

Dundalk Town Council

Rockview Farm Flood Risk Assessment

Peer Review

Report
February 2008



Client Dundalk Town Council
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Peer Review of Rockview Farm, Dundalk
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1.0 Introduction

Scott Wilson was contacted by Dundalk Town Council (DTC) with regard to providing a 'peer' review of a Flood Risk Appraisal (FRA Report) associated with lands at Rockview Farm, Dundalk. Discussion took place with Dundalk TC to define the extent of such a review and it was agreed that it would include the following:-

- Assessment of site conditions
- Review of coastal conditions
- Review of flood hazard
- Review of flood alleviation options
- Reporting

This report follows the defined brief in reviewing the assessment of the flood risk associated with the lands at Rockview Farm, Dundalk undertaken by Royal Haskoning dated June 2007.

The lands at Rockview Farm comprise approximately 85 ha of farmland. The area is protected along its seaward boundary by an existing earth embankment which offers protection from tidal events. Part of the site is proposed for residential development whilst the remainder is a proposed amenity area which includes a coastal walk and cyclepath.

Dundalk Bay is an area of significant environmental importance for both flora and fauna. In recent times protection measures have been put in place including the designation of extensive areas under both European and National conservation directives which include a Special Protection Area (SPA), Special Area of Conservation (SAC) and a Proposed Natural Heritage Area (PNHA).

Flood risk assessments (FRA) should contain all the relevant information in a clear and concise manner, using appropriate methodologies which can be reviewed by the planning authority, and other relevant parties. The detail and technical complexity of a flood risk report will relate to the extent of the study which in turn is influenced by the significance and risks associated with the proposed development.

The review of the Rockview Farm Flood Risk Assessment is based on the following documents:

- 1 Rockview Farm Flood Risk Assessment Report by Royal Haskoning. This report includes a Water Level Assessment for Dundalk undertaken by RPS in the Appendix D2;
- 2 Chapter 9 of the Dublin Coastal Flooding Protection Project (DCFPP) Report. The document obtained is an extract of the report and is not complete i.e. Section 9.4 is missing.

The basis of the peer review has been to assess the methodologies and analysis used in the original reports. It should be noted that the original data, calculations & numerical model files have not been checked.

2.0 Review of Site Data

A number of plans, maps and surveys are included in the FRA Report. The plans are at an appropriate scale and include geographical features, road names etc. They identify all significant water courses or other bodies of water in the vicinity which may have an influence on the site.

It is understood that a detailed level survey of the site and the embankment dated 2004 was provided to Royal Haskoning by Tobin Consulting Engineers. A survey of the embankment consisting mainly of cross sections at 100m intervals dated 2002 was also provided by DTC and RPS Consulting Engineers. Royal Haskoning carried out a comparison of the 2 surveys and found there was a good correlation. Scott Wilson did not receive copies of either of these surveys but existing embankment cross -section data was available in Appendix C and Appendix F of the FRA Report.

Site inspections of the sea embankments were undertaken by Royal Haskoning on 13th and 14th March 2007. An extensive photographic record of the embankment was taken during the inspection with details of the front and rear slopes, crest, drainage ditch and other features, e.g. evidence of breaches. These photographs were included in Appendix C of the FRA Report. The findings of the visual inspection are detailed in Section 3 of the FRA Report.

As part of the peer review process Scott Wilson carried out a visual inspection of the embankment on 9th January 2008. The main embankment is generally trapezoidal but varies considerably in width and crest level along its length. At certain locations the width of the crest is less than 1 metre. The ground levels along the seaward toe of the embankment also vary with a grassy berm evident along sections. There does not appear to be any wave protection along the seaward face of the embankment apart from along the toe at the southern end. The embankment is heavily vegetated and badly maintained. Locations of the previous breaches to the north of the Rockview Farm site referred to in the FRA Report were examined.

The main drainage ditch along the landward side of the embankment was also inspected as part of this review and the findings agreed with the FRA Report. The outfall was not visible during the site inspection as it was covered by high tide.

Generally the findings of the reviewer's visual inspection agreed with the findings of those inspections referred to in the FRA Report.

3.0 Review of Existing/Historic Data

According to the FRA Report there are no records of coastal flooding having occurred at the Rockview Farm site but embankment breaches and the associated flooding have occurred at locations adjacent to the site. Evidence of these breaches were observed during the walk over survey by the Reviewer. According to records the breaches referred to in the previous section occurred during the 1st February 2002 event. Dundalk County Council has reported that the extreme tide on that date was approximately 3.65mODM.

The susceptibility of a sea embankment to wave erosion/damage is governed by a number of factors. These include the depth of water on the seaward face, the gradient of the approach and the roughness of the approach surface, in so much as it dissipates energy.

Therefore an important element of natural protection against erosion and flooding is provided by the extensive saltmarsh over the whole length of the site. A saltmarsh generally exists between Mean High Water of Spring tides and Mean Low Water of Neap tides. The saltmarsh also has a significant environmental value supporting a variety of species of flora and fauna and provides high water roosting sites for significant numbers of waterfowl.

Aerial photographs of the saltmarsh are available for 1974, 1995 and 2004. When these photographs are compared it can be seen that the saltmarsh has been accreting over the past 30 years.

4.0 Review of Extreme Water Level Calculation

4.1 General Work Approach

It is considered that the general work approach by Royal Haskoning to the determination of extreme water levels follows best practice. There is a lack of measured water level data at the site. Therefore the relationships of tide and surge between the project site and Dublin Bay have been derived through the use of (i) data published in Admiralty Tide Tables and (ii) through numerical modelling. An allowance for sea level rise has also been incorporated into the analysis.

Two correlation methods were considered for use in the FRA Report.

- 1 The use of a Jerzy Graff Relationship. This was found to be not reliable for the study by Royal Haskoning and was therefore not used further;
- 2 Astronomical Tide and Surge Transfer Relationships. The methodology was split into three parts:
 - i. **Initial analysis of tidal and surge relationship**

A linear relationship for the astronomical tides between Dublin and Dundalk was determined with Admiralty Tide Table data. For the surge component of the water level, an assumption was made that the surge at Dublin was equal to the surge at Dundalk.
 - ii. **Correlations based on numerical modelling**

Relationships for astronomical tides and surge between Dublin and Dundalk were developed through the use of 2-D coastal numerical models. This modelling (undertaken by RPS Consulting Engineers) predicted water levels due to a number of tides and historical storm scenarios. The 1 in 200 year water level at the project site was transferred from Dublin based on a 0.02 year tide.
 - iii. **Sensitivity tests**

Various combinations of tide and surge were used to determine the final extreme water level calculation. Using the astronomical tide and surge relationships established by RPS, the sensitivity test incorporated an allowance for the effects of seiche in Dublin Bay.

The following can be concluded as part of the peer review:-

- The description of the above methods given in the reports is comprehensive.
- The relationships calculated for the astronomical tides between Dublin and Dundalk are based on reliable methods.

- The extreme water level at the project site has been based on somewhat arbitrary combinations of astronomical tides and surge. The implications of this are discussed further in the following sections.

4.2 Data used in the Study

Royal Haskoning have thoroughly researched the availability of data at the project site but little data was found to be available. Therefore the basis of the assessment has been to transfer extreme water levels information from Dublin, where longer records exist.

There are several decades of tide records at Dublin Port. The extreme water level analysis at Dublin is comprehensive as presented in the chapter 9 of the Dublin Coastal Flooding Protection Project (DCFPP) report.

The use of tidal, meteorological and bathymetric data in the RPS numerical modelling has followed a best practice approach.

4.3 Tidal Surge Model Setup and Inputs

It is considered that the setup of the RPS tidal surge model for Ireland follows an appropriate methodology and is therefore robust. The computational method used in the 2-D coastal model, finite volume method, is state-of-art. The extent of the model is sufficient for the purposes of the assessment. The resolution (i.e. spatial density of locations at which calculations are performed), of about 200m along most of the Irish coastline is sufficient for its purposes (RPS report (Appendix D2) of the FRA Report).

The bathymetric input is a combination of data from C-Map (digitized Admiralty Charts), and site-specific surveys of several banks and coastal areas. This is an appropriate use of bathymetry for projects of this type.

The tidal and meteorological data used in the setup of the numerical model are based on the best data available.

4.4 Model Calibration

The RPS tidal surge model was validated against measured data mostly from UK NTSLF tide gauges. As illustrated in the RPS report, the model calibration, for both tide and surge, is excellent and the model can therefore be considered robust.

4.5 Water Level Correlations between Dublin and Dundalk Astronomical Tide Correlations

Tide relationships between Dublin and Dundalk were established in the FRA Report utilising 3 data sets:

- 1 Based on the Admiralty Tide Table for spring tide levels; (used in the **Initial analysis of tidal and surge relationships** see Section 4.1 of this report)
- 2 Based on measured data 17-19 May 1992; (not used in the final analysis)
- 3 Based on RPS modelling results of mean high/low waters in spring/neap tides. (used in the **Correlations based on numerical modelling & Sensitivity Analysis** see Section 4.1 of this report)

The relationships derived for methods 1 and 3 are considered appropriate by this peer review.

The relationship used in method 2 is derived by correlating the measured tides at Dublin and Dundalk that occurred at the same time. However, since there is a tidal phase difference between Dublin and Dundalk (i.e. the high waters do not occur at the same time), such a correlation is not strictly correct. Due to the fact that the time difference of high water between the two sites is less than 0.25 hours, the relationship derived in this way is similar to relationships derived in methods 1 and 3. The relationship derived in method 2 was not used in the final analysis.

Surge Correlations

The surge relationship between Dublin and Dundalk was established in the FRA Report with the simulation of 25 historical storm events where surges were greater than 0.5m. This analysis is considered to be comprehensive and therefore the calculated relationships between Dublin and Dundalk are appropriate to use in the determination of extreme water levels.

4.6 Calculated Water Levels

To summarise, the predicted 1 in 200 year surge tide levels are as follows:-

RPS Report dated May 2007 3.64mOD Malin

Royal Haskoning dated June 2007 3.70mOD Malin

The highest recorded level was reported to be 3.65mOD Malin

The estimate of water levels at Dundalk is based on predicted water levels at Dublin and the tide and surge relationships established by RPS. As described in the previous section, the correlations of tide and surge between Dublin and Dundalk are appropriate.

The 1 in 200 year extreme water level at Dublin used in the Royal Haskoning report is +3.13mOD Malin. According to Table 4-1 in the report, the relationship between metres Chart Datum (mCD) to mOD Malin is -2.51. That gives a 1 in 200 year extreme water level at Dublin of +5.64 mCD. Referring to the chapter 9 of DCFPP report, this value is the result from a joint probability analysis (of astronomical tide & surge levels). This is the best available estimate for Dublin, as concluded in chapter 9 of the DCFPP report.

The 1 in 200 year extreme water level at Dundalk was calculated with a sensitivity test of various combinations of tide and surge, as well as a reduction to account for seicheing at Dublin. The final value for the 200 year extreme water level at Dundalk was taken as the median value from the above sensitivity tests. This final step in the calculation of the extreme water level estimate is somewhat arbitrary, as only a limited number of astronomical and surge combinations have been considered. For example, the final extreme value could be 0.17m lower than the case where extreme water occurs at an astronomical tide level of +2 mODM. Bearing in mind that the Mean High Water Spring is +2.1 mODM, the final extreme value could be under estimated.

It is considered that it would be better to finalise the water level estimate at Dundalk by the more comprehensive method of transferring the joint probability of tide and surge from Dublin.

4.7 Review of Sea Level Rising Consideration

A median value for sea level rise was used in the assessment. Consideration should be given to use of an upper sea level rise rate to be conservative for such a large development site.

5.0 Review of Assessment of Flood Hazard

5.1 Extreme Wave Conditions

The extreme wave was taken to be depth limited based on the existence of a wide salt marsh. This is an appropriate methodology.

5.2 Comment on the implications of Waves to Flooding Risk

The waves were appropriately considered in the design by calculating wave overtopping to avoid flood risk.

Overtopping volumes could be considered further to assess whether these present a residual flood risk or whether there are any implications for drainage at the site.

6.0 Review of Outline Flood Alleviation Options

6.1 Standard of Protection

It is considered that the recommended standard of protection for the new development and the overall surrounding area protection of not less than 1 in 200 years with an allowance for sea level rise up to the end of the century (2100) is appropriate.

6.2 Shape of the Embankment

The proposed front and back slopes of 1:3 and 1:2.5 respectively and crest width of 4 metres minimum for refurbished embankment are considered appropriate. The provision of a berm at the rear of the embankment to facilitate the coastal walk will improve the stability of the sea embankment and provide access for maintenance. However if the general level of the berm is set 1.25 metres below the crest it will prohibit views over the saltmarsh particularly for children using the walkway.

There were no details of how the sea embankment would be made watertight.

6.3 Crest Level of Embankment

It is normal practice to determine crest levels by the amount of overtopping. Three appropriate methods were considered for assessing the overtopping amounts.

6.4 Armouring of the Embankment

The choice of the Armourflex system as a possible armour protection for the embankment is appropriate in this location because of the existence of the saltmarsh. The system will ensure the integrity of the structure against overtopping and wave action. When the vegetation is established in the cellular openings the surface should be acceptable in this environmentally sensitive location.

6.5 General Options

Three options were considered as follows:-

Option 1 Improving the main coastal defence.

Option 2 Improving the main coastal defence and raising of the development level.

Option 3 Improving main coastal defence and provision of a new secondary embankment.

Options include return embankments to the North and South of the development site to prevent flood water entering the site.

All the options considered are viable.

6.6 Option Costs

A breakdown of costs was not available so no review of costs was undertaken. The Option 2 cost did not include the cost of infilling of development site to the proposed level which is likely to be considerable.

6.7 Evaluation of Options

The preferred Option 2 is the most sustainable option in the longer term. However it will be a more expensive option as it will include the cost of infilling of the development area. As the reviewer has no ground level information available for the development site, it has not been possible to assess the quantities of fill material required.

7.0 Conclusions and Recommendations

The Review concurs with the conclusion and recommendation for Option 2 outlined in the Flood Risk Assessment.

However the following issues should be considered further;-

- 1 The 1 in 200 year water level at the project site is predicted to be +4.1 mODM. The procedures used to calculate the extremes are appropriate with the exception of the last step of selecting a median value from the sensitivity analysis. As such, it is possible that the extreme water level at the project site could be underestimated.

Considering the risk of flooding and the potential hazard, transferring the joint probability of tide and surge from Dublin to Dundalk should be carried out to provide a comprehensive analysis for the determination of the 1 in 200 yr event.

- 2 Consideration should be given to use of an upper sea level rise rate for such a large development
- 3 The preferred Option 2 cost does not include for the cost of infilling the proposed residential land to a level of 4.25mODM.
- 4 The proposed level of the landward berm of 1.25 metres below embankment crest level should be reconsidered to ensure the benefits of the walkway /cycleway are not unduly limited as a result of restricted views over the saltmarsh.
- 5 The Report did not comment on finished floor levels for the developments.

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