

SU70NW370

SITE SOUTHMOOR LANE, HAVANT FIGURE 2a

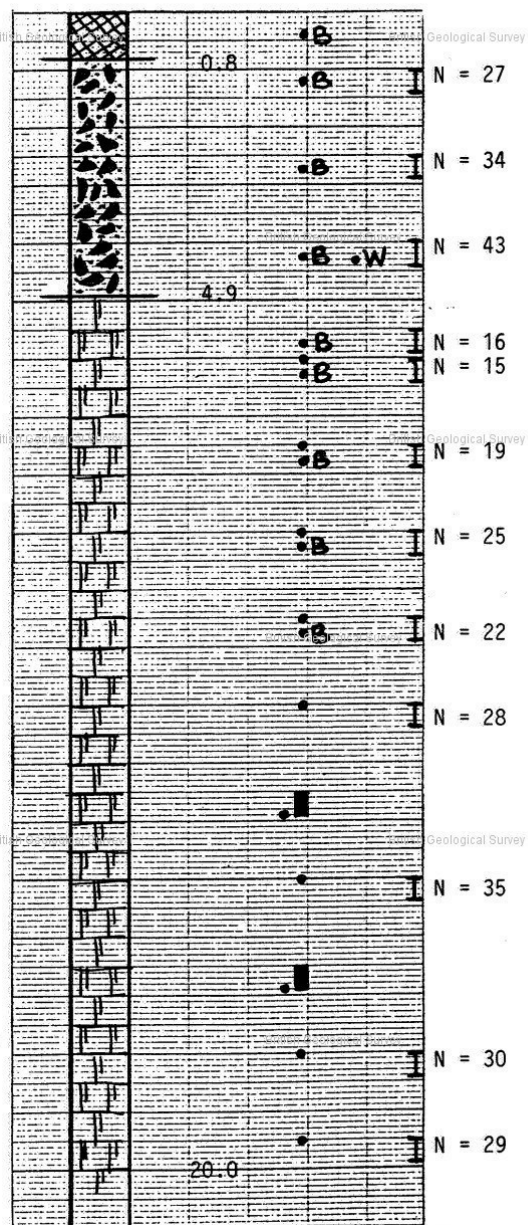
BOREHOLE 1 DIAMETER 150 mm DEPTH 25.0 m DATE 28-29/11/91

Scale: 1:100

TOPSOIL and rubble FILL

Medium dense/dense silty
clayey very sandy fine,
medium and coarse flint
GRAVEL with some chalk
nodules

Moderately strong/strong
white CHALK with some
flints



100mm diameter core sample

• disturbed sample

I N (Test 19, BS 1377.1975)

NR ... non-recovery

•W ... water sample

•B ... bulk sample

APPENDIX G

Operation and Maintenance

TABLE B.25 SuDS maintenance inspection checklist

General information									
Site ID									
Site location and co-ordinates (GIS if appropriate)									
Elements forming the SuDS scheme								Approved drawing reference(s)	
Inspection frequency								Approved specification reference	
Type of development								Specific purpose of any parts of the scheme (eg biodiversity, wildlife and visual aspects)	
Inspection date									
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date Completed	
General inspection items									
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?									
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?									
Have any health and safety risks been identified to either the public or maintenance operatives?									
Is there any deterioration in the surface of permeable or porous surfaces (eg rutting, spreading of blocks or signs of ponding water)?									
Silt/sediment accumulation									
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)?									
If yes, state depth (mm) and extent.									
Is removal required?									
If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)									

continued...

continued from...

TABLE SuDS maintenance inspection checklist
B.25

Inspection date									
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed	Date Completed
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (eg underdrained swale or infiltration basin)?									
Does permeable or porous surfacing require sweeping to remove silt?									
System blockages and litter build-up									
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?									
Is there any evidence of any other clogging or blockage of outlets or drainage paths?									
Vegetation									
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (Check against approved planting regime.)									
Does any part of the system require weeding, pruning or mowing? (Check against maintenance frequency stated in approved design.)									
Is there any evidence of invasive species becoming established? If yes, state action required									
Infrastructure									
Are any check dams or weirs in good condition?									
Is there evidence of any accidental damage to the system (eg wheel ruts?)									
Is there any evidence of cross connections or other unauthorised inflows?									
Is there any evidence of tampering with the flow controls?									

continued...

continued from...

TABLE B.25 SuDS maintenance inspection checklist

Inspection date									
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed	Date Completed
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)									
Other observations									
Information appended (eg photos)									
Suitability of current maintenance regime									
Continue as current									
Increase maintenance									
Decrease maintenance									
Next inspection									
Proposed date for next inspection									

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

An introduction to sustainable drainage systems or SuDS

SuDS are a new environmentally friendly approach to managing rainfall that uses landscape features to deal with surface water. SuDS aim to:

- control the flow, volume and frequency of water leaving a development area
- prevent pollution by intercepting silt and cleaning runoff from hard surfaces
- provide attractive surroundings for the community
- create opportunities for wildlife.

SuDS at Robinswood Primary School and Matson Park

The SuDS are designed to prevent flooding of Robinswood Primary School and to control the flow of water from springs in Matson Park using attractive landscape features.

- A low bank has been constructed in the park as a dam when water flows down the route of an old ditch during heavy rain.
- The everyday flow from springs above the path in the park has been directed along a new stream in the park, which keeps a new wildlife pond full of water but also allows it to soak into the ground or flow onward to a controlled outfall into the school grounds.
- The controlled outfall into the school grounds allows heavy rainfall to leave the park slowly and make its way through green space above the school playing field.
- Exceptional storms or prolonged heavy rain can overflow from the park across a grass weir on the bank into the “environment space” at the top of the playing field retained by a low bank running along the contour to the old oak tree.
- The school wildlife pond, with a toddler fence around it, gives children in the school an opportunity to learn about animals and plants that live in water and to understand how the SuDS control system works.
- Water will slowly soak into the ground as it travels along the SuDS system, but in exceptional storms some water may overflow down the side of the playing field towards the road as it did in the past but without going through the school first.

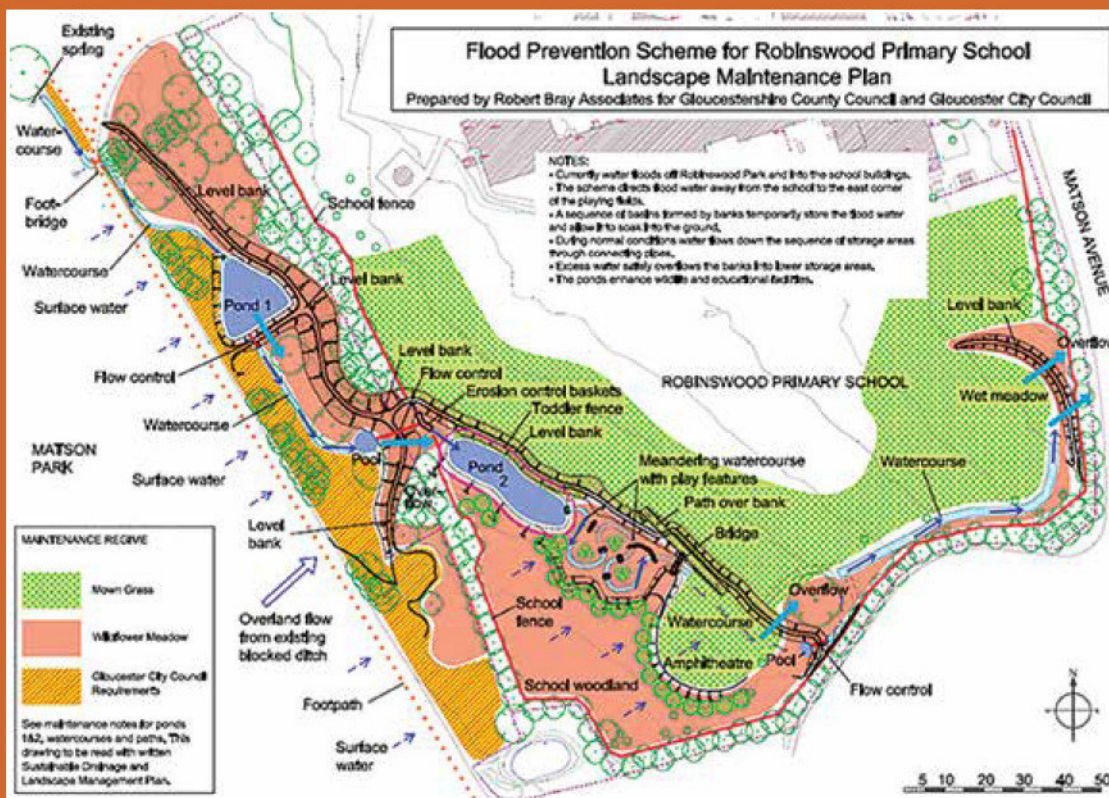
Managing the SuDS

The SuDS at Robinswood Primary School have been designed for easy maintenance to comprise:

- regular day-to-day care – litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a SuDS feature
- occasional tasks – managing pond vegetation and removing any silt that builds up in the SuDS features
- remedial work – repairing damage where necessary.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Matson Park SuDS management

The SuDS sequence begins where the springs emerge above the path, near the park entrance from Underhill Road, and take a changed route under a new bridge to form a stream in the park.

Action:

- Strim or mow grass where the springs emerge and allow vegetation to grow to at least 100 mm or to full height annually in the low flow channel or stream bed.

The new stream carries water to the first wildlife pond (Pond 1 – see site plan).

Action:

- Mow the path verge and grass up to the stream as current practice by GCC.
- Cut stream vegetation annually in September–November, removing cuttings to a wildlife pile or from site.
- Allow grass beyond the stream to develop as meadow and cut at 100 mm September–November removing cuttings to a wildlife pile or from site.

The wildlife pond will develop wetland vegetation round the edge with reasonably short grass towards the park side to allow people to look at the water.

Longer meadow grass on the far side of the pond and beyond the stream will provide a home for wildlife and an opportunity for creative play.

Action:

- Mow the path verge and grass up to the stream and pond edge from park side as current practice by GCC.
- Cut meadow grass beyond stream at 100 mm September–November removing cuttings to a wildlife pile or from site.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

- Monitor how the pond edge develops, and cut 30% of vegetation at 100 mm each year during September–November, if required, removing cuttings to wildlife piles or from site.
- Occasionally remove pond vegetation, if it spreads across the pond, by hand clearing, raking or machine clearance, using a 1–3 tonne tracked vehicle, with cuttings removed to wildlife piles or from site.
- Check the outlet from the pond and the inlet on the other side of the bank are clear.

The stream flows onward from the pond through grass to a “micropool”, before it leaves the park through a final outlet into the school grounds “environment space” at the top of the playing field.

There is a grass overflow weir over the bank down to the school fence which should be cut annually to ensure that erosion does not occur. Brambles should be allowed to re-colonise the base of the bank on the school side for security reasons.

Action:

- Mow path verge and grass to the stream from the park side as current practice by GCC.
- Cut meadow grass beyond stream at 100 mm September–November removing cuttings to a wildlife pile or from site.
- Cut “micropool” vegetation annually September–November, if required, removing cuttings to a wildlife pile or from site.
- Cut overflow weir as meadow grass at 100 mm September–November removing cuttings to a wildlife pile or from site.

Robinswood Primary School SuDS management

Water from the Matson Park flows slowly through the bank, or overflows over a grass weir in exceptional rainfall. The water arrives on the school site through the fence onto a stone-filled basket channel flowing along a grass swale to the second wildlife pond and “environment space” (Pond 2 see site plan).

Action:

- Strim or mow grass around stone-filled basket channel and along the swale to the pond at 100 mm with grass at maximum height 150 mm.

The school wildlife pond will develop a wetland edge along the 1 m wide wet ledge before rising up to a flat dry ledge (or bench) provided for safety.

Action:

- Allow grass beyond the pond and away from the school side to develop as meadow and cut at 100 mm in September–November removing cuttings to a wildlife pile on site.
- On the school side, cut the grass regularly at 100 mm with grass at maximum height 150 mm for access.
- Monitor pond vegetation and cut 30% of edge at 100 mm each year, if necessary, during September–November, removing cuttings to wildlife piles.
- Occasionally remove pond vegetation if it spreads across the pond by hand clearing or raking being careful not to damage the pond liner.

The water leaves the pond under a small bridge into a swale maze flowing to a flat activity area.

Water leaves the southern end of the environment space through an outlet in the bank with a micropool in front of it.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School
Action:

- Cut the grass in the swale maze channel once each year, September–November, at 100 mm removing cuttings to wildlife piles.
- Cut grass paths, verges and the flat activity area at 35–50 mm with 75 mm maximum, leaving cuttings *in situ* or remove to wildlife piles.
- Cut all other areas within the environment space as meadow cut at 100 mm in September–November removing cuttings to a wildlife pile on site during school summer holiday.
- Check that the outlet and the inlet on each side of the bank is clear.

Should water reach the outlet from the environment space then it will flow down a grass swale, a flat bottomed grass channel, to another holding basin before overflowing slowly through the boundary onto the road.

Action:

- Cut the shallow swale and meadow as part of normal playing field maintenance.

SuDS and landscape maintenance – summary

		Frequency	Unit Rate	Total
Regular maintenance				
1	Litter management			
1.1	Pick up all litter in SuDS and landscape areas and remove from site	12 visits monthly		
2	Grass maintenance – all cuttings to wildlife piles			
2.1	Mow all grass verges, paths and amenity at 35–50 mm with 75 mm max, leaving grass <i>in situ</i>	As required or monthly		
2.2	Mow all dry swales, dry SuDS basins and margins to low flow channels and other SuDS features at 100 mm with 150 mm max Cut wet swales or basins annually as wildflower areas	4–8 visits as required Annually		
2.3	Wildflower areas strimmed to 50 mm in September or at the end of school holidays Or Wildflower areas strimmed to 50 mm on 3 year rotation 30% each year	1 visit annually 1 visit annually		
3	Inlets and outlets			
3.1	Inspect monthly, remove silt from slab aprons and debris, strim 1 m round for access	12 visits monthly		
4	Hard surfaces – not applicable			
4.1	Sweep all paving regularly, sweep and suction brush permeable paving in autumn after leaf fall	1 visit		
Occasional tasks				
5	Inspection and control chambers – not applicable			
5.1	Annual inspection, remove silt and check free flow	1 visit		

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

		Frequency	Unit Rate	Total
6	Wetland and pond vegetation			
6.1	Wetland vegetation to be cut at 100 mm on 3–5 year rotation, 30% each year, all cuttings to be removed to wildlife piles or from site	As required		
7	Silt management			
7.1	Inspect swales, ponds, wetlands annually for silt accumulation	1 visit		
7.2	Excavate silt, stack and dry within 10 m of the SuDS feature, but outside the design profile where water flows, spread, rake and overseed	As required		
8	Native planting			
8.1	Remove lower branches where necessary to ensure good ground cover to protect soil profile from erosion	1 visit annually		
Remedial work				
9	Inspect SuDS system regularly to check for damage or failure Undertake remedial work as required	As required		

SuDS scheme checklist

SuDS schemes include landscape features and control structures to manage runoff as it flows to site outfalls. The following lists the SuDS components and extra features which may be found on a site.

- **Filter strips** are grass verges that allow runoff to flow through vegetation to a swale, wetland, infiltration area or other SuDS component.
- **Swales** are linear, flat-bottomed grassed or vegetated channels that convey water from one place to another. They can also store water and allow it to soak into the ground.
- **Underdrained swales** are stone-filled trenches with a perforated pipe in the bottom covered by engineered sandy soil and turf. These intercept dirty water and allow it to soak into the ground or lead it to a water storage feature.
- **Filter drains** clean, store and convey water to another feature or allow it to soak into the ground. They are stone-filled trenches, sometimes with a perforated pipe in the bottom. These may be enlarged to treat dirty water, as treatment trenches, or increase soakage into the ground, as infiltration trenches.
- **Permeable surfaces** are permeable block paving, porous asphalt, gravel or free-draining soils that allow rain to percolate through the surface into underlying drainage layers. They should be protected from silt, sand, compost, mulch etc.
- **Infiltration basins, trenches, soakaways** and most of the preceding SuDS features allow water to soak into the ground.
- **Basins, ponds and wetlands** are depressions in the ground where water is stored and treated. Water levels rise after rain and then drop to the normal level as the excess soaks into the ground or is released slowly to a watercourse or drain. Some water may be held back as a pond for final treatment, amenity or wildlife interest.
- **Bioretention areas** are planted areas with engineered topsoil over drainage layers that allow water to soak into the ground.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

- **Green roofs** are planted with sedum or other plant material. They clean and absorb water allowing it to evaporate. Excess water is drained from the roof to other SuDS features.
- **Inlet and outlets structures** are often conveyance pipes protected with mesh guards. They should be free from obstruction at all times to allow free flow through the SuDS.
- **SuDS flow control structures** are usually small orifices in control chamber, slots or V-notches in weirs. They are usually near the surface, so are accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- **Inspection chambers** and rodding eyes are used on bends or where pipes come together. They allow cleaning of the system if necessary.
- **Overflows** can be below ground through gratings and chambers or over grass weirs in the open. They should be kept clear at all times to protect areas from flooding.
- **Flood routes (exceedance routes)** allow water volumes exceeding the capacity of the SuDS system to escape from the site without causing damage to property. This route should be clear of obstructions at all times.

SuDS design usually avoids use of below-ground structures such as gully pots, oil separators and other sumps, which are a wildlife hazard, often ineffective and expensive to maintain. SuDS design also reduces pipework, manholes and interceptors. However, water may be conveyed in surface features such as rills and channels, with changes in level managed in spouts or cascades. These hard landscape features require standard landscape maintenance.

Sustainable drainage maintenance specification
General requirements

General requirements	
Maintenance activities comprise ▪ regular maintenance ▪ occasional tasks ▪ remedial work	Frequency
Generally Litter Collect all litter or other debris and remove it from site at each site visit	Monthly

- **Avoid** use of weed-killers and pesticides, to prevent chemical pollution.
- **Avoid** de-icing agents wherever possible to allow bioremediation of pollutants in permeable surfaces.
- **Protect** all permeable, porous and infiltration surfaces from silt, sand, mulch and other fine particles.

Exclusions

- Maintenance of rainwater harvesting chambers, pumps etc.

Filter strips and swales

- **Filter strips** are grass verges next to hard surfaces that allow runoff to flow through vegetation, removing silt and pollution.
- **Swales** are linear, flat-bottomed grassed or vegetated channels that convey water from one place to another, which can also store water and allow it to soak into the ground.
- **Underdrained swales** are free-draining swales with stone-filled trenches in the bottom covered by engineered sandy soil and turf that clean dirty water and allow it to soak into the ground or lead it to a water storage feature.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Filter strips and swales	
Regular maintenance	Frequency
Grass Mow amenity grass access paths and verges surrounding swales and filter strips at 35–50 mm minimum and 75 mm maximum or as specified. Mow filter strips and swales at 100 mm with 150 mm maximum to filter and control runoff in normal grass swales, removing first and last cut in season, and if grass is longer than 150 mm removing cuttings to wildlife piles on site. Where marsh or wetland develops in the swale due to wet conditions then cut annually, or as required, at 100 mm, removing cuttings to wildlife piles on site	Monthly or as required Monthly or as required Annual or as required
Occasional tasks	Frequency
Where there is a build-up of silt on the filter strip, swale, underdrained swale or at inlets, ie 50 mm or more above the design level, then remove and spread on site. Undertake when ground is damp in autumn or early spring and transplant turf and overseed to original design levels. Spread excavated material on site above SuDS design profile, eg top of banks, in accordance EA (2010)	As required
Remedial work	Frequency
All damage to be made good to design profile unless there is a design flaw	As required

Filter drains

- **Filter drains** are stone-filled trenches, sometimes with a perforated pipe in the bottom, that collect, clean and store runoff before conveying the water to another SuDS feature or allowing it to soak into the ground.
- **Treatment trenches** are enlarged filter drains designed to treat a known volume of dirty water or increase soakage into the ground. They may also be used to intercept overland flows, when they are referred to as **cut off drains**.

Filter drains and infiltration trenches	
Regular maintenance	Frequency
Grass edges Mow 1 m min. wide grass surround to drain at 100 mm and 150 mm maximum to filter runoff and protect drain from silt	Monthly or as required
Occasional tasks	Frequency
Weeds Hand pull or spot treat individual weed growth, only if necessary, ensuring that weed-killer does not enter the filter drain. Weed growth usually dies in dry weather	As required
Remedial work	Frequency
Siltation at surface Where there is no protective geotextile, remove all stone and perforated pipe replacing as original spec. and include separating geotextile as below. Where there is a separating geotextile (see spec.) then remove surface stone layer and separating geotextile that protects the stone drain below. Replace geotextile and top stone layer	As required

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School
Pervious pavements

- **Pervious pavements** including permeable block paving, porous asphalt, gravel or free-draining soils that allow rain to percolate through the surface into underlying drainage layers. They should be protected from silt, sand, compost, mulch etc. Permeable block paving and porous asphalt can be cleaned by suction brushing.

Pervious pavements	
Regular maintenance	Frequency
Cleaning Brush regularly and remove sweepings from all hard surfaces	Monthly
Occasional tasks	Frequency
Permeable pavements: Brush and vacuum surface once a year to prevent silt blockage and enhance design life	Annually
Remedial work	Frequency
Monitor effectiveness of permeable pavement, and when water does not infiltrate immediately advise the client of possible need for reinstatement of top layers or specialist cleaning. Recent experience suggests that jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency	As required

Infiltration systems – soakaways, infiltration trenches and infiltration basins

- **Infiltration basins, trenches, soakaways** and most of the preceding SuDS features allow water to soak into the ground.

Soakaways, infiltration trenches and infiltration basins	
Regular maintenance	Frequency
Grass edges Mow 1 m min. wide grass surround to drain at 100 mm and 150 mm maximum to filter runoff and protect infiltration structure from silt	Monthly or as required
Infiltration basins Protect grass surface from compaction and siltation and manage main area of basin for design function or appearance	As required
Occasional tasks	Frequency
Infiltration basins Where there is a build-up of silt in the basin at inlets (ie 50 mm or more above the design level), remove when the ground is damp in autumn or early spring and turf to the original design levels. Spread excavated material on site above SuDS design profile (eg top of banks), in accordance with EA (2010).	As required
Infiltration trench Hand pull or spot treat individual weed growth, only if necessary, ensuring that weed-killer does not enter the drain and inhibit natural breakdown of pollutants	As required
Remedial work	Frequency
Infiltration basin Where the infiltration basin is compacted, reinstate by removal of silt and de-compaction of the surface by scarifying, spiking or the use of hollow tines to the basin area	As required

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School
Detention basins, ponds and wetlands

- Detention basins, ponds and wetlands are depressions in the ground that store water. Water levels rise after rain and then drop to the normal level as the excess soaks into the ground or is released slowly to a watercourse or drain. Some water is often held back in a pond or wetland for final “polishing” treatment or amenity interest.
- Detention basins are usually dry.
- Ponds can be permanent or temporary and are mainly open water.
- Wetlands are mainly aquatic vegetation but can have small areas of open water like ponds.

Detention basins, ponds and wetlands	
Regular maintenance	Frequency
Grass Mow grass access paths and verges surrounding basins, ponds and wetlands areas at 35–50 mm minimum and 75 mm maximum, or as specified, to provide a cared-for appearance and allow pedestrian access	Monthly or as required
Mow rough grass areas for occasional access or habitat reasons at 100 mm and maximum 150 mm with cuttings removed to wildlife piles	As required, 4–6 times annually
Grass areas not required for access may be managed for wildlife interest and to reduce costs. Two cuts in July and September or one cut annually in September or October as specified, and cuttings removed to wildlife piles	Annually or as required
Wet woodland management Manage annually as detailed spec. with cuttings left in situ or removed to wildlife piles	Annually or as required
Wetland vegetation Cut (strim) at 100 mm with cuttings removed to wildlife piles September–October Or Maintain as a mosaic to be cut 25–30% in any one year at 100 mm in September or October with cuttings removed to wildlife pile	Annually or as required
Occasional tasks	Frequency
Where silt accumulates on apron or area in front of inlet or outlet, remove and land apply within design profile of SuDS. Where silt accumulates more than 150 mm in base of wetland, undertake a phased removal of silt subject to client approval. Confirm whether a liner is present to hold water or prevent pollution of groundwater and protect. Remove silt as instructed, but not more than 30% of pond or wetland area at any one time and to an agreed depth but not the subsoil layer. Retain as much representative existing vegetation as possible to ensure rapid re-colonisation of open areas. Stack excavated material adjacent to wetland to allow de-watering of silt. Undertake silt removal during September–October to minimise damage to protected wildlife and ensure regrowth of aquatic vegetation before winter. Spread excavated material on site above SuDS design profile, eg top of banks, in accordance with EA (2010).	Annually or every 3 years, as required

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Detention basins, ponds and wetlands	
Remedial work	Frequency
Although not usually required, this may be needed due to damage to liners or control structures	Undertake as design details or as required

Inlets, outlets, controls and inspection chambers

- **Inlets and outlets structures** may be surface structures or conveyance pipes with guards or headwalls. They should be kept free from obstruction at all times.
- **SuDS flow control structures** can be protected orifices, slots weirs or other controls at or near the surface to be accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- **Inspection chambers** and rodding eyes are used on bends or where pipes come together and allow cleaning of the system if necessary. They should be designed out of the system where possible.

Inlets, outlets, controls and inspection chambers	
Regular maintenance	Frequency
Inlets, outlets and surface control structures Inspect surface structures, removing obstructions and silt as necessary. Check there is no physical damage. Trim vegetation 1 m min. surround to structures and keep hard aprons free from silt and debris	Monthly Monthly
Inspection chambers and below-ground control chambers Remove cover and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn	Annually
Occasional maintenance	
Check topsoil levels are 20 mm above edges of baskets and chambers to avoid mower damage	As necessary
Remedial work	Frequency
Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary	As required
Repair physical damage if necessary	As required

Overflows and flood routes

- **Overflows** are overland across weirs, through gratings or within chambers and should be kept clear at all times to protect areas from flooding. They allow onward flow when part of the SuDS system is blocked.
- **Flood routes (exceedance routes)** allow water volumes that exceed the capacity of the SuDS system to pass through or round the site without causing damage to property. These routes should be clear of obstructions at all times.

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Overflows and flood routes	
Regular maintenance	Frequency
Overflows – Jet the pipes leading from overflow structures annually and check by running water through the overflow. Check free flow at next SuDS feature – inlet to basin or chamber	Annually
Overflows – Remove any accumulated grass cuttings or other debris on top of grass weirs or stone-filled baskets overflows	Monthly
Flood routes – Make visual inspection. Check route is not blocked by new fences, walls, soil or other rubbish. Remove as necessary	Monthly
Remedial	Frequency
Overflows – If overflow is not clear then dismantle the structure and reassemble to design detail	As required

Ornamental planting and existing vegetation

- **Ornamental trees** – All ornamental planting to be kept weed free and pruned, using secateurs to keep the shrubs to an agreed and reasonable size.
- **Native trees and shrubs** – All native planting to be allowed to grow freely, removing overhanging branches as required.

Planting and existing vegetation – review	
Regular maintenance	Frequency
Grass maintenance	
Amenity grass – Mow all grass verges, paths and amenity grass at 35–50 mm with 75 mm max. All cuttings to remain in situ	16 visits
Rough grass – Mow at 75–100 mm but not to exceed 150 mm All cuttings to wildlife piles	4 – 8 visits
Wildflower areas strimmed to 50 mm in Sept–Oct. Or Wildflower areas strimmed to 50 mm July and Sept. Or Wildflower areas strimmed to 50 mm on 3 year rotation, 30% each year. All cuttings to wildlife piles	1 visit 2 visit 1 visit
Ornamental tree and shrub planting Weed all shrub beds as detailed spec. as necessary. Cut back planting from lights, paths and visibility sight lines in late autumn and as necessary. Cut hedges slightly tapered back from base with flat top at specified height. Do not mulch planting adjacent to permeable or porous paving surfaces. Remove stakes and ties from trees when no longer needed for support and within 3 years of planting. Protect from strimmer damage and remove competitive growth until well established	4 visits

continued...

continued from...

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Planting and existing vegetation – review	
Native trees and shrub planting Prune to shape in year 1. Protect trees from strimmer damage and remove competitive growth until well established. Remove stakes and ties from trees when no longer needed for support and within 3 years from planting	1 visit
Existing trees Check existing trees for safety	1 visit
Remedial	Frequency
Replace trees and shrubs that fail in the first 5 years after planting. Carry out tree surgery as necessary	

Spillage – emergency action

Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system.

Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency, with residual spillage allowed to bioremediate in the drainage system.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung(s). (A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or closely woven fabric.)

Contact the Environment Agency immediately.

Queries regarding a design feature

In the event of a concern or failure of a SuDS design feature contact:

Robert Bray Associates, Sustainable Drainage Consultants and Landscape Architects

Fairfield, Coronation Road, Rodborough, Stroud, Gloucestershire GL5 3SB

T: (01453) 764885

F: (01453) 765545

E: bob@robertbrayassociates.co.uk

W: www.sustainabledrainage.co.uk

Heavy vibrating rollers are definitely not recommended around plastic pipes or tanks due to the high pressures that they can generate. Thin layers with smaller plant are recommended. DfT (2009) should be referred to for guidance for plant and methods for achieving compaction. The manufacturers' recommendations usually limit plant size above geocellular units to no more than 2300 kg/m width. However, the loading resulting from this will still need to be checked in the design. If such plant is to be used adjacent to the units, the resulting compaction pressures need to be checked.

Any arch or flexible pipe structures depend on the even resistance provided from soil or aggregate on both sides of the arch/pipe for their structural capacity. Even slight differences in the level of filling on each side of the arch/pipe as it progresses could potentially cause uneven deflections and increase the stress within the structure above design values. Close supervision during backfilling is therefore vital. The backfill around geocellular tanks should also be brought up evenly around all sides.

Bedding directly below a concrete pipe should have minimal compaction. The fill at the side of the pipe should be well compacted to a level 300 mm above the crown of the pipe. Only light compaction should be applied to the backfill directly over the crown of the pipe to a point 300 mm above it. With reasonable workmanship and supervision, the bedding factors used in the design should be relatively conservative.

21.12.6 Wrapping

All storage tanks should be watertight in accordance with the relevant standards. Geocellular and similar structures using geomembranes to hold water should be sealed in accordance with waterproofing standards (ie welded joints rather than adhesive taped) and the integrity of the seal checked on site through the use of non-destructive testing, to ensure that it is leak-proof. Advice on appropriate integrity and seam tests for geomembranes, that could be adapted for testing membranes around storage tanks, is provided in Mallett *et al* (2014). Care needs to be taken during installation to protect against damage of both the tank structure and the geotextile and the geomembrane wrapping. Follow-on trades can also cause damage and put the integrity and performance of the structure at risk.

21.13 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below-ground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation. **Table 21.3** provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be developed during the design phase, and will be specific to the type of tank that is adopted. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

- Generic health and safety guidance is provided in **Chapter 36**.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

21.14 REFERENCES

BARNES, G E (2010) *Soil mechanics: principles and practice, third edition*, Palgrave Macmillan, Hampshire, UK (ISBN: 978-0-23057-980-4)

BETTESS, R (1996) *Infiltration drainage – manual of good practice*, R156, CIRIA, London, UK (ISBN: 978-0-86017-457-8). Go to: www.ciria.org

BCA (2014) *Design standards for box culverts*, BCA Technical Advice Note, Box Culvert Association, Leicester, UK. Go to: <http://tinyurl.com/qy6bmfx>

BRE (1991) *Soakaway design*, BRE Digest 365, Buildings Research Establishment, Bracknell, UK (ISBN: 0-85125-502-7)

CPSA (2013) *Technical design guide*, Concrete Pipeline Systems Association, Leicester, UK. Go to: www.concretepipes.co.uk/page/technical-guide

D'ARCY, B, ELLIS, J, FERNER, R, JENKINS, A and DILS, R (2000) *Diffuse pollution impacts, the environmental and economic impacts of diffuse pollution in the UK*, Terence Dalton Publishers, Suffolk, UK (ISBN: 978-1-87075-246-6)

DECC (2012) *Government response to "Home insulation. A report on the call for evidence carried out by OFT"*, Department of Energy and Climate Change, London, UK. Go to: <http://tinyurl.com/n9l4psx>

DfT (1998) *Manual of contract documents for highway works. Volume 1: Specification for highway works*, HMSO, London, UK (ISBN: 978-0-11552-705-0). Go to: <http://tinyurl.com/nuhk8c3>

DfT (2001) *Manual of contract documents for highway works. Volume 1: Series 2500 Special structures*, HMSO, London, UK. Go to: <http://tinyurl.com/l3tap4z>

DfT (2009) *Manual of contract documents for highway works. Volume 1: Series 600 Earthworks*, HMSO, London, UK. Go to: <http://tinyurl.com/phx5yj>

20.14 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the pavement to the client, it should be inspected for clogging, litter, weeds and water ponding, and all failures should be rectified. After handover, the pavement should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Extensive experience suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most sites. However, in some instances, more or less sweeping may be required and the frequency should be adjusted to suit site-specific circumstances and should be informed by inspection reports.

A brush and suction cleaner (which can be a lorry-mounted device or a smaller precinct sweeper) should be used for regular sweeping. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced. It is also possible to clean the surface using lightweight rotating brush cleaners combined with power spraying using hot water, as shown in **Figure 20.30**. This is done every two years at the site shown.

If the surface has clogged then a more specialist sweeper with water jetting and oscillating and rotating brushes may be required, especially for porous asphalt surfaces, to restore the surface infiltration rate to an acceptable level. The specialist equipment should be adjusted so that it does not strip binder from the aggregate in the asphalt.

The likely design life of grass reinforcement will be dictated by trafficking and is likely to be about 20 years if designed correctly. For concrete block permeable paving the design life should be no different from standard paving, assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging. Porous asphalt will lose strength and begin to fatigue due to oxidation of the binder. This is likely to occur slightly faster in porous asphalt than normal asphalt, so the design life will be reduced slightly. Porous concrete should have a similar design life to a normal concrete slab.



Figure 20.30 Deep cleaning a supermarket car park, Dundee (courtesy Abertay University)

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

► Guidance on waste management is provided in **Chapter 33**.

Table 20.15 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be prepared during the design phase. Specific maintenance needs of the pervious pavement should be monitored, and maintenance schedules adjusted to suit requirements.

► Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

► Generic health and safety guidance is presented in **Chapter 36**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.



Phase I Environmental Assessment

Langstone Technology Park, Havant, PO9 1SA

Presented to Havant S.a.r.l

Issued: November 2020

Delta-Simons Project No. 15-0754.07



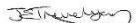
Delta-Simons Environmental Consultants Limited
Head Office: 3 Henley Office Park, Doddington Road, Lincoln, LN6 3QR
Tel: 01522 882555 | www.deltasimons.com



Report Details

Client	Havant S.a.r.l
Report Title	Phase I Environmental Assessment
Site Address	Langstone Technology Park, Havant, PO9 1SA
Project No.	15-0754.07
Delta-Simons Contact	Jayne Trevelyan (Jayne.Trevelyan@deltasimons.com)

Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
01	Final	13/11/2020	-			
				Heidi Richardson Consultant	Jayne Trevelyan Associate	Jayne Trevelyan Associate

About us

Delta-Simons is a trusted, multidisciplinary environmental consultancy, focused on delivering the best possible project outcomes for customers.

Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from ten locations - Lincoln, Birmingham, Bristol, Dublin, Leeds, London, Manchester, Newcastle, Norwich and Nottingham - we employ over 100 environmental professionals, bringing experience from across the private consultancy and public sector markets.

Delta-Simons is proud to be a founder member of the Inogen® Environmental Alliance, a global corporation providing multinational organisations with consistent, high quality and cost effective environmental, health, safety, energy and sustainability solutions. Inogen assists multinational clients by resolving liabilities from the past, addressing today's requirements and delivering solutions for the future. With more than 200 offices located on every continent, more than 6,430 staff worldwide, and projects completed in more than 120 countries, Inogen provides a single point of contact for diverse markets as Automotive, Chemical, Consumer Products & Retail, Financial, Food & Beverage, Healthcare, Insurance, Manufacturing, Non Profit Organisations, Oil & Gas, Real Estate, Services Firms, Technology and Transportation, among others.

Executive Summary

Site Use & Surrounding Area	The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial properties, with car parking, access roads and limited landscaping. The Site is located in a mixed commercial and residential area.
Environmental Setting	The Site is considered to be of a moderate environmental sensitivity given: the presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Principal Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the mixed commercial, light industrial and residential use of the surrounding area.
Contamination Potential	While chemical storage, diesel back-up generators and electrical substations were previously identified on-Site, the Site appeared well managed and no significant potential contamination concerns were noted associated with the current Site use. The Site was predominantly unoccupied until the development of a sewage works in the north-east by 1909. By 1973, the sewage works was no longer present, and the Site had been redeveloped into an IBM computer products manufacturer. Since the 1970's, some redevelopment has occurred on-Site, though the main buildings have largely remained unchanged. Potentially contaminative uses associated with the computer manufactory include previous 'wet' processes in B1000, diesel powered boilers in the area of the current gas boiler systems (B3000), an effluent treatment and chemical storage area in the area of B22, and effluent treatment and former chemical storage in the area of B41 and B42. Also, a former pollution incident was reported to have occurred in the 1980's, however, no further details are known. Based on the recent available information, two hotspots of hydrocarbon contamination have been identified with recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.
Contaminant Linkage Assessment & Land Contamination Conclusions	Delta-Simons has completed a land contamination risk assessment based upon available information. Information has indicated that significant widespread contamination is unlikely to be present. However, localised contamination was recently identified at the Site, which it has been recommended to be remediated (excavated) and given the historical use of the Site, the potential for further localised contamination to be present is possible. It is, therefore, considered that the risk of significant possible contaminant linkages to exist is low to moderate for a continued use and for the proposed redevelopment.
Key Land Contamination Recommendations	No further works are considered to be required for land contamination purposes in the context of an ongoing use. A number of recommendations have been provided associated with the proposed development in Section 4.1.
Overall Land Contamination Statement of Risk	On the basis of available information, Delta-Simons considers that with regard to potential land contamination issues and associated environmental liabilities, in its current use or future redevelopment, the Site represents an overall investment opportunity with a Low to Moderate risk.

Flood Risk Advisory	Based on the information reviewed, the majority of the Site is not located within an area considered to be of an elevated risk of fluvial flooding. Several areas of the Site are shown to be at potential risk of surface water flooding, however, no associated issues were reported on-Site with the exception of minor water ingress at Building 1000. Available information indicates that flooding events have occurred at the Site associated with surcharging of the foul system, however, it is understood that a non-return valve was installed at the Site. Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support the proposed redevelopment of the Client's masterplan.
This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.	

Table of Contents

1.0 INTRODUCTION.....	1
1.1 Appointment.....	1
1.2 Context & Purpose	1
1.3 Scope of Works	1
1.4 Limitations.....	1
2.0 SITE CONTEXT & DATA REVIEW	2
2.1 Site Information.....	2
2.2 Environmental Setting	5
2.3 Historical Use of the Site & Surrounding Area	7
2.4 Environmental Database Review	8
2.5 Planning Review	10
2.6 Regulatory Authority Consultation	11
2.7 Previous Reports	12
2.8 Flood Risk Advisory	15
3.0 LAND CONTAMINATION RISK	17
3.1 Introduction	17
3.2 Conceptual Site Model	17
3.3 Contaminant Linkage Assessment	17
4.0 CONCLUSIONS & RECOMMENDATIONS.....	20
4.1 Land Contamination/ Ground Conditions	20
4.2 Statement of Risk/Land Contamination Liability Assessment	20
4.3 Flood Risk Advisory	21
4.4 Other Redevelopment Considerations	21

Figures

Figure 1 Site Features Plan

Drawings

Drawing 1 Proposed Masterplan

Appendices

Appendix A Data Sources
 Appendix B Limitations
 Appendix C Site Photographs
 Appendix D Historical Mapping
 Appendix E Previous Landmark Envirocheck® Report
 Appendix F Planning Information
 Appendix G Regulatory Authority Information
 Appendix H Previous Reports

1.0 Introduction

1.1 Appointment

Delta-Simons Environmental Consultants Limited ("Delta-Simons") was instructed by Havant S.a.r.l (the "Client") to carry out a Phase I Environmental Assessment of Langstone Technology Park, Havant, PO9 1SA (the "Site").

1.2 Context & Purpose

The aim of this assessment is to consider the potential for land contamination related liabilities to be present prior to the potential investment of the Site, and future redevelopment with several new buildings for the park.

1.3 Scope of Works

The scope of works undertaken for this assessment was:

- ▲ Review of the environmental setting of the Site, including the current use/ status of the Site and surrounding area, and review of the geology, hydrogeology and hydrology;
- ▲ Review of the historical activities of the Site and surrounding area;
- ▲ Review of regulatory database information relating to the Site;
- ▲ Review of the online planning records for the Site;
- ▲ Consult and review information from the Local Authority in relation to Part 2A of the Environmental Protection Act;
- ▲ Review of relevant third party reports relating to the Site or surrounding area;
- ▲ Develop an outline Conceptual Site Model and a qualitative assessment of the potential for land contamination related liabilities to be present; and
- ▲ Complete a review of the flood risk associated with the Site.

A list of the data sources consulted is provided in Appendix A.

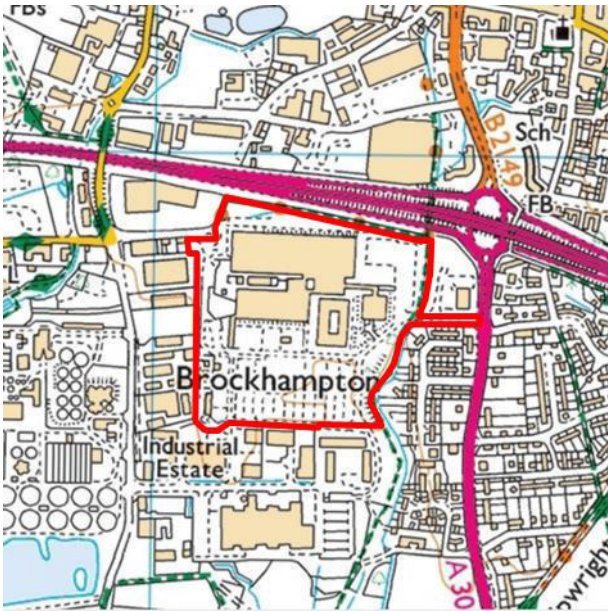
The scope of works did not include a Site reconnaissance; however, Delta-Simons have previously undertaken visits in 2015, 2018 and 2019.

1.4 Limitations

The standard limitations associated with this assessment are presented in Appendix B.

2.0 Site Context & Data Review

2.1 Site Information

 Contains OS data ©, Crown Copyright and Database Right (2020)		 Bing maps	
Site Location		Site Layout	
Co-ordinates	Centred approximately at National Grid Reference 471300, 105700.	Elevation	Approximately 4 to 8 m AOD
		Area	14.3 Ha
Site Location	The Site is located to the south-west of the junction of the A27 and A3023, in the Langstone area of Havant.		
Current Site Use	The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial buildings, with car parking in the south, east and north of the Site, hardstanding and access roads and landscaping confined to limited areas. A brief summary of the building uses is summarised below: ▲ Building 1000 (B1000) – predominantly offices (partly vacant) with some laboratories and a warehouse; ▲ Building 2000 (B22) – general maintenance store and water softening equipment; ▲ Building 3000 (B3000) – main plant room (including boilers and chillers); ▲ Building 4000 (B4000) – offices and canteen; ▲ Building 5000 (B5000) – data centre, offices and small electronics repair centre; ▲ Building 6000 (B6000) – main reception, offices and call centres; ▲ Building 7000 (B7000) – offices and laboratories; ▲ Building 41 (B41) – gym; ▲ Building 42 (B42) – electrical substation; and ▲ A nursery is also present in centre of the Site.		

Previous Site Reconnaissance	Delta-Simons has conducted Site visits on 29th July 2015, 27th April 2018 and 18th June 2019 as part previous assessments. A series of Site photographs from the walkovers are presented as Appendix C and a Site Plan showing the references to the main features is presented as Figure 1. Pertinent information that was observed or reported on-Site is summarised as follows: ▲ A large waste storage area and waste processing building (E and 1C, Figure 1) constructed in circa 2011 was present in western part of Site, comprising: two compactors for general, mixed recycling and cardboard waste, trade waste bins and wheelie bins. A large water tank and pump room was also located in this area. Two further waste storage areas comprising the same waste streams but also including feed waste were located adjacent to the backup generator by B4000 (1D, Figure 1) and within B4000 (1E, Figure 1) associated with food waste and banded waste cooking oil storage (spill kits were noted to be present). Dark staining was noted on the asphalt hardstanding in the vicinity of the waste cooking oil. A large cooking pot containing waste oil was also noted in this area without secondary containment. A Waste Electrical and Electronic Equipment (WEEE) bin and a fluorescent light bulb container were stored at ground level in B1000 (1F Figure 1); ▲ A diesel back-up generator with an associated banded 1,400 L capacity aboveground storage tank (AST) and a battery bank was located on an enclosed concrete platform between B3000 and B4000 (1D, Figure 1). No staining was noted beneath the external fill point or within the tank bund, however, minor staining was present beneath the generator unit. Spill kits were observed in this area. The Site representative stated that the AST was refilled manually using 200 L drums once per year. The bund was also fitted with a leak alarm; ▲ A tenant operated diesel-powered back-up generator with an associated approximate 6,000 L capacity AST was located adjacent to the west of B2000 (1G, Figure 1). The Site representative informed Delta-Simons of a small diesel leak, however, this was contained within the generator's transmitter box in 2018. The total amount of spilled oil was approximately 3 L; ▲ The Site representative stated that there were a further three tenant operated diesel-powered back-up generators located within B1000. However, no access was granted during the Site walkover; ▲ Two sprinkler pumps were located in B1000 (1F, Figure 1) of which one was electricity powered and one diesel powered. The diesel powered pump was connected by aboveground pipework to an approximate 1,000 L capacity AST situated in a bund. No hydrocarbon staining was noted within the bund or within the vicinity of the pipework and pump. The Site representative indicated that the AST was refilled manually from drums using a hand pump; ▲ Asbestos containing materials (ACMs) are common across the Site. An online, interactive register is held and asbestos signage is present in several areas. Envirochem were reportedly responsible for annual reinspection and asbestos removal at the Site. A secure ACMs store (assumed from maintenance activities) and fire extinguisher store was located within B1000 Area 3 (1F, Figure 1). ACMs are collected by a specialist contractor on an ad-hoc basis; ▲ A former chemical storage and processing area (V, Figure 1) was present in the south-west of the Site. Only concrete plinths and bunds remained, and no significant staining was observed. One of the bunds was reportedly undergoing infilling with construction materials (asphalt, concrete etc.). A former vehicle washdown area/catchment pit was present in this area, and an area of adjacent car parking was noted to be partially flooded; ▲ The area in the south-west (V, Figure 1) in 2015 was reportedly associated with a deionised water production plant and caustic storage area, in addition to an effluent treatment plant and buffer holding tanks. Used engines/ motors were noted to be stored on pallets externally in this area in 2015;
--	---

	▲ In 2018, a newly landscaped area with a vent pipe (assumed associated with drainage) was located along the south-western Site boundary; ▲ A former gardener's store was present in the south-west (N, Figure 1); ▲ A secure drum store with several 200 L capacity drums containing substances marked as toxic organic solids, mixed agrochemicals and agrochemical washings (some provided with drip trays) was situated at ground floor level in the south-western area of B1000. A compressed gas cylinder store was also located in this area which included air, nitrogen, hydrogen and helium (F, Figure 1). A bunded 10,000 L capacity AST for diluted waste process fluid, associated with fertilizer application research, was additionally located in the area of the drum store; ▲ A waste pallet storage area and compactor were present to the west of B5000 (G, Figure 1); ▲ Gardening waste storage, a contractor parking area and former electricity substation were located to the south-west of B5000 (H, Figure 1); ▲ A total of 15 electrical plant rooms were present across the Site (including J, K and L, Figure 1), including substations, transformers and electrical switch gear. All appeared to be in good order and no spillages of transformer oils was noted, barring minor staining within a transformer bund to the east of B3000. During the walkover in 2018, Delta-Simons was informed by the Site representative that all PCBs had been removed and converted to silicone-based oils; ▲ A building (B22) in the north-west of the Site (M, Figure 1) was used as a general maintenance store and contained a brine tank, water softening tanks and rainwater tanks. Also, present were: two 200 L capacity drums containing switchgear insulating oil on a wooden pallet; two 200 L drums containing waste water and glycol mix; a small hazardous chemical store; battery store; paint locker; rock salt store; gardening equipment; and chemical store. Delta-Simons was informed by the Site representative that a former pH testing and deionising plant had been removed approximately 10 years ago. A disused waste process water treatment plant was also located in B22; ▲ During the 2015 walkover, the Site Facilities Manager stated that the area around B22 had been used by the former tenant (IBM) as a chemical store and processing area, with two remnant ASTs remaining in 2015. The former processes were understood to include air and chemical extraction systems, solvent recovery plant, carbon absorption tanks, and storage of hydrochloric acid, sodium hyperchloride, xylene, nitrogen and cyanide; ▲ B3000 (1H, Figure 1) contained three gas boilers, water treatment chemicals (zinc chloride, biocide, sodium nitrite and potassium hydroxide all provided with secondary containment) and three chillers; ▲ During the 2018 walkover, a small diesel spill from a vehicle was reported in the south-west of the southern car park area, which was reported to have been managed with spill kits. Also, empty cooking oil drums and an abandoned vehicle were identified next to the Mill Stream; ▲ In 2015, Delta-Simons was informed by the Facilities Manager that a pollution incident which required remediation works had occurred in 1984, however, no further details were available; ▲ A surface water pump house was present to the east of B6000 (O, Figure 1); ▲ According to a drainage plan provided for review on-Site, eight oil interceptors are present within the Site's surface water drainage system (including P & Q, Figure 1) which were reported to be inspected every six months and serviced/ emptied every 18 months. The Site representative indicated that surface water runoff from the eastern area of the Site discharges into the Mill Stream; and
--	--

	▲ A discharge consent (Ref: 725513403, dated 13th July 2007) for the release of waste-water from the cooling tower system to the sewer is held on-Site. <i>While chemical storage, diesel back-up generators and electrical substations were present on-Site, the Site appeared well managed and no significant potential contamination concerns were noted associated with the current Site use. However, based on discussions with Site personnel and observations, potentially contaminative processes were undertaken on-Site associated with the former use, particularly in the south-west and in the central western area. A former pollution incident was also reported in the 1980's.</i>	
Current Surrounding Area	North	Landscaping and the A27 with a retail park beyond (including a petrol filling station).
	East	The Mill Stream with a hotel, restaurant and residential properties with gardens beyond.
	South	Endeavour Business Park comprising commercial office and distribution units.
	West	Commercial office, distribution and light manufacturing units with a sewage works beyond.
	<i>The surrounding land use is considered to represent a potential off-Site source of contamination.</i>	
Future Redevelopment	It is understood that the Client may undertake redevelopment of the Site in future. Planning permission has been granted for 'Part-demolition of Building 1000 and associated works; the erection of new flexible use industrial units; and a new parking layout with associated works' on 22nd July 2020 (reference: APP/19/00703). However, the current proposed masterplan includes additional redevelopment of the majority of the Site to include the demolition of several buildings and refurbishment of Buildings 4000 and 6000, with the addition of a multi-storey car park. A copy of the masterplan is provided as Drawing 1.	

2.2 Environmental Setting

Geology	From Geology Mapping within the Envirocheck® Report and information provided by the BGS, the Site is indicated as being predominantly underlain by superficial deposits of Alluvium comprising clay, silt, sand and gravel. River Terrace Deposits, comprising sand, silt and clay are shown in the north-western and south-western corners of the Site. A small area of Head Deposits, comprising clay and gravel, is shown in the south-west of the Site between the boundary of the Alluvium and Terrace Deposits. The underlying bedrock comprises the Lewes Nodular, Seaford, Newhaven, Culver and Portsdown Chalk Formations. An area of Made Ground is shown adjacent to the north-east of the Site. While no Made Ground is shown on-Site from available BGS mapping, given the development history, Made Ground would be anticipated to be present above the superficial deposits.
Specific Geology	During an investigation across the southern area of the Site in 2019, ground conditions identified comprised: ▲ Tarmac and sub-base, or grass and topsoil, underlain by Made Ground (granular deposits with brick, concrete and occasional pottery and slate or cohesive deposits with gravels including flint, concrete and occasional brick and chalk) to 3.1 metres below ground level (m bgl);

	▲ Superficial River Terrace/ Brickearth across the majority of the Site comprising silty, sandy gravelly Clay, with silty peat identified at one location to, and also clayey sandy gravel to 5.5 m bgl; ▲ Weathered Chalk bedrock comprising sandy gravelly clay or clayey sandy gravel with gravel comprising chalk and flints to 6.0 m bgl; over ▲ Chalk to a maximum depth of 24.9 m bgl. Fragments of organic material (including decaying wood, rootlets and grass) were also identified at three locations between 0.2 m and 3.1 m bgl.
Hydrogeology	The EA classifies the superficial deposits as Secondary A Aquifers and the Chalk as a Principal Aquifer. The EA data also indicates that the Site is not in a designated groundwater Source Protection Zone (SPZ), however, a SPZ 1 (inner zone) is located approximately 170 m to the north-east associated with two potable groundwater abstractions listed 460 m to the north and 710 m to the north-west. During a recent investigation, groundwater was identified within the superficial deposits between 2.1 and 2.8 m bgl rising to 2.0 and 2.5 m bgl. Within the two deeper locations, groundwater was identified at depths of 5.8 and 6.0 m bgl rising to 3.0 m bgl.
Hydrology	The Mill Stream is located adjacent to the east of the Site, which flows to the coast approximately 750 m to the south. According to the Envirocheck® Report, there are no licensed abstraction records from surface water located within 1 km of the Site.
Coal Mining	The Site is not located within an area that is potentially affected by coal mining activity.
Radon Gas	The Site lies within an area where less than 1% and 3-5 % are at or above the Public Health England recommended “action level” for radon. The Envirocheck® Report indicates that basic radon protective measures are necessary in the construction of new buildings or extensions at the Site.
Ecological Receptors	It is understood that there is a tree preservation order in place for the north-western area of the Site. It is understood from information provided within the Envirocheck® Report that the Chichester and Langstone Harbour, listed 315 m to the south and 459 m to the south east of the Site, is classed as: an Area of Outstanding Natural Beauty; a Ramsar Site; a Site of Special Scientific Interest; and a Special Protection Area.
Heritage Interest	According to historicengland.org.uk, the closest area of heritage interest is located approximately 95 m to the north-east of the Site associated with a Grade II Listed Building (Langstone Hotel). The Solent Maritime located 545 m south-west is also classified as a Special Area of Conservation.
Environmental Sensitivity	<i>The Site is considered to be of a moderate environmental sensitivity given: the presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Principal Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the mixed commercial, light industrial and residential use of the surrounding area.</i>

2.3 Historical Use of the Site & Surrounding Area

Approach	The historical development of the Site and surrounding area has been assessed through a review of available historical OS maps, Google Earth historical satellite imagery and other sources. A summary of the key historical Site uses and developments in the surrounding area is presented below. Copies of pertinent historical maps are included as Appendix D.
Historical Features On-Site	From the earliest available mapping dated 1867, the Site was predominantly in agricultural use with small unspecified buildings, watercourses, and an orchard partially located in the north-west. On 1897 mapping, an aqueduct and sluice were labelled along a watercourse in the south of the Site, subsequently labelled as a drain from 1953 mapping. By 1909 mapping, the north-east of the Site was developed with a sewage works with associated filter and sludge beds, and an engine house. Further development to both the sewage works and small buildings are noted between 1932 and 1969 mapping. From 1953 mapping, an allotment garden was labelled in the centre of the Site. From 1968 mapping, the entire Site had been redeveloped with a works and hardstanding in the centre of the Site. A separate building and an electricity substation were located in the south of the Site also at this time. It is noted that slopes are shown surrounding the majority of the buildings suggesting that Site levels were raised. Between 1984 and 1989 mapping, the Site was further developed to a layout largely consistent with the current format when the southern third of the Site was redeveloped with car parking removing the former structure in this area. Also, the south-west of the Site was occupied by several tanks, with further tanks and an electricity substation labelled in the west of the Site. A review of aerial imagery provided by Google Earth shows the Site in its contemporary layout between 1999 and current imagery, with the exception of minor reconfiguration of plant and buildings in the south-west of the Site and around B22.
Historical Information from other Sources	From internet searches, it is understood that the current Langstone Technology Park was formerly used by IBM as a computer products manufacturer (known as IBM Havant where many IBM computer products were made, such as disk files, mainframe computers, printers, ATMs, multiplexors and mid-range computers). In 1994, the Site began trading as Xyratex. A WSP 2005 assessment (discussed in Section 2.7) reported that the Site representative stated that B1000 was historically used for wet manufacturing processes. This included activities such as etching and substrate processes. The Site representative also reported to WSP that remediation in the form of decontamination of acid, arsenic and copper penetrated concrete was undertaken in 1998/ 1999 in B1000. This is reported to have involved the removal of concrete until it was proven that the remaining concrete was no longer contaminated. Effluents generated from B1000 were reported to be transferred to B41 (south-west corner of the Site) for treatment. After treatment processes were undertaken, the effluent was discharged from the Site via foul sewer. This discharge was reportedly regulated by a trade effluent discharge consent. The effluent treatment facilities were no longer operational in 2005 and had been partially decommissioned. It was also reported that B41 was historically used as a de-ionising water treatment plant. WSP indicated that B42 was reportedly formerly used for the storage of petroleum mixtures. A report produced by Campbell Reith Hill (discussed further in Section 2.7) suggests that the wider area was associated with decoy sites to draw German bombing raids away from areas such as Portsmouth during the Second World War.

Potentially Contaminative Historical Features Off-Site	Potential sources of contamination within 100 m of the Site include: ▲ Buildings associated with the wider sewage works located adjacent to the north of the Site between 1909 and circa 1969 mapping; ▲ Havant Mill (corn) located approximately 60 m to the north-east of the Site between 1867 and circa 1967 mapping; ▲ A works and plastics factory located approximately 25 m to the south-west of the Site from 1973 to the most recent map edition of 2015; ▲ A boatbuilding works/ unspecified works located approximately 50 m to the north-west of the Site from 1973. The unit was labelled as an unspecified works from 1993 and remains present; ▲ A pumping station with tank located approximately 25 m to the south-east of the Site from 1973 to circa 1993; ▲ A marine accessory works located approximately 60 m to the west of the Site from 1973. The unit increased in size by 1989 and was located 25 m west and the unit remains present; ▲ Industrial properties including factories, an electronics factory, an engineering works and a warehouse located approximately 80 m to the north of the Site from 1969 to circa 2006 when a large number of these were redeveloped as a superstore with a petrol filling station; and ▲ Further industrial units (including unspecified works, engineering works and factories) to the west from 1987 to the present. Within the wider area, pertinent features include Budd's Farm Sewage Works from approximately 125 m west from 1963. The works increased in size by 1969 and 1993, and remains present.
Unexploded Ordnance (UXO)	According to the Zetica risk map, the UXO risk at the Site is moderate. A Detailed Unexploded Ordnance Report by 1st Line Defence (DA8760-00, dated May 2019) has been identified for the Site. Overall, the report considered that there was a medium risk from German aerial delivered UXO and anti-craft UXO, with a low to medium risk from items of Allied Ordnance. A copy of the report is included within the Previous Reports as Appendix H.
Implications for Land Contamination Risk	<i>The historical uses of the Site, most notably the sewage works, computer manufacturing and ancillary processes, are considered to represent potential sources of contamination. Potential sources of contamination identified in the surrounding area include a mill, a sewage works, factories, an engineering works, a warehouse, a boatbuilding works/ works, a plastics factory, works, a pumping station with a tank and a petrol filling station.</i>

2.4 Environmental Database Review

Approach	The Landmark Envirocheck® Report provides a database of environmental information held by various bodies including the EA, Local Authority (LA), Health & Safety Executive (HSE) and the British Geological Survey (BGS) amongst others. A full copy of the Envirocheck® Report is provided in Appendix E and the most relevant information is summarised below.
Features On-Site	There are several relevant entries included within the Landmark Envirocheck® Report relating to the Site, summarised as follows: ▲ Four Discharge Consents (two noted to be 1 m off-Site; however, the operator names are consistent with the on-Site discharges) for the discharge of 'other matter-surface water' into a freshwater river, first granted in April 1978. The Site

	representative previously informed Delta-Simons that a discharge consent for the release of wastewater from the cooling towers into the sewers is held on-Site; ▲ Two revoked Integrated Pollution Controls associated with Adflex Solutions Ltd for processes involving halogens within the chemical industry. The permit, dated 1997, is assumed to be associated with a former operator at the Site; ▲ A Part B Permit (formerly Local Authority Pollution Prevention and Control) was granted to Teleplan and White Electronics in June 2013. From an internet search this is understood to be associated with the assembly of hard disk drive testers; ▲ A Licensed Waste Management Facility associated with Teleplan and White Electronics relating to a WEEE treatment facility in the west. The licence was issued in June 2013; ▲ Several areas of potentially infilled land which appear to be associated with the former drainage ditch network; and ▲ Three Contemporary Trade Directory Entries for a printers', general engineers and computer manufacturer.
Potentially Contaminative Features Off-Site	Pertinent entries in the Landmark Envirocheck® Report located within 100 m of the Site includes: ▲ Four Part B Permits associated with the coating of metal and plastic, and for the respraying of road vehicles; ▲ Two Pollution Incidents to Controlled Waters located 80 m east (minor incident) associated with the release of oils to a stream in 1995 and 95 m north-east (significant incident) associated with diesel in the stream from vehicle washing and de-waxing in January 1997; ▲ Four Registered Radioactive Substances located 45 m and 90 m north-west for the disposal of radioactive waste; and ▲ Thirty-three Contemporary Trade Directory Entries, which includes: tool design and manufacture; domestic appliance servicing; air conditioning; cleaning services; engineers (general, precision and aviation); spraying (paint & coatings); garage services (body builders and repairs); crane hire and sales; electronic component manufacture; and marine electrical services. Within the wider area, pertinent entries include: ▲ A Historical Landfill located 190 m to the south-west of the Site that was licensed to accept wastes types including household; no dates are provided; ▲ A Local Authority Recorded Landfill Site located 210 m to the south-west of the Site that was licensed to accept household, acid and commercial waste until December 1965; ▲ A Fuel Station Entry and Part B Permit associated with a petrol station located 140-150 m north of the Site; and ▲ A obsolete Fuel Station Entry located 140 m to the west of the Site.
Implications for Land Contamination Risk	<i>The former chemical processes and waste management facility are considered to represent potential on-Site sources of contamination. Whilst entries within the immediate vicinity of the Site have been identified, they are considered to represent limited potential sources of off-Site contamination.</i>

2.5 Planning Review

On-line Planning Portal	Havant Borough Council	Date Accessed	19/10/2020
Findings	From a review of the Council's online planning database, a large number of applications have been identified for the Site. These include a number of extensions, new car parking areas, new buildings, the creation of ditches and culverts, and for the installation of infrastructure (including a fume cupboard, waste compactor, back-up generators and cooling units) between the early 1990s and 2013. Pertinent applications identified include the following: ▲ APP/10/00272 – 'Demolition of existing steel-clad building and two portacabins to make way for a single storey timber framed building to house a 52 place nursery school'. This application was granted consent in September dated 2010. No contaminated land conditions were set. ▲ APP/13/00411 – 'Extension of standby generator room to accommodate attenuating louver for installation of additional generator unit and installation of 6 Liebert and 3 Excool roof mounted cooling units'. This application was granted consent in June 2013; and ▲ APP/15/00484 – 'Change of use from store to gym facility of B41'. This application was granted consent in July 2015. Whilst no contaminated land planning conditions were set, correspondence with the Environmental Control Officer dated July 2015, which included a Site inspection, indicated that while the potential for contamination could not be ruled out, the officer was satisfied that the change of use could go ahead without the need for intrusive ground investigation. However, this was caveated to say that should the area be redeveloped, the potential contamination risks should be further assessed. An Envirochem laboratory analysis report is provided which appears to relate to effluent in the area. The context of the testing is not clear and appears for waste disposal. The contaminant levels are generally low; ▲ APP/19/00296 – 'Erection of a new building entrance structure, reception lobby refurbishment and associated hard and soft landscaping works (Building 6000)'. This application was granted consent in May 2019. No contaminated land conditions were set; ▲ APP/19/00297 – 'Proposed alteration to the existing east facing elevation to accommodate a new entrance threshold and associated external works (Building 6000)'. This application was granted consent in June 2019. No contaminated land conditions were set; ▲ GEN/19/00354 – 'EIA Screening Opinion - Erection of new industrial units and rationalisation of south car park, demolition of part of the northernmost building with new elevation on the remaining part of the building, new screen on adjacent building and extension to existing car park'. No documentation was available to view on the online planning portal. This application was decided in May 2019, however, there is no information to confirm whether an EIA was undertaken; and ▲ APP/19/00703 – 'Part-demolition of Building 1000 and associated works; the erection of new flexible use industrial units; and a new parking layout with associated works to layout and access and felling of two trees subject to a Tree Preservation Order (Norway Maples)'. The application was granted in July 2020. As part of the application a Preliminary Risk Assessment (19-0687.01) by Delta-Simons was submitted, and information from the Environmental Control Officer indicates that the Council were in agreement of the recommendation for intrusive investigation. Subsequently, a contaminated land condition was imposed as Condition 9 and		

	required: an intrusive investigation (Part 1), and if required the submission of an appropriate remediation strategy (Part 2) and verification plan (Part 3). Copies of the relevant documentation is provided as Appendix F.
--	---

2.6 Regulatory Authority Consultation

Local Authority – Part 2A	From correspondence in August 2015 with the Contaminated Land Officer (CLO) at Havant Borough Council, the CLO confirmed that the Site is not considered to be a priority for inspection under Part 2A of the EPA 1990. During a subsequent telephone conversation as part of a 2018 assessment and email exchange in 2020, the CLO confirmed that the Site's status under Part 2A remains unchanged.
Local Authority – Additional Comments	The CLO confirmed in August 2015 that the former uses of the science park were associated with manufacturing, research and development and waste processing activities. Potential sources of contamination identified by the CLO include on-Site transformers, boiler house, UPS facilities, fuel stores, flammables storage and sealed drainage systems with the majority concentrated in the south-west of the Site. The CLO noted in August 2015 that they had undertaken a visit to the south-western corner of the Site (associated with planning application APP/15/00484). No comments in relation to significant concerns were identified at that time. Whilst the CLO identified potential sources of contamination from diesel fuel and 'flammables' likely to be toluene BTEX and possible plasticisers (phthalate, vinyl chloride), the CLO noted that given the good management practices, provision and condition of containment and the lack of staining or spillages, the risk of contaminant release was considered to be low. The CLO also noted that the Council is aware of three separate reports associated with the Site, however, it was not known if these were in the public domain: ▲ Travers Morgan, dated 1993; ▲ Structural Soils Ltd, dated 1995; and ▲ GVA Grimley, dated 1999. As part of the 2018 enquiry, the CLO issued several reports relating to the Site or nearby land, which are discussed in Section 2.7. A copy of the previous and current Regulatory Authority response is included as Appendix G.
Building Control	The WSP 2005 report (discussed in Section 2.7) references consultation with the Building Control Officer at Havant Borough Council. The Officer is reported to have informed WSP that the Site was raised above ground level thereby reducing the possibility for flooding. The Officer is reported to have commented that they were unaware of any significant ground stability issues within the area. However, they were aware that part of the subject Site had been built with piled foundations. WSP reported that the Officer was unaware of any ground gas problems in relation to the historical use of the Site or from current neighbouring site activities. Additionally, WSP reported that the Officer was not aware of any flooding issues in the immediate area of the Site, although the Officer did confirm that the 'Langstone Mill Stream' adjacent the Site boundary was known to be susceptible to partial flooding further inland.

2.7 Previous Reports

List of Reports	Delta-Simons has obtained the following reports relating to the Site and wider area: ▲ Ground Investigation Report, IBM, Langstone Road by Soils Limited dated April 1994 (extracts only and relates to land off Site to the south); ▲ Wetland Study by Symonds Travis Morgan dated April 1997 (relates to land off-Site to the south); ▲ Contamination Assessment Report by Campbell Reith Hill dated May 2001 (relates to land off-Site to the south); ▲ Site Investigation Report by STATS dated October 2003 (relates to the north-west of the Site); ▲ Phase I Environmental Audit by WSP dated September 2004 (relates to the entire Site); ▲ Geo-Environmental Appraisal Report by Clancy Consulting, dated October 2019 (relates to the north-east and south of the Site; and ▲ Supplementary Site Investigation by Clancy Consulting, dated September 2020 (relates to the north-east and south of the Site). Copies of the reports are provided in Appendix H.
Soils Limited Ground Investigation (1994)	The available information comprises extracts only, with no Site plan or context of the assessment, however, the following was reported: ▲ Significant contamination was not identified in soil samples; ▲ Facial coliforms were identified in a groundwater sample (indicated to likely be associated with an 'offsite' sewage works or damaged foul pipe); ▲ No putrescible materials that could give rise to hazardous gases was encountered; ▲ A landfill site was located to the west; ▲ No significantly elevated ground gases were recorded; and ▲ Piles or ground improvement was recommended.
Symonds Travis Morgan Wetland Study (1997)	The report relates to land to the south and presents a detailed hydrogeological study associated with the then proposed development to the south of the Site. While the majority of the information is irrelevant to this assessment, a plan in the report confirms that the above Soils Limited Ground Investigation relates to land off-Site to the south of the Site.
Campbell Reith Hill Contamination Assessment (2001)	The report relates to land off-Site to the south and indicates the following pertinent information: ▲ Previous investigations are reported to have identified that historically sewage sludge spreading may have taken place. One of these investigations reported elevated levels of mercury concentrations in the drainage ditches and waters adjoining the site. The spreading of sewage sludge and a historical nearby plating works were identified as possible sources. No recordable concentrations of mercury were however identified in the soils by the following investigation; and ▲ Slightly elevated concentrations of polycyclic aromatic hydrocarbons (PAH) and arsenic were recorded in soils and sediment from drainage ditches, however, they were below the adopted screening criteria.

STATS Site Investigation Report (2003)	The report relates to the north-western area of the Site in relation to a proposed new paved car park and roundabout (which does not appear to have been taken forward). The assessment comprised a desk study and ground investigation comprising the excavation of 13 trial pits and 8 dynamic cone penetration tests (to generate CBR values). No exploratory hole plan is provided. Pertinent points are summarised as follows: ▲ A sub-surface concrete tank was uncovered which was presumed to be related to the sewage works that were present on the Site. The tank was found to be in-filled with a clayey sand containing many whole bricks and occasional metalwork; ▲ Elevated copper and zinc were recorded, although below Delta-Simons screening values, and all other soil contamination was below the screening criteria adopted by STATS. No groundwater analysis was conducted; ▲ Geotechnical hazards reported included shrinkable clay soils, compressible soils, obstructions, Made Ground and silt rich soils; ▲ Aggressive Chemical Environment for Concrete (ACEC) Classification is AC-1s with a Design Sulphate Class of DS-1 was reported. STATS suggested that a design CBR value of 6% could be adopted; and ▲ STATS considered the Site fell into the "moderately low subsidence risk" category relating to potential chalk dissolution and states that Edmund's database of known natural and man-made chalk solution features illustrates there are no such features in the immediate vicinity of the Site.
WSP Phase I (2005)	The report was undertaken in the context of the proposed investment purchase of the Site. Potentially contaminative activities identified during a Site walkover were limited to the storage of diesel fuel in two above ground storage tanks (with a total capacity of 3,000 litres) and the storage of waste materials. No significant issues were identified associated with the current use of the Site. The following third-party reports were also reviewed by WSP as part of the assessment (not seen by Delta-Simons): ▲ A 1999 Environmental Monitoring Program undertaken by CASELLA Ltd. The report detailed results of effluent monitoring, industrial emissions monitoring, groundwater monitoring, surface water monitoring and building fabric monitoring. It was stated that the report reviewed a number of intrusive and non-intrusive investigations, which identified potential issues associated with: low concentrations of toluene and purgeable hydrocarbons from effluent monitoring for B2000; groundwater contamination associated with chlorinated solvents; and copper contamination within a concrete slab. It was noted by WSP that the effluent treatment facility had been decommissioned, that the identified groundwater contamination was outside of the Site boundary and that the concrete slab had been remediated; ▲ A 1999 Initial Ground Investigation by Soil Consultants Limited (reported to have been associated with the northern area of the Site), which was stated to have identified potential issues associated with elevated levels of cadmium within two boreholes, and elevated levels of arsenic, lead, copper, zinc and mercury within a single borehole, however, it was noted by WSP that the soil guidance values used for comparison at that time were no longer applicable; and ▲ A 2004 Addendum, Site Investigation Report undertaken by STATS. It was stated that the report identified potential issues associated with elevated levels of ground gas within Made Ground. It was noted that the report was based on a single monitoring event and did not record flow rate. It is also suggested that Batelle UK Limited and Havant International Limited had an outstanding intrusive investigation report for the north-west area of the Site, with intrusive

	boreholes placed west of B1000 to assess groundwater and other ground environmental factors. This report has not been seen by Delta-Simons. WSP concluded that based upon the information and intrusive investigations reviewed, no significant contamination issues had been identified for the continued commercial use of the Site. However, it was noted that the potential presence of residual contamination, which may require remediation in the event of redevelopment could not be discounted. It was considered that the Site represented a low/ medium environmental risk.
Geo-Environmental Appraisal (2019)	Clancy undertook an intrusive investigation in July 2019 across the north-eastern and southern areas of the Site to support the demolition and redevelopment works detailed in planning application APP/19/00703. The report also includes limited discussion of the UXO Report discussed above in Section 2.3. Investigation works at the Site included the advancement of eight window sampler boreholes to 5.5 m bgl, four hand trial pits to 1.4 m bgl, four cable percussive boreholes to 24.9 m bgl and the excavation of two trial pits for soakaway testing purposes. Visual and olfactory evidence of hydrocarbon contamination was identified at two locations (WS2 & WS5) between 1.0 to 1.6 m and 2.5 to 3.5 m, respectively. From nine samples of Made Ground and six samples of natural soils, no elevated levels (in comparison to Site Screening Values (SSV)) of inorganic contaminants for a commercial/ industrial end use were identified. In regard to organic determinands, elevated levels of hydrocarbons (aliphatic C10-12, C12-16 & Aromatic C12-16) were identified at WS2 and WS5 noted to be above 'Water Screening Values'. It is noted that from a review of the values, these fall below Delta-Simons soil Generic Assessment Criteria (GAC) for a commercial/ industrial use; however, exceed GAC values for potable water. It was noted by Clancy that no elevated levels of hydrocarbons were identified from samples taken from 3.9 m bgl. Clancy noted that WS2 was located in an area of former waste storage and existing substation, with WS5 located adjacent to historical tanks in the west which were considered to likely be the source of contamination. From four rounds of gas monitoring, carbon dioxide levels were identified up to 7.2 % v/v with a maximum flow rate of 0.7 l/hr. No elevated levels of methane were identified. The Site was considered to represent a Characteristic Situation 1; however, given the level of carbon dioxide (above 5 %), depth and nature of the Made Ground, and presence of peat in the area, Clancy recommended for the Site to be raised to a Characteristic Situation 2. Overall, the following recommendations were provided: ▲ Additional investigations in the area of WS2 and WS5 to delineate the identified hydrocarbon contamination with regards to controlled waters; ▲ Preparation of a remediation strategy following delineation; ▲ The installation of gas protection measures in line with CS2 within new units with independent verification; and ▲ The consideration of UXO during future excavations with the potential for supervision by an EOD engineer to brief and support site personnel.
Supplementary Investigation (2020)	Clancy undertook a supplementary investigation across the south of the Site in July 2020. The report also makes note of two letter reports by Clancy Consulting from September 2019 (10/1425/002) and June 2020 (10/1425/003), which have not been seen by Delta-Simons; however, information from these was noted to be included within the report. Further works at the Site included the advancement of two cable percussive boreholes to 20.0 m bgl, and twenty-five window sample boreholes to 4.5 m bgl.

	Ground conditions identified Made Ground (consistent with the material identified in 2019) to 1.1 m bgl. Visual and olfactory evidence of contamination was identified at one location. From three samples of Made Ground and twenty-four samples of natural ground, a slight exceedance of perylene was identified at one location; however, given the very low value and relatively low volatility, this was not considered to represent a significant risk to future Site users. Total petroleum hydrocarbon (TPH) compounds were recorded in Made Ground in excess of solubility limits at two hotspot locations along with a number of elevated volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC). From six groundwater samples, slight exceedances of lead and nickel were identified at one location, along with marginally elevated total PAH (maximum of 0.96 µg/l) and TPH (maximum of 283 µg/l); however, the concentrations were not considered to be significantly elevated. It was noted by Clancy that no elevated source of PAHs was identified within soils, and it was considered that this was representative of either an off-Site source or on-Site source which had not yet been identified. Based on testing it was considered that the majority of Made Ground and natural soils would be suitable for disposal as non-hazardous waste with localised TPH impacted soils requiring disposal to a hazardous waste landfill. Overall recommendations for the proposed development included the following: ▲ Development of a Remediation Method Statement; ▲ Development of a Materials Management Plan if Site won soils are proposed for re-use on-Site; ▲ Excavation and removal of identified contamination hotspots in the vicinity of WS2 and WS5 with subsequent inspection and verification of excavation works; ▲ Implementation of a watching brief for previously unidentified soil contamination during the groundworks; ▲ Collection and laboratory analysis of soil samples from finished formation level across the Site to verify that residual contaminant concentrations are below guidance values; and ▲ Provision of a Verification Report to assist with discharge of planning conditions relating to contaminated land.
Implications for Land Contamination Risk	<i>Several ground investigation reports appear to have been produced for the Site, a number of which have not been seen by Delta-Simons. Based on the recent available information, two hotspots of hydrocarbon contamination have been identified with recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.</i>
Implications for Redevelopment	<i>Considering the recent investigations only covered areas in the north-east and south, and the proposed development covers the majority of the Site, further intrusive investigation is recommended.</i>

2.8 Flood Risk Advisory

Initial Flood Risk Review	A review of mapping provided by the EA indicates that whilst the majority of the Site is not located within an area at risk of flooding from rivers or the sea, a small area of the access road is shown to be at medium risk of fluvial flooding from Mill Stream. Anecdotal information previously provided from a Site representative indicates that this small area of the access road does not have a history of flooding.
----------------------------------	--

	The EA Long-Term Flood Risk Map (Surface Water) indicates the majority of the Site largely to be at very low risk from surface water flooding. There are localised areas of low risk, small areas of medium risk (around the boundary of Building 5000 and the south-west corner of Building 7000), and an isolated pocket of high risk associated with a localised topographical depression south of Building 1000. During previous Site visits, Delta-Simons was informed that all surface water from the car parking passes through interceptors and a surface water pumping station in the east of the Site, prior to discharge into the Mill Stream. It was also noted that water ingress occasionally occurs within a electrical switch room located within Building 1000 following intense rainfall with evidence of sandbags and flood barrier observed at the entrance. The Site is located within an area considered to be at potential susceptibility from groundwater flooding; however, no incidents of groundwater flooding have previously been highlighted. Delta-Simons has previously reviewed a Foul Water Flood Risk Assessment produced by Atkins in 2008 (2008 FRA) which highlighted an incident of historic foul water sewer flooding in 2008 due to surcharge of the foul water system. The 2008 FRA also recommended several mitigation measures to prevent flooding associated with the foul water systems on-Site. Information provided to Delta-Simons in 2019 indicates that a non-return valve was installed near Building 7000, which is likely to reduce the risk of sewer flooding at the Site. It should be noted that all the flood maps are <u>indicative</u> only.
Clancy Consulting Flood Risk Assessment and SUDS Strategy (2019)	A FRA and SUDS strategy was produced for the Site in 2019 associated with the proposed reconfiguration of Building 1000, addition of car parking and redevelopment of the south-western area of the Site. Overall, it was considered that the development area was at low risk of flooding (from all sources) with the proposed drainage to attenuate flows from impermeable areas to current run off rates through underground geocellular tanks, oversized pipes, permeable paving and flow control devices. Two letter reports by Clancy have also been identified from August and October 2019 which further discuss the potential flood risk at the Site following comments from the EA. The letter reports note that a flood defence (embankment) is present to the east of the Site which comprises a crest height of approximately 2 m above the modelled river level (including 20% climate change) which would therefore provide suitable protection from potential flood events.
Implications for Flood Risk	<i>Based on the information reviewed, the majority of the Site is not located within an area considered to be of an elevated risk of fluvial flooding. Whilst a small area of the access road in the east of the Site is shown to be at moderate risk of flooding associated with the Mill Stream, this is understood to be protected by an embankment.</i> <i>Several areas of the Site are shown to be at potential risk of surface water flooding, however, no associated issues were reported on-Site with the exception of minor water ingress at Building 1000.</i> <i>Available information indicates that flooding events have occurred at the Site associated with surcharging of the foul system, however, it is understood that a non-return valve was installed at the Site.</i>
Implications for Redevelopment	<i>Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support the proposed redevelopment of the Client's masterplan.</i>

3.0 Land Contamination Risk

3.1 Introduction

A Conceptual Site Model (CSM) represents the relationships between contaminant sources, pathways and receptors, to support the identification and assessment of Possible Contaminant Linkages (PCL).

Where PCL are identified, a preliminary risk assessment is undertaken to assess the likelihood that each possible linkage exists and to determine whether these pose potentially unacceptable risks to identified receptors and require further assessment. Where this linkage is of a form that subsequently leads to the potential for land being identified as 'contaminated land' under the terms of Part 2A of the Environmental Protection Act 1990, the linkage is termed a significant contaminant linkage.

At the preliminary risk assessment stage, which is typically based upon desk study information and Site reconnaissance, the decision on whether a PCL poses a potentially unacceptable risk is based upon professional judgement. The significance of the PCL will also be determined dependant on the context of the land use and the purpose of the assessment.

Assessing risks from land contamination underpins the suitable for use approach adopted under Part 2A of the Environmental Protection Act 1990 and its associated regulatory regime.

3.2 Conceptual Site Model

The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial properties, with car parking in the south, east and north of the Site, hardstanding and access roads, and landscaping confined to limited areas. While chemical storage, diesel back-up generators and electrical substations were previously identified on-Site, the Site appeared well managed and no significant potential contamination concerns were noted associated with the current Site use.

The Site was predominantly unoccupied until the development of a sewage works in the north-east by 1909. By 1973, the sewage works was no longer present, and the Site had been redeveloped into an IBM computer products manufacturer. Since the 1970's, some redevelopment has occurred on-Site, though the main buildings have largely remained unchanged. Potentially contaminative uses associated with the computer manufactory include previous 'wet' processes in B1000, diesel powered boilers in the area of the current gas boiler systems (B3000), an effluent treatment and chemical storage area in the area of B22, and effluent treatment and former chemical storage in the area of B41 and B42. Also, a former pollution incident was reported to have occurred in the 1980's, however, no further details are known.

Potential sources of contamination identified in the surrounding area include a mill, a sewage works, factories, an engineering works, a warehouse, a boatbuilding works/ works, a plastics factory, works, a pumping station with a tank and a petrol filling station.

The Site is considered to be of a moderate environmental sensitivity given: the presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Principal Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the mixed commercial, light industrial and residential use of the surrounding area.

Based on the recent available information, two hotspots of hydrocarbon contamination have been identified with recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.

3.3 Contaminant Linkage Assessment

Based on the information reviewed within this Report, the following preliminary risk assessment table has been formulated, which identifies all PCL in the context of the Sites proposed redevelopment.

Risk definitions used for the following assessment are provided as follows:

- ▲ Low risk – Low likelihood and either no or mild severity. Negligible/ unlikely contaminated land situation. Either no action recommended, or possible action during changes in conditions;

- ▲ Moderate risk – Likely probability and medium severity. Plausible contaminated land situation. Possible action recommended following further risk assessment; and
- ▲ High risk – High likelihood and severe severity. Likely or demonstrable contaminated land situation. Action (possibly urgent) recommended.

Contaminant Linkage Assessment				
Source(s)	Pathway(s)	Receptor(s)	Risk Rating	Justification & Mitigation (if required)
Potentially contaminated soils and/or groundwater located beneath the Site.	Direct contact/ ingestion and inhalation of dust and vapours.	Site users.	Low Risk	Whilst the presence of further localised contamination is possible, given the Site is to be predominately covered by buildings and hardstanding, which will significantly constrain the associated pathways, the risk is considered to be low.
	Direct contact, ingestion and inhalation of dust and vapours.	Maintenance workers during any future sub-surface works at the Site.	Moderate Risk	Site workers may become exposed to localised contaminated soils and shallow groundwater during intrusive groundworks undertaken at the Site. Safe working practices should be undertaken and appropriate Personal Protective Equipment (PPE) should be used that will reduce the risk to low.
	Leaching of contaminants and vertical migration.	Groundwater beneath the Site.	Low to Moderate Risk	Previous investigations across the southern area of the Site have identified localised contamination and the potential for further localised contamination to be present is possible. Also, there is the potential for contaminants to be mobilised during construction works, and in the absence of Site-wide available information, the risk is considered to be low to moderate.
	Permeation of hydrocarbons through plastic pipe work.	Water supply pipes.	Low to Moderate Risk	Hydrocarbons, especially aromatics and chlorinated solvents are known to permeate plastic pipes, particularly when encountered at high concentrations. Whilst widespread hydrocarbon contamination was not previously identified, the proposed redevelopment may introduce water supply pipes to potentially localised areas of contamination. Upgraded water supply pipes may be required in order to reduce this risk to low.
	Lateral migration through any groundwater beneath the Site.	Off-Site receptors (neighbouring properties/ users and nearby surface water).	Low to Moderate Risk	The Mill Stream is located adjacent to the east of the Site and available information indicates that groundwater will be present at shallow depth. While the buildings and hardstanding across the majority of the Site will limit potential contaminant migration, the construction activities may mobilise contaminants. Therefore, the risk to off-Site receptors is also considered to be low to moderate.
Ground gas.	Vertical and lateral migration of ground gases.	Site users & the buildings on-Site.	Low to Moderate Risk	Based on the available information, slightly elevated levels of carbon dioxide were previously identified in the southern and north-eastern areas of the Site in line with Characteristic Situation 2. The Site is also partially located within an intermediate radon gas area. Based on the proposed development, basic gas protection measures are likely to be required in any new buildings.
Potentially contaminated soil and groundwater from off-Site sources.	Lateral migration and subsequent inhalation.	Groundwater beneath the Site and future Site users.	Low Risk	Whilst potential off-Site sources of contamination have been identified, given the proposed use of the Site, which will be predominantly covered by buildings and hardstanding, the risk to Site users is considerably reduced. Overall, the risk is considered to be low.

4.0 Conclusions & Recommendations

4.1 Land Contamination/ Ground Conditions

Risk Assessment Summary/ Conclusions	Delta-Simons has completed a land contamination risk assessment based upon available information. Information has indicated that significant widespread contamination is unlikely to be present. However, localised contamination was recently identified at the Site, which it has been recommended to be remediated (excavated) and given the historical use of the Site, the potential for further localised contamination to be present is possible. It is, therefore, considered that the risk of significant possible contaminant linkages to exist is low to moderate for a continued use and for the proposed redevelopment.
Recommendations – Ongoing Use	No further works are considered to be required for land contamination purposes in the context of an ongoing use.
Recommendations – Future Redevelopment	Given that a future redevelopment of the Site is proposed that covers a wider area than originally investigated, it is expected that the regulatory bodies will require a further intrusive investigation, under the planning process. In the first instance, it is recommended that an up to date Preliminary Risk Assessment is completed and submitted along with any future planning application. Following an updated Preliminary Risk Assessment and Ground Investigation, a Detailed Quantitative Risk Assessment (DQRA) may be required in order to confirm whether any remedial works are required and in order to derive Site-specific remediation targets. Following a DRQA, localised remedial works is possible. Also, additional costs could be incurred by: any ground materials requiring off-Site disposal; the upgrading of water supply pipes; the provision of ground gas/ radon protection measures; and importing clean/ certified topsoil in any areas of future landscaping. Ground conditions are variable with deeper areas of Made Ground and relic foundations from historical structures. Ground improvement and/ or a piled foundation solution are likely to be required, which costs should be considered. It is also prudent to further consider the potential for encountering UXO during future groundworks. Any ground workers who are required to perform sub-surface work at the Site should be made aware of the possibility of encountering localised contamination. Therefore, good standards of personal hygiene should be observed with appropriate levels of PPE provided and utilised and toolbox talks given to contractors prior to the commencement of works.

4.2 Statement of Risk/Land Contamination Liability Assessment

This Assessment considers both perceived and actual risks using the contaminant linkage concept, with the principal measure of risk being whether significant harm (to people, animals, property (including buildings, cattle etc.), or statutory ecological receptors) or pollution of controlled waters (surface water bodies, aquifers, coastal waters, or territorial waters) is being caused, or whether there is a significant possibility of such harm being caused.

The overall risk classification, based on the source-pathway-receptor principle, adopted for this preliminary assessment, is defined as follows:

- ▲ Low risk – issue unlikely to present a liability or cost;
- ▲ Moderate risk – issue may present a liability or cost, but these may be limited; and

▲ High risk – likely that significant liabilities and/or costs exist.

Regulatory Action under Part 2A, EPR or EDR	There is considered to be a Low risk of enforcement action by the regulatory authorities under Part 2A of the Environmental Protection Act 1990, the Environmental Permitting Regulations 2016 or the Environmental Damage Regulations 2015, whilst the Site remains in its current use. However, it should be noted that appropriate works (including additional intrusive investigation) will be required in order to support the future development proposals.
Third Party Liability	The potential for legal action by surrounding landowners based on the potential for contamination to migrate off-Site and result in private or statutory nuisance is considered to be Low .
Investment/Asset Impact	Delta-Simons considers there to be a Low to Moderate risk of impact on the value of the Site from significant contamination issues, in the context of the Site remaining in its current use or for the proposed redevelopment.
Overall Statement of Risk	On the basis of available information, Delta-Simons considers that with regard to potential soil and groundwater contamination issues and associated environmental liabilities, the Site represents an investment opportunity with a Low to Moderate overall risk status in the context of its current use and proposed redevelopment.

4.3 Flood Risk Advisory

Conclusions & Recommendations	Based on the information reviewed, the majority of the Site is not located within an area considered to be of an elevated risk of fluvial flooding. Several areas of the Site are shown to be at potential risk of surface water flooding, however, no associated issues were reported on-Site with the exception of minor water ingress at Building 1000. Available information indicates that flooding events have occurred at the Site associated with surcharging of the foul system, however, it is understood that a non-return valve was installed at the Site. Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support the proposed redevelopment of the Client's masterplan.
--	---

4.4 Other Redevelopment Considerations

Recommendations	Additional environmental surveys were completed and submitted to the Local Planning Authority to support the previous proposed development works, which included those associated with ecology, heritage, air quality, noise and sustainability (BREEAM). These are all likely to require updating for any future planning re-submission.
------------------------	---

Figure 1 – Site Features Plan