



RSK Land & Development Engineering Sustainable Drainage System (SuDS) Risk Assessment

**Bellway Homes
Abingworth Fields, Thakeham**

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1 INTRODUCTION

This SuDS Risk Assessment document has been prepared by RSK Land and Development Engineering Ltd on behalf of Bellway Homes, in relation to the project Abingworth Fields, Thakeham (The Development).

The purpose of this risk assessment is to ensure that any health and safety risks/hazards identified are reviewed and mitigated to an acceptable level to ensure that the implementation of SuDS features within the development will pose as low a risk as is possible to the general public.

The SuDS considered for the purposes of this risk assessment, include drainage features that will be employed to reduce and manage surface water runoff from the adjacent fields to a design return period of one hundred years plus climate change. This is required so that The Development will at a greatly reduced risk of being impacted by the risk of flooding from the adjacent landscape. All flood mitigation features will be formed using SuDS measures, and will direct flows along the eastern development boundary to discharge flows into a local watercourse network in the north east. SuDS features include the following:

- Swales
- Attenuation Basins
- Filter Drains
- Bunds

This document outlines the risks associated with the proposed surface water system for the end user in this case the general public/local residents and the management company.

Reference should also be made to the following documents, some of which provide further detail on the proposed structures and maintenance operations required:

- CIRIA Report C753, *'The SUDS Manual'*, 2015
- CIRIA Report C625, *'Model Agreements for Sustainable Water Management Systems'*, 2004;
- Design and Construction Guide (App C SSG), May 2021
- Building Regulations Part H

Further assessment of the health and safety risks may be required dependent upon the outcomes of this assessment. It would be anticipated that any further risk assessment would be undertaken by the Royal Society for the Prevention of Accidents (RoSPA).

2 RISKS ASSOCIATED WITH SUDS FEATURES

2.1 Principal health and safety risks/hazards

The principal risks/hazards associated with SuDS features should be considered throughout the design process and be mitigated to an acceptable level. These risks/hazards are most notably:

- Drowning,
- Slips, Trips and Falls,
- Ill health due to untreated or polluted water (water quality issues).

Further reference must be made to Chapter 36 Health and safety of CIRIA Report C753, *'The SuDS Manual'*, 2015 which details guidance on health and safety principles and practices relevant to SuDS.

Sections 2.2, 2.3 and 2.4 below detail the key items and factors to consider as per "36.3 Effective Health and Safety Risk Management" in The SuDS Manual with extracts shown in italics and quotation marks.

2.2 Drowning Risk Management

Drowning is considered to be the primary risk associated with SuDS features that retain bodies of water at depth either permanently or temporarily during and after storm events. This is particularly critical if a SuDS feature like a pond is to have a permanent wet zone which results in the outlet being above the base of the pond for the provision of amenity spaces. *"Drowning more frequently occurs from accidentally falling in rather than by deliberately accessing a body of water and then getting into difficulty. The risk may be increased during the hours of darkness and when there is unsupervised access to open water, particularly by younger children or those under the influence of alcohol or drugs."*

"The risk of drowning is also exacerbated when features such as steep banks, deep bankside or wateredge silt and/or overhanging branches are present. Fast flowing water or areas that become inundated very quickly with a rapid rise in water level may also increase the risk of drowning. Such hazards should always be avoided in SuDS designs."

Fencing Requirements

Fencing may be required as a suitable measure where depths of the SuDS feature are significant, depth of water is significant, bank gradients are steep, the presence of vertical drops due to retaining walls or presence of hard features such as culverts or steps. In these circumstances the height of fencing should be considered to prevent unsupervised young children from entering the feature but also allow adults entry should it be necessary for emergency or maintenance situations. This would typically be in the form of a toddler proof fence 600-750mm high and should be a vertical pale type rather than a horizontal rail construction which could be used as a climbing frame.

"If fencing is not appropriate, different types of planting at the margin can provide an element of physical protection and create a clearly identifiable visual border." Fencing may also be used as a temporary measure until planting has matured to provide the protection and deterrent measures that have been proposed.

Siting & Location of SuDS features

"Careful consideration as to the positioning and design of a SuDS pond is important in terms of minimizing misuse and vandalism, and increasing natural surveillance."

It is important to consider the positioning of above ground SuDS features. If these are located in areas accessible to local roads, footpaths and properties then the risk is reduced due to observation provided by the residents and general public whilst also maximizing the potential amenity benefits.

Access to the water

"Where the water is accessible, the edge gradient above and below the water line and the depth profile of the water are important. In many situations, paddling in the water would be considered acceptable and safe. However, swimming in SuDS components should be actively discouraged. A safe approach is to design the edge of the permanent or temporary body of water with:

1. a “dry bench” before the component to provide a level surface for an individual to assess the surroundings; this could be designed with a reverse slope to stop anyone slipping or riding unhindered into the water
2. all slopes (where people have direct access) not greater than 1 in 3, to allow unaided movement in either direction for able-bodied visitors or maintenance personnel to mow and clear vegetation
3. a level “wet bench” at or just below the normal water surface level which will be both clearly wet and uncomfortable underfoot for anyone who has accessed the water body; this may dry out occasionally in exceptionally dry periods but by and large will remain boggy; the appropriate width of this bench will be dependent on the size of the water body, but a reasonable minimum is considered to be 1.5 m
4. clear identification of the water edge, for example using planting or soft or hard edging (where appropriate)."

Access to the water should be discouraged and where appropriate use suitable measures to reduce the risks such as the following:

- “shallow, muddy margins”
- “reeds and shrubs that do not obstruct visibility, but provide a safe deterrent and barrier to paddling and swimming.”
- Suitable barrier planting or guarding to identify and deter individuals from entering the water but do not obstruct visibility of the water and surrounding area.

Maintenance of all measures detailed above must be incorporated into the appointed management company or adopting authority's (where appropriate) maintenance regime to ensure that all features are maintained in perpetuity to ensure future public safety.

Water Body

“Most SuDS designs should not be using components close to houses or other buildings where normal still water depths are greater than 600 mm, or normal velocities are greater than 0.5 m/s.”

In some cases it will be necessary to have deeper SuDS features and as such it is important that the features are risk assessed to provide the required mitigation measures for the implementation of deeper SuDS features. Water velocities should not be high within SuDS features and effective ways of managing sub-catchments within the drainage design should be utilized to reduce velocities. *“The maximum water velocity in an open component should be low enough so that if anyone inadvertently enters the water’s edge they can remain standing. The same principle should be applied to flood flows for events up to the 1:100 year (1% annual probability of occurrence) or 1:200 year event (0.5% annual probability of occurrence), where floodwater may be conveyed and stored in exceedance zones.”*

Table 36.1 gives an interpretation of the guidance provided by Defra (2006) for SuDS application

TABLE 36.1 – Recommended depths and velocities for SuDS and exceedance flow routes

Maximum Velocity (m/s)	Depth (m)	Comments
0-0.4	< 1.5	Level benches recommended: • At or just below water surface • At a depth of 600m
0.5-0.9	< 0.6	Level bench recommended: • At or just below the water surface
1.0-2.0	< 0.3	

Life-Saving Equipment

The provision of life rings and other pieces of public rescue equipment (PRE) should be considered for implementation only if the water conditions and location suggest that these are necessary during the risk assessment as they have been unnecessarily provided in the past. *“For PRE to be effective, the person in the water needs to be noticed when in trouble, which is affected by the siting of a pond.”*

“PRE is frequently abused and its presence can provide a false sense of security for those thinking of entering the water. Where they are provided, they should be regularly inspected, maintained and immediately replaced if used or missing.”

Warning Signs

In public areas and on developments it may be necessary to provide warning signage as a way of educating and informing the public about the health and safety risks associated with the SuDS features in the area. Signs are required when deep water or other significant hazards (which are not recommended for SuDS design) exist. If these situations exist then signs should be placed at the entrance to the location/site and other access points which should clearly state the following:

- “site name”
- “emergency instruction: “Dial 999 in an emergency””
- “main hazard and prohibition symbols and supplementary text”
- “details of site supervision services and contact details”
- “location and postcode (needs to be understood by local emergency services)”
- “site map showing, rescue equipment, first aid and supervisory help, telephones”
- “organisational logos.”

These signs should also be replicated along routes around the associated SuDS features to reinforce the health and safety risks relating to any hazards in the area.

“Where the system includes significant areas of open water, the site will require monitoring for ice formation, and appropriate temporary warning signs will be needed (RoSPA should be approached for advice in such scenarios).”

2.3 Slips and Trips

Physical injuries, due to slips, trips, falls and possible entrapment are potential risks that can be associated with SuDS features which need to be reduced/removed during the design development stage to safeguard the general public. This is especially critical within any amenity or public open space areas that are intended to provide areas for recreational use.

Consideration must be given to the potential weather that may create wet and slippery conditions, lighting, bank steepness, depth of SuDS features and water (freeboard if possible), footway condition and any hazards that could create any trip or fall into any deep features or water. This is particularly important when considering the age of the general public and any disabilities that they may have.

“Accessible surfaces that convey runoff, or through which runoff is designed to pass, may be more vulnerable to a deterioration in structural integrity or build-up of algae that can cause the surface to become slippery, and potentially result in ice formation during winter months.”

Structural Integrity

The condition of SuDS features must be contemplated whilst taking into account the possibility of any antisocial behaviour (vandalism), durability of products and materials and the proposed ongoing maintenance regimes of said features. SuDS features that require access for maintenance purposes should include suitable measures such as slip resistance (where surface water flow can be expected), adequate space allowance and consideration for maintenance being undertaken when features have surface water flowing through them.

“The risks associated with ice formation should also be considered and managed appropriately, but the same considerations as for general water safety will apply - shallow water features are preferred.”

Vertical drops/steep sided structures

When developing the design of SuDS features, where possible the requirement for deep and steep sided structures and high vertical drops should be avoided as these will be a significant risk to any slips, trips or falls within or adjacent to the feature. This will be specifically important where there is likely to be significant depths of water within the SuDS feature. Headwalls should not need to be excessively high and be accommodated within the bank slope profiling. If steep slopes and large vertical drops are required then these should be designed in a way where deterrent or protection measures can be incorporated into the design. The detailing of deterrent and protection measures should also consider any future maintenance (this is a CDM requirement) of not just of the measures but the SuDS feature itself.

Level changes

“Unexpected changes in level, particularly if not immediately visible, should be avoided. Slopes should be gentle at 1 in 3 or less, where accessible, and other changes in level visible and expected.”

Inlet/outlet/safety grilles

Safety grilles are only required for pipes with a diameter of 350mm or more as per the guidance set out in The SuDS Manual and Design and Construction Guidance (App C SSG), May 2021. Any incoming pipes into a SuDS feature with a headwall should be connected in at an angle of 45 degrees and in the direction of surface water flow where applicable to reduce the risk of debris or other detritus blocking up the safety grilles.

2.4 III health from untreated/polluted water

“Rainwater runoff in SuDS components is no different from the water that runs across roads and car parks and stands as puddles for lengthy periods after rainfall. Many existing water features in parks and public open spaces already take highway runoff. Indeed, with good SuDS design and effective source control, accessible SuDS components should contain “treated” runoff, and therefore any pollution levels should be very low.

However, as with any natural water bodies, water in SuDS could potentially contain toxins that could potentially cause ill health, and there are management principles that should be followed to minimize potential risks.

Blue-green algae, leptospirosis, cryptosporidium and E. coli are examples of possible toxins. However, as with pollutants, the risks associated with the presence of these in SuDS components should be, at worst, no greater than in, for example, recreational ponds in parks, and it should be lower in a well-designed SuDS Management Train that removes pollution at source. Robust routine inspection and operation and maintenance practices should deal with the low risks associated with these hazards.”

3 SUDS RISK ASSESSMENT

Design Items To Be Considered & Assessed (Hazard Identification)	
Item	Comments
Location of SuDS features to retain bodies of water	Public Open Space (POS) along south east/ east site boundary.
Does the area provide any local amenity benefits and if so what features are located within this area	No formal access routes to be proposed through the area although a Footpath existing along the eastern boundary and no formal access restriction (i.e. Fencing etc.) is proposed to prevent informal access through the area to the Development Site.
Consider the age profile of persons in close proximity to the SuDS and using the area – Evaluate proximity to schools, parks, play areas, rights of way etc.	Existing Right of Way present on the east, potentially linking through SuDS area informally. No local play spaces, Schools etc. in the immediate vicinity. Access for all Age Profiles to be considered but likely Users to be more prevalent as Teenagers, Families accompanying younger children, Older Adults.
Is visibility and natural surveillance of the proposed SuDS features suitable?	Swale and Basin is proposed to the rear of the Residential Plots and therefore natural surveillance is unlikely.
Type and nature of water edge planting – Consider time taken to mature and precautions required to protect feature during this period	Landscape Architect to advise – but planting scheme is likely to be an important contributor to access controls/ mitigating potential risks. Details to be incorporated into the landscape management plan.
What are the gradients and extent of slopes above, at and below the water level	No Standing water is proposed. General side slopes of features are steeper than normal at 1:1.6 to 1:1. Depths of Swales limited to 1m, Basin to 1.2m
What is the definition of water edge and nature of ground (e.g. soft/hard)	Water edge to be soft with small (circa 0.5m) flat strips at the top of slopes, particularly on the western site side. Potential Planting may be appropriate to help manage access and risks. Bunding on site side of features introduces potential increased fall height but will likely serve to restrict access to the smaller flat areas located on this side – hence edge widths for access are likely to be significantly greater than 0.5m
Water depth profile within SuDS features (Swales and Basins)	Varies depending on storm duration and intensity. The critical 1 in 100yr + 45% climate change event would see the Swales filled to approximately 0.7m – 0.8m. Basin depths are projected at a maximum of circa 0.6m to 0.75m.

Extent of water surface area	Surface area will be the basin base for most storms and will rise to different levels depending on the storm duration and intensity with the basin filling to the top water level for the critical 1 in 100yr + 45% climate change event. Swales include check dams are therefore depths of water, and therefore surface area, is expected to be relatively constant during significant rain events at about 80% - 90% total width.
Are there any underwater obstacles or traps	Swales have check dams included which present frequent obstacles. Basin outfall is via bagged headwall which is unlikely to present significant risks.
What are the potential currents and velocities of surface water within the SuDS features	Outflow from the Basin to the downstream 300mm pipework may achieve significant velocities of up to 3.5m/s in the 1 in 100 year plus 45% climate change event. Flow rates are a peak at about 230 l/s, based upon the 70m³ peak volume levels changes will be small on drain down (order of mm/second) and hence general flow currents/velocities in Basin will be low. During filling initial inflows and rates of rise will be greater. Swale velocities in the bulk (i.e. below 600mm in depth) will be low due to the check dams. Flow rates above the check dams will be greater.
Potential increase in depth of water and rate of rise	Basin and Swale depths are generally less than 0.8m so potential increase in depth of water will be that. Rate of rise will depend upon the type of storm. Rates of rise in Swales to 600mm are expected to be relatively rapid, rises above this will be much slower as weir flow becomes the dominant flow regime between swale lengths.
Is there any potential for ice formation	Weather dependent there may be periods of prolonged water depth, particularly within the Swale. No permanent water is proposed in the Basin and outflow rates are likely to limit depths to a low height and duration.
Are any headwalls or channels located within the SuDS features	Headwall in Basin are proposed to be Bagwork headwalls closely matching the bank profiles. No low flow channels proposed.
Headwall height or channel depth/width	Headwall heights will be minimal as a Bagwork headwall system is proposed. Profile to closely match the Banks.
Slope of headwall or channel profile	As stated above.
Are there any excessive level changes proposed within the SuDS features	No step changes proposed in profiles which will be generally gentle. Check dams will introduce vertical features but levels either side expected to be similar.

What is the inlet/outlet pipe diameter and are grilles required?	300mm diameter maximum, grilles required for pipes 350mm diameter or greater as noted in the adoptable guidance Design and Construction Guidance and The SuDS Manual.
Depth of chambers - Is access possible?	Chambers are located upstream of Land Drain and downstream of Basin for outfall pipe. Access is possible for the 1200mm chambers but depths are limited to 1.2m including catchpits.
Likely contamination of water via rat urine or dog fouling etc.	Potential for dog fouling around top of pond due to adjacent footpath. Consider installing dog bins although owners should provide sufficient mitigation. Potential for rodents to be present within features due to semi-rural however there is no obvious food supply in the area. Management company will be responsible for inspecting site and SuDS features for signs of any rodents and will need to remove any rodents found safely as part of their management and maintenance responsibilities.
Likelihood of toxic algal blooms	N/A

4 RISK ASSESSMENT EVALUATION

Risk Impact Scoring

SuDS Risk Assessment Matrix (Scoring Adapted from Table 36.2 of The SuDS Manual)			Consequence				
			1	2	3	4	5
			Insignificant No injury or health effects	Minor Minor injury or health effects	Moderate Injury but not life threatening. Some ill health effects	Major Serious injury. Dangerous near miss. Serious ill health	Extreme Serious injury or death. Serious life-threatening disease.
Likelihood	5 Almost certain (frequent)	Is expected to occur/ recur frequently or within a short period of time (most weeks or months)	5	10	15	20	25
	4 Likely (probable)	Will probably occur/ recur in most circumstances (several times a year)	4	8	12	16	20
	3 Possible (occasional)	Possibly will occur/ recur occasionally (once every few years)	3	6	9	12	15
	2 Unlikely (Uncommon)	Uncommon might occur/recur at some time in the future	2	4	6	8	10
	1 Rare (Remote)	Unlikely to occur/ recur May only happen in exceptional circumstances	1	2	3	4	5

KEY

Risk	Action
Extreme risk 17-25 (E)	Design stage – not acceptable – design must be changed Management stage – immediate attention and response needed to reduce the level of risk
High risk 11-16 (H)	Design stage – not acceptable – design must be changed Management stage – attention and response needed to reduce the level of risk
Medium risk 5-10 (M)	Design stage – review if it is practical and reasonable to change design to reduce level of risk Management stage – review options to see if there are practical and reasonable options to reduce risk
Low risk 1-4 (L)	Design stage – acceptable – no changes required Management stage – no response needed to reduce the level of risk, continue to review on regular basis

890951 – Abingworth Fields, Thakeham - RSK SuDS Feature Designers Risk Register

ID	RISK DESCRIPTION	IDENTIFIED BY	IDENTIFIED DATE	RISK IMPACT	RISK OWNER	BODY AT RISK	LIKELIHOOD	CONSEQUENCE	RATING	CONTROLS/MANAGEMENT ACTION	COMMENTS ON THE CURRENT PROGRESS	STATUS
1	Risk of drowning in Attenuation Basin	RSK	04/11/2025	Potential loss of life or serious injury. Basin is 0.8m deep for storage purposes.	RSK /Client / Landscape Architect	General Public & Management Company	1	5	5	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children. Risk is highly time limited (circa 10 minutes) during significant rainfall event (1 in 100 Year +45%) based on modelling.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
2	Risk of ice formation in Attenuation Basin	RSK	04/11/2025	Potential moderate injury. Basin is 0.8m deep for storage purposes.	RSK /Client / Landscape Architect	General Public & Management Company	1	3	3	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children. Risk is highly time limited (circa 10 minutes) during significant rainfall event (1 in 100 Year +45%) based on modelling.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
3	Risk of Slips/Trips/Falls around Attenuation Basin	RSK	04/11/2025	Potential moderate injuries. Side slopes are greater than the normal 1:3 (~1.1.6) and therefore there is elevated risk associated with access. Location mitigates frequency of access and suitable space is available at 'flat' grade on all likely access routes.	RSK /Client / Landscape Architect	General Public & Management Company	1	3	3	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
4	Entry into pipes or confined spaces within Attenuation Basin	RSK	04/11/2025	Potential for unsupervised children to enter pipes or other confined spaces and get into difficulty or injured.	RSK / Client / Management Company	General Public & Management Company	1	3	3	Pipe sizes are 300mm Ø maximum and manholes are only accessible from manhole covers so no further action required.	N/A	CLOSED
5	Risk of drowning in Swales	RSK	04/11/2025	Potential loss of life or serious injury. Swales likely to have 0.6m retained water for periods of time following rainfall, compounded by check dams providing underwater obstacles. Risks mitigated by low flow velocity and small overall dimensions.	RSK /Client / Landscape Architect	General Public & Management Company	1	5	5	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children. Risk is highly time limited (circa 10 minutes) during significant rainfall event (1 in 100 Year +45%) based on modelling.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
6	Risk of ice formation in Swales	RSK	04/11/2025	Potential moderate injury. Swales likely to have 0.6m retained water for periods of time following rainfall	RSK /Client / Landscape Architect	General Public & Management Company	1	3	3	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children. Risk is highly time limited (circa 10 minutes) during significant rainfall event (1 in 100 Year +45%) based on modelling.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
7	Risk of Slips/Trips/Falls around Swales	RSK	04/11/2025	Potential moderate injuries. Side slopes are greater than the normal 1:3 (~1.1) and therefore there is elevated risk associated with access. Location mitigates frequency of access and suitable space is available at 'flat' grade on all likely access routes.	RSK /Client / Landscape Architect	General Public & Management Company	1	3	3	Provide deterrent measures such as signage & vertical fencing to discourage entry into attenuation basin and prevent falling by young children.	Client to review proposals and provide comments with a view to progressing the item.	ONGOING
8	Risk of Slips/Trips/Falls around Bunding	RSK	04/11/2025	Potential minor injuries. Bunding to be 0.5m high with 1:1 side slopes. Locations is such that frequency and likelihood of access is considered low.	RSK /Client / Landscape Architect	General Public & Management Company	1	2	2	Likelihood and Consequence are considered low and hence the Risk is considered appropriate for the setting.	N/A	CLOSED

9	Risk of ill health due to water quality issues.	RSK	04/11/2025	Moderate Illness. No features to have permanent wet base. Possibility for potential toxins or pollutants but solely associated with Agricultural Runoff or wildlife sources.	RSK / Client / Maintenance Contractor	General Public & Management Company	1	2	2	Potential for rodents to be present within Swales/ Basins due to location however there is no identified food in the area. Management company will be responsible for inspecting site and SuDS features for signs of any rodents and will need to remove any rodents found safely as part of their management and maintenance responsibilities.	Client to detail responsibilities to the appointed Management Company.	ONGOING
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