BOP - primary and secondary hazards

BOP Hazards	
Higher priority	
Primary hazards	**Secondary hazards**
Dam failure	Drought
Earthquake - severe	Human pandemic
Flooding - river/stream	Major accident (marine/port)
Storm surge	Plant & animal pests & diseases
Tsunami - local	
Tsunami - distal	
Volcanic - local	
Wind storm (including tornado)	
Medium priority	
Primary hazards	**Secondary hazards**
Coastal erosion	Civil unrest/terrorism
Flooding - urban/rural ponding	Lifeline utility failure

[3] As defined in the Local Government Act 2002.

[4] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

Hazardous substances release	Major transport accident (air, road, rail)
Rural fire	
Slope instability (landslide, debris flow, slumping)	
Volcanic - caldera unrest	
Volcanic - distal	
Low priority	
Geothermal	Urban fire
Regional deformation (long term)	

Applying Table 3-1 and the information provided in relation to specific hazards outlined in the BOPCDEM 2014 Hazard Risk Profile report[5] the database was searched for entries on a hazard type specific basis.

3.2 Topics

All the entries within the database relating to a particular hazard were assessed in order to ascertain what sub-topics/components of each hazard were missing. These sub-topics/components related to some of the responsibilities BOPCDEM has in relation to hazards and can be broadly categorised as:

- Awareness and education;
- Knowledge/science (i.e. how, why and when the hazard occurs);
- Risk reduction including planning/policy measures;
- Risk assessments (i.e. probability, scale of damage, area of impact etc.);
- Plans/contingencies (i.e. evacuation and emergency management plans etc.); and
- Future projections/considerations (i.e. population growth, sea level rise).

3.3 Assumptions

It was assumed that the database provided by the BOPRC was complete and accurately represented a full list of what is held on file by local authorities within the BOP.

3.4 Limitations

It should be noted that the analysis conducted by T&T did not include a review of statutory planning documents prepared under the Resource Management Act 1991 ("RMA") by local authorities within the BOP. These documents may or may not contain provisions relating to hazards and relate to the BOPCDEM's responsibility to reduce risk through an involvement in the preparation and implementation of RMA planning and policy measures. T&T suggests that this review of statutory planning documents is undertaken and the results incorporated into the spreadsheet. Not only will this identify further gaps, but also inform BOPCDEM of how prepared the relevant local authorities are and what policies and plans they have in place to reduce and manage risk.

3.5 Missing entries

In order to ensure the spreadsheet was the most up to date it could be and accurately reflected the data and information held by TAs in the BOP relating to hazards, each TA was contacted and a request made to confirm if any information over and above the spreadsheet was held. The response

[5] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

times from the TAs were slow and in most cases nothing was received at the time of writing this report. T&T recommends that this request is made again by the BOPCDEM or BOPRC.

T&T notes that there is likely to be information relating to hazards held by consultants that may not be detailed in the database. T&T suggests that the BOPRC or BOPCDEM approach these consultancies and request that they supply a list of their reports relating to hazards in the BOP.

3.6 Spreadsheet errors

T&T noted that there were errors in the spreadsheet that make using it difficult and time consuming. Some examples of these were:

- No dates are provide for some entries. It is recommended that at the time new entries are added to the spreadsheet publication dates are entered also, even if this means consultation with the author is required;
- Inclusion of maps as a separate entry. Typically these maps were an annexure of a document or publication and therefore it was confusing in some instances to have the map listed separately;
- Inconsistencies with database entries such as some had keywords entered and some did not; and
- Incorrect categorising of entries. An example of this would be many of the coastal erosion and storm surge documents were held within the "extreme weather" category. This categorisation system confuses the natural occurrence or "trigger" of the hazard with the hazard itself. This made searching the database time consuming.

4 Results

4.1 Primary hazards

After searching the T&T library, communicating with participating TAs and conducting some internet based research, T&T found 18 documents over and above those listed in the database that were deemed relevant to hazards in the BOP. These 18 documents are contained on a separate sheet of the final results spreadsheet supplied with this report electronically.

Following the input of the 18 additional entries to the database, T&T searched the amended database for information that was lacking in relation to hazards affecting the BOP. The scale of the knowledge gap for each hazard was then categorised as either "significant", "moderate" or "insignificant". Table 4-1 provides a summary of the scale classification undertaken. The full results table, setting out the reasons for the classification, is annexed to this report as Appendix A.

Table 4-1: Information gaps for BOP hazards- scale for specific hazards.

	Scale of information gap		
	Significant	**Moderate**	**Insignificant**
Hazard	Dam failure Wind storm Hazardous substance release Rural fire	Storm surge Slope instability Geothermal Coastal erosion Regional deformation	Earthquake Flooding Tsunami Volcanic

The scale of the knowledge gap (i.e. significant, moderate or insignificant) was determined by one or more of the following criteria:

- Information was outdated or possibly too old to be relevant;
- The hazard was not mentioned; and
- There was information lacking relating to some but not all sub-topics/components of the hazard (refer to Section 3.2) i.e. the information available for the hazard was deemed incomprehensive.

It is worth noting that for some of the identified gaps, there may actually only be a gap in the data entered into the database, and not an actual gap in the knowledge or research that is available. This is most likely the case for many of the hazards in the "insignificant" category of Table 4-1, which are generally well researched. In these cases, the small gaps identified may reflect gaps in the information BOPRC and the TAs hold and/or share relating to the hazard. For most of the hazards in the insignificant gap category there is a lot of information available, but it may need to be amalgamated and collated within the database to be more accessible and up to date.

Those hazards that were severely lacking information (i.e. "significant" in Table 4-1) were dam failure, wind storm, hazardous substance release, and rural fire. All of these specific hazards lacked information relating to all of the sub-topics/components set out in Section 3.2 of this report.

Dam failure and wind storm have been classified by the CDEMBOP as higher priority hazards[6] and therefore obtaining more detailed information pertaining to these two hazards would seem highly important.

Five hazards fell into the moderate information gap category. For some of these hazards further reporting and research is most likely required, however for others it may be a case of sourcing existing research and collating it all in the database or an alternative central repository. In the case of the hazards found to have moderate scale information gaps these gaps were not consistent and therefore able to be grouped like for significant and insignificant scale gaps. Table 4-2 sets out in summary form the specific gaps identified for hazards having moderate information gaps. The full results table, setting out the reasons for the classification, is annexed to this report as Appendix A.

Table 4.2: Information lacking within the database for hazards identified as having moderate information gaps

Hazard	Gap in knowledge	Priority assigned by BOPCDEM[7]
Storm surge	Clarification is required as to whether this term "storm surge" covers coastal inundation. There appears to be no model results/predictions of storm surge in coastal areas. No evidence was found of obvious contingency plans or hazard management methods such as use of planning zones, evacuation routes etc. Nothing specific found for storm surge risk in the BOP. Particularly lacking in regards to sea level rise (SLR) and harbours and estuaries (with the exception of Tauranga Harbour), e.g. Ohiwa, Maketu and Pukehina. Prevention/reduction/management options and methods appear to be lacking.	Higher
Coastal erosion	Lacking specific detail for coastal settlements such as Maketu and a few other areas such as more recent settlements like Waiotahi Drifts.	Medium

[6] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.
[7] Ibid.

	Nothing specific about SLR and its effects on coastal erosion. Not much on local level risk reduction or planning. Also lacking information on harbour coastal hazards. There is a small amount of information relevant to the Tauranga Harbour but nothing for Ohiwa or Maketu estuaries regarding erosion or inundation risk. Note that there are no setbacks, hazards lines or SLR effects studies, data and information for any harbours.	
Slope instability (landslide, debris flow, slumping)	Good understanding for the Opotiki District, Tauranga area and Whakatane District (particularly Matata), but nothing specific on reduction strategies. Other districts (Kawerau, Rotorua, Western Bay of Plenty) lacking and nothing in Tauranga area relating to harbour areas and more strategic management plans for reduction/management.	Medium
Geothermal	Lacking information regarding impacts on resource capacity given future development and use potential. No mitigation planning or contingency plans.	Low
Regional deformation (long term)	Nothing found relating to management plans or future risk, especially related to geothermal as more resources are used/exploited.	Low

With regard to Table 4-1 and 4-2, T&T notes that there appears to be a gap in the database in relation to cross-hazard effects, such as increased sea level rise increasing liquefaction hazard.

4.2 Secondary hazards

As identified in Table 3-1 of this report, there are a number of secondary hazards that BOPCDEM do not have a direct mandate to manage, but at times retain some involvement in. These include:

- Drought;
- Human pandemic;
- Major accident;
- Plant and animal diseases;
- Civil unrest/terrorism;
- Lifeline utility failure;
- Major transport accident; and
- Urban fire.

Following the completion of the gap analysis it became apparent that there is a lack of information related to BOPCDEM's role and contribution in managing secondary hazards contained in the database. In order to provide support to the lead agency and ensure the hazard is adequately managed and the risk minimised, the BOPCDEM need to hold relevant information, such as copies of management plans for each secondary hazard.

4.3 Additional hazards/natural occurrences

Following a review of the BOPCDEM's Hazard Risk Profile report[8], T&T considers that there are some hazards and natural occurrences (refer Section 5.1 of this report) that may be required to be either added, or listed within the database rather than as a component of another hazards. These additional hazards are outlined in Table 4-3 overleaf.

[8] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

Table 4-3: Possible additional hazards/occurrences to be considered for the database

Hazard	Comment
Liquefaction (including lateral spread)	T&T considers liquefaction to be a separate and specific hazard. Liquefaction is not as part of an earthquake as a hazard. Liquefaction can be managed through identification of susceptible locations and risk reduction whereas a severe earthquake cannot.
Climate change	Climate change and its relationship with SLR, increases in extreme rainfall and wind storm etc is not considered in the database at present. Climate change is likely to exacerbate existing hazards.
Sea level rise	SLR and its interactions with other resources is important. For example SLR's influence on groundwater levels. There is not much information currently available within the database relating to the effects to harbours and landforms adjoining them of SLR.
Extreme rainfall events/thunderstorms	T&T considers that extreme rainfall/thunderstorms could be treated as a separate and specific occurrence to those hazards of flooding and wind (tornado) which are listed. We note that hail and lightning are hazards and that extreme rainfall events may become more frequent with climate change. Nothing was found within the database relating to contingency/response plans or a risk assessment/likelihood report for extreme rainfall/thunderstorms.
Sedimentation/deposition	This hazard is not currently covered by the database. It could be considered a separate hazard as it can result in blocked transport pathways, flooding and cause property damage (for example windblown coastal sand deposition on beachfront properties at Pukehina).
Coastal inundation	T&T considers that coastal inundation should be identified as a hazard and that it should be separated from coastal erosion. This is because it can be an individual hazard i.e. flooding up rivers, estuaries etc combined with full tides/storm surge and it can also occur without coastal erosion, and cause coastal erosion. T&T also considers that storm surge is component of coastal inundation.

5 Recommendations

5.1 Hazard vs natural occurrence

"Natural hazards" are defined in the Resource Management Act 1991 and the Building Act 2004. The Civil Defence and Emergency Management Act 2002 defines "hazards". Each legislative definition varies according to the purpose of the said Acts. T&T considers that hazards are products of natural occurrences or phenomena and that these two separate concepts are not synonymous. By way of example Table 5-1 sets out the natural occurrence of an earthquake and its related hazards.

Table 5-1: Natural occurrence and hazards

Natural occurrence	Resulting Natural hazard
Earthquake	Fault rupture Liquefaction and lateral spreading Ground shaking Landslide and rock fall Tsunami

T&T considers that the BOPCDEM's Hazard Risk Profile report[9] could be amended to provide better clarity around hazard definition. This would provide a good foundation for the population of the database/alternative central repository and also a discussion around whether to include the additional hazards and occurrences identified in Table 4-3.

5.2 Further research

The gap analysis has confirmed that the database currently lacks information relating to the following hazards: dam failure; wind storm; hazardous substance release and rural fire. T&T recommend that priority is given to conducting further research in relation to these hazards and undertaking discussions with external agencies, which may also have responsibility for managing these hazards, to source additional information. For example, dam owners such as Trust Power may be able to provide information specific to dams they own and the New Zealand Fire Service may hold information relating to Emergency Management Plans for releases of hazardous substances.

Some additional research may be needed for the other hazards listed as having moderate and insignificant information gaps within the Table 4-1. However, some of the gaps identified for these hazards may be alleviated by sourcing information currently available, collating this information for each hazard and updating the database.

5.3 Central repository creation

A central repository which is up to date and accessible to numerous users could be a very useful tool for BOPCDEM, the BOPRC and also TAs in order to manage information relating to hazards in the BOP.

We recommend the use of a centralised, secure system for holding all the entries preferably with geo-spatial access. This system would be accessed by a set group of users (such as BOPCDEM, the BOPRC and also TAs) and any edits made monitored. An example of a suitable type of facility is Project Orbit, an information management system developed by T&T[10] which is the platform for the

[9] Ibid.

[10] http://www.tonkin.co.nz/Project-Orbit/features.html

Canterbury Geotechnical Database. The advantage of a new information management system over the existing database is that data interrogation, linkage and filtering functionality can be in built. With over 700 entries (likely to increase significantly with time) this type of functionality would be very helpful. For more information on Project Orbit please refer to the capability summary sheet annexed to this report as Appendix B.

As part of re-developing the database or establishing a new information management system, a set of entry standards should be developed so that all entries, no matter whom they are entered by, follow the same format and require certain fields to be entered. This will minimise and potentially prevent the type of errors/shortcomings as identified in Section 3.6 of this report, and also ensure efficient searching of the database/information management system.

The database/information management system should be updated regularly and then fully audited at regular intervals. This would allow for the users to ensure any new or updated information was added. Other benefits would be that the risk of information going undetected or being repeated would be alleviated and it would allow for collaboration/sharing of costs in relation to commencing separate but related or iterative work streams.

Once the information management system was in place and all data captured within it was easy to access and interpret, then it could be valuable to create a tool that allows a summary form of the data to be displayed via publicly accessible GIS databases such as the WBOPDC and TCC "Mapi" and BOPRC "Bay Explorer". These GIS database could have a new layer added which allows a summary of the hazard information, as it related to spatial locations, to be viewed. Full copies of the report(s) could then be requested if necessary.

5.4 District and City plan search

TAs in the BOP have developed provisions relating to the management and planning for natural hazards within their respective district or city plans. It would be valuable to review all of these documents and discussing them with the TAs to better identify the information that informs these provisions (to make sure these types of documents are captured by the spreadsheet/information management system). It would also be useful to undertake a critical of the city and district plans and ascertain the extent to which the hazard management measures contained within them relate to other documents such as the BOPCDEM's Hazard Risk Profile report[11]. T&T considers that there could also be merit in adding the relevant chapters from city and district plan relating to hazards to the spreadsheet/information management system.

5.5 Consultants' reports

It would be useful for the BOPCDEM to approach individual consultancy firms and request a list of reports they have prepared which relate to hazards in the BOP.

5.6 Resource Consent/Plan Changes

It is likely that files held by the BOPRC and TAs relating to resource consents, plan changes and designations contain information relating to hazards. In the case of major infrastructure development (such as the Tauranga Eastern Link) and major urban growth areas (such as Te Tumu, Wairakei, Omokoroa, and Tauriko) there are likely to be substantial bodies of information available relating to hazards contained on the consent authorities' files. Consequently, it would be worthwhile to initiate a review of these resource consent, plan change and designation files.

[11] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

5.7 Secondary hazards

As outlined in Section 3.1 of this report, there are some hazards that BOPCDEM do not have a mandate to manage but do actually play a role in managing. Information relating to these hazards may not be lacking, but rather needs to be obtained from the relevant lead agency, so that BOPCDEM can be satisfied the hazard is being adequately managed, and can provide support when and where needed. Therefore, we recommend BOPCDEM contact the relevant lead agencies and request information they hold relevant to these hazards.

6 Conclusion

In order to effectively identify, assess and manage relevant hazards in the BOP, the BOPCDEM require a comprehensive understanding of the hazards that affect or could affect the BOP.

The purpose of this research project undertaken by T&T was to provide a gap analysis of current information available within the database relating to hazards. The gap analysis identified those hazards which are not well researched and also determined areas within each hazard where it is considered further detail could be required.

During the gap analysis priority was placed on primary hazards which are the direct responsibility of BOPCDEM to manage.

The gap analysis showed that generally most hazards were not well researched and/or documented. However, for some of the identified gaps, there may actually only be a gap in the data entered into the database, as opposed to an actual gap in the information and/or research that is available. The gap analysis produced the following key results:

- Hazards identified as severely lacking information on any level were dam failure, wind storm, hazardous substance release, and rural fire;
- The following hazards well grouped into a moderate information gap category: storm surge; slope instability; geothermal; coastal erosion; and regional deformation. For the majority of these hazards further reporting and research is likely to be required;
- Information available for secondary hazards within the BOP is inadequate. It is recommended that BOPCDEM source and hold relevant information, such as copies of emergency management plans, for each secondary hazard, in order to provide support to the lead agency and ensure the hazard is adequately managed and the risk minimised;
- Information pertaining to cross-hazard effects, such as increased sea level rise increasing liquefaction hazard, appears to be missing;
- The BOPCDEM may wish to review their Hazard Risk Profile report[12] and clarify hazard vs natural occurrence. Following this exercise it may be necessary to add or delete hazards from the database/information management system;
- A central repository for storing, updating/amending and tracking the available research and information relating to hazards in the BOP would be valuable; and
- The current database may be able to be updated relatively promptly following contact being made with the TAs and selective consultancies who are known to have undertaken hazard research in the BOP.

In summary, a lot of information relating to hazards exists in the database (over 700 entries). However, in order to more adequately understand and manage hazards, the database needs to be further developed to be a more adaptive, efficient and effective tool with data interrogation, linkage

[12] *Review of the regional hazard risk profile for the Bay of Plenty Region 2014* BOPCEM, December 2014.

and filtering functionality. Lastly, it is likely that a clear information gap exists for some hazards and remedying this by conducting further research should be a priority for BOPCDEM.

7 Applicability

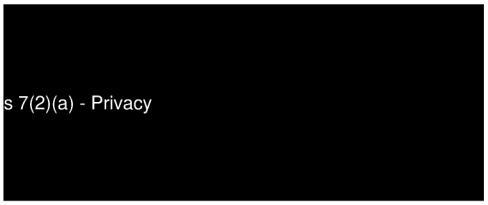
This report has been prepared for the benefit of the Bay of Plenty Regional Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Authorised for Tonkin & Taylor Ltd by:

Environmental Scientist

Project Director



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Appendix A: Gap anaylsis results table

Bay of Plenty Hazards	Gap analysis results	Gap present?	Level of knowledge gap *(this refers to the amount of information lacking)*
Higher Priority			
Dam Failure	Few reports on specific dams but nothing recent (since 1990's). No RMP's for any dams which are required under legislation so must be out there somewhere. No data on estimates of dams or dam failure risk in BOP. Possibly some info in consent/compliance files re modelling and risk management plans etc. Nothing on causes or consequences of dam failure e.g. modelling and nothing about CDEM plans/contingencies in event of failure . Also might be worth having more info on risk of failure due to other hazards e.g. earthquake/tsunami/flooding/seismic/deformation/rifting in BOP, specifically long term hazards like rifting and deformation as this should be factored into future planning and RMP's.	yes in all aspects	major
Earthquake - Severe	Has been some study done related to earthquake hazard in the BOP but not since 1999. Some more detailed studies on liquefaction (a hazard resulting from an earthquake event) were undertaken for smarthgrowth areas, Papamoa and WBOP but nothing more detailed for the other areas of the BOP, particularly populated ones. Also only Whakatane and WBOP have had microzoning studies - perhaps this should be region wide. Only small amount of info on offshore EQ hazards and not alot on EQ hazard outside the region i.e. Taupo Rift, Hawkes Bay, Auckland etc. No risk modelling, planning or education documents and no mention of how it will affect i.e. drainage scheme/other council assets.	yes	minor
Flooding - River/Stream	Spreadsheet is lacking floor/design levels for buildings from TA's (Have TCC's from 1997). EBOP asset assessment needs update - last one 2002. No overarching management or contingency plan i.e. evacuation. No mention of planning needed/being undertaken to reduce risk i.e. delineating flood zones, floor levels, etc.	yes, but largely just requires tying it all in	minor
Storm surge	Not much on file at all, needs clarifying as to what this covers i.e. inundation as well. No model results. Contingency plans, planning zones, evac routes etc. all absent. One T&T report 1999 for Tauranga Harbour (we (T&T) know we have undertaken more recent reporting on this), and 2013 NIWA report on storm tide hazard but nothing for storm surge risk in BOP. Particularly lacking in regards to sea level risk and harbours (other than Tauranga, e.g. Ohiwa, Maketu, Pukehina). Prevention/reduction/management options and methods lacking, i.e. setting "no build' zones, regular modelling etc.	yes, more research required but also need to pull together all known info in one place, particularly policies/methods the TA's have in place.	medium

Bay of Plenty Hazards	Gap analysis results	Gap present?	Level of knowledge gap *(this refers to the amount of information lacking)*
Tsunami - Local	A lot of info available and some specific to areas of BOP, maybe more needed on planning/policies to reduce risk associated with tsunami i.e. building restrictions/planning zones etc. Also no mention of any contingencies or management plans	could be more on planning/policies to reduce risk	minor
Tsunami - Distal	Nothing specific found relating to distal tsunami and BOP (we know GNS and others have done reports on this) - info must exist within national reports/modelling results but perhaps needs writing into a management plan, risk assessment etc.	yes but the info most likely exists already	minor
Volcanic - Local	Seems to be a lot of info in the CDEM Hazard Risk Profile Report so maybe this should be put into an overarching document. Recent info and particularly contingencies and potential risk lacking for Mayor and White Island (any relevant info is from 1995). There is a 2003 Tarawera evacuation report/plan but is this still relevant? 2007 contingency plans for Okataina Volcanic Caldera. 1993 NIWA eruption scenarios, but maybe need more recent? no info on planning/policy for risk reduction of Okataina Volcanic Caldera. Edgecumbe report on likelihood of failure is from 1995. big lack in planning/policies and also anything recent for White and Mayor Islands and also lacking info on effects of (any) volcanoes to wider BOP. Not sure how much info exists on secondary volcanic hazards i.e. shockwaves, ash and debris, pyroclastic flow, fire fountaining and poisonous gases	possibly	minor
Wind storm (including tornado)	Not in CDEM Hazard Risk Profile Report. Not much in spreadsheet (extreme weather) Nothing on tornado specifically except maybe in GNS report on Natural Hazards from 2013. NIWA did 2013 report on climate and weather of BOP but nothing on the hazards associated or risk. No info on sources, assessments of risk, contingencies, education or plans.	yes	major
Secondary			
Drought	No information on file - what are CDEM doing to reduce/manage risk? NIWA give forecasts, do BOPCDEM/BOPRC/TAs do anything with them? Do they develop policy or help at all?	maybe, but mostly MPI managed	
Human Pandemic	Managed by MOH however CDEM need to be involved and have contingencies, particularly if this coincides with another hazard i.e. earthquake or tsunami etc. Not much on how to minimise and or isolate, even internally i.e. if BOPCDEM staff are affected	possible gap, dependant on what mandate CDEM have.	

Bay of Plenty Hazards	Gap analysis results	Gap present?	Level of knowledge gap *(this refers to the amount of information lacking)*
Major Accident (Marine/Port)	Nothing in spreadsheet, do have some jurisdiction through harbour master. The oil spill response plan needs to be put in spreadsheet as with the bi-annual hazard risk assessments undertaken by the harbourmaster. Does the oil response plan cover fire, and other contaminants? If not then this a potential gap. Are there any risk assessments on future events given increase in port traffic/cruise ships and any contingency planning for this?	yes but mostly MSA	
Plant & Animal Pests & Diseases	Nothing on file. Do manage through Biosecurity Plan, but more managed by MPI. BOPCDEM are developing reduction protocols and procedures. maybe need better clear plan of what to do with future/potential diseases rather than known ones. Maybe put MPI plans/procedures/research/info in the spreadsheet.	possible gap, dependant on what mandate CDEM have.	
Medium Priority			
Coastal erosion	Generally abundant info on pockets of coastal erosion. Lots on Ohope and Ohiwa and some Opotiki and Waihi. Maybe lacking specific detail other more recent settlements like Waiotahi. Generally NERMN reporting means there is good monitoring of shoreline change. A lot of info on climate change in the bay but nothing specific about SLR and coastal issues. Alot on risk mitigation/management but at a higher level i.e. central govt, not so much on local level risk reduction or planning. Also harbour coastal hazards, Tauranga has a bit of info nothing for Ohiwa, Maketu etc. regarding erosion or inundation risk. Note that there are no setbacks, hazards lines or SLR effects studies for harbours.	Information relating to sea level rise and harbour impacts are lacking.	medium
Flooding - Urban/Rural Ponding	Couldn't find anything specific for floor/design levels for building, apart from TCC ones from 1997. EBOP asset assessment needs update - last one on file was 2002. Nothing mentioned on flooding that starts outside region but this may not be an issue? No overarching management or contingency plan i.e. evacuation plan and no information on planning and policies in place to reduce risk i.e. limiting building in flood zones, adding flood zones to LIM reports etc.	possible gap in the information related to reduction of risk and maybe an updated assessment is required (previous was 2002).	minor
Hazardous Substances Release	Nothing	Yes	major

Bay of Plenty Hazards	Gap analysis results	Gap present?	Level of knowledge gap *(this refers to the amount of information lacking)*
Rural Fire	Nothing on spreadsheet, bit about wildfire but nothing specific to BOP	gap in risk assessment, modelling of potential fire 'pathways', management plans/evacuation etc. and risk reduction i.e. planning, working with rural fire services etc.	major
Slope Instability (Landslide, Debris Flow, Slumping)	Good understanding for Opotiki District, Tauranga area and Whakatane District (particularly Matata) but nothing specific on reduction strategies. Other districts (Kawerau, Rotorua, WBOP) lacking and nothing in Tauranga area relating to harbour areas and the more strategic management plans for reduction/management or even response to an event etc. May be some info for the Rotorua district but no overarching risk assessment or modelling on rainfall intensities (as one of the natural events that trigger the hazard), flooding distribution etc.	Yes	medium
Volcanic - Caldera Unrest	Nothing specific to BOP but is mentioned in GNS caldera unrest sourcebook. However no management, risk reduction information	Gap in terms of managing longer term volcanic issues and impacts.	minor
Volcanic - Distal	An ash response plan was done in 2012. There appears to be lots of info on the Tarawera Volcanic Cladera, but not a lot on other distal sources i.e. Auckland. However, no major gaps, may just need to be bought together.	possibly	minor
Secondary			
Civil Unrest/Terrorism	Handled by police		

Bay of Plenty Hazards	Gap analysis results	Gap present?	Level of knowledge gap *(this refers to the amount of information lacking)*
Lifeline Utility Failure	Nothing in spreadsheet, more covered by utility operator. Maybe gap in likelihood estimates, seems like there may be info out there but not in the spreadsheet and possibly not promoted or mentioned so this should be added to spreadsheet. Suspect the BOP lifelines group may hold info	yes, but may just involve tying some existing info together into a strategy	minor
Major Transport Accident (Air, Road, Rail)	Nothing in spreadsheet, more covered by emergency services. May be gaps in plans/contingencies as were identified in the CDEM Hazard Risk Profile Report, i.e. commuter management plans, vulnerability study and org resilience.	yes, but may just involve tying some existing info together into a strategy	minor
Low Priority			
Geothermal	Lots of science, not a lot on future scenarios though, particularly given land and industry development in Geothermal areas, and use of the geothermal resource. i.e what are the geothermal risks if geothermal use increased by 20% in the next 10 years? No mitigation or planning or contingency plans, i.e. are we restricting access or development of land in known geo areas within policy docs?	yes	medium
Regional Deformation (Long Term)	Nothing on future risk especially related to geothermal as more resources are used/exploited.	gap - no reports that we know of and possibly no plans in place to manage.	medium
Secondary			
Urban Fire	Nothing in spreadsheet, more covered by fire service. A bit on wild fire and rural fire.	yes but not directly managed by CDEM	

Bay of Plenty Hazards	
Higher Priority	
Primary	**Secondary**
Dam Failure	Drought
Earthquake - Severe	Human Pandemic
Flooding - River/Stream	Major Accident (Marine/Port)
Storm surge	Plant & Animal Pests & Diseases
Tsunami - Local	
Tsunami - Distal	
Volcanic - Local	
Wind storm (including tornado)	
Medium Priority	
Primary	**Secondary**
Coastal erosion	Civil Unrest/Terrorism
Flooding - Urban/Rural Ponding	Lifeline Utility Failure
Hazardous Substances Release	Major Transport Accident (Air, Road, Rail)
Rural Fire	
Slope Instability (Landslide, Debris Flow, Slumping)	
Volcanic - Caldera Unrest	
Volcanic - Distal	
Low Priority	
Primary	**Secondary**
Geothermal	Urban Fire
Regional Deformation (Long Term)	

Appendix B: Project Orbit capability summary

Explore ProjectOrbit

Tonkin & Taylor

(http://www.tonkin.co.

orbit

(index.html)

Features & Benefits

Features	Benefits
Microsoft environment, built on SharePoint	A familiar user environment for rapid user uptake and systems acceptance
Light IT footprint (Web-based solution with hosted option)	Rapid system deployment with no IT infrastructure investment or setup
Document Management	
Collaboration to allow parties to share and work on documents and files	Increased productivity
Centralised document/file management with revision control over all documents.	Reduced opportunity for errors or mistakes through use of incorrect documents or revisions.
Security based on user roles to protect information integrity (View only access)	Knowledge sharing while maintaining integrity of information
Powerful document and file searches	Reduce time to locate information
Live document registers.(Drawings, specifications and other project related documentation)	Accurate and current registers for key documents/files
Geospatial	
Geospatial maps showing detailed construction activity, locations and precise instrument positions	Spatial analysis to locate and display any project detail (documents and data)
Ready to use maps or, where relevant, client-specified map or photographs	Maps make it easy to locate, highlight and display any project detail
Spatial context, using colour patterns, to help identify trends needing investigation	Early trend identification of key factors requiring monitoring
Risk Management	
Risk/opportunity recording and coding	Formal recording to increase focus on risks/opportunities

Actions, task, and alerts	Allocation of tasks to relevant personnel
Analysis of risk (Time and money)	
Workflow Forms	
Formal workflow to control and record process	Process driven for greater efficiency
Covers key processes including; Request for Information, drawing/specification Transmittal, Non Conformance, Notice to Engineer or Contractor)	Ability to track and audit all aspects of these critical processes
Monitoring	
Site identification definition with coding to group locations into logical areas. Record of site co-ordinates using both primary and secondary co-ordinates	Base information to define sites and provide data for reference and geospatial mapping
Grouping to record Instrument type. Differing icons can subsequently be displayed for instrument type when using the geospatial viewer	Instrument grouping to support geospatial view “layering” to focus on instrument type
Associate multiple instruments to a location, with detail of the purpose of the instalment and its date of installation	A permanent record, by serial number of all instruments and their location for auditing purposes
Instalment “as built” record showing details of its installation, placement at the location, geological units and any instrument protection	Centralised recording of key information pertaining to instrument installation
Calibration record, by date and operator, to record instrument calibration settings.	Audit record, by operator, of calibration to ensure the device is working as intended and is properly calibrated
Instrument alert configuration settings to define the alerts and alarms. These alarms can be defined by project phase, allowing for different alarm levels to be deployed as the project progresses	To ensure that trigger levels can be defined by project stage, and that the necessary alerts and alarms are provided to the project team
Automation of data entry using either file upload and/or automated file capture and “on processing” (potentially using telemetry)	Reduced workload, greater accuracy and timely recording of data from the field
Output of Alarms and Alerts using SMS Messaging or Email messaging to convey alarms or alert conditions, by instrument	Notification of issues to ensure timely responses to potential issues for wider project team, potentially to regulators
Graphical reporting	Graphical context for trend analysis, with access to historical data for reference
Detail reporting showing all recorded data as a permanent record	Base information for compliance and an audit record for all relevant parties, held in a secure central location
Geospatial view of all locations, instruments and data, including any alert or alarm records	Geospatial context for simplified view of information, supported by colour/texture for trend analysis

orbit (index.html)

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