



- SuDS Management Train
- Permeable Paving
- Master-planning
- Major Development
- Shared Surfaces

paving

case study



GREAT WESTERN PARK
DIDCOT
OXFORDSHIRE

Interpave

THE PRECAST CONCRETE PAVING
AND KERB ASSOCIATION



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Introduction

This case study is part of a series exploring the application of current approaches to master-planning, urban design, hard landscape and external surfaces. In this case, we focus on the use of concrete block permeable paving as an essential part of an integrated sustainable drainage system (SuDS) management train throughout a major new development in Oxfordshire.

Great Western Park is being developed over 9 phases by a consortium led by Taylor Wimpey and David Wilson Homes. This case study considers aspects of the master-plan including street design and its integration with the drainage strategy based on SuDS principles. It then focuses on implementation within the partially completed first phase of the site.

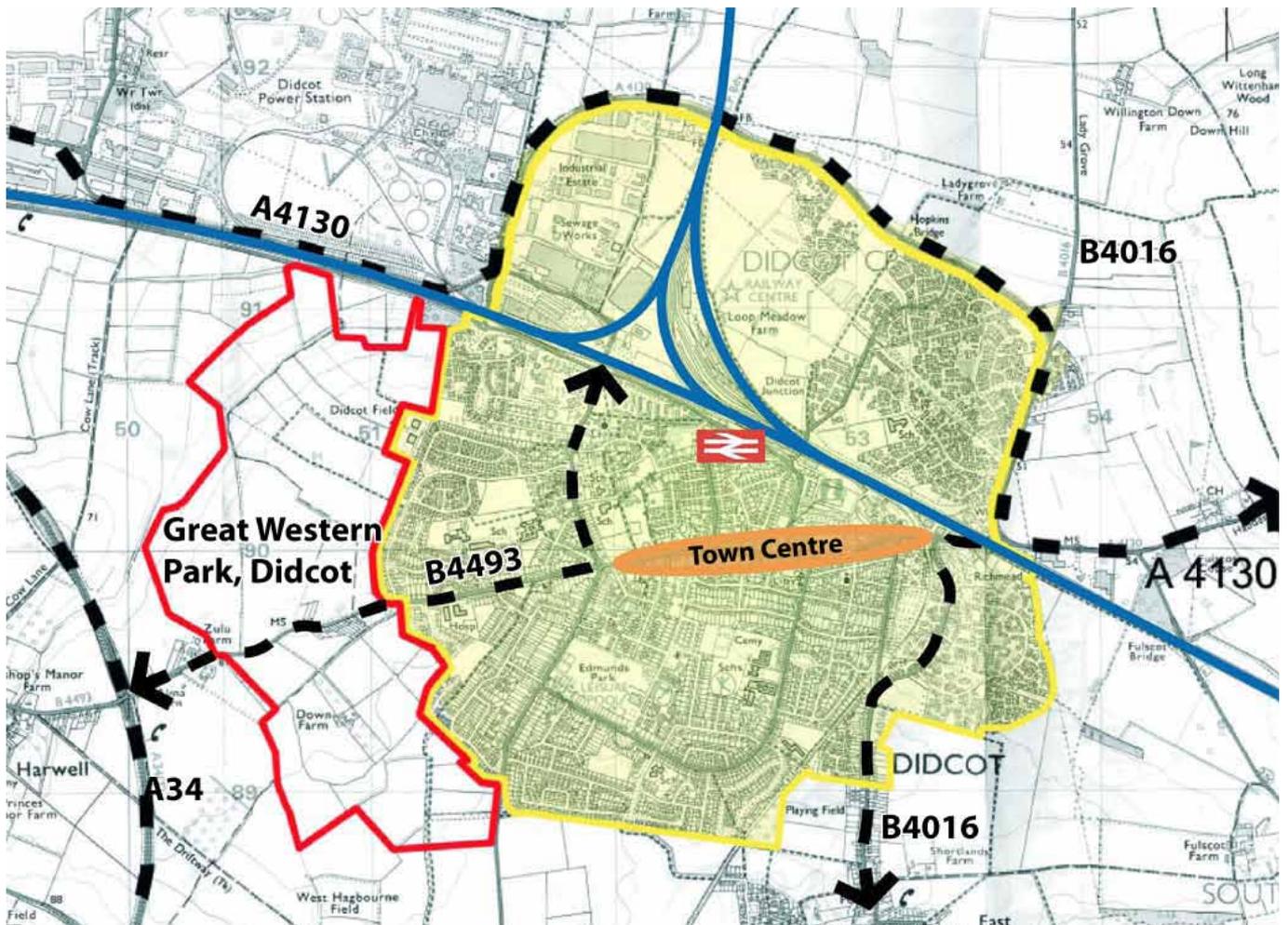
Oxfordshire County Council considers SuDS to be an essential component of any development and concrete block permeable paving as mainstream technology which it has been adopting for some 15 years. Oxfordshire advocates the close involvement of all stakeholders with the design process from the start and will be adopting much of the SuDS, including permeable paving, at Great Western Park. An earlier Interpave Case Study – Adoption in Oxfordshire – discusses this approach.

Context

Great Western Park is being developed on 160 Ha of essentially greenfield land to the immediate west of Didcot. Once complete, it will increase the urban area of Didcot by around 20%, eventually providing:

- **3,300 new homes** – with an average net density of 40 dwellings per hectare comprising: 30% 1 and 2 bedroom units; 35% 3 bedroom units; and 35% 4 plus bedroom units
- **a secondary school and two primary schools**
- **three mixed use centres** – incorporating shops, community buildings and homes
- **extensive informal public open spaces and formal sports facilities**

“It is essential for SUDS to be integrated as part of the project design from the very start with all parties on board.”



Master-planning Strategy

The site changes in character from north to south, with sloping land wrapping around the north and west parts, a plateau in the centre and gently sloping land to the south of Wantage Road which bisects the site.

The master-plan creates three areas, each with a distinctive character:

- **Northern Neighbourhood** – the 'gateway' to Great Western Park from the north with Main Street gradually changing from a rural landscape to an urban street environment as it passes south. Mature hedgerows are integrated into the development, creating green 'wedges'
- **District Neighbourhood** – the mixed-use 'heart' of the development with a strong urban character and streets giving a sense of enclosure reminiscent of Oxfordshire market towns
- **Southern Neighbourhood** – the final area for development where Main Street loses its urban character and formality.



The northern 'gateway' to Great Western Park with Main Street leading up into the development.

Valuable environmental features – including mature trees, hedgerows, semi-improved grassland, ponds and water channels – have been incorporated into the master-plan wherever possible.

Two of the 'Key Character Generators' identified in the Development Strategy are:

- Topographical conditions should be incorporated where possible to inform the public realm design.
- The incorporation of landscape features and structural elements, including water, can change the character of the public realm.

The development will create a new edge to Didcot, designed to present a green buffer to open farmland by retaining much of the western part of the site as open space.

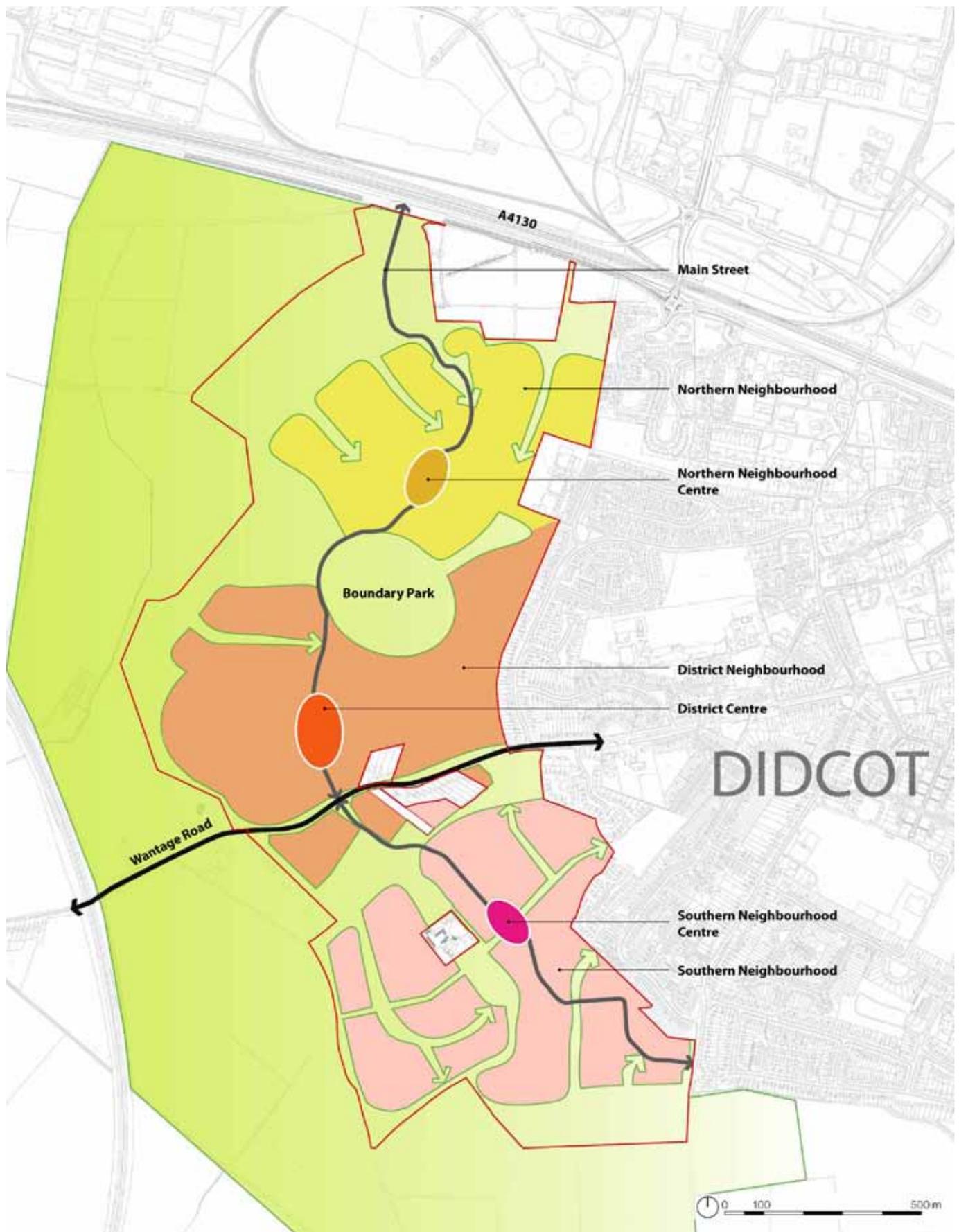


The Northern Neighbourhood takes on a more urban character.

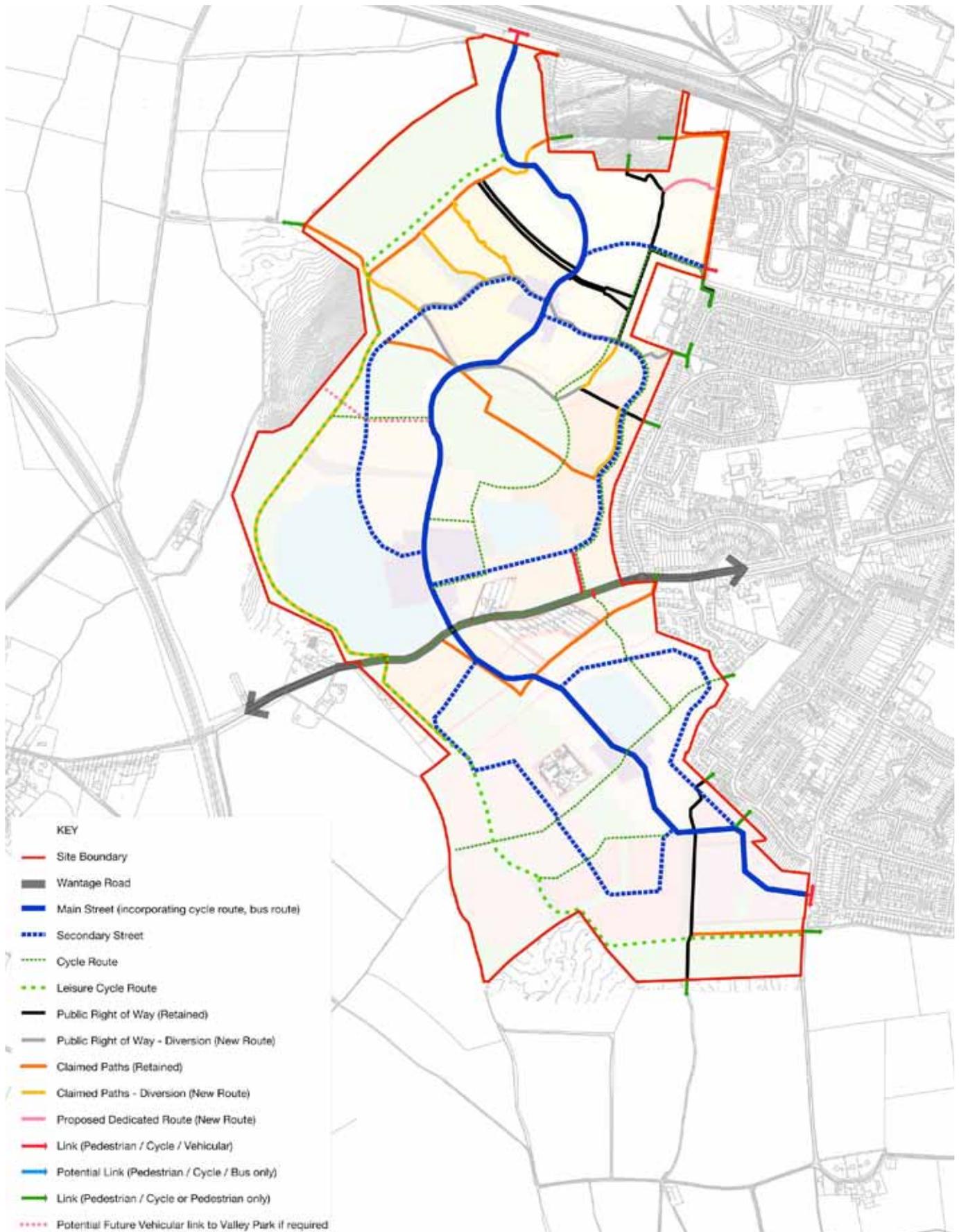
Street Hierarchy

Main Street forms the major bus route and incorporates cycle routes, while secondary streets provide direct access to larger residential areas within the development and, in some places, provide an alternative north-south route. Other hard landscaped spaces range from linear routes alongside existing hedgerows, to public squares and smaller shared surface spaces, connected by a series of green corridors. Permeability throughout the whole site is considered a key requirement.

Development Strategy



Street Hierarchy



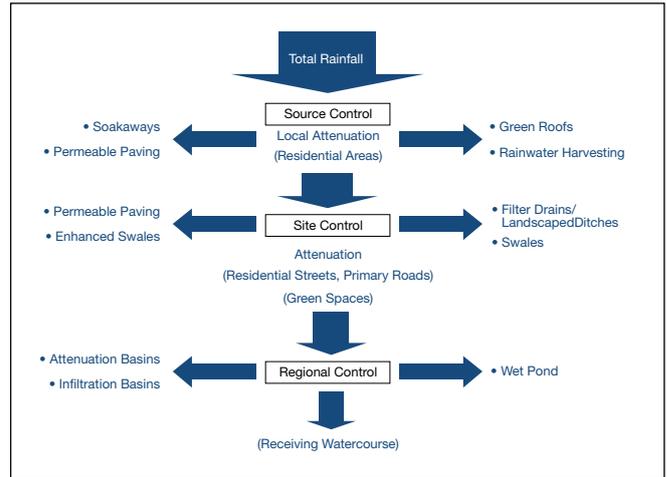
Drainage Strategy

Key to the drainage strategy is to embrace SuDS and develop the established 'SuDS Management Train' of: PREVENTION >> SOURCE CONTROL >> SITE CONTROL >> REGIONAL CONTROL.

- The three pillars of SuDS are to:
- minimise water runoff QUANTITY
 - improve water QUALITY
 - provide AMENITY and biodiversity.

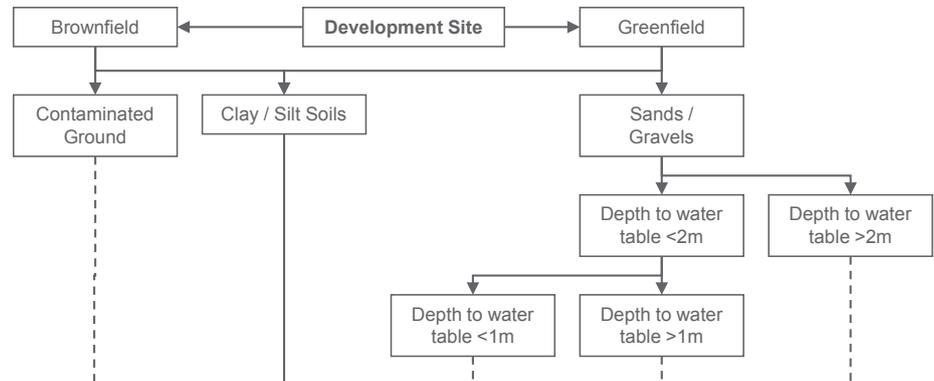
The designers used a 'SuDS Decision Tree' to select the various SuDS techniques for the Management Train.

At Great Western Park, concrete block permeable paving is being used widely as a source control, delivering all three of the above SuDS requirements. In addition to both attenuation and pollution source control characteristics, concrete block permeable paving also provides amenity with an attractive pavement surface suitable for trafficking, as well as a drainage system, and requires no additional land-take in the more urban areas. Additionally, water from permeable paving will be used for irrigating allotments as well as feeding wildlife ponds on this project.



“Surface water is attenuated on site up to the 1 in 100 year storm event + 30% for climate change. Discharge from the whole site is limited to 2l/s/ha, avoiding downstream flooding.”

Part of the SuDS decision tree



SuDS Feature	A	B	C	D	E
Soakaways (ring, house, modular cells, trench)	No	No	No	No	Yes (subject to freeboard)
Permeable Paving	Yes (lined with connection to drainage)	Yes (with overflow to drainage)	Yes (lined with connection to drainage)	Yes	Yes
Green/brown roof	Yes	Yes	Yes	Yes	Yes
Rainwater Harvesting	Yes	Yes	Yes	Yes	Yes
Filter drains	No	Yes (with overflow to drainage)	No	Yes (subject to freeboard)	Yes
Filter strips (requires soft landscaping)	Yes (lined)	Yes	Yes	Yes	Yes
Swales (requires soft landscaping)	Yes (lined)	Yes	Yes	Yes	Yes
Modular Storage	Yes (with suitable liner)	Yes	Yes (but consider floatation)	Yes	Yes
Bioretention (requires soft landscaping)	Yes (lined with connection to drainage)	Yes (with overflow to drainage)	Yes (lined with connection to drainage)	Yes (subject to freeboard)	Yes
Infiltration Trench	No	Yes (with overflow to drainage)	No	Yes (subject to freeboard)	Yes
Channets/rills	Yes (lined with connection to drainage)	Yes (with overflow to drainage)	Yes (lined with connection to drainage)	Yes (subject to freeboard)	Yes
Sand filters	Yes (lined with connection to drainage)				

SUDS ON THE GROUND – PHASE 1

Following completion of landscaping around the north entrance from the A4130, the first phase of housing development is being carried out just to the south, immediately above the escarpment of the hill facing the A4130. Rainwater drainage is dealt with using a SuDS Management Train consisting of:

Permeable Paving – forming part of the diverse concrete block surfaces used extensively within residential areas

Attenuation Basin – containing water storage tanks beneath its base connected to the nearby allotments for irrigation

Detention Basin and Pond – installed in 2010 to allow time to establish, increase biodiversity and encourage wildlife

Enhanced swale – serving the impermeable surfaced Main Street.

A conveyance ditch is designed to link source control measures (permeable paving, soakaways, etc.) to the wider area control measures.





Permeable Paving drains adjacent impermeable surfaces as well



Attenuation Basin overlooked by housing



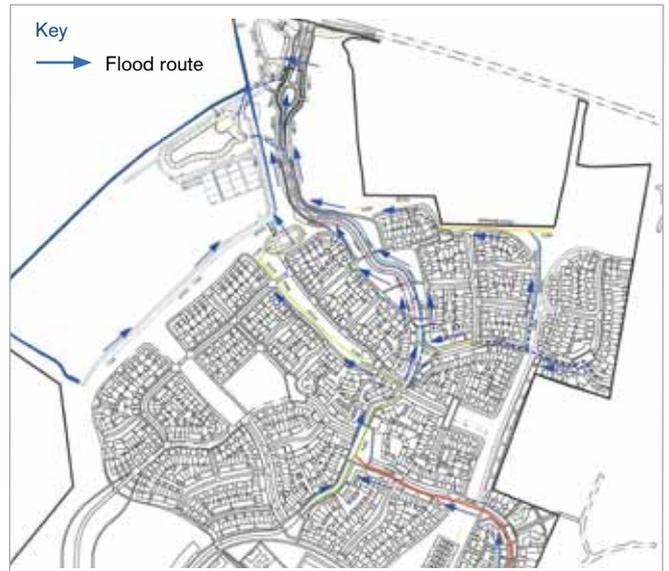
Detention Basin and Pond characterise the northern site entrance



Enhanced swale with precast concrete dropped kerb inlets

SUDS DESIGN – PHASE 1

Drainage engineer Chris Patmore explains the SuDS design in more detail: *“In locations where ground conditions allow, source control infiltration techniques such as individual soakaways, infiltration trenches and permeable pavements in car parking areas or side roads are used. In extreme weather events, excess water will follow the flood flow routes (shown as blue arrows) into the attenuation basin and wet pond.”*



“Rainwater from roofs is collected in the private drainage networks within the curtilage of each house, including a water butt collecting water for irrigation and car washing. There is also rainwater harvesting on the proposed apartment block. Surplus rainwater will be handled by

soakaways and infiltration trenches, which will also provide attenuation. Overflow from these features will discharge into modular storage units or permeable paved car parking and residential streets. Again, the permeable pavements will discharge some of the surface water through infiltration but where permeability is limited, modular storage units will be used for attenuation.

“Where this level of attenuation cannot be achieved in the private areas alone, further attenuation, as well as infiltration, will be provided in the permeable paved residential streets. In extreme weather events – when the 1 in 100 year plus climate change event has been exceeded – overflow from private areas will be discharged into the adopted highway stormwater drainage network as well as local ditches and swales.



“Residential streets are generally permeable paved and designed to provide residual attenuation for the private areas and also attenuation for the residential street itself. Discharge from these streets will be through infiltration where possible with an overflow into the adoptable highway drains which discharge into the stormwater network within the primary road network comprising of piped networks and enhanced swales. These enhanced swales increase the capacity of the highway drainage network while providing a valuable ecological corridor.”

“Concrete block permeable paving is used widely as a source control, providing attenuation and reducing pollution without demanding additional land-take in the more urban areas.”

“The enhanced swale consists of a continuous perforated pipe, laid in a gravel media designed to promote the infiltration of surface water into the underlying soils. At the surface, within grassed verges, a 300mmm deep swale is formed, fed by dropped inlets within the conventional concrete kerbs. The system has proved capable of coping with up to the 1 in 100 year plus climate change storm events. In order to utilise the capacity of the swales, a series of check dams has been introduced along the length of the swale, many of which are formed by footway and road crossings of the swale, thus avoiding additional features.”



An impermeable paving service crossing within a permeable paved area

HARD LANDSCAPE – PHASE 1

Key lessons have been learnt from 15 years experience of concrete block permeable paving in Oxfordshire, which have been applied at Great Western Park. Layouts for statutory and other services are of fundamental importance to long-term performance. Service runs can be a major issue and routes for statutory undertakers' plant outside the permeable pavement should form part of the initial design.

It is important to remember that all surface areas don't have to be permeable, as concrete block permeable paving can cope with runoff from adjacent impermeable surfaces, including roofs, based on a rule of thumb ratio of 2:1, impermeable : permeable. This approach has been applied throughout Phase 1 where services and utilities are located within conventional impermeable block paving, service corridors or verges – avoiding the permeable paving, negating the need to excavate and removing the risk of disturbing it to access these services.



Phase 1 covers two distinct urban areas, either side of the Main Street, developed by different companies and displaying distinct characters. Although both adhere to the same permeable paving principles discussed above – typically with streets centrally split between permeable and impermeable paving – these are interpreted with different palettes of paving colours, patterns and designs. Firstly, David Wilson Homes' east side uses a limited palette of rectangular blocks with a red-based colour mix contrasting with larger concrete setts in more earthy tones.



DAVID WILSON HOMES



TAYLOR WIMPEY



Taylor Wimpey's west side also includes streets split centrally between permeable and impermeable block paving in matching colour mixes. However, more diverse colours and techniques are applied to characterise different areas, including panels of paving enclosed by contrasting borders. This is particularly apparent in urban squares and shared-surface mews areas.



Precast Concrete Paving Principles

With precast concrete paving and kerbs, distinct, modular units and designed variations in colour, texture and shape can break up areas giving visual interest and a human scale not possible with monotonous, formless materials such as asphalt. In recent years, Interpave manufacturers have transformed this concept, moving away from simple, regular patterns and colours to expand an extensive palette of styles, shapes, colours and textures to meet current demands in urban design, matching – and often exceeding – the visual qualities of materials such as stone. This is a valid and sustainable interpretation of the requirement for 'local materials' in adopted guidelines. It is generally unrealistic on cost, availability and accessibility grounds to specify locally extracted stone which may have been used in the past, while imported stone fails to meet sustainability criteria.



Essential requirements for paving materials, from Manual for Streets and other guidelines, can be summarised as follows:

- visually attractive able to deliver distinctive local character
- capability for visual or tactile differentiation between distinct areas
- durable and maintainable with reliable product supply
- accessible to all with consistent slip and skid resistance
- well drained to avoid standing water and compatible with SuDS
- sustainable – in the widest sense

More information on how precast concrete paving is uniquely placed to satisfy all these requirements can be found in *Planning with Paving and Understanding Permeable Paving* via www.paving.org.uk.

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Chris Patmore – formerly a Director of RSK (LDE)

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Allen Pyke Associates – landscape architects involved in the preparation of Design Code documents for Great Western Park, which set out the landscape and public realm strategy for different phases of the project.

RPS – RPS is an international consultancy providing advice on the development and management of the built and natural environment. RPS has been involved with the development of Great Western Park since 1996 and has managed the planning and environmental process for the development since its inception.

Tibbalds Planning and Urban Design Ltd – strategic master-planners for the development.



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