Planning and environmental statement

November 2017

Contents

Chapter one
Introduction and background

1.1 The Cranfield University Masterplan defines a vision for the University's physical estate over the coming 25 years, delivering a comprehensive programme of construction and renewal, and importantly addressing the way the estate is structured and occupied.

1.2 The Masterplan is a significant step forward for the University, reflecting the aspirations set out in its Corporate Plan which recognise the need for continued investment in the built environment to ensure the institution remains competitive and successful within the higher education sector.

1.3 The University has been working in partnership with Central Bedfordshire Council (CBC) to assist with the preparation of its Masterplan. This collaboration is seen as vital to ensure a transparent process and to support council endorsement of the Masterplan and its supporting documentation as Technical Guidance.

1.4 Similar to a planning application, key environmental studies have been identified and commissioned in support of the Masterplan to review constraints and strategic impacts, the findings of which are summarised in this Statement. The key studies are:

- Masterplan protected species report prepared by Applied Ecology.
- SuDS and stormwater management outline strategy prepared by Pearce Design Consultants.
- Landscape statement including visual impact prepared by Oobe.
- Transport statement prepared by Mayer Brown.

1.5 In addition to confirming that the strategic Masterplan sits within the environmental capacity of the locality, the environmental reports define principles which will assist in shaping more detailed environmental appraisals when specific planning applications are brought forward for development projects.

1.6 The remainder of this Statement provides the context of the site, sets out the planning policy framework for the Masterplan and then summarises the findings of the strategic environmental reports that will frame future planning applications.

Chapter two
Context

2.1 Cranfield campus is approximately 50 miles north of central London adjacent to the village of Cranfield, Bedfordshire. The nearest large towns are Milton Keynes and Bedford, the centres of which are both about 8 miles away. Cambridge is approximately 30 miles east. The extent of the wider Cranfield site is shown on the plan below which identifies the areas within the campus, however it should be noted that the site subject to the Cranfield Masterplan exercise excludes the Airport and Air Park:

- Academic zone.
- Technology pa.
- Airport.
- Residential and recreational area.

Cranfield University functional zones

2.2 The entire Cranfield campus covers a site of 250 hectares currently accommodating approximately 150,000sqm of floorspace, consisting of academic, administrative and non-domestic buildings together with on-campus student accommodation. Health services are provided on-campus with a dentist and counselling services being available. The Cranfield Medical Centre has recently moved off-site and amalgamated with services in Cranfield and Marston village surgeries. This move has allowed for resources to be better co-ordinated with additional appointments being made available at both surgeries to accommodate patients who were previously been seen on campus.

Topography

2.3 In general the campus is relatively flat which is to be expected given the choice of the area as the location for an airfield.

2.4 The majority of the Airport site slopes down broadly from south-east to north-west to a low point around 103m AOD at the north-western boundary with the Academic Zone. The high point of the Airport site is in the south-eastern corner of the site at around 110m AOD. North of the low point, the topography gently rises and continues to do so to the northern boundary of the site.

2.5 The Academic Zone generally follows the topography of the Airport site. The low point is located adjacent to the western boundary with the Residential and Recreational Zone at around 100m AOD. The topography of the Residential and Recreational Zone rises from a low point (defined by the main north-south watercourse) both to the east and to the west. There is also a slight fall towards the northern boundary of the site, the low point of which is around 99m AOD.

2.6 The Technology Park topography is defined by a high point located close to the roundabout adjacent to the airfield site constructed as part of the infrastructure works during the early 1990's. The high point is at around 108m AOD and from here the topography falls very gently to the north-east to the boundary.

Landscape character

2.7 Situated on a range of hills on the Buckinghamshire border, Cranfield forms part of the Clay Farmland character area in Central Bedfordshire. The soil is heavy, with an underlying solid geology of Oxford Clay; this lime-rich, loamy soil has impeded drainage in the area. The area is characterised as a medium-large scale plateau landscape, predominantly open and exposed, with large scale, intensive arable crop production with regular fields bounded by open ditches and trimmed, often species-poor hedgerows.

2.8 The campus character retains the rural quality of its setting; mature trees and hedgerows define boundaries and filter into older parts of the campus. There is a mix of architectural styles on site including repurposed RAF buildings alongside newer contemporary buildings. The campus layout has developed organically, with little coordination between buildings and external spaces.

2.9 The rural setting means that the campus has a high level of biodiversity with a habitat mosaic of scrub, woodland, wetland and farmland, however the proximity to the airfield has implications on some biodiversity opportunities.

2.10 Tree cover is well established on site with many protected trees along the central stretch of College Road.

2.11 To the north of the residential area is a dense broadleaved wood and copse area adjacent to Chicheley Brook This woodland provides suitable habitat for a range of plant and animal species, and the woodland edge hosts a number or shrubs, grasses, flowers, birds, and invertebrates.

Water

2.12 The Chicheley Brook runs through the campus and connects to the River Great Ouse in Newport Pagnell which then flows through Bedford. A number of other surface water drainage channels also run through the site, entering the brook, and balancing ponds also feature namely near the sewage treatment and near the Nissan tech park. There is also a water feature outside Martell House although this is ornamental in nature.

Chapter three
Planning policy framework

3.1 While responding to the growth aspirations of the University, development must also accord with national and local planning policy.

3.2 The planning policy framework informing this masterplan and future proposals is predominantly made up of the following:

Policy

- National Planning Policy Framework (NPPF) (2012).
- Central Bedfordshire Council core strategy and development management policies document (2009).
- Site allocations development plan document.
- Proposals map.

Planning Guidance

- Central Bedfordshire Council sustainable drainage guidance 2014 (updated in 2015).
- Central Bedfordshire design guide 2014.
- Central Bedfordshire landscape character assessment (2015).

National planning policy framework

3.3 The NPPF was published in 2012 and communicates the Government's economic, environmental and social planning policies for England. It articulates the Governments vision for sustainable development and acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decision about planning applications.

3.4 The NPPF establishes the presumption in favour of sustainable development, and this is seen as the 'golden thread' running through both plan-making and decision-taking (paragraph 14, NPPF). Specifically, paragraph 19 states that the planning system should do all that it can 'to support sustainable economic growth' in order to create jobs and prosperity and meet the challenges of global competition alongside a low carbon future.

3.5 There are three dimensions to sustainable development: economic, social and environmental which are mutually dependent on one another and should not be considered in isolation.

3.6 Paragraph seven sets out the role of the planning system in respect of these dimensions:

3.7 These dimensions give rise to the need for the planning system to perform a number of roles:

- An economic role by contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure.

- A social role by supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being.

- An environmental role by contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

3.8 Paragraph 21 recognises the importance of supporting business sectors and the need to plan positively for the location, promotion and expansion of clusters or networks of knowledge driven, creative or high technology industries.

3.9 Chapter seven highlights the significance of good design not only in terms of individual buildings but also in terms of well-considered public and private spaces. Paragraph 58 notes developments should 'establish a strong sense of place, using streetscapes and buildings to create attractive and comfortable places to live, work and visit'. Such spaces should be safe, function well and raise the overall quality of the area. NPPF requires the planning system to take account of climate change, including factors such as flood risk, water supply, changes to biodiversity and landscape. Where development is brought forward in sensitive or vulnerable locations, NPPF requires risks to be managed through suitable mitigation measures including sustainable drainage systems.

3.10 Chapter 11 of the NPPF emphasises the importance of conserving and enhancing the natural environment. Developments should seek to minimise their impact on biodiversity, and provide net gains in biodiversity where possible. In addition, developments should seek to establish coherent ecological networks that are more resilient to current and future pressures.

Local policy

3.11 Central Bedfordshire Council's Adopted North Local Development Framework consists of the adopted Core Strategy and Development Management (CSDM) Policies Document, Site Allocations Document and Proposals Map.

3.12 The CSDM was adopted in 2009 and sets out the vision, objectives, spatial strategy and overarching policies to guide development in the north area of Central Bedfordshire up to 2026.

3.13 The adopted CSDM continually refers to Cranfield Campus and Technology Park as significantly contributing to the economic prosperity of the region. Indeed Policy CS1: Development Strategy notes 'additional employment opportunities will be provided for at the University Campus and Technology Park, to help reinforce its importance as a sub-regional employment location.' The Vision for Cranfield in section 3 of the CSDM mirrors this stance and also emphasises that the 'continued aviation use of the Cranfield Airfield will be protected.'

3.14 The Cranfield Masterplan is considered to align with the thrust of both national and local policy and seeks to support and enhance the economic, social and environmental position of the campus.

3.15 Central Bedfordshire Council's current Local Plan designates Cranfield campus and Technology Park as 'Significant facilities within the countryside'. This policy necessitates designated sites to bring forward a masterplan, in agreement with the council, prior to significant expansions/redevelopment taking place. The production of the Cranfield University Masterplan responds directly to this designation. In addition, the following policies and site designations are relevant and will need to be responded to where relevant by future proposals:

CS1: Development strategy
CS9: Providing jobs
CS10: Location of employment sites
CS13: Climate change
CS15: Heritage
CS16: Landscape and woodland
CS18: Biodiversity and geological Conservation
DM1: Renewable energy
DM2: Sustainable construction of new buildings
DM3: High quality development
DM11: Significant facilities within the countryside
DM14: Landscape and woodland
DM15: Biodiversity
E1: Safeguarded key employment sites
EMP4(6): Cranfield Technology Park

3.16 Central Bedfordshire Council is currently embarking on a new Local Plan covering the period up to 2035. The Masterplan is considered to align with emerging policies and once adopted future proposals will be assessed against them.

Chapter four
Environmental considerations

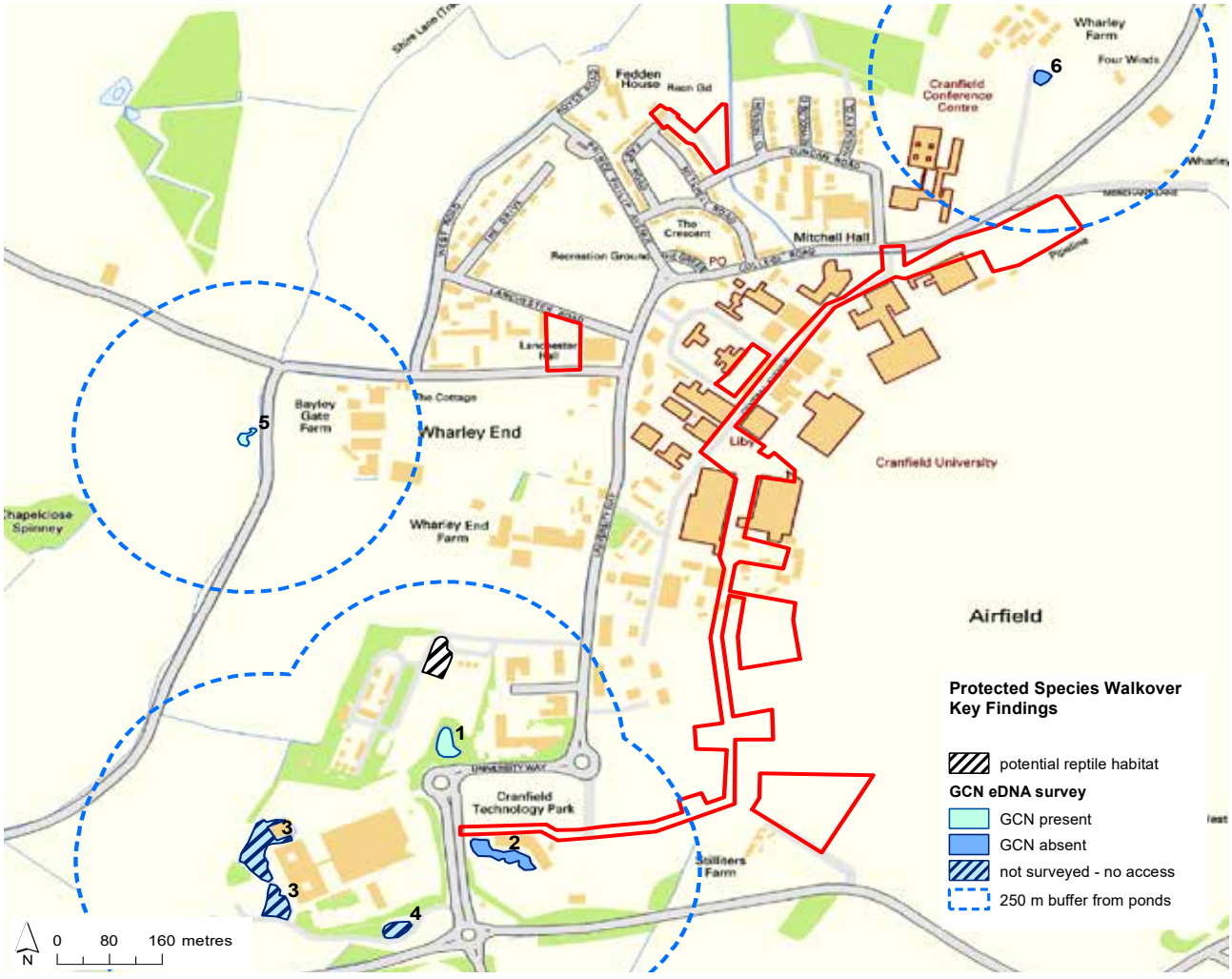
4.1 As noted within the introductory section to this Statement, the following supporting reports have been prepared to inform the Masterplan:

- Masterplan protected species report prepared by Applied Ecology.
- SuDS and Stormwater management outline strategy prepared by Pearce Design Consultants.
- Landscape statement including visual impact prepared by Oobe.
- Transport statement prepared by Mayer Brown.

Ecology

4.2 In order to ascertain the existing ecological make up of the site, a protected species walkover survey was carried out by AEL Ecologists. All ground subject to the proposed Masterplan was walked and carefully investigated for evidence of the presence of animal species protected by wildlife law or covered by biodiversity planning initiatives. The findings are described below:

Protected species walkover key findings



Great crested newts

4.3 In February 2016 all accessible ponds as indicated by OS maps and aerial photos, within 500m of the site boundary were visually inspected, and a habitat suitability index assessment completed to assess their potential value for the legally protected amphibian Great Crested Newt Trirurus cristatus (GCN). The location of the ponds are shown in Figure 2.1.

4.4 Subsequently, on 28 April 2016, ponds 1, 2, 5 and 6 were subjected to an eDNA water sampling survey following the protocol stipulated in the test kits supplied by ADAS to determine the presence/absence of GCN.

4.5 Double-ended funnel traps were set in Pond 1 on the evenings of 13, 17, 19, 24, 25 and 31 May 2016 following confirmation (eDNA results) on 12 May that the pond supported GCN. The traps (40 cm x 20 cm, with a 3mm square mesh) were set at regular intervals around the entire perimeter of the survey pond in order to capture newts. The traps work on the same basis as plastic drinks bottle traps but are larger and have two as opposed to one inverted funnel entrance. The number of traps used was roughly proportional to the range of littoral aquatic habitats present in the waterbody and set at regular intervals around easily accessible perimeter areas.

4.6 A search for GCN eggs on a selection of suitable submerged aquatic vegetation was conducted on each survey occasion or up until GCN eggs were found in each respective water-body. Searches were conducted for approximately five minutes on each occasion.

4.7 A summary of the eDNA surveys is provided in table 4.1 below:

Table 4.1 – eDNA survey results

Pond ID	Habitat Suitability Index	eDNA results
1	0.85 – Good suitability	Positive
2	0.70 – Good suitability	Negative
3	n/a	Not surveyed (access permission denied)
4	n/a	Not surveyed (access permission denied)
5	0.73 – Good suitability	Positive
6	0.77 – Good suitability	Negative

4.8 Based on the eDNA survey results and in recognition of future masterplan development, a six funnel-trapping survey was completed on pond 1 only to establish the GCN population size. Pond 5 was discounted due to its distance (over 350m) and relative isolation from future development. The results of this are provided in Table 4.2.

Table 4.2 Population survey results

Date	Air Temp	No. of traps	GCN				Smooth newts	Other	Egg search
			Male	Female	Juvenile	Total GCN			
13.5.16	6	10	1	2	0	3	24	n/a	0
17.5.16	10	15	15	19	6	40	32	n/a	0
19.5.16	13	15	1	6	1	8	24	n/a	0
24.5.16	7	15	0	3	1	4	23	n/a	0
25.5.16	15	15	1	3	0	4	4	n/a	0
31.5.16	11	15	1	1	1	3	6	n/a	0

Reptiles

4.8 Of the areas proposed to be impacted by the development only one area – a patch of rough grassland in the south of the site – was considered suitable habitat for reptile species. The location of this area is shown in Figure 2.1.

Badgers

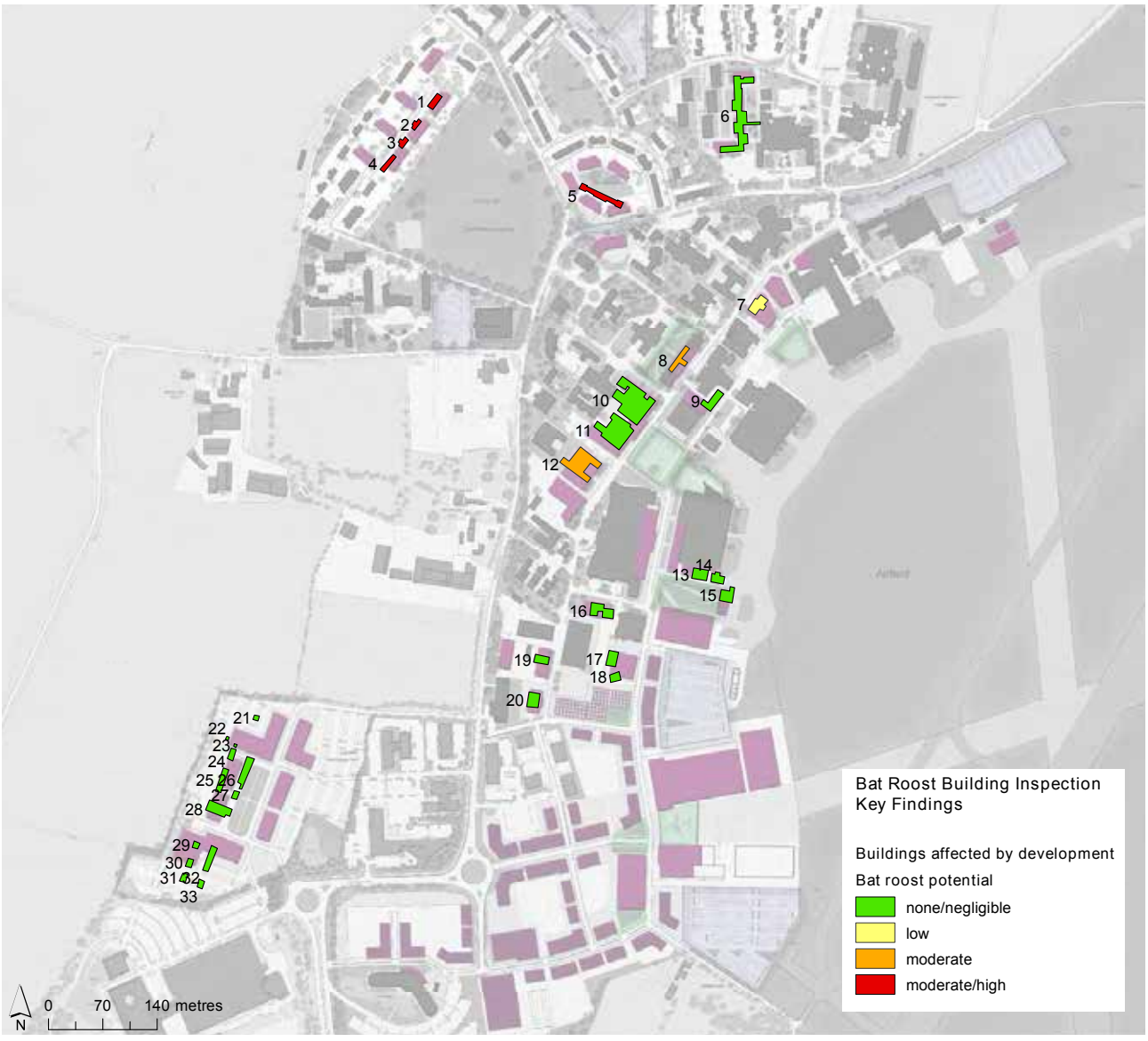
4.9 A main badger sett was present in woodland to the north of the site, close to the treatment works. At least ten active holes were located. In addition, a single-hole outlier sett was present on the western edge of the same woodland block. No setts or signs of badger activity were present in close proximity to any buildings potentially affected by the proposed development.

Bats

4.10 The buildings inspected as part of the survey and their suitability for roosting bats are shown in Figure 2.2.

4.11 A number of residential buildings in the north-west of the site (Buildings 1–5) had several features suitable for bats to access the loft spaces, including displaced tiles, gaps below ridge tiles, gaps between the walls and soffits, and ventilation gaps (some of these buildings have previously been inspected and found to contain bat droppings). These were assessed as having at least Moderate suitability for roosting bats. Building 8 and Building 12 were of Moderate suitability for roosting bats, as each had several potential access points to roof voids, including displaced and lifted tiles and

Bat roost building inspection key findings



gaps between the walls and soffits. Building 7 was assessed as having low suitability, as it had various potential access points of potential use for small numbers of bats but lacked a roof void and was poorly situated.

Birds

4.12 A number of the buildings inspected were being used by nesting birds or had features potentially suitable for nesting birds. Buildings 1–4 all had ventilation gaps, some of which were covered in mesh, while others held breeding jackdaws Corvus monedula and had the potential to support other species such as house sparrow and starling. Building 5 had two pairs of house martins Delichon urbicum nest-building beneath the eaves, and a pair of starlings also breeding in a hole beneath the eaves.

4.13 In order to avoid the development having an adverse impact on the present bird population, the works should be completed outside the bird breeding period of March to August, or once the area has been cleared by an ecologist.

Conclusions and recommendations

Great crested newts

4.14 The maximum number of GCN caught in pond 1 on any one occasion was 40 newts which represents a moderate breeding population.

4.15 Any development that affects suitable terrestrial habitat for GCN within 250m of pond 1 or pond 5 is likely to result in an adverse impact on GCN in their terrestrial life stages, such that site clearance and construction may need to be implemented under the auspices of a GCN development license once planning permission is granted. In the long term, consideration should be given to creating a new GCN population in suitable habitat elsewhere within the Cranfield Campus.

Reptiles

4.16 Prior to any development of the rough grassland area I the south of the site (see figure 2.1), a reptile survey should be completed during the reptile active period of April to October to verify reptile presence/absence.

Bats

4.17 The buildings identified as having bat roost potential should be subject to internal (roof void) inspections by a suitably experienced ecologist and bat worker.

4.18 In addition, the buildings identified as having bat roost potential should be subject to emergence/re-entry surveys during the peak bat active period (May to August). Low suitability buildings should be subject to one dusk emergence or dawn re-entry survey; moderate and moderate/high suitability buildings should be subject to up to three separate emergence/re-entry surveys in line with best practice guidelines.

Birds

4.19 Vegetation clearance to enable development, or the demolition of any buildings identified as having the potential to support nesting birds, should be completed outside the bird breeding period of March to August, or immediately following a check by an ecologist that breeding birds and their dependent young are absent from the area.

Drainage

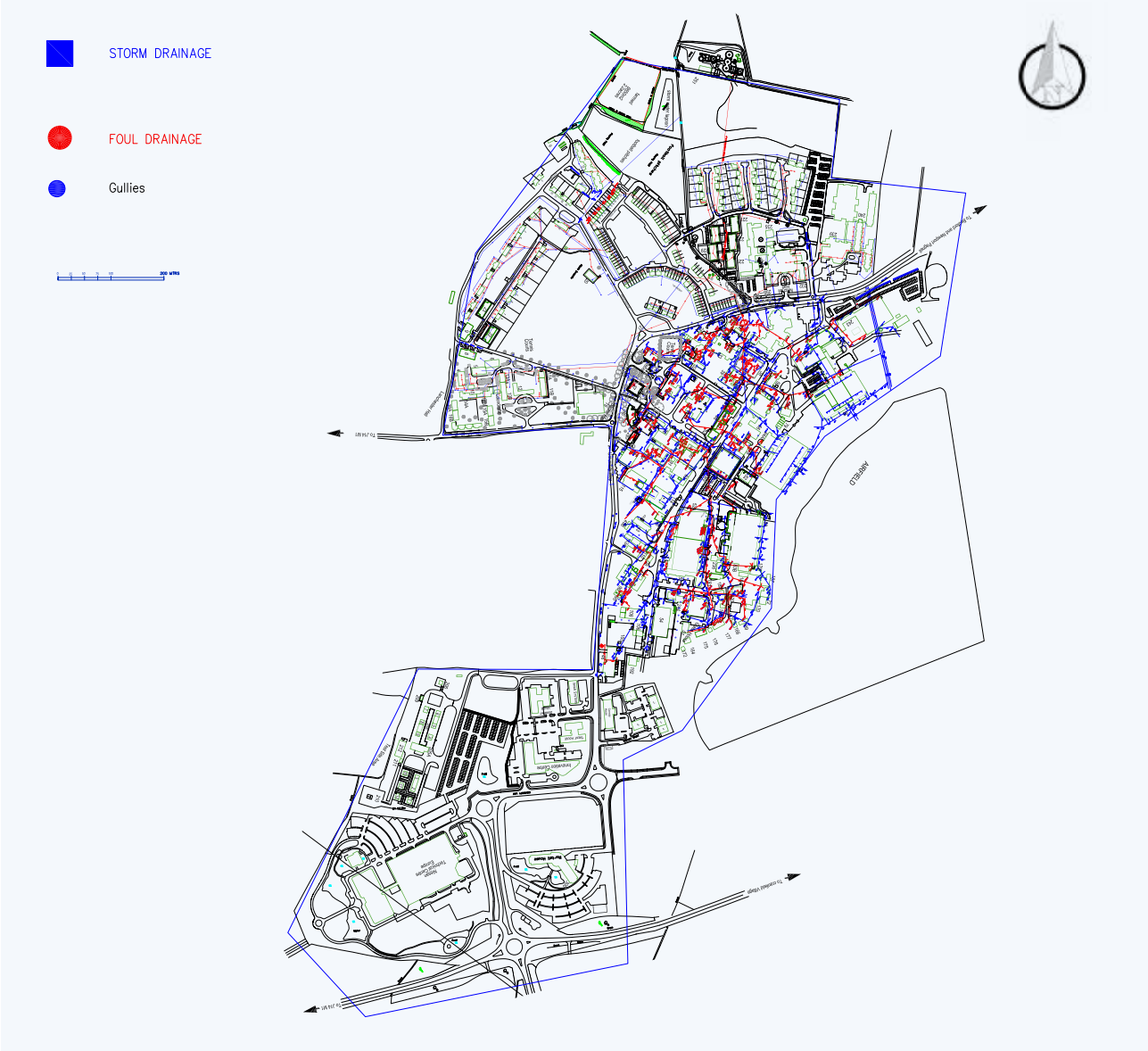
4.20 The existing stormwater drainage on the site is extensive and complex. Works have been carried out throughout the life of the overall site which may not have been accurately recorded or indeed, not recorded at all.

4.21 Through dialogue with the University's Estates and Facilities team a review of the existing site drainage has been undertaken. This involved a site walkover to view the key elements of the drainage network and also involved a review of all available including that in archive. Through this review certain issues were raised and generally related to the academic zone and also the residential and recreational zone, the following points were highlighted:

- Maintenance issues such as tree root ingress and also partial collapse of sewers within the academic zone causing surcharging of the network upstreams
- Flooding issues associated with the large former hanger buildings on the campus which are now part of the Universitys
- Occasional pollution incidents generated within the campus potentially affecting downstream watercourses.

4.22 As a result of the first two issues noted above the Estates and Facilities team have been undertaking a programme of maintenance and survey works to determine pipe size and invert levels on the stormwater network within the academic zone, this work is ongoing. The image below illustrates the current drainage records available.

Drainage strategy



Existing drainage catchments

4.23 The airport site is drained via an extensive network of land drains which were constructed originally with the airfield. The runway and taxiway areas are drained via perimeter french drains. The stormwater is collected via a network of pipes which convey the stormwater and groundwater to an outfall position into a watercourse adjacent to college road which flows to the south-west for a distance before heading north into the residential and recreational zone.

4.24 The receiving watercourse is directly linked upstream to a watercourse which crosses the airfield and defined the original airfield boundary prior to the northern runway extension being constructed. This section of the watercourse collects stormwater and groundwater from the northern part of the airfield.

4.25 The academic zone is heavily developed and is drained via a gravity stormwater network which broadly follows the site topography. The stormwater drainage for the eastern side of the campus, including the large former hanger buildings, connects to the piped network from the airfield close to the low point of the airfield. There are 3 x 450mm diameter sewers which collect all of the stormwater from these areas which outfalls via a headwall into the watercourse, as noted above.

4.26 The watercourse which is located parallel and adjacent to college road appears to be a former natural watercourse which may have been realigned and re-profiled historically and now has the form of a steep-sided ditch.

4.27 There are also field drains and ditches on the western side of college road which connect to the receiving watercourse for the campus and airfield which are part of the wider catchment area but outside of the site ownership boundary.

4.28 There is also a watercourse which is located parallel with university way on the eastern side which flows south to north. This is in the form of a re-aligned and re-profiled ditch and receives stormwater discharge from the western side of the campus. There are sections of this watercourse which have been culverted. This watercourse flows to a point where it meets the similar feature flowing in the opposite direction carrying the stormwater flows from the airfield and eastern side of the campus. At this point the watercourses effectively combine and flow to the north below college road via a concrete box section culvert. From this point the watercourse enters the residential and recreational zone and becomes briefly more naturalised. The watercourse is known as chicheley brook to the north of college road.

4.29 The residential and recreational zone generally comprises suburban streets with significant green spaces between in the form of grassed areas and playing fields. In addition, located close to the northern boundary, there is a wooded area.

4.30 The developed areas are drained via a stormwater drainage network which outfalls in several locations into the main watercourse (chicheley brook) which flows to the north. This watercourse is the primary means of conveyance of stormwater from a significant proportion of the airfield and also effectively all of the academic zone and residential and recreational zone. Chicheley brook appears to be a natural watercourse which has been historically channelised in sections and also significantly re-profiled such that it has the form of a steep-sided drainage ditch for much of its length.

4.31 At the northern boundary of the site chicheley brook continues to flow north through farmland. It has the appearance of a more naturalised watercourse from this point.

4.32 There is an off-line stormwater storage feature located adjacent to Chicheley Brook on the western side at the northern boundary. This is known as the 'Lagoon' as referred to previously. The title is somewhat misleading as the feature is effectively a detention basin and is dry for the vast majority of the time. There is a flow control device within the watercourse which effectively causes the feature to fill when there are significant flows upstream during a storm event. The stored water flows back into the watercourse when the flows are returned below the limit of the flow control device. The flow control device is a concrete weir with an orifice however during visits to the site during 2015 and early 2016 the orifice size had been artificially adjusted with timber. We were advised by the Environmental team at CU that this was in response to control of potential pollution incidents.

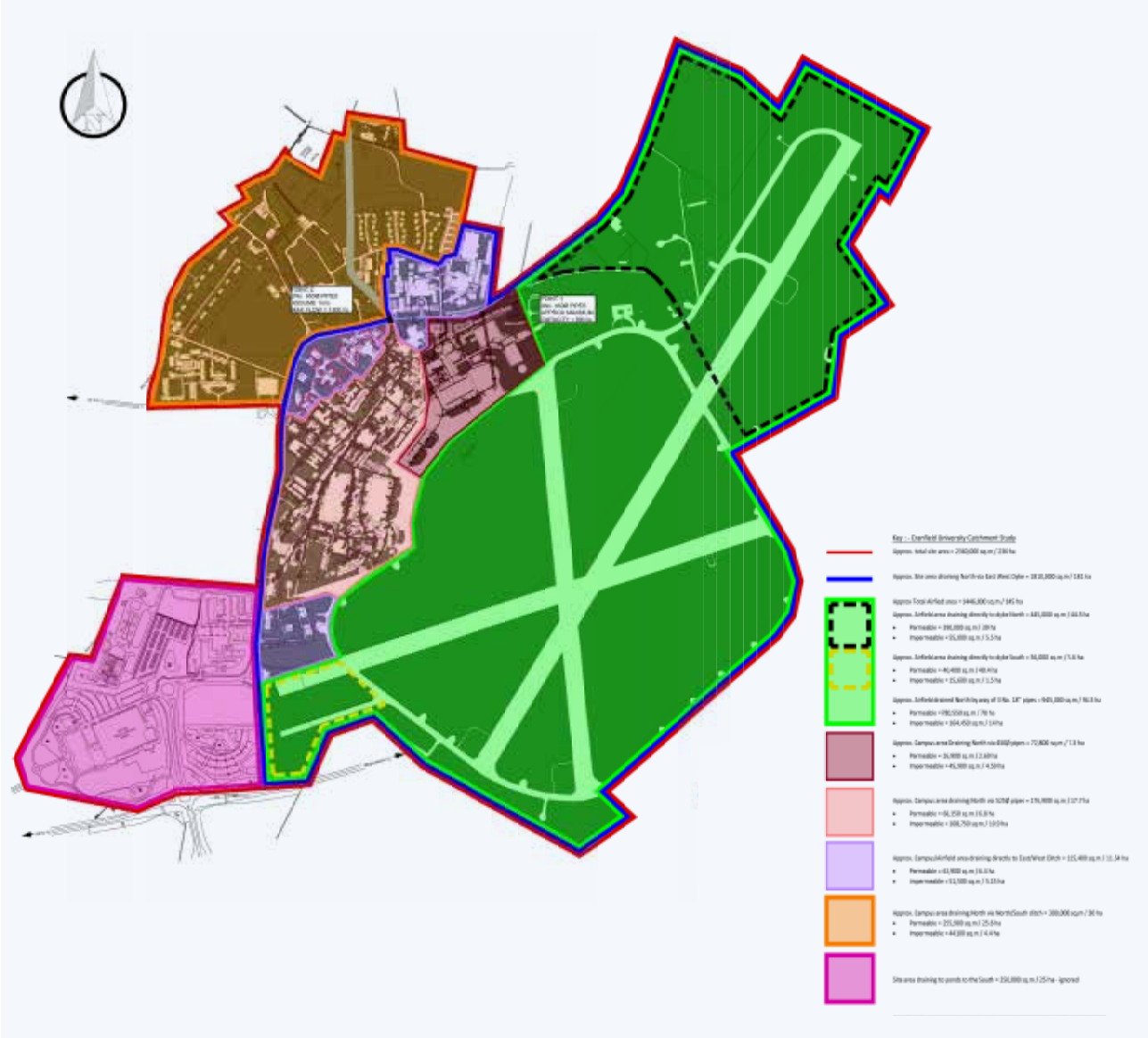
4.33 The form of the Lagoon is a grassed depression. The feature is fenced off from the watercourse and playing fields to the south and there is no clear means of access. It also appears that there is no maintenance regime in place for the Lagoon which is heavily vegetated.

4.34 There is also a wastewater treatment works located close to the northern boundary which is a private facility which receives domestic waste water from the academic and residential and recreational zones. The treated water discharges into the chicheley brook at the northern boundary.

4.35 The stormwater network for the existing technology park effectively operates independently of the campus to the north and the airfield. This is principally due to the topography as detailed above whereby the high point of the technology park site is close to the southern boundary of the academic zone and therefore much of the existing infrastructure and buildings are constructed at a lower level further south.

4.36 When the road infrastructure was re-aligned and reconstructed in the early 1990's the associated drainage to receive discharge from future plot developments was constructed to flow to the south. This is a piped network which flows south and then west from the roundabout following the road alignment. There is a pond located to the south-west of the Innovation Centre which is used to control and provide storage for stormwater discharge. The outfall from the pond flows to the west and then discharges into a watercourse located adjacent to the western boundary. This drainage (apart from the pond) is adopted by Anglian Water.

Surface water drainage existing catchment study



4.37 The stormwater drainage for Martell House is a separate network to the above. This is a piped network which was designed to receive discharge from the currently undeveloped plot to the north of Martell House plus the Martell House site itself. This flows to the south of the car park to Martell House and discharges into a detention basin on the southern side of the adopted highway known as Cranfield Road. The outfall from this feature flows to the west below the highway and discharges into a watercourse which flows to the south.

4.38 The southern part of the Nissan Technical Centre to the south-west of the site has an independent stormwater network which discharges to a natural watercourse further to the south-west. The northern part of the Nissan site outfalls into the adopted Technology Park drainage network to the north.

4.39 The Anglian Water plans show the adopted foul water drainage from the Technology Park. Note that there is a pumped main which flows to the east adjacent to the southern boundary of the site.

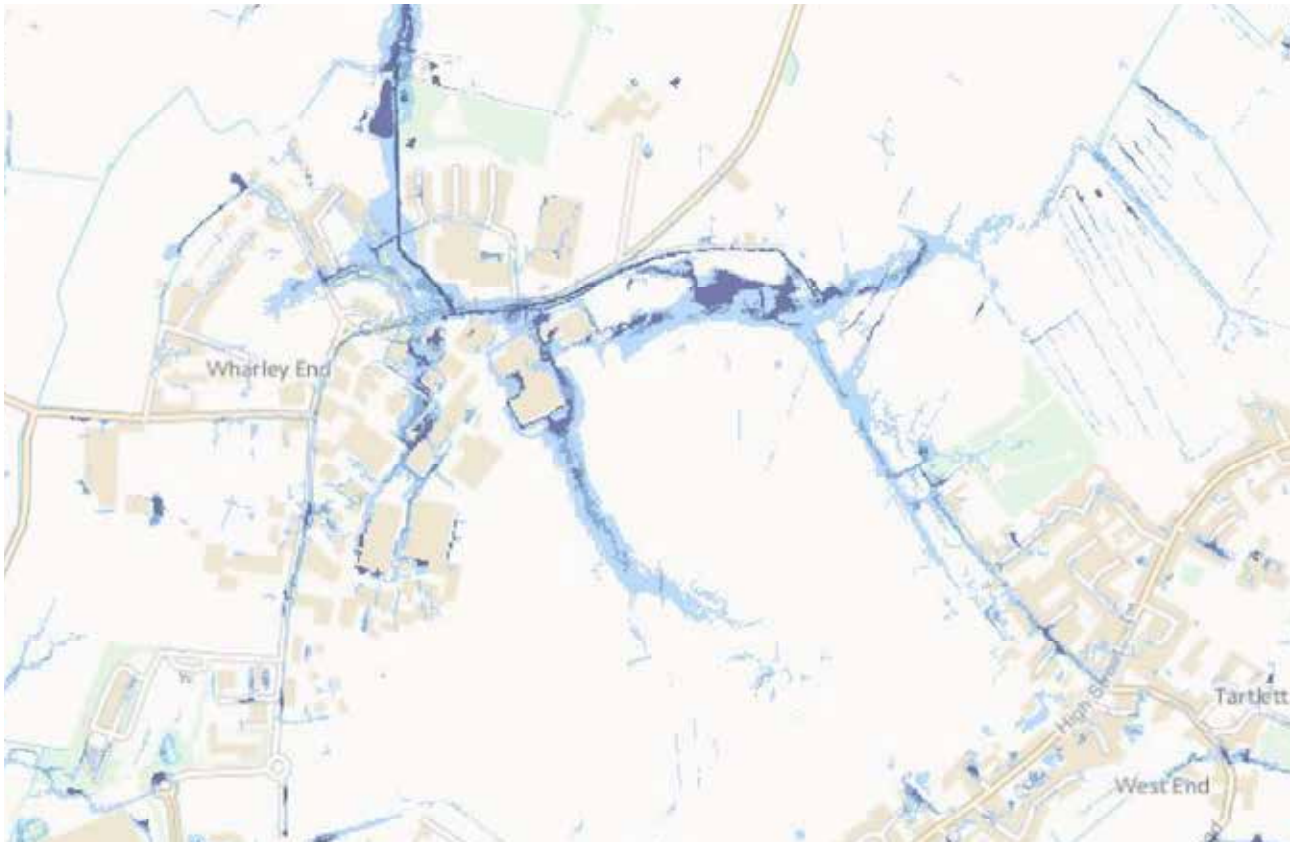
Existing flood risk

4.40 Presently, the campus is not specifically referred to in Central Bedfordshire Council's Preliminary Flood Risk Assessment or Local Flood Risk Management Strategy. However the Council have recently engaged an external consultant to carry out a Strategic Flood Risk Assessment (SFRA) of the area in support of its new Local Plan.

4.41 The Environment Agency records indicate the following:

- There is no major flood risk from rivers and sea. There is evidence of flooding to Chicheley Brook however this is significantly further north of the site boundarys.
- There is no flood risk on the site from reservoirs.
- There is some risk of flooding from surface water, and this is shown on the Environment Agency flood map below. The areas at risk appear to be associated with the watercourses particularly to the Chicheley Brook and also to the watercourse to the northern section of the airfield. Note that there is flooding risk associated with the discharge from the southern part of the airfield close to the connection with the Academic Zone.

Environment agency flood map



Flood event – June 2016

4.42 A significant storm event occurred in the Cranfield area on the evening of 7 June 2016. It is understood that based on published rainfall data the storm was approximately a one in 30 year event.

4.43 This storm event resulted in major surface flooding of the main campus area in addition to flooding of varying severity within approximately 30no. of the University buildings. It is also believed that watercourses within the campus area and also further downstream overtopped in a number of locations.

4.44 A detailed investigation would be required to assess the specific issues and the mechanisms which took place within the catchment and campus area stormwater drainage network during this event. However based on observations made during and after the storm event it is reasonable to conclude the following:

- Localised surface flooding occurred due to insufficient capacity within the existing stormwater network. This was probably due to a combination of inadequate local capacity or design issues, defects or inadequate maintenance and also downstream issues causing surcharge of the network.
- Restrictions on flow capacity and/or insufficient watercourse capacity caused overtopping of the watercourses.
- There is evidence to suggest that inadequate drainage on higher parts of the catchment, including parts of the airfield, resulted in overland flooding towards the campus area and the low point of the site which would have significantly compounded flooding issues within the campus area.
- It is understood that the attenuation basin known as the 'lagoon' located close to the outfall of the site into the Chicheley Brook performed as per expectations during the storm event and the subsequent short-term period.

4.45 The storm event on 7 June 2016 effectively demonstrated the existing issues within the stormwater network on the site which are discussed within this report and it also strongly reinforces the requirement for the SuDS and stormwater management strategy to be implemented. If consistently and coherently applied during the delivery of the Masterplan, it is considered that the drainage strategy will will improve the overall situation and reduce the effects of major storm events in the future. However additional work will need to be carried out to assess the existing catchment and network. This is in order to understand where specific issues may exist and therefore identify and implement works independently of the Masterplan which could improve the existing situation.

Stormwater design philosophy

4.46 The stormwater philosophy throughout the delivery of the Cranfield Masterplan will be based on consideration of the existing conditions and hydrology and ensuring that the post-development conditions replicate the pre-development conditions as closely as possible. Therefore issues such as groundwater recharge and watercourse discharge capacities and locations will be a key element of the design approach. Specific existing site features will require particular consideration in respect of the development.

4.47 The existing watercourses and channels generally on the site will remain largely unchanged hydraulically. However some works may be carried out to the watercourse profiles for safety, amenity or biodiversity issues as part of a wider improvement and integration with the wider landscape strategy.

4.48 The stormwater management approach will vary significantly in detail throughout the various development areas defined by the Masterplan. However there will be a unified strategy in terms of aspirations and technical design criteria to be adopted. For example, development within the academic zone will be partially constrained by the existing stormwater drainage network and also space constraints. Conversely, proposed development within the Technology Park, particularly to the 'new' areas to the south-east, will allow greater opportunities for infrastructure SuDS features and also creative integration with the landscape design.

4.49 The overall stormwater management strategy will also be influenced by the sequencing and timescales for delivery of the Masterplan. For example, there will be SuDS features which are associated with the initial infrastructure design of a typical area within the development site and also SuDS features which are part of the individual plot developments or group of plots. This will be partly driven by financial constraints because infrastructure costs will generally need to be kept

as low as possible. Therefore, SuDS features associated with infrastructure development may need to be flexible in order to allow subsequent modification or expansion without compromising completed works. Temporary features and interim outfalls may also need to be part of the works. The outline strategy will provide guidance as to how this is to be achieved however the Masterplan will be a live and evolving document and therefore the detailed delivery of the stormwater management will need to be reviewed accordingly. Future changes to policy and legislation are also likely to influence detail.

4.50 The SuDS and stormwater management strategy is defined by identification of sub-catchments within the site ownership boundary and this is partly based on consultancy work carried out by Rodgers Leask Limited in 2008 and PPI Consultants in 1990. This involved a detailed catchment study which compared pre-development discharges with post-development and also reflected future planned developments within the Technology Park area. A number of the future planned developments are part of the Masterplan on the basis that the final Technology Park area comprises completion of the original site layout in addition to the extension of the Technology Park into the airfield area.

4.51 To ensure the successful operation of SuDS features and to encourage a more integrated SuDS scheme it is proposed to limit the size of individual storage areas incorporating them into the built environment without compromising the key aspects of the urban design and layout. For example, use of public realm areas of the proposed layouts will be used where suitable as part of the infrastructure SuDS management train.

4.52 All proposed stormwater drainage including SuDS features are to be constructed on private land within the site ownership boundary. As such, there is no intention at this stage for Local Authority adoption of the proposed drainage system.

Stormwater technical design criteria

General

4.53 The following sections describe the technical criteria for stormwater design to be applied to the Masterplan development site. The design criteria are partly based on scoping opinion from the preconsultation process and also based on assessment of available legislation and technical guidance documentation.

Specific technical design criteria

4.54 The SuDS treatment train philosophy will be applied for delivery of the Cranfield Masterplan, utilising a sequence of SuDS features arranged to ensure run-off passes through the required number of treatment levels prior to reaching the receiving watercourse.

Levels of Treatment:

- Run-off from roof areas to be provided with one level of surface water treatment.
- Run-off generated by residential paving, car parking areas and shared surfaces will be provided with two levels of surface water treatment.
- Roads will also be provided with two levels of surface water treatment.

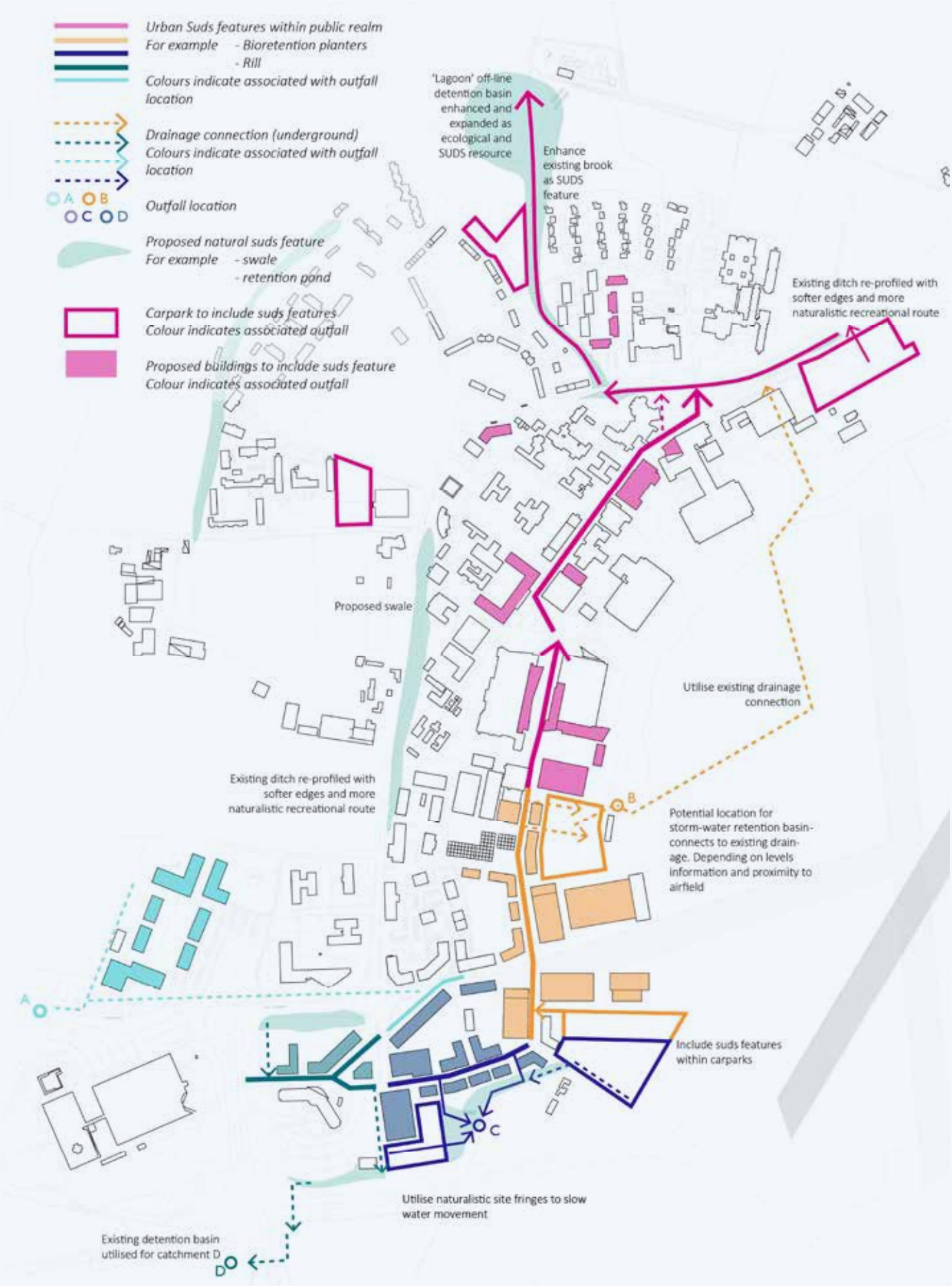
4.55 A series of SuDS features will be adopted which depend on the specific technical requirements for each phase of the works. Typically these will include the following:

- Specific plot development private ‘at-source’ features such as rainwater harvesting; green roofs (where applicable); private permeable paving; soakaways and filter trenches.
- Public ‘at-source’ features such as permeable paving; bioretention planters.
- Infiltration basins and swales.
- Detention basins.

4.56 Greenfield run-off:

- Existing greenfield runoff rates and volumes will be estimated to determine the acceptable post development discharge rate(s) which will be limited to that produced by the critical duration of the one in two year event. This will quantify interception, detention and long term storage requirements for all storms up to and including the one in 100 year event without creating the risk of flooding to buildings or emergency access ways from flooding.
- The method for greenfield run-off calculation adopted is the Institute of Hydrology Report 124 as applied by the Joint DEFRA/EA publication; ‘Preliminary Rainfall Run-off Management for Developments’.

Stormwater Design Diagram



4.57 The development will be drained in areas based on the existing topography and flows from each area will be directed to existing watercourses and outfalls at the controlled rates. Local storage and infiltration is proposed in order to retain and dispose of at least the first 5mm of any storm event, known as interception storage. Extended detention basins will be created to provide the long term storage requirements and will be in the form of large depressions incorporated into large open spaces such as parks and green spaces.

4.58 Traditional piped surface water drainage will be designed to a minimum velocity of 1 m/s for pipes receiving direct surface water run-off and 0.3m/s for those only receiving overflow discharge from SuDS features.

4.59 The pipe networks will be designed for no surcharge during the one in two year event and no flooding during the one in 30 year event.

4.60 Downstream SuDS features will need to be designed for exceedance events i.e. greater than one in 30 year to provide Long Term Storage (LTS).

4.61 Hydraulic design of SuDS features will generally be carried out in accordance with CIRIA C753; The SuDS Manual.

Stormwater design proposals

4.62 The Statement sets out the stormwater strategy however the detailed SuDS and stormwater design will require all aspects to be considered and balanced in terms of cost, sequence, programme, buildability and technical issues prior to final selection of the stormwater management solutions for each of the development areas defined by the Cranfield Masterplan. Consultation with CBC and other stakeholders will be required on an ongoing basis.

Residential and recreational zone

4.63 Masterplan includes a fundamental strategy to relocate car parking from within the central campus area to peripheral locations within the residential and recreational zone and also the extended technology park areas. In terms of sequencing and programme these works are to be generally carried out early in the timeline of the Masterplan delivery. In respect of the Residential and Recreational Zone there are car parks to be constructed in the following locations:

- Adjacent to the existing sports centre.
- Within the Residential area.

4.64 The detailed design process for both of these facilities is well progressed. Consultation with the consulting engineer and also the landscape architect has been undertaken. The stormwater proposals for both areas is based on the strategy detailed within this document and the design incorporates permeable block paving to car parking bays in conjunction with a tanked voided sub-base. Filter drains with perforated pipework receive discharge from these areas. This arrangement will store and attenuate flows to the appropriate greenfield run-off rate. For the residential car park there is also an under-drained swale adjacent to the paved areas which then outfalls into the adjacent Chicheley Brook.

4.65 The SuDS strategy will provide two levels of treatment from car parks and access roads.

4.66 There are also proposals to develop further accommodation within the residential and recreational zone. In general this is located in areas which are on plots occupied by existing housing and accommodation blocks. It is likely that the overall impermeable area will be marginally greater than existing and on this basis localised SuDS features will be required to limit discharge to greenfield run-off limits due to any nett increase in impermeable area. It is envisaged that these features may be shallow detention basins within the soft landscaping zones of the proposed developments. Outfall from these features to the receiving watercourse, Chicheley Brook, will generally be via the existing piped network.

4.67 It should be noted that the proportion of impermeable area within the residential and recreational zone is very low particularly compared to much denser development areas such as the academic zone and the technology park.

Academic zone

4.68 The academic zone is a well-established and densely developed area served by a significant stormwater drainage network. The Masterplan

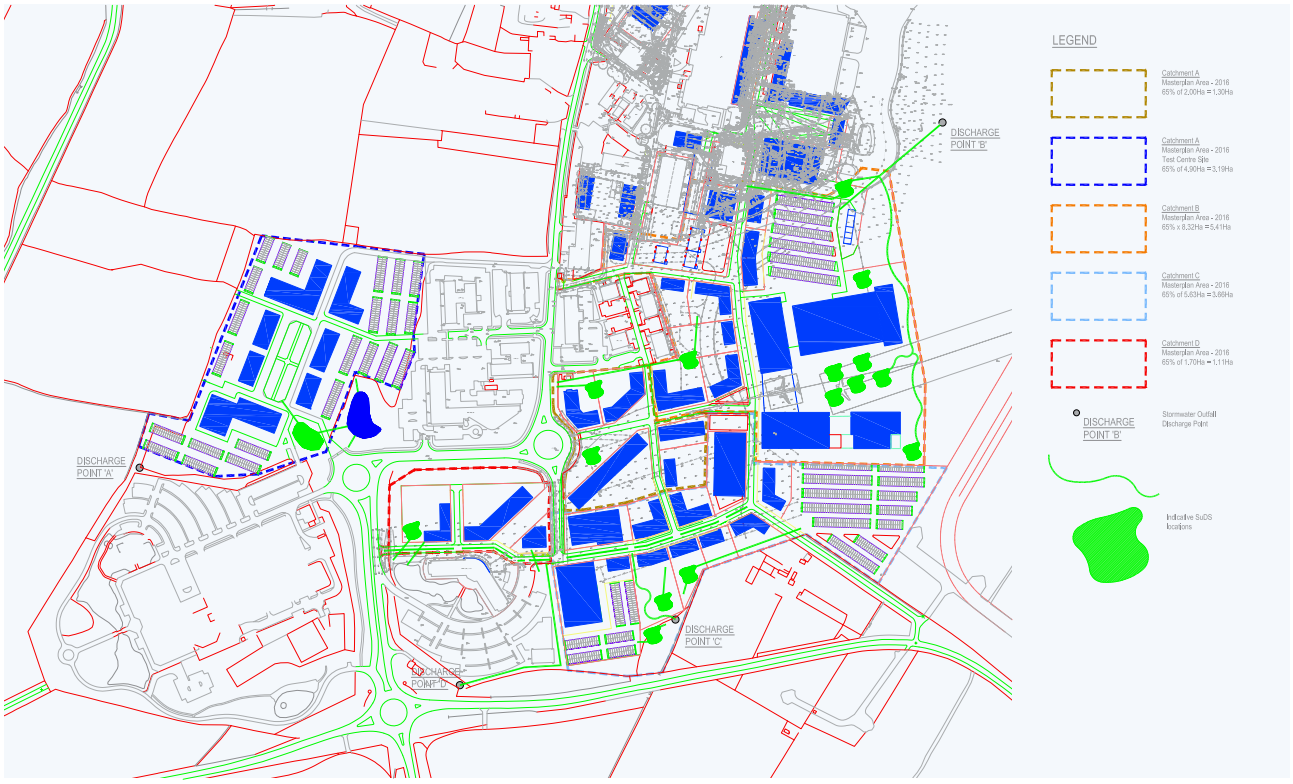
within this area is intended to achieve a more coherent and pedestrian-orientated campus experience by implementing the following:

- Removal of existing car parking within the central campus and relocating it towards the site periphery.
- Creation of key public realm areas.
- Removal of unsuitable and redundant buildings and replacement with new development plots.
- Extensions to existing buildings

4.69 In terms of the SuDS and stormwater management strategy this is envisaged as being delivered as follows:

- New plot developments within the established campus area will be assessed using the following criteria. A calculation will be made of the existing stormwater discharge from the specific area of the site under development. A calculation for the proposed impermeable area will be made and an associated calculation for permitted discharge carried out based on the design criteria advised by Central Bedfordshire Council provided during consultation dicussions. On the basis that the proposed value is less than 5l/s and the existing value is greater than 5l/s the plot will be designed for a maximum discharge of 5l/s. On the basis that the existing value is less than 5l/s the proposed development will be designed for the lower existing value. If the proposed value is greater than 5l/s the higher figure will be applied.
- The relocated car parks will occupy large areas and these are located at the north-east and also to the south of the existing academic zone which is effectively within the extended technology park area. The car park stormwater design will be assessed based on similar criteria to the plot developments within the campus. On the basis that these are large areas a maximum design discharge value of greater than 5l/s may be applicable.
- Public realm is likely to comprise hard and soft landscaped areas which again will be designed in accordance with the above criteria.

Outline strategy: proposed southern catchments



4.70 The preferred strategy would allow a coherent approach between SuDS feature design and construction for infrastructure and those associated with individual plot developments or groups of adjacent developments.

4.71 Where the opportunity for SUDs features is limited, for example for larger developments occupying relatively small plot areas storage may be limited to below-ground tanks or oversized pipes although this should be avoided wherever possible and an integrated design solution with the landscaping is preferred.

4.72 In general, the proposed developments within the campus area will discharge into the existing stormwater network. On the basis that improvement will be made in respect of reduction of discharge capacities and also improvements in water quality due to use of SuDS features the overall situation will be improved.

Airport

4.73 The airfield will remain largely unchanged except for the expansion of the Technology Park into the western area. The drainage in this area is a network of land drains and also French drains adjacent to the runways and taxiways. The drainage in the proposed Technology Park expansion area will be modified to suit the proposed works. As noted above, this is within Catchment 'B' and future outfall from the Technology Park developments will discharge into the airfield drainage as discussed within Section

Technology park

4.74 The Technology Park is the most complex area of the Masterplan in respect of stormwater drainage. There are effectively four sub-catchment areas (A, B, C and D) each with a defined discharge point which will receive stormwater discharges from both the existing and proposed development areas.

4.75 A key element of the proposed infrastructure to deliver the Masterplan is a section of new road which will effectively connect the Technology Park directly to the heart of the academic campus. This will commence from the existing adopted highway adjacent to Martell House orientated west to east across the north of Martell House and continuing further east before turning north and connecting to the existing site road. This section of road and associated services is a separate project planned to commence on site in 2017 and is known as the MUEAVI road project. This section of infrastructure will provide a new primary reception gateway to the overall campus and also provide access to the initial relocated car park facilities plus access to future development plots along its length.

Development site to north-east of Masterplan boundary

4.76 This development area is outside of the Campus Masterplan boundary but consideration of the impact on the existing and proposed academic zone and wider Masterplan area is required. In general topographical terms, the high point is close to the northern-most part of the runway. Therefore the northern half of the site will drain and outfall towards the north-east. This will need to follow the same SuDS and stormwater management principles however it should have little impact on the campus and Masterplan area.

4.77 The southern half of the site however slopes down towards Merchant Lane so stormwater management is more critical in terms of potential impact on the Masterplan area. There are existing watercourses which follow Merchant Lane and effectively collect stormwater from the whole northern catchment (i.e. from Merchant Lane up to the high point close to the runway extent). Historically, this northern area was a later extension to the original airfield and previously Merchant Lane and its associated watercourse ran across the site at the original boundary toward the village. The watercourses are now piped across the airfield and discharge into the remaining sections of open watercourse towards the west.

4.78 The aforementioned watercourse continues towards College Road and connects with the watercourse which follows College Road to the south-west. At the low point of the campus area all watercourses merge and turn north-west past Mitchell Hall towards the 'Lagoon' The southern half of the development area will be therefore discharging into the Merchant Lane watercourse and therefore could directly affect the whole campus stormwater network. The critical issue is to

ensure that the stormwater discharge post-development does not exceed the current discharge and ideally the proposed arrangement should be an improvement over the existing bearing in mind there are significant existing issues during major storm events. Clearly this will require a detailed SuDS and stormwater management strategy which follows the principles of the outline strategy for the Masterplan including an assessment of the existing stormwater drainage.

Additional recommendations

4.79 The existing arrangements within the Technology Park area can be summarised as follows:

Catchment 'A'
This is defined by the existing developments within the northern part of the Technology Park site. The original design allowed for stormwater discharge from both plot developments and infrastructure roads via private and adopted sewers into Discharge Point 'A' on the western boundary. This included an allowance for developments not constructed to the immediate south of Conway House and also included the impermeable area of the runway adjacent which will no longer be discharging into the Catchment 'A' stormwater network when the Masterplan is constructed.

The report issued following the Rodgers Leask simulation carried out in 2008 suggested the following:

- Balancing Pond 'A' had a capacity over 6000cu.m although their simulation indicated that the 100 year 60 min winter storm only required storage of c.3000cu.m.
- The flow from the catchment to discharge point 'A' was a controlled discharge of 252l/s. This value was based on a Catchment study of the pre and post-development situations.
- The impermeable area of the catchment used for simulation was 8.39Ha. This included 0.70Ha associated with a development area which has not been constructed and also 0.81Ha of runway/ taxiway which will be removed as part of the Masterplan delivery.
- The 1990's original design drawings by PPI Consultants were not available and the original design criteria used for the network and balancing pond were not known. The simulation was apparently based on detailed survey data

It is not clear whether allowances for Climate Change were included by Rodgers Leask in their simulations although it was requested by the EA at that time.

PDC have carried out a high level assessment to verify the accuracy of the Rodgers Leask report which suggested that for a one in 100 year event (including 20% Climate Change) the required volume would be in the order of 3000cu.m indicating that their simulation appeared broadly correct. A detailed simulation should produce a lower storage volume compared to a high level assessment.

Catchment 'D'
This is defined by the Martell House plot and also the development plot to the immediate north of Martell House which was designed to discharge into the stormwater drainage network constructed as part of Martell House.

The report issued following the Rodgers Leask simulation carried out in 2008 suggested the following:

- Balancing Pond 'D' south of Cranfield Road. The simulation indicated that the 100 year 600 min winter storm was critical which required storage of c.1200cu.m. This included a freeboard of 400mm although apparently up to 600mm is available
- The flow from the catchment to Discharge Point D was 14.2l/s based on a 100 year 15 minute summer event. Originally 11l/s had been agreed by the EA and Bedford and River Ivel IDB. The difference was apparently due to the fact that an orifice plate was installed rather than a Hydrobrake
- The 1990's original design drawings by PPI Consultants were not available and the original design criteria used for the network and balancing pond were not known. The simulation was based on survey data for the highway elements only.

It is not clear whether allowances for Climate Change were included by Rodgers Leask in their simulations although it was requested by the EA at that time.

4.80 The proposed arrangements within the Technology Park area can be summarised as follows:

Catchment 'A'
The Masterplan proposals include completion of the plot developments south of Conway House originally envisaged during the 1990's but not carried out at that time. The stormwater drainage network was designed to receive the associated discharge plus the runway adjacent, as noted above.

The proposed additional impermeable Area within Catchment 'A' is estimated to be 1.30Ha which is less than the impermeable area allowed which either has never been built or will be removed (1.41Ha). Due to the significant apparent capacity available within Balancing Pond 'A' the proposal would be to allow roof stormwater discharges from the Masterplan development area to discharge directly into the existing 600mm dia. sewer adjacent designed for this purpose. The hardstanding areas would require one level of SuDS treatment on plot. However it is recommended that a new simulation is carried out to demonstrate compliance with current design criteria.

The proposed Masterplan Catchment 'A' development area is likely to need to effectively increase, as discussed below, relating to probable levels issues within Catchment 'B'. On this basis, the new simulation would include the additional area, as appropriate. PDC have carried out a high level assessment to check the likely effect of increasing the Catchment 'A' development area. This suggested that for a 1 in 100 year event (including 40% Climate Change) a storage volume within the existing Balancing Pond 'A' would need to be c.4300cu.m. On the basis that the pond has an apparent capacity in excess of 6000cu.m this would appear to be a viable strategy. The increased Catchment 'A' impermeable area used for this high level assessment was 9.01Ha which ignored any future on-plot SuDS. Note that the outfall discharge into the watercourse would remain as per the existing value of 252l/s. A detailed simulation should produce a lower storage volume compared to a high level assessment.

There is an existing plot site located to the north-western part of Catchment 'A' which is referred to as the test centre site. The Masterplan includes redevelopment within this area which also includes an existing car parking area used by Nissan. The SuDS and stormwater management strategy will require a detailed study of the existing stormwater network and outfall in this specific location which is currently largely unknown. However, around half of the Nissan car park area appears to outfall into the adjacent Balance Pond 'A' and the other half discharges into the piped network downstream of the pond.

Therefore the strategy for this area would be to calculate the existing discharge into the pond and sewers and provide storage and attenuation for this wider development area to limit the proposed discharge to the existing figure. On this basis, a SuDS management train using 'at-source' features connecting to a defined green corridor commencing with the landscaped courtyard within the plot area linking to a green area adjacent to the plot boundary could be adopted.

Catchment 'B'
Catchment 'B' and the associated Discharge Point 'B' are within the Technology Park expansion area which is currently part of the airfield. The strategy for this area is to provide approximately 50% of the storage and attenuation required as 'at-source' features and 'on plot' features with the remaining 50% provided within the wider area landscaping. This could be a series of under-drained detention basins located to the runway axis area. This would allow the duration for visible storage to be limited to 24 hours for a one in 30 year event which is deemed to be the maximum time permitted given the close proximity of the airfield. The outfall from these features would connect into the car park outfall which ultimately connects to the existing airfield drainage at the notional Discharge Point 'B'.

As discussed within the Catchment 'A' section above, we believe that there may be a levels issue with the proposed Masterplan developments to the west of Catchment 'B'. This is because the topography is flat in this location and also the outfall drainage to the east is shallow. On this basis, the preferred solution would be to include these developments within Catchment 'A'. This appears to be viable without any on-plot storage and attenuation however the plot developments in question would still need to be designed to meet the criteria defined within this document, prior to discharge into the existing pipework to the west. If implemented, this would however

reduce the storage demands for Catchment 'B' because the impermeable area would be significantly reduced.

The outfall from the MUEAVI road project which will be the first constructed works within this catchment will need to outfall, via bioretention planters, close to the north of the catchment boundary towards the airfield and will be designed as part of the outfall from the AIRC car park likely to be constructed at a similar time.

A high level assessment by PDC suggests that the total volume required to limit discharge from development areas to 4l/s/Ha will be around 5200cu.m in total, based on a one in 100 year event (including 40% Climate Change). This would be reduced assuming part of the Masterplan development areas within Catchment 'B' needed to discharge into the Catchment 'A' drainage network, as discussed above. In addition, this figure includes the whole development area but the MUEAVI road and AIRC car park will be constructed in advance of plot developments with attenuation and storage fully included to a greenfield run-off rate.

Furthermore, the above exercise excludes the previous pre-1990 impermeable area (2.16Ha) drained into the catchment discharge point. Discussion and agreement with CBC will be required on the extent that this value can be used to offset future discharge rates.

Catchment 'C'
Catchment 'C' incorporates all proposed development area as defined by the Masterplan. This comprises a section of the MUEAVI road as discussed above and also the plot developments and associated car parking which will be accessed via this section of proposed infrastructure.

Ideally the strategy for this area would allow all infrastructure drainage including SuDS features to be constructed with the MUEAVI road project which would allow subsequent plot developments to be connected to the infrastructure. Funding constraints may not allow this strategy to be adopted therefore the proposal is to provide a temporary outfall from the MUEAVI road to Discharge Point 'C'. This could comprise a piped section of sewer from road bioretention planters to the south of the future plots to a swale which then connects to the outfall into the existing ditch at Discharge Point' C'. A series of detention basins from the plot developments could connect to the swale at a later time. The integrated SuDS and landscaping design is envisaged to be naturalised within this area.

Subsequent plot developments will need to fund construction of sections of the permanent SuDS management train such that this can be expanded later as further plot development are added.

The strategy would separate roof stormwater requiring one level of treatment and external areas requiring two levels of treatment.

The proposed SuDS management train would be as indicated on the proposed catchment plan on page 22 which follows the natural site topography. This could be a series of under-drained naturalised detention basins allowing the duration for visible storage to be limited to 24 hours for a one in 30 year event which is deemed to be the maximum time permitted given the close proximity of the airfield. The outfall from these features would connect into Discharge Point 'C' via a headwall.

A high level exercise by PDC suggests that the total volume required to limit discharge from development areas to 4l/s/Ha will be around 3500cu.m in total, based on a one in 100 year event (including 40% Climate Change).This figure includes the whole development area but the MUEAVI road and southern car park will be constructed in advance of plot developments with attenuation and storage fully included to a greenfield run-off rate.

Furthermore, the above exercise excludes the previous pre-1990 impermeable area (0.77Ha) drained into the catchment discharge point. Discussion and agreement with CBC will be required on the extent that this value can be used to offset future discharge rates.

Catchment 'D'
As noted above, this is defined by the existing Martell House plot development in addition to the development plot to the north and also the section of the proposed MUEAVI road within this catchment area.

We believe that the existing drainage for the Martell House plot was designed to allow future connection close to the northern boundary. Unfortunately the as–constructed drainage information is not available and

therefore the detail of this connection cannot be established. It will be necessary to carry out a full drainage survey of the Martell House plot and outfall to discharge point 'D' to enable the detailed assessment to be made.

It is envisaged that the MUEAVI road will connect to a suitable point within Martell House plot following collection from bioretention planting within the proposed highway. On the basis that there is an existing detention basin on the southern side of Cranfield Road this will provide the required two levels of treatment from this area.

The development plot to the north has been assessed as potentially slightly smaller in area than assumed for the calculations carried out by PPI Consulting and Rodgers Leask. The Rodgers Leask simulation did not reflect the actual Martell House on-plot constructed drainage network to which the development plot will need to be added as per the original design intent. The detailed simulation reflecting the as-built drainage plus current design criteria will need to be done to determine the volume of on-plot attenuation within the development plot to the north. This is envisaged to be in the form of detention basins and swales draining the external areas. The roof water will connect directly to the existing network. Suitable piped connection will need to be constructed as part of the MUEAVI road project below the road construction for future use.

A connection from the MUEAVI road project bioretention planters will need to be formed into the head of the existing on-plot drainage to Martell House or connected at the south of the car park.

It should be noted however that the existing feature pond to Martell House is apparently not fed via roof stormwater and requires topping up using mains water. A feed from the roof water of Martell House or the proposed plots would be a sensible revision to the existing plot drainage. A pipe will need

4.81 A Flood Risk Assessment (FRA) for all major plot developments and sections of infrastructure road will need to be carried out. This will influence the detailed design of the SuDS and stormwater based on the outline principles established within this document.

4.82 Discussions have taken place throughout the Masterplan process with Central Bedfordshire Council in respect of potential improvements to existing watercourses and landscape in respect of amenity, biodiversity and environment. The key recommendations are as follows:

- Reprofiling of existing watercourses as part of wider landscaping strategy improvement works to create more naturalised profiles which would improve safety, visual amenity and biodiversity. These works would include construction of check dams along the length of the various watercourses to improve visual amenity and biodiversity.

- Remove fencing to the northern 'Lagoon' and carry out a suitable landscaping maintenance regime to allow general access and also creation of cycle and footpaths.

- Remove temporary flow control device to weir to Chicheley Brook close to the northern boundary and install a penstock for future flow/level control and pollution control. Also a watercourse maintenance strategy should be implemented in general but especially in this location.

- Carry out appropriate works to allow access into the wooded area to the east of Chicheley Brook with suitable cycle and footways linking to the lagoon and wider residential and recreational zone.

- Install penstocks to existing manholes within key main sewers to the existing stormwater network to the academic zone for additional flow and pollution control.

4.83 As part of this assessment, a high-level existing catchment study has been prepared. This suggested that pinch points within the network may exist although the assumptions made in respect of infiltration and time of entry are likely to be significantly different in practice. The culvert crossing to College Road is now a concrete box culvert rather than twin 900mm diameter pipes as shown on the original drawings. Therefore it is also recommended that a detailed catchment study involving measurement of flows and creation of detailed models is carried out in order to plan for future developments associated with the Masterplan and could be best achieved as part of a postgraduate research project.

Landscape and views

4.85 Cranfield sits within the area designated at the Forest of aid and enhance planting in this area which the Masterp'ans planting and landscape strategy respond to.

4.86 Development in this area must seek to enhance planting and the University's surrounding area of the University largely open and in some areas exposed. Within the campus, there is no sense of exposure owing to surrounding trees, woodland and the proximity of buildings.

4.87 There are three key landmarks currently on campus; Cranfield University library designed by Foster+Partners at the centre of the campus, Martell House to the South, and the Old Military Water Tower on University Way. The Centre of Competitive Creative Design (C4D) by Niall McLaughlin Architects is a building which sits in the shadow of the library but has its own strong character which could be emphasised more. C4D and the library frame the square which is full of poor quality planting and parking which detract from the quality of the space.

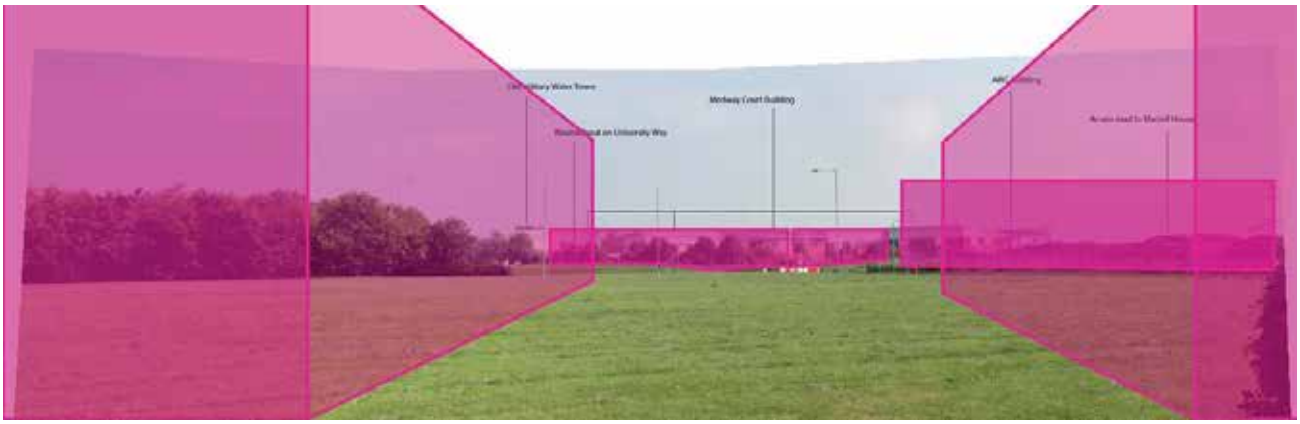
4.88 The airfield is also an identifiable feature for the campus, and while views out to the airfield are significant for the University's identity there are often occasions when these views are blocked by buildings or partially obscured by functional and often massive buildings such as the hangars.

4.89 Due to its slightly elevated location, Cranfield is visible from the adjacent Clay Vales although views are partially sheltered by woodland planting.

4.90 The following views of the University provide an indicative assessment of the visual impact of the proposed development. The views are not verified, and the building masses shown are indicative, however the following images provide an indication of the future impact of masterplan development.

Location of indicative views

Site appraisal photograph 1: View north from Martell House towards Medway Court



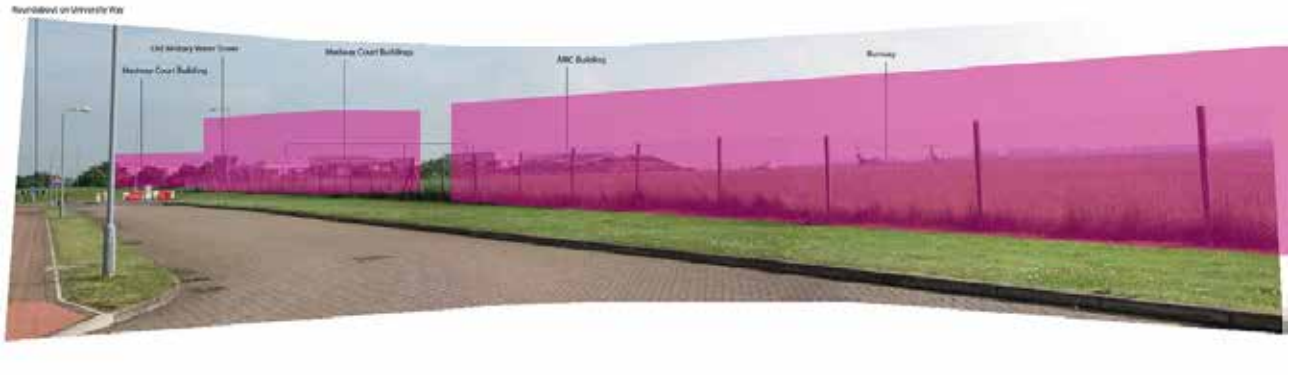
Indicative proposed site appraisal photograph 1: View north from Martell House towards Medway Court - indicative building mass shown in pink

View one

491 View north from the current rear exit of Martell House towards the campus. This looks across open mown grass towards the roundabout on University Way to the two storey buildings at Medway Court.

4.92 The proposed masterplan development will significantly change this view; new buildings are anticipated directly in front of Martell House as well as in front of the buildings at Medway Court. It is therefore important to visually connect Martell House to the main campus, linking views.

Site appraisal photograph 2: View north from access road outside Martell House towards Medway Court



Indicative proposed site appraisal photograph 2: View north from access road outside Martell House towards Medway Court - indicative building mass shown in pink

View two

4.93 This view is from the current access road to Martell House, overlooking the airfield which is predominantly cut grass.

4.94 The view will be significiantly changed by the proposed masterplan development; a new roundabout will be located at this junction, and proposed buildings will sit along the road screening views towards the airfield. The facades should be well considered as they will be prominantly visible from Martell House.

Site appraisal photograph 3: View north west from Cranfield Road across the airfield towards Cranfield University campus

Indicative proposed site appraisal photograph 3: View north west from Cranfield Road across the airfield towards Cranfield University campus - indicative building mass shown in pink

View three

4.95 This view is taken from Cranfield Road which connects the main vehicular entrance to the University to the south of Cranfield village. There are few vertical elements in the landscape to screen views across the airfield towards the University Campus. The three existing airport hangers are visible on the horizon, their façades broken up with small clusters of trees.

4.96 This view will be affected by the proposed development; however, the change will be low as the new buildings will sit in-front and alongside existing buildings. Continuing the small clusters of trees will help to break up the buildings structure. The existing hangars are quite attractive and iconic in the landscape.

Site appraisal photograph 4: View north west from Cranfield Road/High Street across south of airfield towards Cranfield University campus

Indicative proposed site appraisal photograph 4: View north west from Cranfield Road/High Street across south of airfield towards Cranfield University campus - indicative building mass shown in pink

View four

4.97 This view is taken from Cranfield Road at the south end of Cranfield Village High Street. The view is looking west over the open airfield, the University campus buildings are prominent on the skyline, in particular the new AIRC building. Martell House is almost fully screened by woodland.

4.98 The proposals will have an impact of this view, new buildings will screen the unattractive Medway Court buildings, and will extend along the horizon to meet the existing campus buildings. Continuing small clusters of trees will help break up the long building structure and screen the rear buildings.

Site appraisal photograph 5: View west from Merchant Lane across centre of airfield towards Cranfield University campus

Indicative proposed site appraisal photograph 5: View west from Merchant Lane across centre of airfield towards Cranfield University campus - indicative building mass shown in pink

View five

4.99 This view is taken from the end of Merchant Lane in Cranfield village, the houses on this lane do not face the campus directly. The view is over the open airfield with limited vertical elements in the foreground, planted woodland screens views to the north of the airfield and University campus. The campus is visible along the horizon with small clusters of trees providing visual breaks.

4.100 The proposed development will be visible to the south, however much of the development will sit in front of existing buildings. Continuing small clusters of trees along this section of the campus will help to break up the horizon and integrate the campus in to the setting.

Site appraisal photograph 6: View east from West Road towards Lanchester Hall student accommodation - no proposed changes to this view

View six

4.101 This view is taken from the western approach to the University and shows Lanchester Hall student accommodation. This view is far more enclosed than views from the east, wooded hedgerows line the roads and screen existing buildings.

4.102 There are no new buildings proposed in this view, it is proposed that the planting will be further developed to provide a habitat corridor around this edge of the campus.

Findings and recommendations

4.103 Views internal to the campus out onto the airfield will be maintained and enhanced to aid with circulation and provide a constant reference point along the campus. Views into existing and proposed landmarks will also be framed to aid with wayfinding and provide definition to routes and spaces.

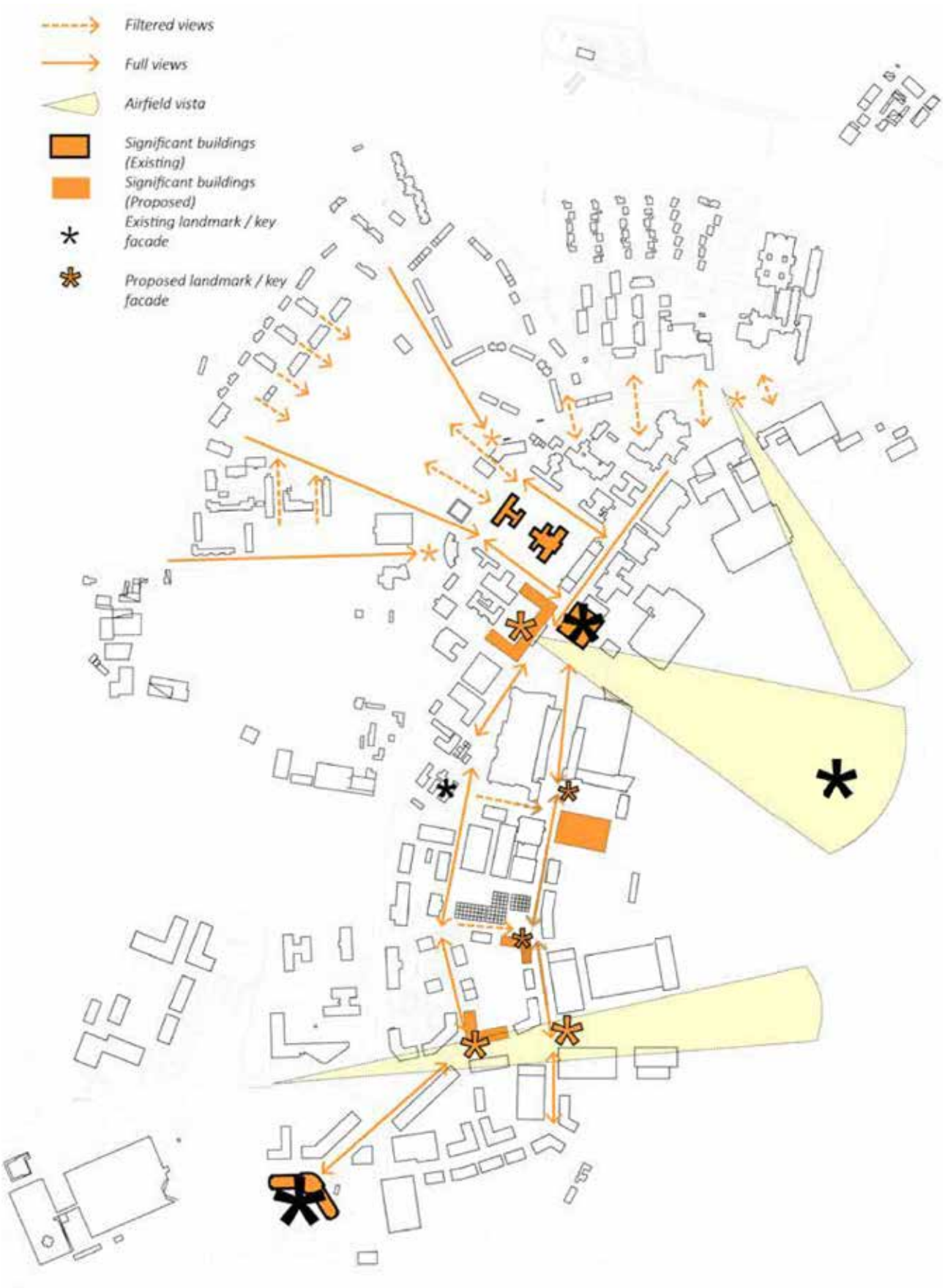
4.104 There will be a number of significant views through campus particularly on the north-south axis, these will be full views to aid navigation and will be defined by building structure and a wider planting strategy. There are currently a number of landmarks within campus and views to these should be framed and celebrated, these include views to Martell House and to Cranfield University library designed by Foster+Partners.

4.105 The airfield is also one of the University's key landmarks, airfield views are unique to the University and should be celebrated. The diagram highlights three key airfield views – one from the south entrance of college road, one from the north campus entrance, and one from the central plaza of the University. The airfield will also be used as a navigational tool, glimpse views between buildings will help visitors to orientate themselves.

4.106 Proposed buildings and landscape features should be located at key points at the end of full views to direct visitors across campus. The new north-south link road will be punctuated by a series of landmark features which can be co-ordinated with University faculties to further aid campus navigation and wayfinding.

4.107 External views from Cranfield village will be altered as a result of Masterplan development, however given the scale of development which currently abuts the airfield, future proposals are not considered to significantly alter long distance views into the campus. However, planting should be included in appropriate locations to provide visual breaks to build development.

Cranfield University: views, navigation and landmarks diagram



Transport

4.108 The objectives of this travel plan, as identified both by the University and through stakeholder consultation are to:

- Make alternatives to the private car, such as cycling and walking, easier and safer for staff and students to use
- Further promote and develop existing sustainable travel initiatives (car share/public transport)
- Extend the scope of the University's carbon management plan to include travel emissions and seek to reduce CO_2 from University associated transport.
- Tackle travel issues which have arisen as the University continues to develop and grow, for example increase in demand for car parking spaces;
- Make the Cranfield campus a more attractive environment to encourage student intake and improve staff working environment;
- Support future planning applications associated with the University

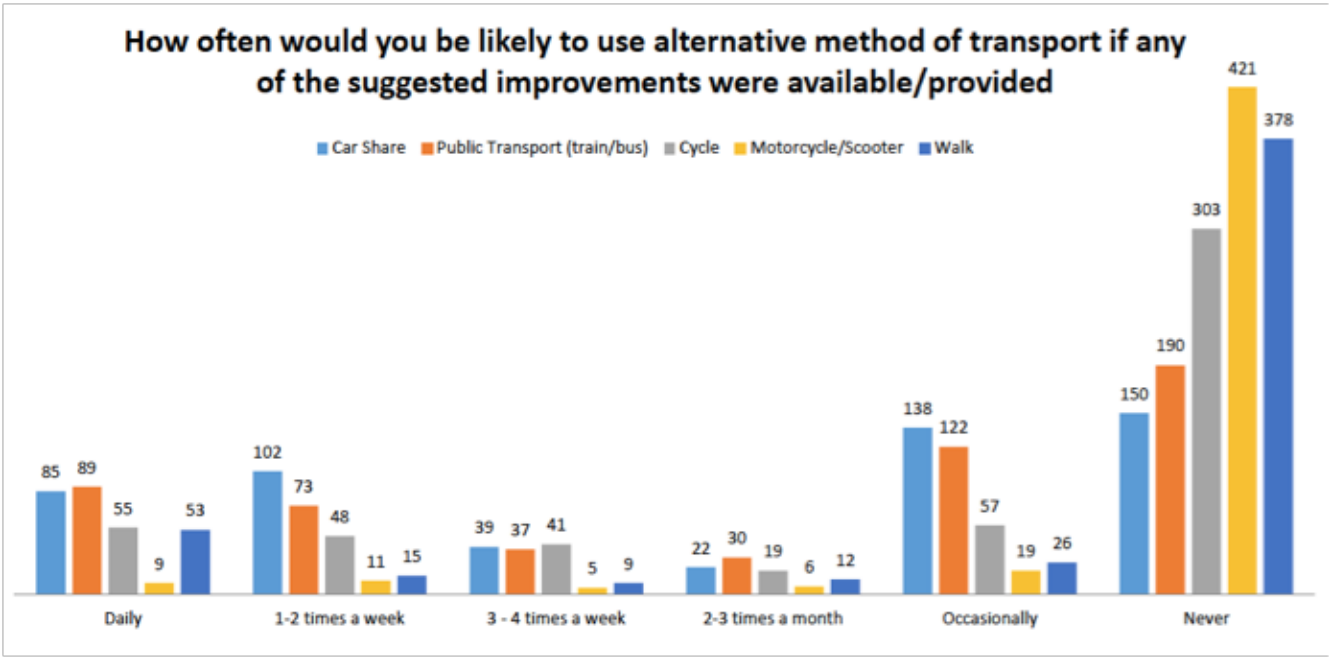
4.109 The travel plan also requires a travel summary to be conducted every year. When posed the question **'how often would you be likely to use alternative method of transport if any of the suggested improvements were available/provided?'** public transport scored the highest. Followed by car share for commuting on a daily basis (89 and 85 votes consecutively). The majority of people voted they would only liftshare/take public transport one-to-two times a week or on an occasional basis. Cycling would also be of high interest if the provisions were provided.

4.110 2014 v 2016: In 2016, there is an increase in people wanting to use car share, use pubic transport and cycle on a daily basis if improvements were in place. It should be noted that in 2016, using public transport on a daily basis scored higher than in 2014 (89 votes in 2016 compares to 63 votes in 2014). Cycling also scored higher compared to 2014 for a daily basis (55 votes compared to 40 votes in 2014).

4.111 Despite noticeable improvements in staff and students using 'greener' transport methods, there is still room for further improvement to encourage greater use of alternative transport. Car sharing has not increased in the same way that cycling and bus use have. So we will be focusing on improving this in particular. We will look at these and other ideas to help make continuous improvements to travel options.

4.112 Further details in respect of transport implications as a result of Masterplan development are set out within the accompanying transport statement.

Travel survey findings 2016



Chapter five
Conclusion

5.1 The Cranfield Masterplan defines a vision for the University's physical estate over the next 25 years, and this document, read in conjunction with the Masterplan, represents a significant step forward for the University.

5.2 This Statement summarises the position of the Cranfield Masterplan in planning policy terms, confirming that the Masterplan aspirations conform to both national and local policy.

5.3 The environmental reports which have been commissioned have been undertaken at a strategic level and set out key principals which future development projects will need to consider and address as part of detailed design, and further survey work were appropriate.

5.4 This Statement provides a number of detailed recommendations, and these are summarised below:

Ecology

5.5 Consideration should be given to creating a new Great Crested Newt population in suitable habitat elsewhere within the Cranfield Campus.

5.6 Prior to the development of the rough grassland area towards the south of the site, a reptile survey should be completed during the reptile active period between April and October.

5.7 The buildings identified as having bat roost potential should be subjected to internal inspections and emergence/re-entry surveys when appropriate.

5.8 Clearance of vegetation which may contain nesting birds should be completed outside the bird breeding period.

Drainage

5.9 A Flood Risk Assessment (FRA) for all major plot developments and sections of infrastructure road will need to be carried out.

5.10 Reprofiling of existing watercourses as part of wider landscaping strategy improvement works to create more naturalised profiles which would improve safety, visual amenity and biodiversity. These works would include construction of check dams long the length of the various watercourses.

5.11 Remove fencing to the northern 'lagoon' and carry out a suitable landscaping maintenance regime to allow general access and also creation of cycle and footpaths.

5.12 Remove temporary flow control device to weir to Chicheley Brook close to the northern boundary and install a penstock for future flow/level control and pollution control. Also a watercourse maintenance strategy should be implemented in general but especially in this location.

5.13 Carry out appropriate works to allow access into the wooded area to the east of Chicheley Brook with suitable cycle and footways linking to the lagoon and wider residential and recreational zone.

5.14 Install penstocks to existing manholes within key main sewers to the existing stormwater network to the academic zone for additional flow and pollution control.

5.15 A high-level existing catchment study has been prepared. This found that pinch points within the network may exist although the assumptions made in respect of infiltration and

time of entry are likely to be significantly different in practice. It is also recommended that a detailed catchment study involving measurement of flows and creation of detailed models is carried out in order to plan for future developments associated with the Masterplan and could be best achieved as part of a postgraduate research project.

Landscape and views

5.16 Views internal to the campus out onto the airfield should be maintained and enhanced to aid with circulation and provide a constant reference point along the campus.

5.17 Significant views through the campus will be defined by building structure and a wider planting strategy, and are intended to aid navigation.

5.18 Airfield views are unique to the University, and should therefore be celebrated. The airfield will be used as a navigational tool: glimpse views between buildings will help visitors to orientate themselves.

5.19 Proposed buildings and landscape features should be located at focal points across the campus, whilst the proposals contained within the Masterplan are not considered to impinge upon long distance views into the campus.

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