GREENING THE GAMES MAJOR PROJECT REPORT

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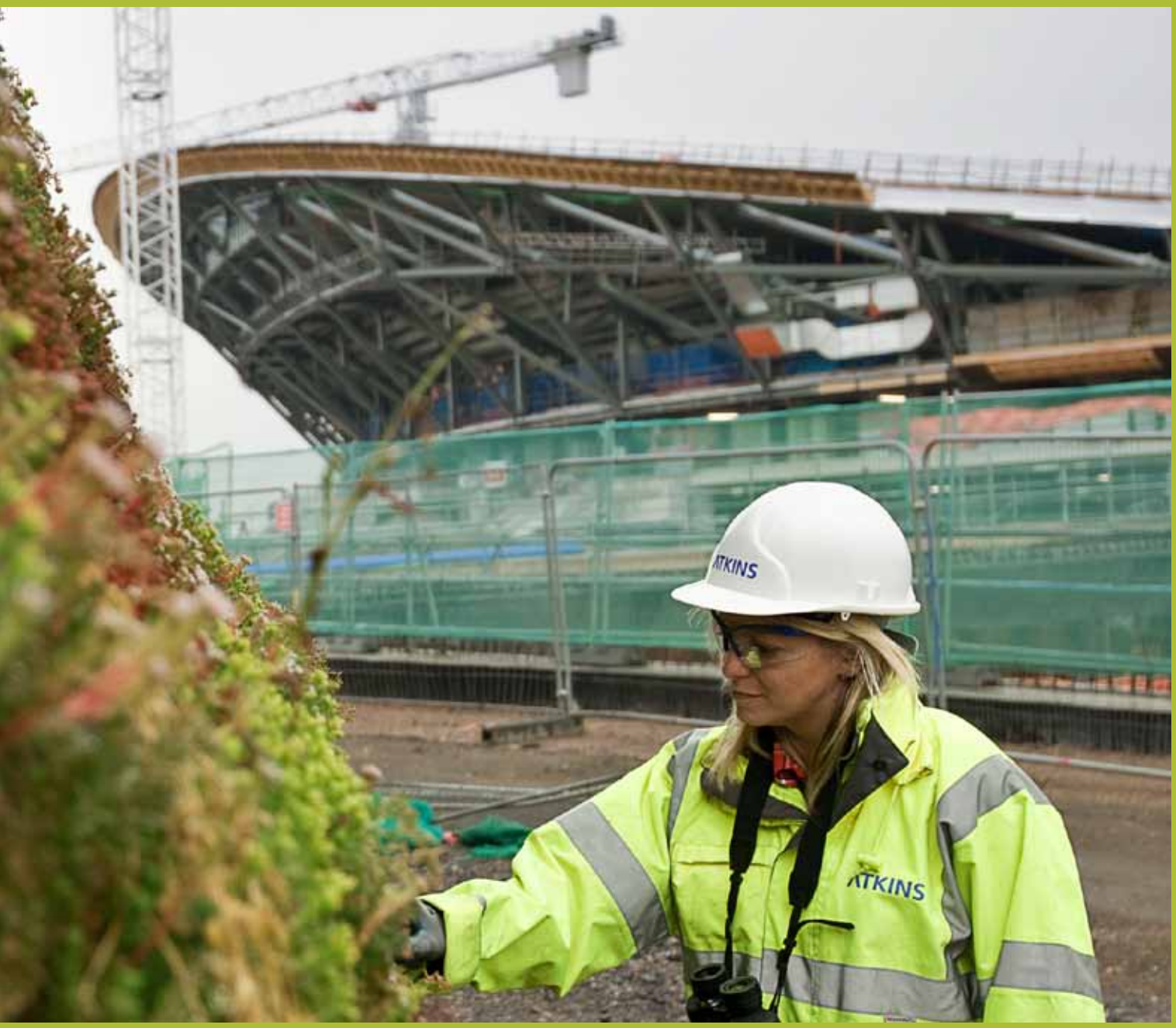
LONDON 2012
BROWN TO GREEN
24HA OF DERELICT LAND IS BEING REBORN AS A BEAUTIFUL PARK FOR THE NEXT OLYMPIC GAMES



Olympic challenge: Landscape works are running in tandem with venue construction

LONDON 2012: BROWN TO GREEN

In East London 246ha of derelict land is being reborn as a beautiful park for the next Olympic Games and for the city's enjoyment for decades to come. Margo Cole and Declan Lynch report on the transformation taking place.

When the International Olympic Committee (IOC) made its decision to award London the 2012 Games, the site that was earmarked for the Olympic Park was still occupied by a myriad of businesses; the full legacy of centuries of industrial activity on the site was not fully understood; and the planning process had not even started. Despite this, the organising committee for the London Games had committed to delivering what it hoped would be the world's most sustainable sporting event.

Now, five years on from that announcement, the site has been transformed. Gone is the industrial dereliction, and in its place, trees, meadow flowers and wetland plants are being planted in parallel with construction of the iconic games venues.

Responsibility for managing the transformation of the Olympic Park site from "brown to green" has fallen to Atkins, under its enabling works contract with the Olympic Delivery Authority (ODA). "It is easy to underplay it now, but we quickly realised that getting the land and cleaning the land were two of the biggest risks of delivering the whole 2012," says Atkins project director Mike McNicholas.

"The ODA had to deliver both a site for the Games and a place that would be transformed into a vibrant and well-served new London community," he adds.

Atkins was appointed as project manager for the enabling works at the start of 2006, when, as McNicholas recalls, "there was a strange state of flux. There was no planning permission for the whole park, and people were still moving out".

"The planning strategy developed by the ODA and LDA [London Development

First aid: A 'soil hospital' was set up to clean the most contaminated soil

Walk in the park: Log walls provide new habitats for invertebrates

Agency] was very important," he adds. "We had to identify how we could start construction in line with the needs of the programme – from a stakeholder management perspective, a technical perspective, hitting the budget together with the ODA, and developing the design management strategy."

McNicholas says Atkins' experience in managing remediation of the Greenwich Peninsula ahead of constructing the Millennium Dome (now the O2) was critical to its success on the Olympic site, although there are significant differences between the two. "The Greenwich Peninsula was one of the only jobs in Europe where a clean-up like this has been done on a time-critical site," he explains. "The remediation here [the Olympic Park] is not as complicated as that, but logistically it's far more complicated as there's so much more to do.

"Greenwich Peninsula was a 100ha site with a fence round it given to us on day one. This is more than twice as big and involves a £450M capital programme in itself. It is a massive civil engineering project in its own right and the scale of the scheme is awe-inspiring. The complexity of the project is unprecedented, but we also had to chart our way through all that while raising the bar on issues like sustainability."

McNicholas talks about working in a "real time" environment: with very little of the Olympic Park fully designed at the start of the project, everyone involved has had to be capable of reacting quickly and responding to change. "No matter how late an important change came up it had to be integrated as real time," he says.

"To enable that fast decision-making and constant communication with the client, local planning authorities, regulators and contractors, Atkins pulled in experts from throughout the UK and co-located them in a single project office in London, which had its own culture and behaviours. And at the top were managers brought in for their leadership capability, rather than their technical knowledge.

"You need leaders with the vision and the belief to be able to motivate staff to do something they didn't think they could do themselves," says McNicholas. "We bought into the fact that the programme was sacrosanct, and had the mindset that we could make it work."

"The ODA had to deliver both a site for the Games and a place that would be transformed into a vibrant new London community"
Mike McNicholas, Atkins

According to McNicholas, the project has been "transformational" for Atkins, as well as for the Olympic Park. "As a company we have always been able to bring together diverse teams, but this was raised to new levels on London 2012 because of the requirements of the job," he says. "We created teams of engineers who worked with ecologists, carbon experts and archaeologists, all of them pulling in the same direction.

"It's been a real learning experience and it's changed cultures."

The overall vision for creating the park came from the ODA, and its project sponsor for parklands and public realm, John Hopkins, is proud of the way the park's transformation has taken place. "After all the hard work it is wonderful to see the parklands rising out of this former industrial lansdcape," he says.

Remediation

A key element of London's commitment to make the 2012 Games the most sustainable ever held was the choice of the site for the main Olympic Park: a 246ha piece of brownfield land in east London bounded by railway lines, crisscrossed by neglected waterways and boasting a history of industrial pollution dating back two centuries. An important remit of the Games is to transform this landscape into an urban park that will be enjoyed for many years to come.

At the start of Atkins' enabling works contract, many businesses were still occupying the site, but as each one moved out, teams went in to carry out full investigation of the ground below, eventually doing over 3,000 intrusive site investigations (including boreholes, trial pits and window samples) to add to information already known about the historic uses of the site. These include a waste tip, fridge mountain, chemical works, glue factory, landfill site and a bus depot – all adding their own particular type of contaminant to either the underlying soil or the groundwater.

Each borehole survey helped Atkins establish exactly what was in the ground, and fed into the design of the remediation strategy. "Legacy requirements drive the remediation design – for example if an area is going to be residen- »

OLYMPIC PARK: CLEAN-UP

» tial, or parkland or industrial," explains Atkins enabling works deputy project manager Saphina Sharif. "Knowing through your site investigation what's in the ground and where your water courses are, and looking at the legacy use, enables you to produce the remediation design."

The sustainable element of London's Olympic vision includes keeping as much material on site as possible, and remediating it on site for re-use. For the demolition the ODA set a target that 90% of materials should be reclaimed for recycling or re-use. "We knew that target was challenging, but believed that by careful thought and by being very organised about how we went about the demolition, we could achieve it," says Sharif. In fact, over 98% of demolition materials have been recovered.

The tougher target was on the remediation side, where the team committed to retaining 80% of the soil on site. A cut and fill balance has been created across the site, with excavated material going into building the platforms for the sporting venues, so there is no major import or export of bulk material, but it is still extremely challenging to commit to cleaning up 80% of highly contaminated soil to a level where it is suitable for redevelopment. However, according to Sharif, the team is on course to meet that target.

The site was split into two – north and south – for the remediation, with Morrison Construction and Bam Nuttall winning the clean-up contracts for the two halves. Both used a variety of techniques, including bio-remediation, soil washing, chemical and geotechnical stabilisation, with Atkins setting up a shared "soil hospital" where the excavated contaminated soil could be brought for ex situ remediation.

"Our default position was to expect anything, purely because this is such a large site with such a range of contamination"
Saphina Sharif, Atkins

Across the site there is a 600mm deep separation layer of soil that meets the highest remediation levels. Below this the degree of remediation depends on the future use. "As we took material out, it was pre-characterised so that we could try to understand where it could be re-used," explains Sharif.

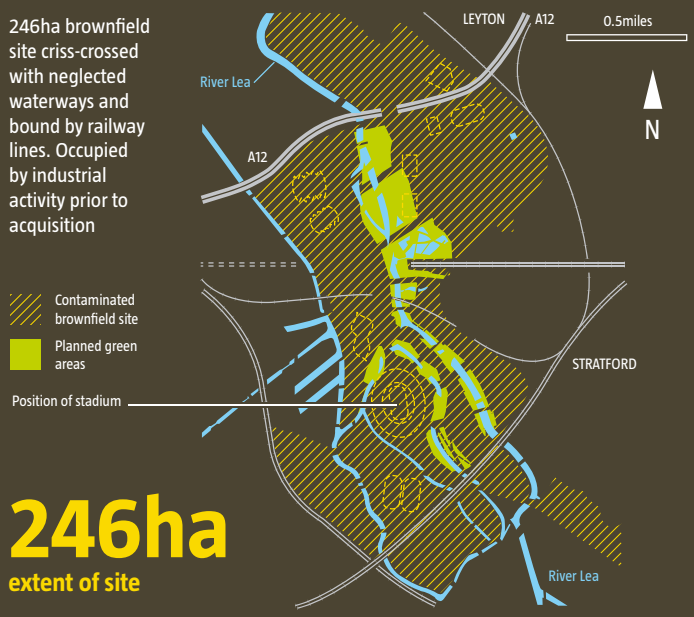
High levels of contamination were also found in the groundwater beneath the site, with contaminants including polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds. "Our default position was to expect anything, purely because this is such a large site with such a range of historical contaminative activities," says Sharif.

Some permanent systems have been installed to try to

CLEANING THE OLYMPIC PARK

1. THE SITE

246ha brownfield site criss-crossed with neglected waterways and bound by railway lines. Occupied by industrial activity prior to acquisition



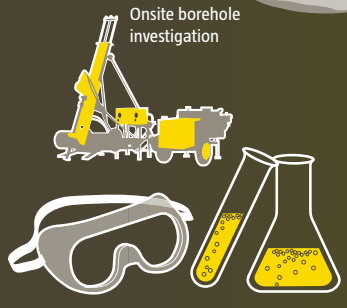
246ha
extent of site

2. CONTAMINATION

Contamination from over 200 years of industrial activity. Previous business uses include waste tip, chemical works, glue factory, landfill site and bus depot. All giving rise to an accumulation of diverse contaminants that had penetrated both soil and groundwater

200yrs
industrial activity

3. ANALYSIS



As each business vacated the site, teams went in to carry out full ground investigation. Data from the studies was added to historic information about how the site had been used. In all 3,000 borehole-based investigations were conducted

3,000
borehole-based investigations

prevent further groundwater contamination, including a cut-off wall near the new hockey stadium, and a new bio-remediation technique has been used for the first time in the UK to remove ammonia from water beneath the Olympic stadium. Here, archae – a naturally occurring type of bug – have been dropped down boreholes. The archae have a natural affinity with ammonia, and can completely degrade it.

Although the remediation design has been dictated by the legacy use of the site, handovers have been dictated by the construction programme for the Olympic venues.

So far there have been over 300 handovers, from the massive stadium site – given to the construction team three months early – to small discrete sections of riverbank.

Ecology

Despite the presence of more than 200 buildings on the site when work started on the Olympic Park, it was also something of a wildlife haven, according to Atkins senior ecologist Kim Olliver. "It was a brownfield site, but within that there were quite a lot of different habitats. The invertebrates here are totally different to those you would get in an ancient woodland, and you get certain species of plants that will thrive in brownfield habitats," she says.

One such habitat was an old railway sidings, where specialist environmental consultant Five Rivers found toadflax brocade moth, a priority species for conservation under the UK Biodiversity Action Plan.

"There were a lot of different habitats. Invertebrates here are totally different to those you would get in an ancient woodland"
Kim Olliver, Atkins

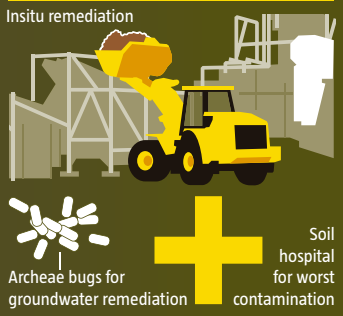
"My aim was to retain as much habitat that was viable," Olliver says.

As each building was demolished it was assessed for roosting bats and nesting birds; all bird species on site have been catalogued – including sand martins along the rivers and a pair of peregrine falcons nesting in an electricity pylon; trees have been surveyed and cuttings collected for a "tree nursery"; newts have been moved to a new home off site; and fish have been taken out of some of the smaller rivers and moved into the River Lea.

One of the biggest problems has been dealing with invasive species like Japanese knotweed, Himalayan balsam, floating pennywort and giant hogweed. "These types of site, which have basically been left derelict for years and include rail and water corridors, tend to be breeding grounds for invasives. There were few parts of the site that were untouched by invasives," says Olliver.

During the last three and »

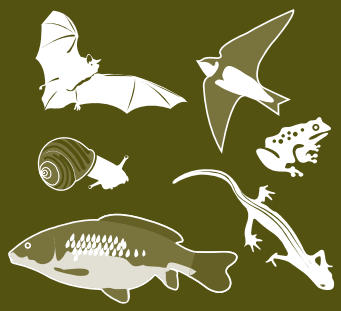
4. REMEDIATION



The remediation strategy was to keep as much soil on site as possible. Techniques include soil washing, bio- remediation, chemical and geotechnical stabilisation. 98% of demolition material was reclaimed and reused. Archae bugs were used to clean the groundwater

80%
of soil retained and reused

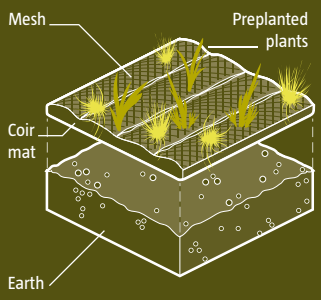
5. ECOLOGY



Despite the presence of 200 buildings, this brownfield site also contained habitats for a wide range of flora and fauna including invertebrates, birds and moths. Where possible species were collected and translocated or their habitats maintained

45ha
of created habitat

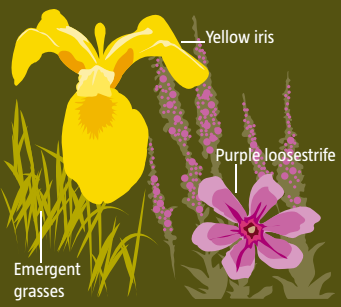
6. COIR MATTING



After exhaustive testing coir pallet planting was found to be the most successful way of delivering native wetland plants back to this challenging section of the River Lea. Seedlings are delivered to site ready planted in coir mats

380,000
Individual wetland plants

7. PLANT TYPES



A year-long planting trial identified which wetland species coped best with the site's tough conditions. These include emergent grasses, yellow irises and purple loosestrife, which should be in flower during the games

15,000m²
of wetland planting

OLYMPIC PARK: CLEAN-UP

» a half years, Olliver says she has found that people working on the site have been happy to get involved – supporting the ecologists who were carrying out bat surveys before demolition and even helping pick smooth newts out of drained rivers by hand.

Olliver's work at the Olympic Park has demonstrated beyond doubt that habitats can flourish on derelict land, and once there should be preserved. "Wildlife will colonise anywhere," she says.

Rivers

A major feature of the Olympic Park will be the waterways that snake through the site. The main stadium is almost surrounded by water, including the River Lea, which runs through the entire park from northwest to southeast. The southern part of the site has always been the most urbanised, and will remain so in legacy. Here, the waterways tended to have concrete walls, built in the 1940s, and these are now being restored and rebuilt.

In the northern section of the site, however, there was less development, and the River Lea had not been channelised to the same extent. The masterplan for the Olympic Park was to retain 2.6km of soft banks in the area known as the North Park and to make this a far more natural landscape than the south.

"Initially the banks were going to have high, steep slopes with a path along the top, but in 2008 the masterplan changed," explains Atkins principal engineer Mike Vaughan. "Getting the river geometry just right was a delicate balancing act. If they were too steep the banks would need expensive artificial reinforcement, but too shallow and they would start to eat into valuable space on the site.

"In the end we opted for a slope of 1 in 2.5 – about 22°."

He adds: "Working with the landscape architects we looked at how they could incorporate the river more and open up the corridor to make it a feature and draw people towards it. By dropping the slopes we've brought the river into the park and made it much more accessible. People can get close to the river and see what's going on there."

In order to turn the waterways into a major feature of the park, the first task was to understand exactly how they behaved and linked together. Flows and velocities were measured at different locations, and the data used to construct a detailed hydraulic model to predict flood risk.

In training: Slopes have been designed to bring visitors close to the water and the new habitats

During 2008 a lock was built at the south end of the River Lea, where it joins the tidal Thames, to prevent tidal water flowing up the Lea and to permit navigation. The result is that twice a day, when the lock is closed, the water in the Lea is effectively impounded, causing water levels to fluctuate by around 400mm.

Atkins' models showed the potential impact of this impoundment and also predicted an increased risk of flooding, which led to some changes in the profile of the bank slopes, including raising the height of the riverside paths by up to a metre.

"Working with the landscape architects we looked at how they could incorporate the river and open up the corridor to make it a feature and draw people to it"
Mike Vaughan, Atkins

Planting

Planting is a major feature of the new landscape that is being created. As well as contributing to an attractive environment during the Games, the plants will help give stability to the river banks and create vital wetland habitats.

There are many native wetland species that should be suitable for this environment, but the Lower Lea has some characteristics that made it challenging to design the planting regime, including the 400mm fluctuation in water level. Any plants introduced on the riverbank have to be able to cope with these major fluctuations.

In addition, the Lea is a heavily silted river, so the plants also have to be tough enough to withstand layers of silt being deposited on the bank.

To find the right plants, Atkins instigated a 12-month planting trial in 2008, using a variety of plants native to the Lea and Thames estuary, and different planting methods, including plug (or cell) planting, where the plants are individually plugged into the soil; bare root planting; planting in five litre containers; and coir pallets, in which the young plants are delivered to site ready planted in coir mats.

The trial involved a 50m stretch of riverbank in wetland area of the North Park.

"We trialled plants on different elevations with different installation techniques, and it really helped us work out exactly what species we should plant and where," says Vaughan. "Virtually everything that was plug planted died pretty quickly."

The trial also identified which species coped best with the tough conditions, and since 2009 specialist company Salix has been growing a range of native wetland plants that are currently being delivered to the site. They consist mainly of emergent grasses and sedges, as well as yellow irises and purple loosestrife, which should be in flower during the Games.

"We ended up doubling the size of our nursery to accom-

Winning through: Trials proved that planting in coir matting would be best

Under inspection: The wetland plants were grown for a year off site

modate the plants for the Olympics," says Salix technical director David Holland. "There are about 380,000 individual plants, all grown in the Gower and then moved to be planted in the coir in Thetford in Norfolk. The whole thing equates to about 15,000m² of plants."

After a year of growth in the nursery, the wetland plants have now started arriving on site on their coir pallets and rolls, and are being installed under the supervision of Bam Nuttall, which has a contract to manage the landscape works. They will arrive on 300 lorries, with each of the 1,000 pallets and rolls tagged to indicate exactly where it fits on the riverbank, enabling them to be pieced together like a massive jigsaw puzzle.

With the ground at the river edge being soft and wet, the contractors are using a specially adapted pontoon to give them access to the banks for planting.

Legacy

It is widely believed that London won the right to host the 2012 Olympics because of its commitment to use the event to create a lasting legacy. The organisers boast that 75% of all the money spent on the event goes on something that will remain long after the Games are over. Crucial to that is the creation of one of Europe's largest "urban parks" around the sports venues.

ODA project sponsor for parklands and public realm John Hopkins says: "After the Games we will spend a year transforming the site from a secure compound into an open, inviting parkland. The park will transform the area from the urban Hackney Marshes to the rural Lea Valley."

The new park has two distinctly different parts. The South Park will be very colourful and decorative and more urban, with lawns and mature trees, while the North Park is more natural, and restored to how it might have looked before the industry came along.

The landscape designer has produced some very precise landforms with the intention that it feels like you are out in the countryside with the velodrome and basketball venue almost hidden in between.

New wetland habitats will be created along the section of River Lea that runs through the North Park, together with an area of wet woodland – a rare British habitat with a dark, hostile feel that supports trees like willow, alder and black poplar. This area needs to be kept damp, so Atkins has designed a system that will allow water to overtop a section of riverbank once every four weeks.

During the Games a pedestrian link will pass close to the wet woodland to give access to one of the temporary bridges into the stadium, but in legacy this will be removed, so the woodland can be allowed to grow further without disturbance, while a footpath will enable visitors to walk past at canopy level. "For the next couple of years the park will be carefully managed and manicured, but after the Games are over, one of the most exciting aspects will be allowing and watching the woodlands materialise," says Vaughan.

"After the Games we will spend a year transforming the site from a secure compound to an open, inviting parkland. It will transform the area"
John Hopkins, ODA

Other new habitats include three frog ponds fed by drainage from the venue concourses.

To ensure all the new habitats thrive once the Games are over, they have been designed to require minimum intervention.

"The way we've been tackling the design with sustainability and bio-engineering techniques means we have designed out the need for maintenance in the future," explains Vaughan.

"It's a natural river – let it do what it does."

For ODA chairman John Armitt, the park is crucial to the success of the Games and their long term impact.

"The parklands will be the centerpiece of the Olympic Park during the Games, and are at the heart of the long-term transformation of this part of east London," he says.

THE LEGACY INCLUDES

Wetland bowls and rare wet woodlands will help protect 5,000 properties from a 1:100 year flood.

The London 2012 Garden will stretch for almost 1km and include picnic lawns and 60,000 plants and 60,000 bulbs from 250 different species.

New habitats will cater for otters, kingfishers, grey herons, bees, house sparrows, lizards, black redstarts, flower and fungus beetles, frogs, newts and toads.

250 benches and over 3,300 seats will be built into the parkland so people are never more than 50m from a seat.

There are also 6km of off road mountain bike tracks.