Waterman

Upper Heyford

Flood Risk Assessment

October 2010

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Upper Heyford

Flood Risk Assessment

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This document has been prepared and checked in accordance with
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Issue	Date	Prepared by	Checked by	Approved by
A01	20.09.2010	Sophie Tarran	Brendan McCarthy	Brendan McCarthy
Comments		Draft Issue		
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Comments		Preliminary		

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Executive Summary

Waterman has been commissioned by Dorchester Holdings to undertake a Planning Policy Statement 25 Flood Risk Assessment for the proposed development at Upper Heyford airfield.

The Development proposes the creation of a new settlement, which will include the retention and refurbishment of some existing military housing as well as new build residential development. New social and community infrastructure will be provided as well as landscaping to include formal sports pitches and open space.

The Site is located within Flood Zone 1 and is considered by the Environment Agency to be at a low risk of tidal and fluvial flooding. Furthermore there are no watercourses on-site and no history of fluvial flooding.

The Site is located on top of a plateau, slightly down gradient of the 'flying field'. Overland flows could only emanate from the runway or the Site itself. As there have been no reported instances of flooding to the Site it is assumed that the current on-site drainage network has adequate capacity to deal with surface water runoff. The risk of flooding from pluvial sources is therefore considered low.

Groundwater was located approximately 1.2m below ground level in the northeast of the Site and 7m below ground level in the southwest. Groundwater levels are relatively static and there have been no reported historical instances of flooding on-site. Furthermore, proposed ground levels are to remain as existing so the risk of groundwater flooding to the buildings themselves, or increased flood risk to others caused by displacement of flows would be low.

The on-site surface water drainage network is private, connecting into a number of small watercourses around the southern and eastern boundaries of the Site.

The proposed surface water strategy will mimic the existing situation, restricting flows to the existing rate while taking climate change into account for the lifetime of the Development. Due to anecdotal evidence of flooding off-site, flows entering the watercourse to the east of the Site will be decreased by 10%. This will provide some degree of betterment over the existing situation.

Surface water attenuation will be provided through the use of balancing ponds, permeable paving and attenuation tanks where necessary. Swales will be incorporated within the development parcels and living roofs will be considered where appropriate. The potential for infiltration techniques will also be investigated further at the detailed design stage, to confirm whether soakage rates are favourable.

This report demonstrates that the proposed Development is at a low risk of flooding. It also confirms that surface water runoff from the Development could be drained in such a way as to ensure that flood risk is not increased elsewhere, and where appropriate decreased. It is anticipated that the information provided within this report satisfies the requirements of Planning Policy Statement 25.

1. Introduction and Policy Context

1.1. Waterman was commissioned by Dorchester Holdings to undertake a Flood Risk Assessment in respect to a portion of Upper Heyford airfield (hereafter referred to as ‘Upper Heyford’), located in Oxfordshire.

Site Description

1.2. The existing site (hereafter referred to as ‘the Site’) is approximately 76 hectares in size and is bisected by Camp Road. The north of Camp Road comprises existing residential accommodation in the east and to the west commercial buildings and disused aircraft hangers. To the south of Camp Road commercial buildings are located to the east, with residential bungalows in the central areas. A disused hospital is located in the west of the Site adjacent to the sports fields.

1.3. An unnamed road forms the eastern boundary of the Site and agricultural fields lie beyond the southern boundary. The western boundary comprises the adjacent school and the northern boundary is formed by the ‘flying field’. A location plan and application boundary are shown in Figures 1 and 2 respectively.

Topography

1.4. The topographic survey (seen in Appendix A) shows that the Site falls in a south easterly direction away from the ‘flying field’ situated to the north of the Site. Ground levels fall from approximately 127.5m Above Ordnance Datum (AOD) adjacent to the aircraft hangers to 116.7m AOD near to Field Barn Farm.

Geology

1.5. As taken from the Phase 2 Intrusive Survey Factual Report undertaken by Aspinwall in June 1997 (Ref.1) which covered the entire airfield, shallow ground conditions at the Site generally comprise layers of silt and clay, often sandy with a significant proportion of cobble sized limestone. This is underlain by weathered limestone bedrock at an average depth of 1.5m (range of 2.6m to 0.9m) to the north of Camp Road and 1.3m (range of 2.7m to 0.8m) to the south of Camp Road.

1.6. The solid geology at the Site comprises Middle Jurassic Great Oolite Limestone up to approximately 20m in depth, overlying a thick mudstone sequence with occasional limestone and sandstone bands.

1.7. The underlying Inferior Oolite Group is less than10m thick and includes sand, sandstones and thin mudstone of the Lower Estuarine Series, and sandy limestone, shelly limestones and sandstones of the Northampton Sand.

Hydrology

1.8. Tributaries of the Gallos Brook are located to the south and east of the Site. Surface water runoff from the Site discharges into these watercourses through four outfalls (as seen in Figure 3), two located to the south and two to the east. The Gallos Brook enters the River Ray approximately 11km to the south of the Site.

1.9. The nearest Main River to the Site is the River Cherwell which is located approximately 1.2km to the west of the Site.

Development Proposals

1.10. The development proposals (hereafter referred to as the 'Development') are shown in Appendix B. These illustrate that the development would comprise the creation of a new settlement, which would include up to 1,075 dwellings. Taking a sustainable approach, much of the existing military housing would be retained and refurbished, along with some new build residential development. Some of the residential development would be assisted living accommodation for the elderly and student accommodation involving change of use of existing buildings.

1.11. The proposals also include the provision of new employment uses (Class B1-B8), again comprising the change of use of existing buildings as well as the erection of new buildings.

1.12. New social and community infrastructure will also be created, including a new primary school towards the centre of the settlement area. A range of retail provision, again comprising new build and some change of use would be included, together with a range of Class D1 (non residential institutions) uses.

1.13. The Development would also involve a number of buildings and structures to be removed across the Site, including the boundary fence to the south of Camp Road.

1.14. Requisite infrastructure such as new highways will be provided to serve the settlement. In addition, a range of formal sports pitches and open space would be incorporated within the scheme.

Legislation and National Planning Guidance

Planning Policy Statement 25: Development and Flood Risk (PPS25)

1.15. PPS25 (Ref.2) sets out Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is exceptionally necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere, and where possible reduce flood risk overall.

1.16. PPS25 advocates the use of the risk-based 'Sequential Test', in which new development is steered towards the areas at lowest probability of flooding which are identified by Flood Zones.

1.17. The Site is located within Flood Zone 1, considered to have a low probability of flooding according to the Environment Agency's (EA) internet Flood Zone Map (as shown in Figure 4); therefore the Sequential Test for the Site has been passed.

1.18. PPS25 requires that surface water discharge from any developed site should be no greater than the existing rate, and should be managed in a sustainable manner as far as possible.

1.19. Practice Guidance (Ref.3) which accompanies PPS25 states that annual flow rates up to and including the 1 in 100 year event should be accounted for, including for the impacts of climate change.

1.20. Residential development is generally accepted to have a lifespan of 100 years. As detailed in Table B.2 of PPS25 (Ref.2), it is suggested that for developments of this design life, increasing peak rainfall intensity by 30% may provide an appropriate precautionary response to the uncertainty of climate change impacts.

Local Planning Policy

Strategic Flood Risk Assessment

1.21. The Cherwell District Council and West Oxfordshire District Council Level 1 Strategic Flood Risk Assessment (SFRA) published in April 2009 (Ref.4) sets out the requirements for site specific FRAs dependent upon the location of the Site.

1.22. Table 13.1 states that with regard to Upper Heyford the geology of porous shale could lead to potential land drainage issues and a Level 2 site specific FRA would need to include details of land drainage infrastructure. It concludes that the Level 2 FRA should consider existing available information where possible to further the developer's understanding of flood risk and how this could affect the Development.

Local Development Framework

1.23. The Draft Core Strategy published in February 2010 (Ref.5) forms part of the emerging Local Development Framework and represents Cherwell's policies for development up to the year 2026.

1.24. Policy SD6 encourages the use of Sustainable Drainage Systems (SuDS) to allow for developments to better adapt to the predicted impacts of climate change based on site specific constraints. It states that SuDS should aim to mimic surface water flows arising from the site prior to the proposed development and based on the existing situation.

Scope of Report

1.25. This report assesses the Site in regards to the risk of flooding, taking into consideration tidal, fluvial, groundwater and pluvial sources and the potential effects upon the Development. In line with current policy, the management of surface water will be assessed, and a strategy to effectively manage runoff whilst working within Site specific constraints will be proposed, so as not to increase flood risk elsewhere.

2. Sources of Potential Flooding

Tidal and Fluvial

2.1. The EA's Flood Zone Map, as seen in Figure 4, shows that the proposed Development is located within Flood Zone 1 and has a low probability of flooding (annual exceedance probability <0.1%).

2.2. The nearest Main River to the Site is the River Cherwell situated approximately 1.2km to the west of the Site.

2.3. Mapping provided by the EA (shown in Appendix C) denotes five secondary and tertiary watercourses adjacent to the southern and eastern boundaries of the Site, however the EA do not hold any records of flooding associated with these features.

2.4. Furthermore, the identified watercourses which are tributaries of the Gallos Brook are located down gradient of the development Site. Even in the extremely unlikely event of flooding due to these watercourses, no flooding would occur to the Site. It is therefore concluded that the risk of tidal or fluvial flooding is low.

2.5. Anecdotal evidence provided by the EA (Appendix C) notes that flooding has occurred off-site within Caulcott to the west of the Site and the caravan park to the east.

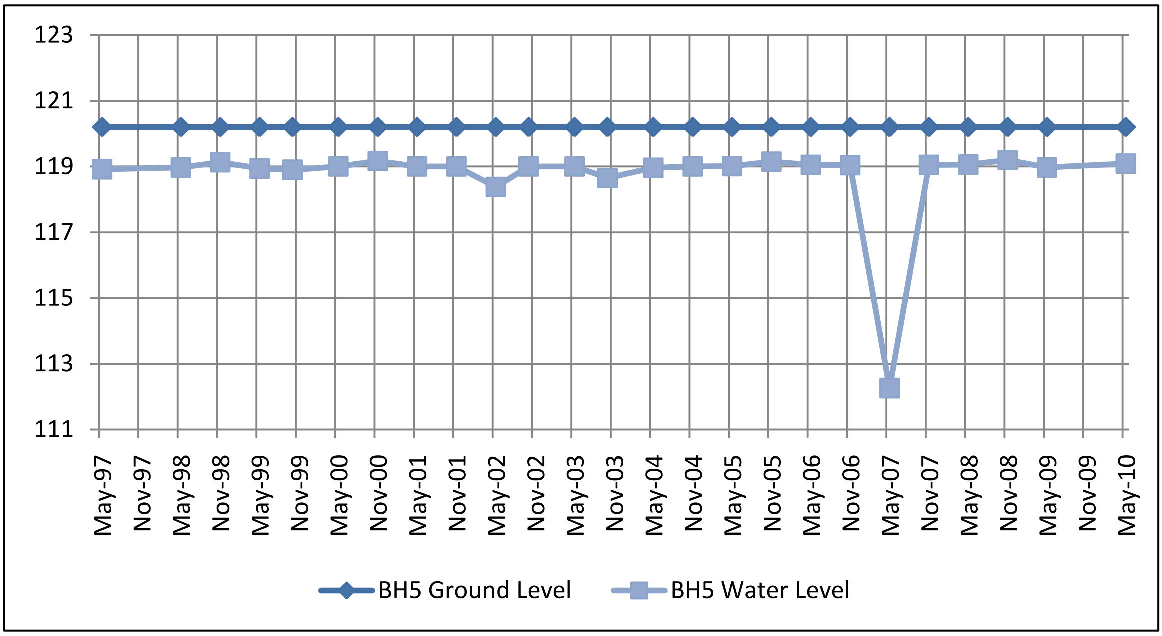
2.6. However, as seen in Figure 1, the Site boundary is such that the proposed development does not drain to the watercourse which flows through Caulcott. Therefore, the development would not affect surface water runoff in this location. Although anecdotal evidence of flooding within the caravan park does not constitute a flood risk to the Site itself, this will be taken into account within the following chapter when considering an appropriate drainage strategy.

Groundwater

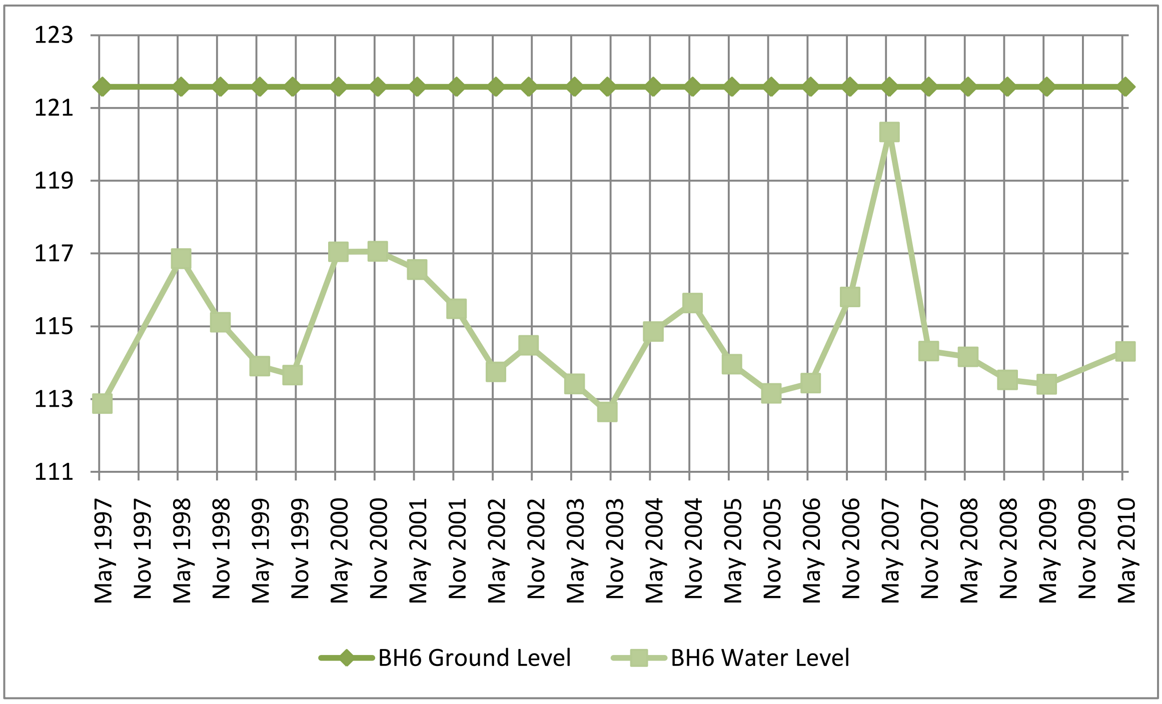
2.7. The Site is not located within a Source Protection Zone according to the EA website. However, the EA classifies the underlying limestone bedrock beneath the Site as a principal aquifer. This classification refers to layers of rock or drift deposits that have high fracture permeability, meaning they usually provide a high level of water storage and they may support water supply and/or river base flow on a strategic scale.

2.8. The Aspinwall report (Ref.1) noted that groundwater was present within a number of horizons dependent upon the lithology present. Boreholes have been monitored on a biannual basis since the report was initially undertaken in 1997. Boreholes 5 and 6 are of significance to the Development and are located to the northeast and southwest of the Site respectively (as seen in Figure 3). The respective relationship between the ground level and water level are shown in the following graphs.

Graph 1: Groundwater Monitoring Borehole 5



Graph 2: Groundwater Monitoring Borehole 6



2.9. As seen in the above graphs, there were two erroneous results taken in May 2007. It appears from viewing the complete set of results that these two readings have been switched between boreholes 5 and 6. These results have therefore been discounted from continued assessment of the potential for groundwater flooding.

2.10. Borehole 5 shows very steady groundwater levels at an average of 1.2m below ground level (bgl) and a minimum of 1m bgl. Borehole 6 in comparison shows a relatively fluctuating water level located an average of 7m bgl, ranging between 4.72m bgl and 8.93m bgl.

2.11. The EA (Appendix C) and on-site management team do not hold any records of groundwater flooding occurring at the Site; furthermore the Development proposes to maintain existing ground levels. It is therefore considered that groundwater flooding would not be an issue either at the Site through ingress of water into newly constructed buildings, or to others caused by displacement of flows.

Pluvial

2.12. Pluvial flooding occurs when natural and engineered systems have insufficient capacity to deal with the volume of rainfall. Pluvial flooding can sometimes occur in urban areas during an extreme, high intensity, low duration summer rainfall event which overwhelms the local surface water drainage systems; or in rural areas during medium intensity, long duration events where saturated ground conditions prevent infiltration into the subsoil. This flood water would then be conveyed via overland flow routes dictated by the local topography.

2.13. There are no public sewers located on-site; however there are private sewer systems which connect into the watercourses along the Site boundary. On-site personnel have no recollection of instances of flooding at the Site (over the last 40 years).

2.14. The surrounding topography of the area gently falls in a southerly direction towards the adjacent fields. The Development would therefore only be at risk of pluvial flooding from the Site itself or the ‘flying field’. No flooding has been reported at the Site and it is therefore assumed that the current drainage network is of adequate capacity to collect and dispose of surface water flows. In addition, as part of the Development, surface water runoff would be managed and hence pluvial flooding would not pose a risk to the Development.

Summary

2.15. The Site is considered to be at low risk of flooding from tidal, fluvial, groundwater and pluvial sources. However, it is also necessary to ensure that the Development itself would not increase flood risk elsewhere through increased surface water runoff. This is examined in the following chapter.

3. Surface Water Drainage Strategy

Current Surface Water Regime

3.1. As seen in Figure 3, there are four discharge locations adjacent to the Site which enter two tributaries of the Gallos Brook. These are namely Outfalls 1 and 2 to the south of the Site and Outfalls 3 and 4 to the east. The presence of these watercourses was confirmed through a Site walkover undertaken on 2 June 2010.

3.2. Figure 5 shows the existing surface water drainage catchments based on information obtained through the topographic survey, on-site records and the CCTV survey undertaken at the Site. Outfall 1 (which ultimately joins Outfall 2) drains the western area of the Site. Outfall 2 located to the south of the Site drains central areas to the south of Camp Road. Outfall 3 located beside Camp Road drains the central areas to the north of Camp Road and Outfall 4 drains the north eastern area of the Site.

3.3. There are large areas of existing residential properties in the south of the Site which do not appear to benefit from positive drainage systems. Through discussions with on-site personnel it is understood that these properties are expected to have individual soakaways, however the location, size and design of these features are unknown. There are no reports of any drainage or flooding issues within these areas, and as such the existing provision is considered satisfactory.

3.4. There is an existing balancing pond located to the south of the Site beside the B4030. All four outfalls located on-site drain to this feature, which aids in reducing flows to downstream catchments.

Sustainable Drainage Systems

3.5. The most sustainable way to drain surface water runoff is through the use of SuDS, which need to be considered in relation to site-specific constraints.

3.6. SuDS work by mimicking the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk these features can improve water quality and provide biodiversity and amenity benefits.

3.7. A variety of SuDS options are available to reduce or temporarily hold back the discharge of surface water runoff. Table 1 overleaf provides the constraints and opportunities to each of the SuDS devices in accordance with the hierarchical approach outlined in The SuDS Manual CIRIA C697 (Ref.6).

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Table 1: Sustainable Drainage Techniques

Device	Description	Constraints / Comments	✓/✗
Living roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	Not suitable for individual properties, potential for inclusion within managed areas/buildings.	✓
Infiltration devices Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	Infiltration likely to be feasible, subject to assessment of contamination and soakage rates during detailed design.	✓
Pervious surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and/or slowly release to sewers.	Potential for infiltration, soakage rates to be confirmed during detailed design. If sufficient soakage not possible, paving could be lined with an impermeable membrane.	✓
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from the Site by reusing water for non-potable uses e.g. toilet flushing.	Rainwater harvesting systems are not considered to provide attenuation for specific storm events.	✓
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff, and allow infiltration (ground conditions permitting).	Potential for inclusion within the development plots and alongside the highways. Details to be confirmed at detailed design.	✓
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.	See Infiltration Devices above.	✓
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from runoff from adjacent areas.	Could be provided adjacent to ponds or basins.	✓
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration.	See Infiltration Devices above.	✓
Wet ponds & Constructed Wetlands (end of pipe treatment)	Provide water quality treatment and temporary storage above the permanent water level.	Could be utilised down gradient of the development plots where spatial constraints allow.	✓
Attenuation Tanks (end of pipe treatment)	Used when the SuDS listed above cannot be installed with sufficient volumes to restrict to the required rate.	A gravity connection should be provided for any underground attenuation tank where practical.	✓

Infiltration Techniques

3.8. Although it is expected that drainage by infiltration would be viable at the Site, localised soakage tests have not been undertaken to date. Additionally, confirmation of areas of contamination would be required and the potential for remediation if required assessed. Therefore, the precautionary principle has been applied to the drainage strategy in order to demonstrate that surface water runoff can be reduced to the required rates without the need for infiltration.

Living Roofs

3.9. Living roofs comprise a vegetative cover over a drainage layer which mimics the natural drainage regime of a Greenfield site, through absorption by the plants and retention of precipitation within the growing medium. This reduces the volume of runoff and attenuates peak flows. Living roofs can also provide ecological benefits through providing replacement and additional habitat within developments. Furthermore living roofs can facilitate in reducing a building's carbon footprint by removing CO_2 and reducing energy demand owing to the thermal benefits.

3.10. In line with the sustainable approach to the Development, a large proportion of the Site is intended to be refurbished and it is not considered feasible to retrofit living roofs to the existing buildings. Living roofs would not be appropriate for new houses, however would be considered during detailed design in areas where there are shared maintenance agreement (e.g. flats and commercial buildings), subject to roof typology and structural stability.

Permeable Paving

3.11. Permeable paving allows infiltration through the surface and filter layers into the sub-base or void structure below. Where soakage rates do not allow for direct infiltration into the underlying subsoil, water would be held within the sub-base and attenuated sufficiently before discharging to the appropriate outfall. Permeable paving would generally be used in non trafficked areas, however could also be utilised on un-adopted highways within the Development subject to appropriate design.

Swales and Filter Drains

3.12. Swales and Filter Drains are designed to convey surface water runoff from adjacent impermeable surfaces, and should ideally infiltrate into the ground.

3.13. Swales could be utilised where topography is favourable within the development plots and alongside the highways to convey runoff to down gradient attenuation features. Where infiltration is not possible, swales would be lined with an impermeable membrane and designed to provide attenuation behind a series of weirs.

Balancing Ponds and Basins

3.14. Balancing ponds collect surface water within the landscape of the Site. Although these require significant land take they can provide ecological enhancement, and improve water quality through the removal of pollutants.

3.15. In line with CIRIA guidance the following assumptions have been taken into account in regards to the design of permanent ponds:

- Side slopes of 4:1, one at 6:1 for safety purposes (dependant on slope stability)
- 1m balancing depth above permanent pool
- Length to width ratio of between 3:1 and 5:1

3.16. These features could be designed as ponds, with a permanent water level in them. Alternatively these could be basins, which would be generally dry during summer months and utilised as amenity and recreation space when not required for attenuation purposes.

3.17. The ponds shown in Figure 6 have been sized assuming that no infiltration is possible; to demonstrate that there is sufficient space available to achieve the required attenuation volume.

Underground Attenuation

3.18. Excess surface water which cannot be controlled through the use of above ground features and permeable paving would be directed to storage tanks and oversized pipes. It is recognised that these measures are considered less sustainable than other methods of attenuation as they provide no water quality, amenity or habitat benefits. However, where surface water runoff cannot be controlled through more sustainable SuDS techniques, the option of attenuation tanks has been considered.

Proposed Surface Water Regime

3.19. The EA have confirmed that in areas identified solely for refurbishment, attenuation would not need to be provided as the buildings, areas of hard standing and drainage networks are to remain as existing. Similarly, no attenuation would be required for areas of the Site which are not intended to be developed. In these areas, the drainage networks would remain as per the existing situation if possible, although minor diversions may be necessary to accommodate the proposed buildings.

3.20. In accordance with PPS25, local policy and EA guidance the rate of surface water runoff from new development would be controlled so that it does not increase over the existing situation for the 1 in 100 year event, while taking climate change into account for the lifetime of the Development.

3.21. In addition, due to anecdotal evidence of flooding to the east of the Site within the caravan park (Appendix C), as agreed with the EA, flows entering the eastern tributary of the Gallos Brook would be reduced by 10% which would provide a degree of betterment over the existing situation.

3.22. Preliminary calculations included within Appendix E show that approximately 1650m^3 of attenuation would be required for Catchment 1, 1903m^3 for Catchment 2, 1986m^3 for Catchment 3 and 511m^3 for Catchment 4. This would mean a total attenuation volume of 6050m^3 would be required across the Site to restrict surface water flows sufficiently.

3.23. As previously noted there is a downstream balancing pond serving the Site. However, due to the existing footprint there is limited scope to increase the volume of this feature. It has therefore been proved that the required attenuation volume can be incorporated on-site.

3.24. Figure 6 shows the associated allowable discharge rates, above ground attenuation features and volumes of below ground storage required per catchment. As agreed with the EA, due to the Masterplan being merely indicative at this stage, the exact location of below ground storage has not been defined. This will allow for some flexibility in the placement of buildings at the detailed design stage, yet ensure that the appropriate level of attenuation will be provided.

3.25. OCC have confirmed that they would adopt SuDS subject to confirmation of design if they serve two or more properties, are located within the most appropriate land topographically and allow access for maintenance purposes. The potential for the adoption of SuDS by OCC will be considered at the detailed design stage subject to confirmation of the Masterplan. If these features were not offered for adoption, these would be maintained through appropriate maintenance companies under a Model Agreement.

3.26. This strategy would provide a robust and sustainable drainage system which would restrict flows sufficiently while providing ecological and amenity benefits. This would ensure that flood risk is not increased to others and where appropriate is decreased.

4. Conclusions

4.1. The Site is located within Flood Zone 1 and is considered by the EA to be at a low risk of tidal and fluvial flooding. Furthermore there are no watercourses on-site and no history of fluvial flooding.

4.2. The Site is located on top of a plateau, slightly down gradient of the 'flying field'. Overland flows could only emanate from the runway or the Site itself. As there have been no reported instances of flooding to the Site it is assumed that the current on-site drainage network has adequate capacity to deal with surface water runoff. The risk of flooding from pluvial sources is therefore considered low.

4.3. Groundwater was located approximately 1.2m bgl in the northeast of the Site and 7m bgl in the southwest. Groundwater levels are relatively static and there have been no reported historical instances of flooding on-site. Furthermore, proposed ground levels are to remain as existing so the risk of groundwater flooding to the buildings themselves, or increased flood risk to others caused by displacement of flows would be low.

4.4. The on-site surface water drainage network is private, connecting into a number of small watercourses around the southern and eastern boundaries of the Site.

4.5. The proposed surface water strategy will mimic the existing situation, restricting flows to the existing rate while taking climate change into account for the lifetime of the Development. Due to anecdotal evidence of flooding off-site, flows entering the watercourse to the east of the Site will be decreased by 10%. This will provide some degree of betterment over the existing situation.

4.6. Surface water attenuation will be provided through the use of balancing ponds, permeable paving and attenuation tanks where necessary. Swales will be incorporated within the development parcels and living roofs will be considered where appropriate. The potential for infiltration techniques will also be investigated further at the detailed design stage, to confirm whether soakage rates are favourable.

4.7. This report demonstrates that the proposed Development is at a low risk of flooding. It also confirms that surface water runoff from the Development could be drained in such a way as to ensure that flood risk is not increased elsewhere, and where appropriate decreased. It is anticipated that the information provided within this report satisfies the requirements of PPS25.

5. References

1. Aspinwall & Company Limited, June 1997. *RAF Upper Heyford Land Quality Assessment Phase Two: Intrusive Survey Factual Report*
2. Communities and Local Government, March 2010. *Planning Policy Statement 25: Development and Flood Risk*
3. Communities and Local Government, 2009. *Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft'*
4. Scott Wilson, April 2009. *Cherwell and West Oxfordshire Level 1 Strategic Flood Risk Assessment*
5. Cherwell District Council, February 2010. *Draft Core Strategy*
6. CIRIA, 2007. *C697 the SUDS Manual*

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FIGURES

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Figure 1: Site Location Plan

Not To Scale

Key

Site Location

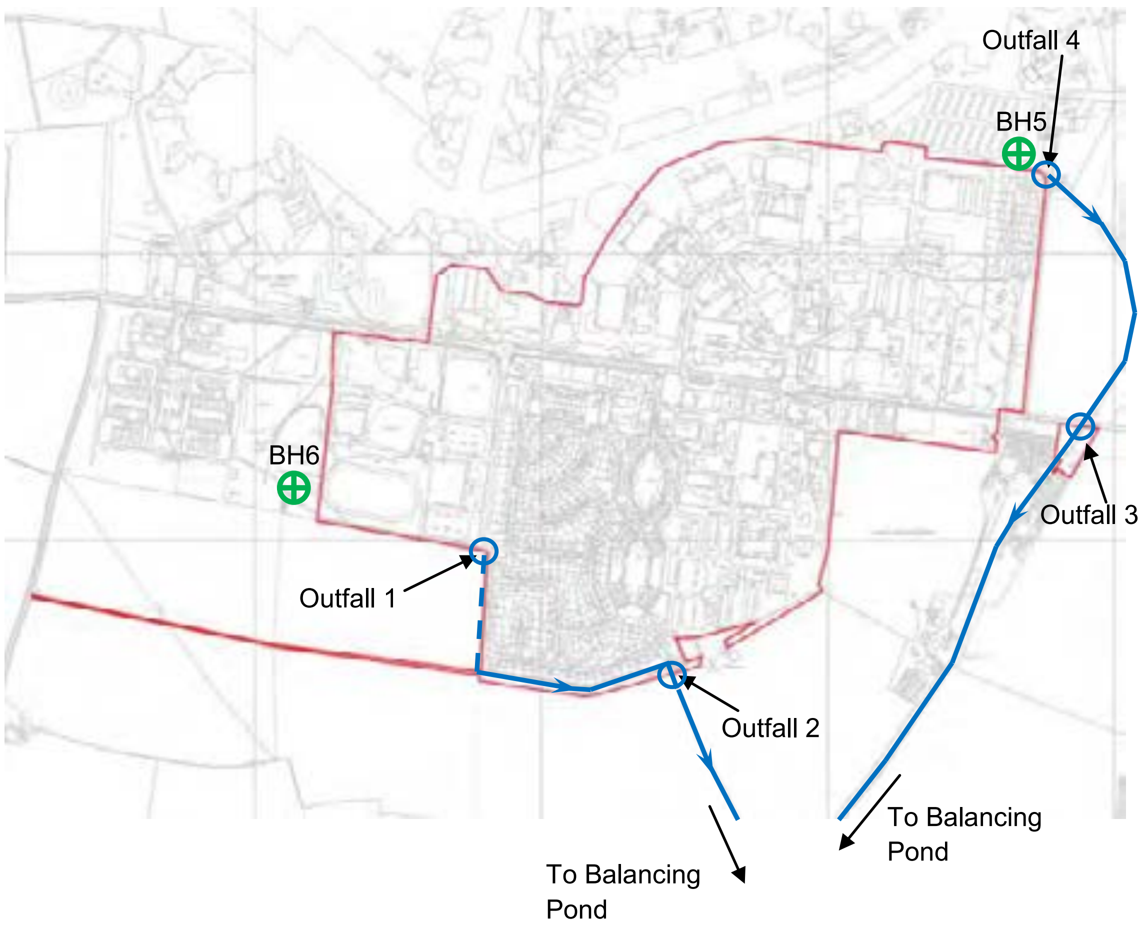
Figure 2: Red Line Boundary

Not To Scale

Key

Application Boundary

Figure 3: Watercourse and Borehole Locations



Not To Scale

Key

Application Boundary

Borehole Location

Outfall Location

Watercourse

Culvert

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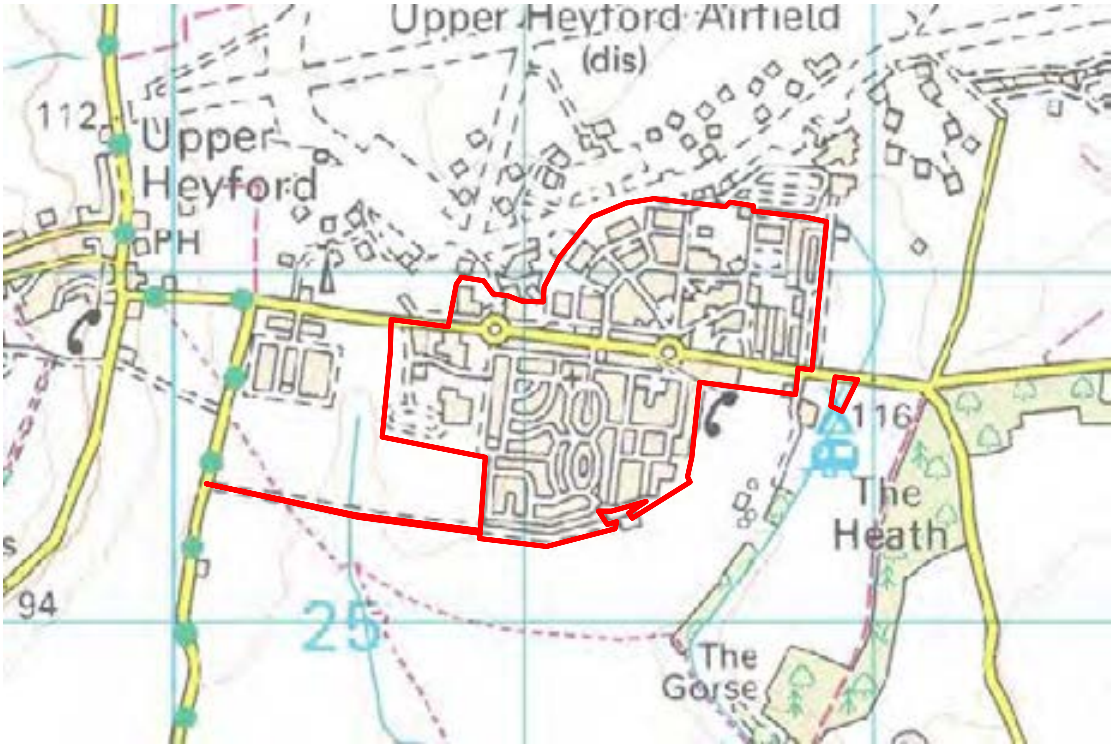
Figure 4: Environment Agency Flood Zone Map



Not To Scale

Key

- Site Location
- Flood Zone 3, High Risk, flooding from rivers or sea without defences
- Flood Zone 2, Medium Risk, extent of extreme flood
- Flood Zone 1, Low Risk of flooding from rivers or the sea
- Flood defences
- Areas benefiting from flood defences

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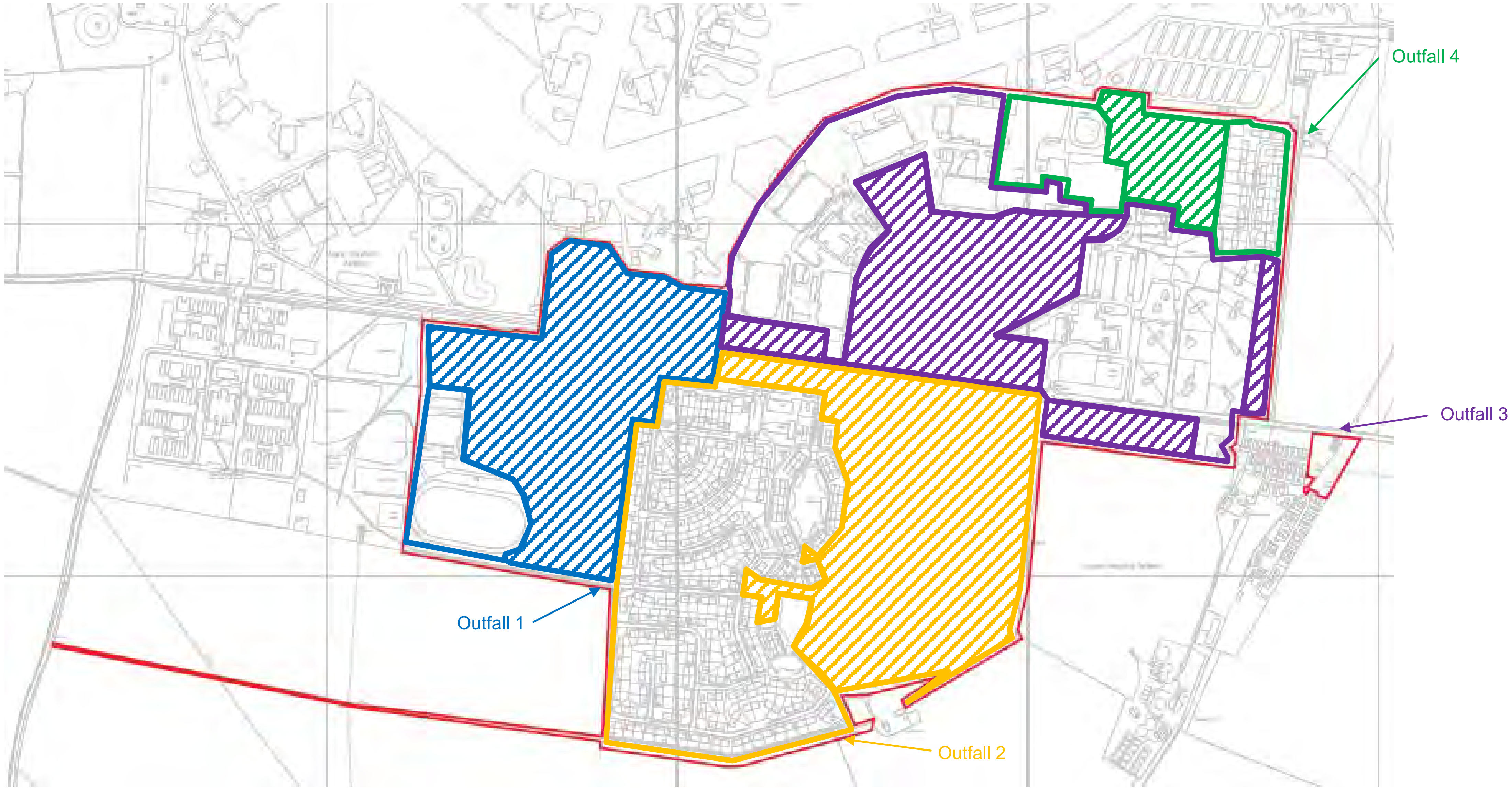
Figure 5: Existing Catchment Boundaries of Developed Site Areas



Not To Scale

Key

Application Boundary

Catchment Area 1

Catchment Area 3

Additional Areas contributing to Catchment, not redeveloped

Catchment Area 2

Catchment Area 4

GENERAL NOTES

KEY

- RED LINE BOUNDARY
- WATERCOURSE
- AREA 1: ABOVE GROUND STORAGE
- AREA 2: ABOVE GROUND STORAGE
- AREA 3: ABOVE GROUND STORAGE
- AREA 4: ABOVE GROUND STORAGE
- AREA 2: BELOW GROUND STORAGE
- AREA 3: BELOW GROUND STORAGE
- AREA 4: BELOW GROUND STORAGE
- INDICATIVE DRAINAGE NETWORK (COLOUR VARIES BY AREA)

Rev	Date	Description	By
A01	16.09.10	ISSUED	ST

Amendments

Project
UPPER HEYFORD

Title
FIGURE 6:
INDICATIVE SURFACE WATER DRAINAGE LAYOUT

Client
DORCHESTER HOLDINGS

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Drawing Status
PRELIMINARY

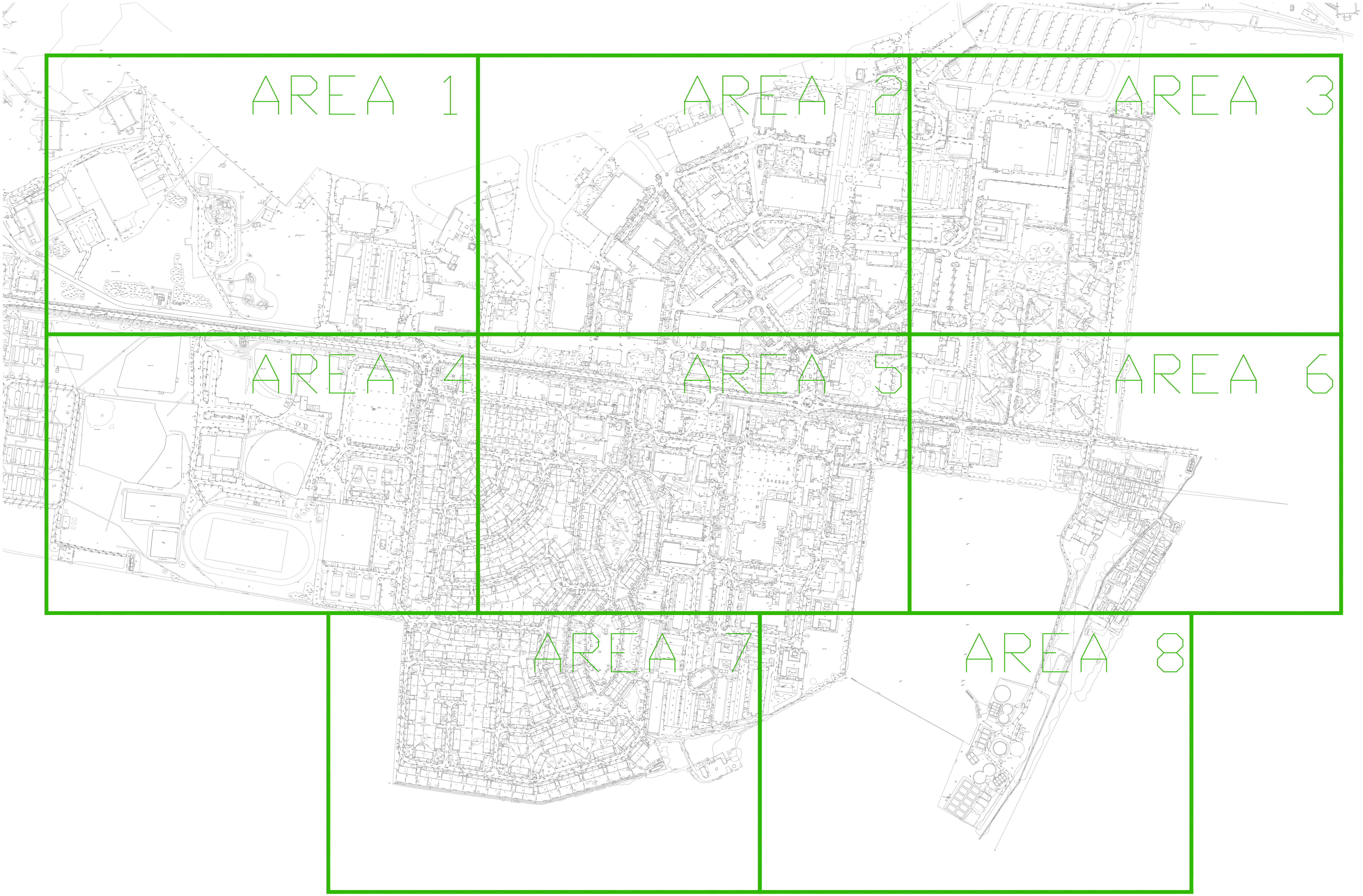
Designed by	ST	Checked by	BM	Project No	C11234
Drawn by	ST	Date	SEPTEMBER 2010		
Scales @ A3 work to figured dimensions only	1:5000@A3			Computer File No	C11234CSA040001.dwg

Publisher	Zone	Category	Number	Revision
C	SA	04	0001	A01

A3-W-SingleContract, x-development uses, x-surface water drainage

APPENDICES

A. Topographic Survey


AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
AREA 7
AREA 8

AIRFIELD LIGHT
3048
3049
259
260
POL 2
250
254
293
VENTILATION SHAFT
UPPER HEYFORD AIRFIELD