

## KENT INTERNATIONAL GATEWAY, MAIDSTONE, KENT

### Flood Risk Assessment

July 2007

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## 1 INTRODUCTION

1.1.1 This Flood Risk Assessment (FRA) has been produced on behalf of Kent International Gateway Ltd. in support of a proposed rail freight interchange development located off Ashford Road (A20), Maidstone, Kent.

1.1.2 The site is predominantly greenfield with a gross area of approx. 113ha. The proposed development will incorporate a road/rail freight interchange facility with related distribution warehousing and commercial development.

1.1.3 The Environment Agency indicative flood plain maps show that the vast majority of the site is located within Flood Zone 1 and therefore at a low probability (<0.1%) of fluvial or tidal flooding. In accordance with Annex D of PPS 25, this FRA therefore concentrates on proposed surface water run-off issues.

1.1.4 This FRA has been produced in accordance with PPS25, DWP's Flooding and Drainage Pre-planning Enquiry Report dated February 2007 and in consultation with the Environment Agency and Southern Water.

1.1.5 The FRA should be read in conjunction with the following documentation and supplementary drawings.

- Hydrogeological Impact Assessment (July 2007) – DWP
- Environmental Statement (July 2007) – RPS Planning
- Geotechnical & Ground Contamination Desk Top Assessment (March 2007) – White Young Green Environmental
- Ground Investigation Report (June 2007) - White Young Green Environmental
- Proposed Development Layout (PRC Dwg No. 6690/FE107 Rev K)

## 2 SITE DESCRIPTION

- 2.1.1 The site is located immediately to the east of Maidstone and is identified on the OS based location plan included within Appendix A.
- 2.1.2 The existing site layout is shown on DWP Dwg No. 2005-180A/C7.15/01 Rev C, included within Appendix J.
- 2.1.3 The site is generally bounded to the north by the M20 motorway, the south by the Ashford Road (A20), to the west by Thurnham Lane and to the east by junction 8 of the M20. It is crossed by the Ashford to Maidstone railway line, Water Lane, Crismill Road and Musket Lane.
- 2.1.4 The site is generally greenfield, consisting predominantly of undulating open farmland. It is also occupied by a small number of residential properties and farm buildings.
- 2.1.5 The site is crossed by three ordinary watercourses, flowing north to south, that are tributaries of the River Len. The most westerly watercourse is known as The Lilk whilst the other two are unnamed. For the purposes of this assessment, the watercourses have been labelled W1 (western watercourse aka The Lilk), W2 (central watercourse) and W3 (eastern watercourse).
- 2.1.6 There are three small existing ponds indicated within the site boundary. These ponds are identified on DWP Dwg No. 2005-180A/C7.15/01 Rev C. The purpose of these ponds is unknown at present but will be investigated prior to any works commencing on site.

### 3 PROPOSED DEVELOPMENT

- 3.1.1 The proposed development layout is indicated on PRC Dwg No. 6690/FE107 Rev K, included within the supplementary information that accompanies this assessment.
- 3.1.2 The proposed development accommodation schedule is included within Appendix E of this assessment.
- 3.1.3 In general terms, the proposed development will provide a total gross internal floor area of approx. 374000m<sup>2</sup>, comprising approx. 171000m<sup>2</sup> of inter-modal warehousing, approx. 192000m<sup>2</sup> of distribution warehousing and approx. 12000m<sup>2</sup> of office accommodation. In addition, the development will provide a rail/road freight interchange facility (inter-modal area) of approx. 6.5ha.
- 3.1.4 The development will be served by associated service/loading areas and car parking areas, accessed by an internal road network via two proposed accesses off Ashford Road (A20).
- 3.1.5 With respect to rail access, new reception tracks will be laid to link the existing railway line to the inter-modal area and the inter-modal warehousing.

## 4 SITE LEVELS

- 4.1.1 A contoured topographical survey of the site, related to OS Datum, is incorporated into all accompanying drawings.
- 4.1.2 The survey confirms the undulating nature of the site and identifies that it is split into three clearly defined greenfield catchment areas associated with the existing three watercourses that cross the site.
- 4.1.3 The existing site levels currently range widely from a minimum of approx. 48m to a maximum of 71m AOD. A significant cut and fill earthworks operation will therefore be required to accommodate the proposed development layout.

## 5 EXISTING FLOOD DEFENCES

5.1.1 This site does not benefit from any existing flood defence measures.

5.1.2 We are not aware of any specific flood defence measures in place to protect any other development in the vicinity.

## 6 SOURCES OF POTENTIAL FLOODING

### 6.1 Fluvial Flooding

6.1.1 An extract of the Environment Agency's indicative floodplain map is included within Appendix B.

6.1.2 The nearest indicated potential source of fluvial flooding is represented by Watercourses W1 and W2. The upstream extent of the indicative floodplain associated with Watercourse W1 is shown to encroach onto the site's southern boundary.

6.1.3 The closest main river to the site is the River Len, located approx. 800m to the south.

### 6.2 Tidal Flooding

6.2.1 Tidal flooding is not a consideration with respect to this site.

### 6.3 Groundwater

6.3.1 Due to the varying permeability of the underlying geology, prevailing groundwater levels vary considerably over the site area. To the south and east, where the underlying strata is primarily Folkestone Beds, the water table has been found to be at depths as shallow as 1.5 – 2.0 mbgl (metres below ground level). To the north and west, however, where the underlying strata is generally gault clay, the Environment Agency has confirmed that the water table can be up to 20.0 mbgl.

6.3.2 A significant portion of the site, generally to the south of the railway line, is located within Environment Agency Source Protection Zone (SPZ) 3. An extract of the Environment Agency's SPZ map is included within Appendix C.

6.3.3 In this instance the SPZ relates to the area that is directly underlain by Folkestone Beds, which is classified as a major aquifer. There are four licensed groundwater abstraction points located within 500m of the site, three of which are licensed to Mid Kent Water Ltd. for public/potable water supply.

6.3.4 A more detailed assessment of existing/proposed hydrogeology and associated risks and impacts associated with this development both temporary (during construction) and permanent is contained within DWP's Hydrogeological Impact Assessment, dated June 2007.

6.3.5 We are not aware of any groundwater flooding problems experienced by the previous owners/tenants of the site.

6.4 Surface Water

6.4.1 The existing site is predominantly greenfield and therefore does not benefit from any significant positive drainage systems.

6.4.2 We are not aware of any flooding to the site resulting from any surface water drainage systems within the vicinity.

## 7 HISTORIC AND MODELLED FLOOD EVENTS

- 7.1.1 The Environment Agency's indicative flood plain map confirms that the vast majority of the site is located within Flood Zone 1.
- 7.1.2 With regard to the indicative flood plain (Flood Zone 3) associated with Watercourses W1 and W2, the Environment Agency does not have any modelled flood data. Neither the Environment Agency nor the local authority has any historic flood levels or any recorded flooding incidents for this area.
- 7.1.3 We would suggest that the actual extent of the flood plain is unlikely to extend onto the site as shown from the south via overland routes due to the presence of the railway embankment. It is, however, possible that the existing culvert beneath Ashford Road may contribute to the area of indicative flood plain shown within the site boundary.
- 7.1.4 The scope of a catchment study for all three watercourses that cross the site is currently being agreed with the Environment Agency, which will provide modelled flood levels for the site.
- 7.1.5 We are not aware of any historic or anecdotal evidence to suggest that the site has ever been subject to flooding from any source.

## 8 EXISTING LOCAL STRUCTURES

8.1.1 As part of the forthcoming catchment study, various structures associated with the three watercourses will need to be taken into consideration.

8.1.2 The key structures in relation to the fluvial flooding of site will be the upstream culverts beneath the motorway, which will potentially restrict flow in the watercourse through the site, and the downstream railway/road crossing culverts which may restrict flows both through and downstream of the site thus potentially adding to flood risk.

## 9 FLOOD PROBABILITY

- 9.1.1 As previously stated, there is no evidence available (anecdotal, historic or otherwise) to suggest that this site is at risk from flooding from any source.
- 9.1.2 On the basis that the site can be considered to be located within Flood Zone 1, it has a less than 1 in 1000 (<0.1%) annual probability of fluvial flooding in any year.

## 10 ASSESSMENT OF FLOOD IMPACT

- 10.1.1 As the site is considered to be located within Flood Zone 1, and therefore at a low probability of flooding, there will be no fluvial flooding impact on the site.
- 10.1.2 On the basis that the site is not at risk of fluvial flooding itself, the proposed development will therefore have no effect on the potential flooding of any other property within the vicinity via the displacement of flood water.
- 10.1.3 An appropriate surface water drainage strategy for the proposed development to ensure that this site and adjoining property will not be placed at any increased risk from flooding as a result of surface water run-off in a 1 in 100 year event (including an allowance for climate change) is outlined within Section 13 of this report. This drainage strategy is subject to the approval of the Environment Agency, Southern Water and the local authority.

## 11 DISPLACED FLOOD WATER

11.1.1 On the basis that the site is not at risk of fluvial flooding, no flood water will be displaced by the proposed development.

## 12 EXISTING DRAINAGE

### 12.1 General

12.1.1 Extracts of Southern Water's public sewer records for the area are included within the supplementary information that accompanies this assessment.

12.1.2 The records confirm that there are no existing public sewers crossing the site.

### 12.2 Foul Drainage

12.2.1 The closest public foul sewers to the site are located within Ashford Road, Crismill Road and the access track serving Woodcut Farm and the surrounding residential dwellings.

12.2.2 The site is predominantly greenfield, although there are approx. 20 residential dwellings currently located within the site boundary. Whilst no investigation work has been carried out on site to date, it is considered that the majority of these dwellings are not connected to the public sewer network.

12.2.3 For the purposes of this assessment and the agreement of a foul drainage strategy for the proposed development, it has been assumed that there is no existing foul drainage discharge to the public sewer network from the existing site to be offset against proposed discharge rates.

### 12.3 Surface Water Drainage

12.3.1 There are no public surface water sewers located within the vicinity of the site.

12.3.2 Whilst there is a limited amount of impermeable area associated with the existing properties and public highways currently within the site boundary, it is assumed that these areas are drained via soakaways or local ditches.

12.3.3 For the purposes of this assessment and the agreement of a surface water drainage strategy for the proposed development, it has been assumed that there is no existing positive surface water drainage discharge from the site to offset against proposed discharge rates.

12.3.4 As previously mentioned, the site is clearly divided topographically into three existing greenfield catchment areas draining to the three watercourses that cross the site. The existing greenfield catchments have been labelled 1 – 3 and are indicated on DWP Dwg No. 2005-180A/C7.15/02 Rev C, included within Appendix J.

12.3.5 A summary of the existing greenfield catchment areas is as follows.

Catchment Area 1 (Western Section)	39.17ha
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Catchment Area 2 (Central Section)	49.01ha
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Catchment Area 3 (Eastern Section)	24.09ha
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12.3.6 Preliminary existing greenfield run off rates have been calculated using the IOH (Institute of Hydrology) Report 124 method. A print out of the results is included within Appendix F. A summary of the 1 in 100 year rates is as follows:

Catchment Area 1 (Western Section)	60.8l/s
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Catchment Area 2 (Central Section)	74.2l/s
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Catchment Area 3 (Eastern Section)	39.4l/s
------------------------------------	---------

12.3.7 It is worth noting that these greenfield run off rates are extremely low at approx. 1.5l/s/ha, rates usually fall within a range of 2 – 10 l/s/ha. The low levels are based on the general soil classification of 0.15 given for the area, typical of a highly permeable underlying stratum such as Folkestone Beds.

12.3.8 The geological maps and ground investigation reports, however, confirm that a significant proportion of the site is underlain by Gault Clay. Greenfield run off for these areas could therefore be considered to be higher. The preliminary greenfield run off rates used at this stage therefore represent a 'worse case' scenario.

## 13 PROPOSED DRAINAGE STRATEGY

### 13.1 General

13.1.1 The proposed foul and surface water drainage strategies outlined in this section are subject to the final approval of the Environment Agency, Southern Water and the Local Authority.

### 13.2 Foul Drainage

13.2.1 Southern Water has confirmed that there is no spare capacity with the local public foul sewer network to serve the proposed development.

13.2.2 In response to the recent Maidstone LDF consultation, Southern Water has stated that they will be seeking a holistic foul drainage solution for future development to be allocated to the south and east of Maidstone to take all proposed flows directly to Aylesford WTW (Wastewater Treatment Works).

13.2.3 Whilst Southern Water would ideally like to see this development incorporated within this holistic solution, it has been accepted that insufficient information is currently known about the forthcoming development allocations and relative timescales to make this a feasible option in respect of this development at the present time.

13.2.4 Two alternative stand alone foul drainage strategy options have therefore been investigated in consultation with Southern Water and the Environment Agency.

13.2.5 Option 1 is an off site solution that would involve foul flows from this development alone being pumped directly to Aylesford WTW located approx. 11km to the west of the site. Option 2 is an on site solution that would see a new WTW constructed to treat all flows from the development.

13.2.6 Due to concerns over the availability of suitable outfall location for the final effluent discharge from a new WTW and the ability of any new WTW to actually meet the stringent consent criteria that are likely to be imposed by the Environment Agency, Option 1 is being promoted and progressed as a basis for the proposed foul drainage strategy.

13.2.7 The key elements associated with the proposed Option 1 foul drainage strategy are illustrated on DWP Dwg. Nos. 2005/180A/C7.15/FW01 Rev E and 02 Rev E, included within Appendix J.

- 13.2.8 In summary, Option 1 will involve the provision of 3 No. on site pumping stations, 1 located in each of the catchment areas. The eastern and central catchments will be served by a network of gravity sewers, discharging to the respective pumping stations, labelled PS3 and PS2. PS3 and PS2 will then pump flows independently to a pumping station located in the western catchment, PS1. PS1 will also receive flows from a network of gravity sewers serving the western catchment and then pump the overall development flows off site to Aylesford WTW.
- 13.2.9 Based on the proposed development accommodation schedule included within Appendix E, the proposed overall peak foul discharge has been estimated to be approx. 48l/s.
- 13.2.10 The vast majority of the on site foul drainage network, including all gravity/pumped sewer networks, PS3 and PS2 will be constructed by the developer for adoption by Southern Water under Section 104 of the Water Industry Act. PS1 and all off site works will be constructed by Southern Water via a requisition agreement under Section 98 of the Water Industry Act 1991 and be maintainable at their expense upon commissioning.
- 13.2.11 Option 1 is acceptable in principle to both the Environment Agency and Southern Water and Stage 1 of the requisition process has already been undertaken providing an indicative scope/route for the off site works and a budget cost estimate.
- 13.2.12 A maintenance regime with respect to PS3 and PS2 and the associated adoptable pumped/gravity sewer networks will need to be agreed with Southern Water and the Environment Agency for the period between commissioning and final adoption.
- 13.2.13 Any temporary foul drainage arrangements required during the construction period and for the development itself before the commissioning of the final drainage system will be agreed with the Environment Agency and Southern Water.
- 13.3 Surface Water
- 13.3.1 The proposed surface water drainage strategy has been developed in consultation with the Environment Agency. The strategy is predominantly SUDS (Sustainable Urban Drainage Systems) based, relying on restricted discharges to each of the three watercourses that cross the site.
- 13.3.2 DWP Dwg Nos. 2005/180A/C7.15/SW01 Rev E, 02 Rev E and 03 Rev E, included within Appendix J, indicate the proposed impermeable areas and their split between the existing catchment areas. The splits have been established to mimic the existing greenfield catchments as closely as possible, given the differences between existing and proposed finished levels.

- 13.3.3 In general terms, it is proposed to discharge surface water run off, restricted to the 1 in 100 year greenfield run off rates identified within paragraph 12.3.6, to the three watercourses using a selection of off line dry detention ponds, development layout permitting, to attenuate remaining flows.
- 13.3.4 The proposed detention ponds have been preliminarily sized using the microdrainage source control software module. A copy of the calculations together with a full summary spreadsheet is included with Appendix G. Clearly, the surface water run off generated by the proposed development is considerable, thus resulting in very large ponds. At this stage, the ponds have been designed to an overall depth of 2.0m (1.8m effective at the 1 in 100 year event) with 1 in 3 side slopes. The remaining 200mm freeboard is currently designed to cater for a 20% climate change allowance. All outflows will be controlled using hydrobrake flow control devices.
- 13.3.5 DWP Dwg Nos. 2005/180A/C7.15/SW04 Rev B, 05 Rev B and 06 Rev B, included within Appendix J, illustrate the proposed ponds design principles in more detail.
- 13.3.6 It is anticipated that the detailed surface water drainage strategy will also incorporate infiltration SUDS techniques. As the site will be the subject of a significant cut and fill operation to accommodate the development, it is not considered appropriate to provide any detail or design in this respect at this stage. Seven preliminary permeability tests have, however, been carried out by White Young Green Environmental to the eastern area of the existing site (underlain by Folkestone Beds) to establish current prevailing infiltration rates. These tests indicate that infiltration SUDS should be feasible in this area at least. A copy of these permeability test results is included within Appendix H.
- 13.3.7 The infiltration SUDS techniques to be used and the respective locations will clearly depend on a number of factors in addition to prevailing infiltration rates. The key factors to be taken into consideration are groundwater quality and recharge.
- 13.3.8 As the site lies within a SPZ, the Environment Agency has confirmed that only uncontaminated roof water will be permitted to discharge directly to the ground. In order to prevent pollution all surface water run off from the proposed service yard areas and the inter-modal area should pass through trapped gullies and petrol/oil interceptors. Surface water run off from the proposed roads should either pass through trapped gullies or receive an adequate level of filtration provided by appropriately designed swales. Surface water run off from car parking areas should pass through trapped gullies or receive an adequate level of filtration provided by an appropriately designed pervious paving construction.

13.3.9 The final choice of SUDS techniques use will need to be made in consultation with the Environment Agency, in accordance with CIRIA guidance, once comprehensive post cut and fill permeability testing has been carried out. At this stage, however, it is anticipated that the following techniques will be used in the locations specified:

SUDS Technique	Areas To Be Served
Swales	On site Highways
Pervious Paving	Car parking areas
Infiltration Trenches	Roof areas

13.3.10 As the detention ponds have designed at this stage on the basis of no infiltration SUDS, any such proposed techniques will serve to reduce the pond sizes currently proposed. In this event, it is proposed that any land currently allocated for the ponds that becomes surplus in respect of attenuation will be used to provide wetland type areas as general ecological mitigation against losses suffered in other areas of the development.

13.3.11 In order to provide the uninterrupted open space required to allow the inter-modal area to function, it will not be possible to use detention ponds to attenuate surface water run off from this area. In addition, because of the higher potential risk of groundwater pollution from this area, the use of infiltration SUDS is not considered an option. It is therefore proposed to attenuate run off from this area within below ground lined cellular block structures. At this stage, it is proposed to construct the inter-modal area from a combination of permeable and impermeable surfacing. An appropriate surface water drainage system to serve this area will therefore have to be designed in consultation with the Environment Agency in order to protect groundwater resources.

13.3.12 A small area of similar cellular block attenuation is also proposed for catchment 3 where the proposed development layout does not allow sufficient space for the use of a detention pond.

13.3.13 All proposed discharges to three watercourses will require formal consent from the Environment Agency under Section 23 of the Land Drainage Act 1991.

13.3.14 The use of brown and green roofs has been given due consideration, however, their use in respect of the large warehousing units proposed will have significant structural design implications and hence their potential financial viability.

13.3.15 The use of rainwater harvesting techniques will be given due consideration as part of detailed design process.

## 14 PROPOSED ACCOMMODATION WORKS

### 14.1 General

14.1.1 Various accommodation works will need to be carried out to allow the proposed development to be constructed. These works generally relate to earthworks and the existing watercourses.

### 14.2 Earthworks

14.2.1 A significant cut and fill operation will be necessary to create a series of development platforms. Whilst these platforms will as far as practicable will respect existing topography, the works will require a detailed method statement to address concerns that such an operation could effect groundwater characteristics in the immediate locality, in particular recharge and the supplies to the nearby abstraction points.

14.2.2 It is recommended that groundwater monitoring is carried out before, during and after the cut and fill works to identify any short and long term impact on groundwater levels.

14.2.3 All hydrogeological issues are considered in more detail within the Hydrogeological Impact Assessment dated July 2007.

### 14.3 Watercourses

14.3.1 All proposed watercourse accommodation works are illustrated on DWP Dwg Nos. 2005/180A/C7.15/03 Rev E and 04 Rev E, included within Appendix J.

14.3.2 To permit a reasonable degree of vehicular accessibility across the proposed development, it will be necessary to provide 3 No. road crossings over the route of the existing watercourses. It is proposed that the watercourses will be culverted at the crossing points with pre-cast concrete box sections.

14.3.3 As previously stated, the proposed inter-modal area is essential to provide a viable rail freight interchange development. In order for the inter-modal area to work safely and effectively, it must be located on a continuous level platform. The location proposed for the inter-modal area has been the subject of much debate and has been chosen to provide the best achievable balance between all likely environmental impact, such as noise pollution, light pollution, potential ecological losses, etc. and workability.

14.3.4 In order to accommodate the inter modal area in the chosen location, it will be necessary to culvert a significant length of watercourse W2. The affected section of open watercourse is approx. 180m in length, running from the existing motorway culvert to the existing railway line culvert. As with the road crossings, it is proposed that this length of culverting will also be achieved using pre-cast concrete box sections.

- 14.3.5 It is recognised that the loss of such a long length of watercourse will need to be mitigated against by the provision of similar ecological environments elsewhere within the development proposals. The precise mitigation required will need to be agreed with the Environment Agency based on the results of the ecological surveys carried out and the forthcoming watercourse monitoring regime.
- 14.3.6 The design of all culverting will be in accordance with Environment Agency guidance, the results of the forthcoming catchment studies and any existing upstream/downstream culverts. All watercourse culverting will require Environment Agency consent under Section 23 of the Land Drainage Act 1991.
- 14.3.7 As already mentioned, it will be necessary to divert existing watercourse routes through the site to accommodate the proposed development layout. Such diversions offer great potential for providing environmental and ecological enhancements as well as mitigating for the lengths of watercourse that will be lost to culverting.
- 14.3.8 The watercourse diversion routes currently proposed result in an overall lengthening of existing routes by approx. 60m. Dependent on more detailed design work, it may prove possible to increase this figure by introducing further meandering. Additional mitigation will also be provided by the proposed wetland areas associated with the detention ponds, in particular their low flow channels.
- 14.3.9 All proposed watercourse diversion proposals will require the approval of the Environment Agency under Section 23 of the Land Drainage Act 1991.

## 15 CLIMATE CHANGE

15.1.1 Annex E of PPS 25 states that allowance for climate change should be made within Flood Risk Assessments.

15.1.2 From the information currently available, the fluvial flooding issues addressed within this assessment are unlikely to change when climate change is taken into consideration. Nevertheless, modelled flood levels that include the effects of climate change will be established in respect of the three existing watercourses by the forthcoming catchment studies to ensure that due consideration is given.

15.1.3 With respect to proposed surface water run-off, any proposed on site surface water drainage systems and attenuation will be designed to prevent surface flooding in a 1 in 100 year event, with a minimum of a 20% allowance for climate change.

## 16 RESIDUAL RISKS

- 16.1.1 As previously stated, the proposed detention ponds will be designed to accommodate the 1 in 100 year event, including a minimum 20% allowance for climate change. The ponds' design will also incorporate overflow channels to the nearby watercourses to deal with flood water in any more extreme event.
- 16.1.2 The large length of culverting that will be required to accommodate the proposed inter modal area poses a potential risk of blocking and possible flooding. Regular inspections and/or cleaning will be required to address this risk.
- 16.1.3 All proposed SUDS systems will require regular maintenance to ensure that they remain operational to their designed capacity.
- 16.1.4 In consideration of the above, an appropriate management plan/regime will need to be agreed with the Environment Agency, possible via a planning obligation, and implemented by the development estate management company.

## APPENDICES

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