Surface Water Management Strategy incorporating a Flood Risk Assessment

Land at Haine Road

Ramsgate

CT12 5ET

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1. Background and Introduction

This Surface Water Management Strategy accompanies a planning application submitted to Thanet District Council. The planning application is for residential development on land at Haine Road, Ramsgate, CT12 5ET. As the site is greater than 1 ha the report also assesses flood risk in accordance with the National Planning Policy Framework (NPPF).

2. Development Location and Description

Development Location

The site is located west of Haine Road, Ramsgate, Figures 1 and 2. It is a partially developed site that covers 4.25ha.

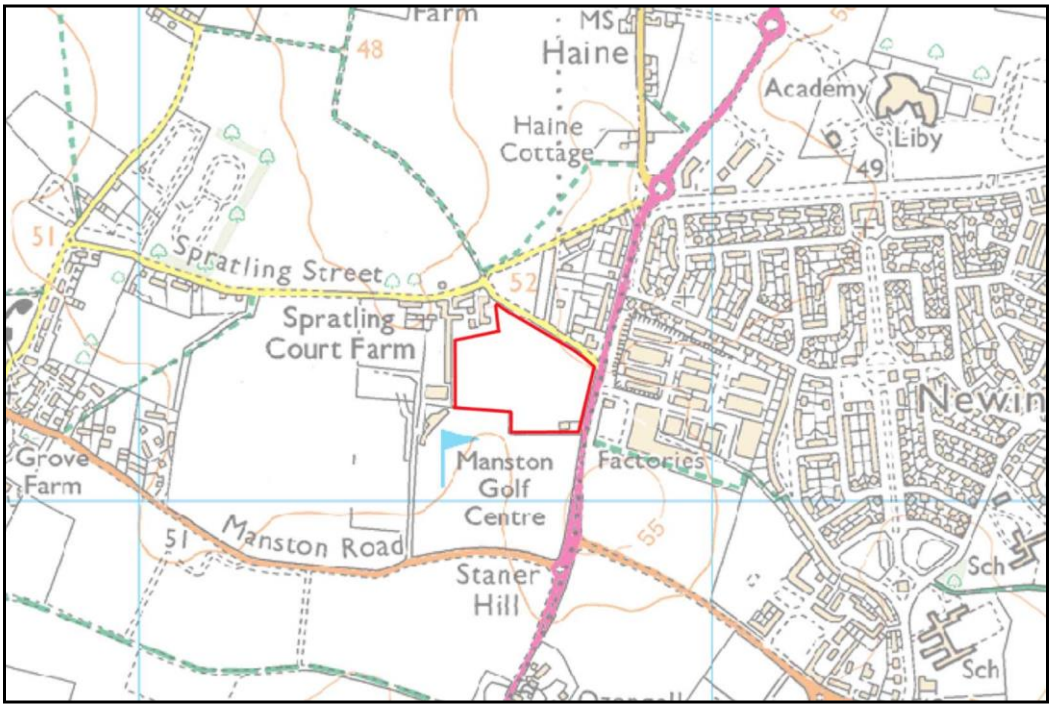

Figure 1. Site location.

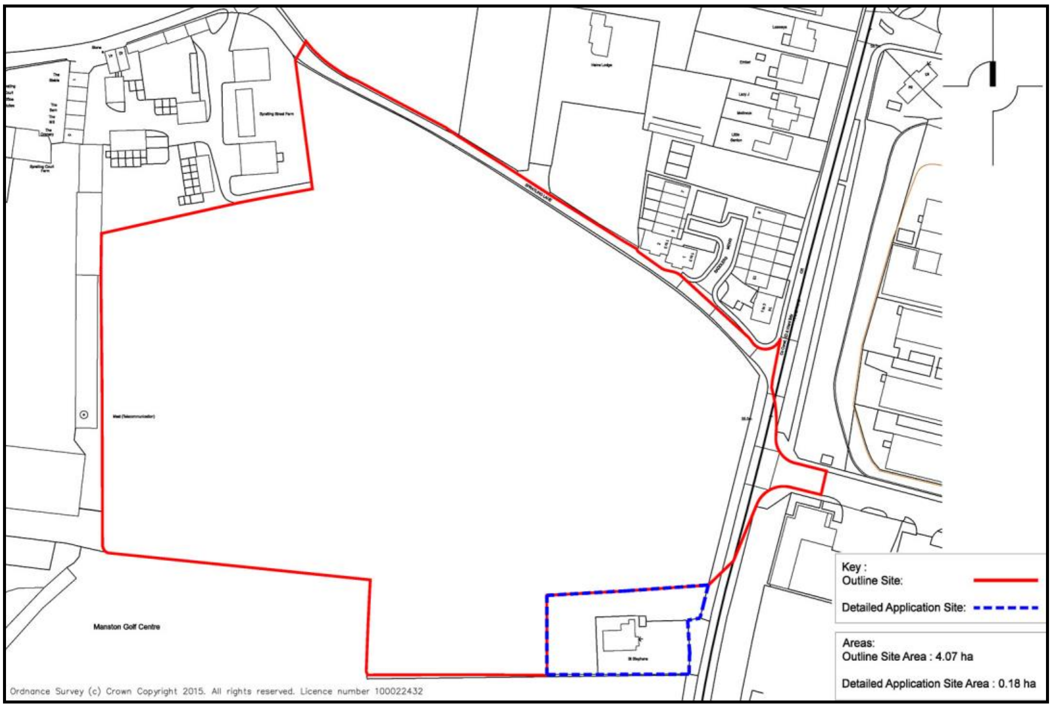

Figure 2. Site location.

Development Proposals

This report accompanies a hybrid planning application for the detailed approval of five dwellings and the outline approval of 95 residential dwellings, Figure 3.

Figure 3. Proposed development.

3. Policy Background

The management of surface water across the development has to comply with a number of local policy documents adopted by Thanet District Council.

Thanet District Council Strategic Flood Risk Assessment

Thanet District Council published a Strategic Flood Risk Assessment (SFRA) in 2009. The SFRA summarises flood risks in Thanet, Table 1.

Source of Flooding	Area at Risk	Risk
Tidal	All coastal areas	Very High
Fluvial	Low lying areas in the Wantsum Channel	High
Surface Water	All areas, especially local topographic depressions	Low
Groundwater	The low lying areas in the Wantsum Channel and the areas of perched Head Deposits over Thanet Sand Formations	Negligible

Table 1. Potential flood risks within Thanet.

The SFRA assesses the potential for infiltration SuDS (Sustainable Urban Drainage Systems), Figure 4 and the potential for surface water runoff generation, Figure 5. The site lies within an area of low infiltration potential with high potential for runoff generation.

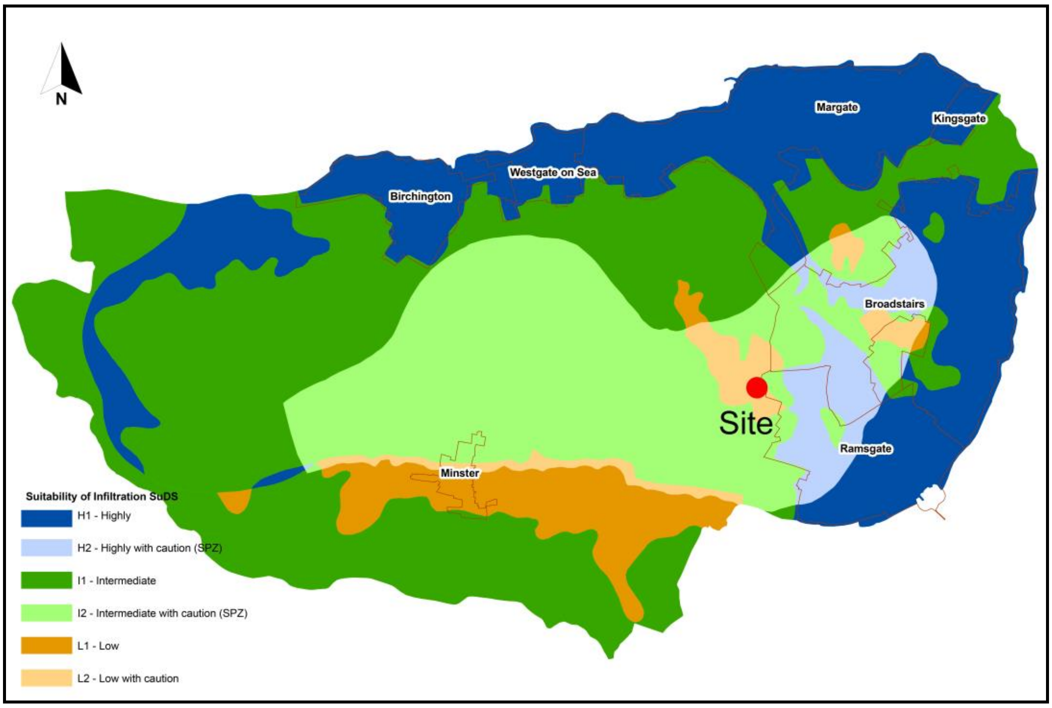

Figure 4. Potential for Infiltration (© Thanet District Council).

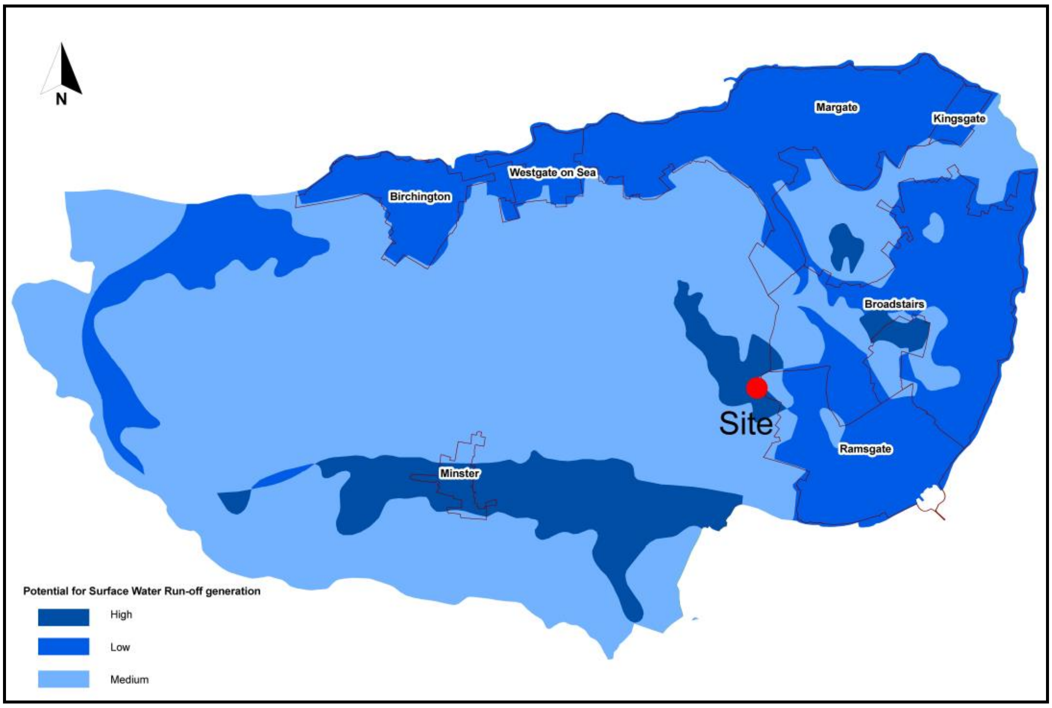

Figure 5. Potential for Surface Water Runoff Generation. (© Thanet District Council).

The drainage and SuDS recommendations state:

The eastern half of Broadstairs is positioned over a Minor chalk aquifer and the western half is positioned over a Major chalk aquifer. This suggests that there is a greater potential for the inclusion of SuDS techniques which discharge to groundwater. A constraint on the implementation of such techniques is presented by the presence of a groundwater source protection zone which covers most of the west of the Broadstairs and Ramsgate areas. This designation restricts the applicability of infiltration techniques to manage surface water. Any proposal should be discussed with the Environment Agency. In all areas site assessment work will be required to assess the feasibility of infiltration techniques. The risk of basement flooding in areas over perched Head Deposits over the Thanet Sand Formation, infiltration techniques are not considered appropriate as they could exacerbate the risk of flooding. In these instances surface attenuation will be required which is designed to discharge to the surface water drainage infrastructure at rates agreed with the sewage undertaker. Developers should be encouraged to include integrated schemes in favour of small scale localised systems (eg infiltration trenches and swales opposed to rainwater butts). This is because integrated schemes have to be centrally managed and maintained, thus providing more confidence in them performing effectively over time than small private devices.

Thanet District Council Local Plan 2006

Groundwater protection is a saved policy from Thanet District Council's Adopted Local Plan.

Policy EP13 - Groundwater Protection Zones

A proposed development in the groundwater protection zones identified on the proposals map would have the potential to result in a risk of contamination of groundwater sources, it will not be permitted unless adequate mitigation measures can be incorporated to prevent such contamination taking place.

Draft Thanet District Council Local Plan to 2031

The emerging Local Plan was placed on consultation in January 2015. The following policies are relevant to the site:

Policy QD01 - General design principles

External spaces, landscape, public realm, and boundary treatments must be designed as an integral part of new development proposals and coordinated with adjacent sites and phases. Development will be supported where it is demonstrated that:

7) An integrated approach is taken to surface water management as part of the overall design.

Policy CC01 – Fluvial and Tidal Flooding

The sequential test and exception test as set out in the NPPF will be applied to applications for development within identified flood risk areas. Development proposals in these areas will need a Flood Risk Assessment to be carried out by the developer.

Policy CC02 – Surface Water Management

New development will be expected to manage surface water resulting from the development using sustainable drainage systems (SUDS) wherever possible. SUDS design should be considered as an integral part of the masterplanning and design process for new development.

Proposals for SUDS at sites within the Groundwater Source Protection Zone as shown on Map 19, or sites near the Groundwater Source Protection Zone, must demonstrate that the methods used will not cause detriment to the quality of the groundwater.

Sites identified as a Tidally Sensitive Area (as identified in surface water management plans) will need to incorporate Sustainable Drainage Methods and a maintenance schedule where appropriate, at the design stage of a planning application, and a Flood Risk Assessment will be required before planning permission can be granted.

4. Site Characteristics

Topography- A detailed level survey has been carried out. The site slopes from northeast to southwest from a high point of 56mAOD (Above Ordnance Datum), to a low point of 51mAOD, Figure 6, at a gradient of approximately 1 in 40.

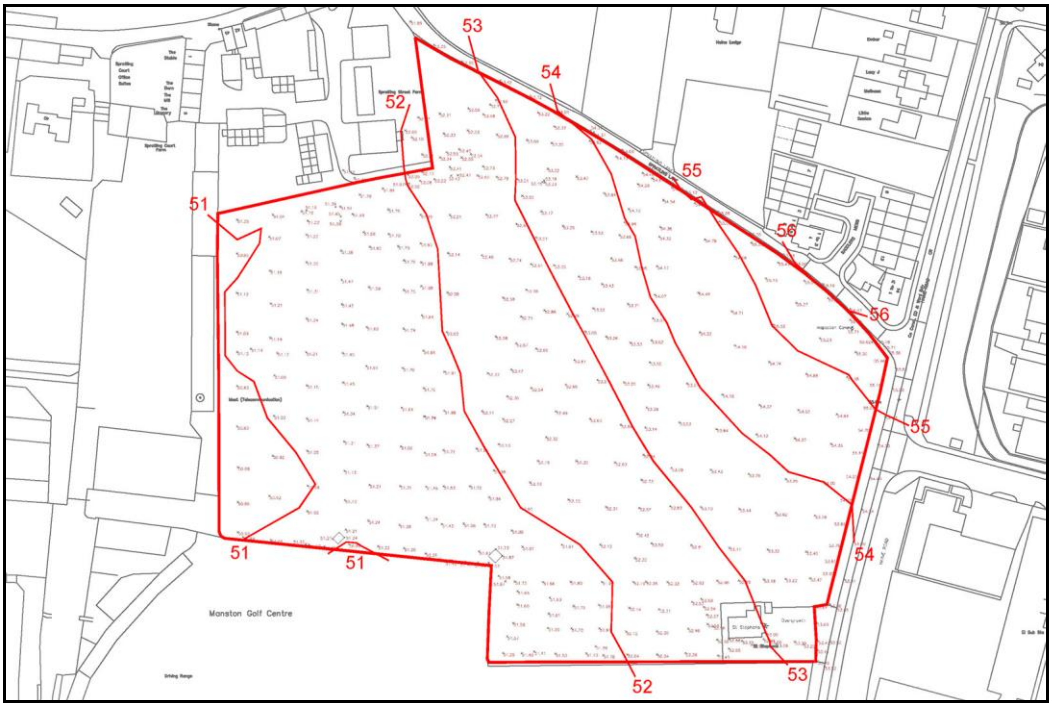

Figure 6. Local topography.

Geology and Soils - The bedrock geology consists of the Thanet Formation, sand, silt and clay. Superficial deposits of Head, clay and silt, cover the western part of the site. The underlying geology is chalk. Boreholes close to the site suggest that the chalk is approximately 4m below the lowest level of the site at 47mAOD. Deeper boreholes indicate that groundwater level is at approximately 4mAOD, 47m below the lowest level of the site. Soils are classified as freely draining loamy soils.

Groundwater Protection Zone - The majority of the site lies within the total groundwater source protection catchment (Zone 3). The southern boundary of the site lies within the outer groundwater source protection zone (Zone 2), Figure 7.

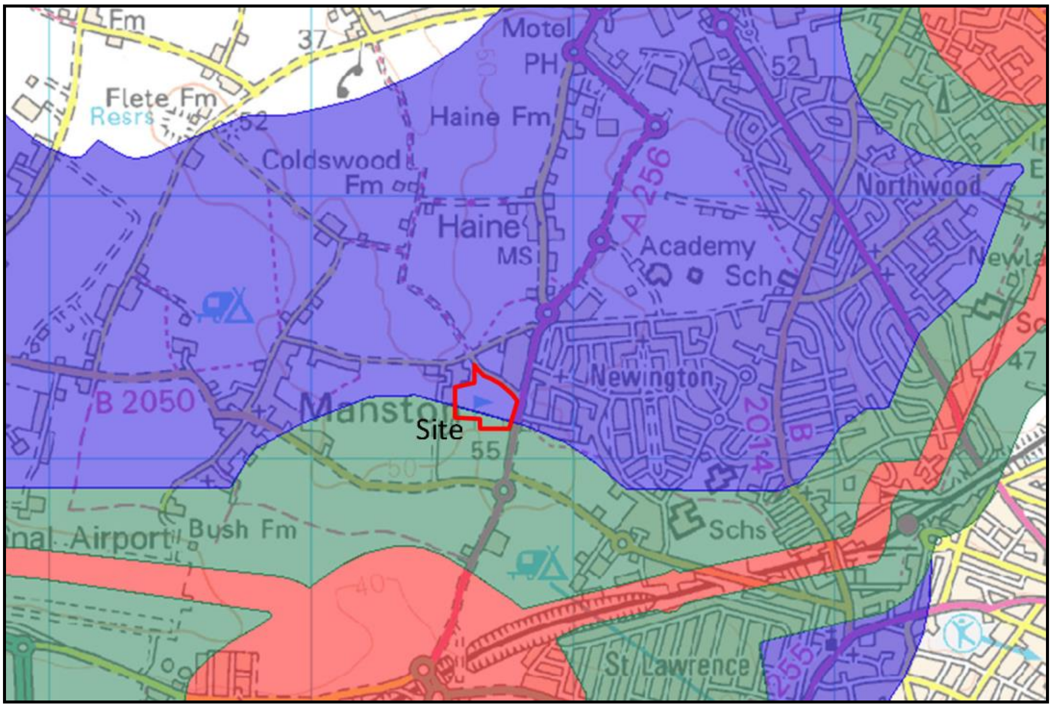

Figure 7. Groundwater source protection zone map showing zone 3 (blue) and zone 2 (green). (© Environment Agency)

The Thanet Formation is designated a secondary bedrock aquifer, Figure 8. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The site lies above the minor aquifer intermediate groundwater vulnerability zone, Figure 9.

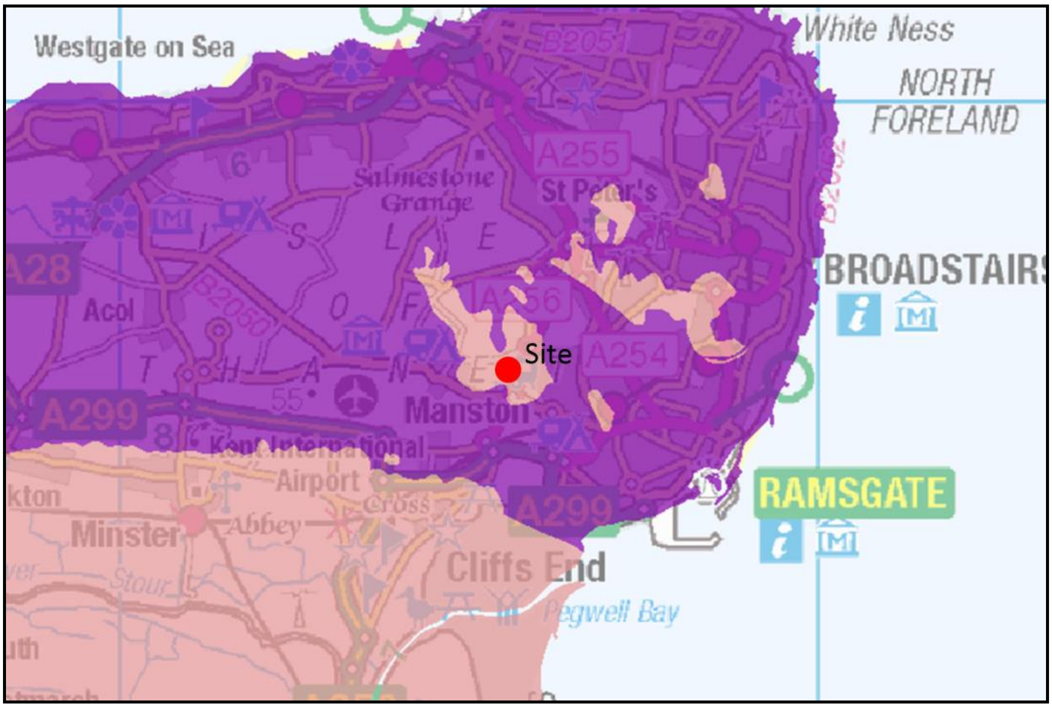

Figure 8. Aquifer map showing principal bedrock aquifer (purple). (© Environment Agency)

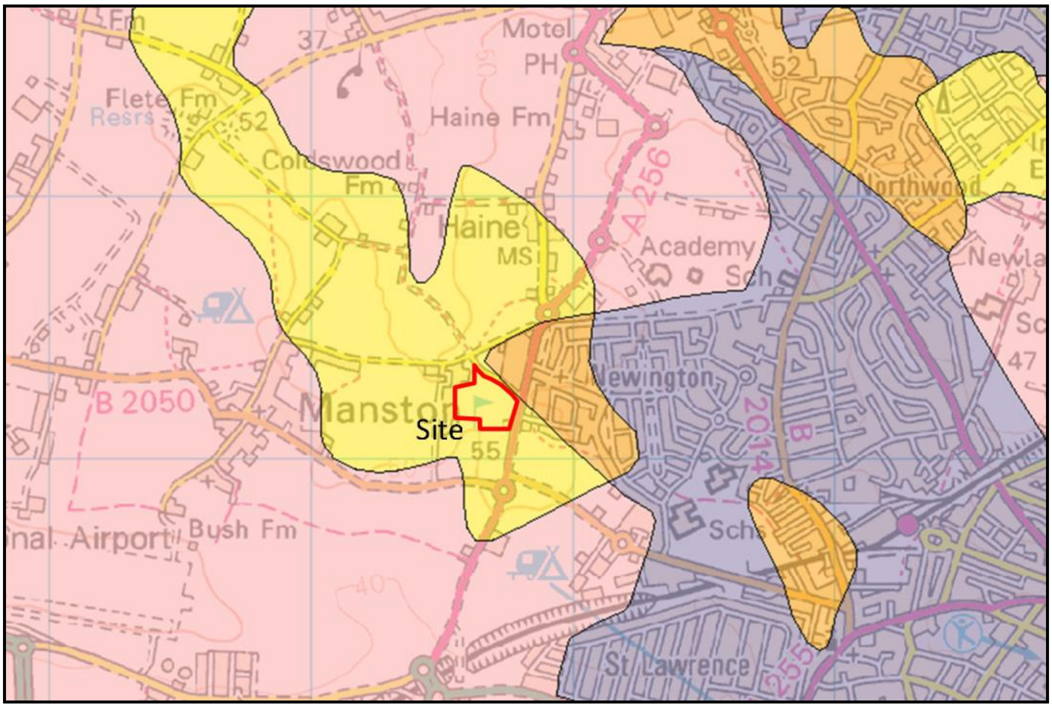

Figure 9. Groundwater vulnerability map showing minor aquifer intermediate zone (yellow). (© Environment Agency)

For principal and secondary aquifers, the Environment Agency has processed national data covering information on recharge (rainfall and infiltration), soil leaching, drift cover (thickness and permeability) and the unsaturated zone in order to classify groundwater vulnerability as:

High: Areas able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability drift deposits.

Medium (Intermediate): Areas that offer some groundwater protection. Intermediate between high and low vulnerability.

Low: Areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of low permeability drift deposits.

Site Investigation - Two site investigations have been carried out at the site.

The first carried out in 2016 covered the southeast corner of the site. Three boreholes were sunk to a depth of 4.45m, approximately 48.55mAOD. The geology consists of silty clay to this level. Made ground/fill was recorded to a depth of 0.30 - 0.45m.

A single infiltration test was carried out at a depth of 0 to 4m. No soakage was recorded at this level. The site investigation report states:

The results of the soakage tests carried out on the site show a virtually no soakage potential.

Conventional chamber soakaways are unlikely to be effective on this site.

Consideration should be given to dispose of surface water off site. It is likely that deep bored soakaways extended into the underlying chalk stratum would be effective but the advice of the Environment Agency should be sought in this respect.

The second site investigation was carried out in 2017. This consisted of five boreholes, three to a depth of 6m, one to a depth of 7m and one to a depth of 20m. Chalk was encountered at depths of between 4.90 - 6.90m below ground level.

A single percolation tests was carried out in the borehole sunk to a depth of 20m. The report states that:

Although chalk was encountered at 4.90m, the test recorded a very poor soakage rate. This rate reflects the soft puttified nature of the chalk encountered. Good soakage rates are normally only achievable via blocky fractured chalk.

The soakage rate recorded was 0.38 l/m^2/min. Over the exposed borehole area of $11.03m^2$ this equates to an outflow of 4.2 l/min or 0.07 l/s.

Infiltration Rates - Site investigation work carried out for the Manston Green development south of the site indicates that infiltration rates within the upper levels of the chalk substrata are approximately 2 x 10^{-05} m/s. This suggests that infiltration rates across the chalk is variable with the high infiltration rates dependent on cutting a fissure within the chalk.

The Environment Agency in their response to the planning application has stated that the following condition should be applied to the development:

<u>Drainage</u>

Condition: *No drainage systems for the infiltration of surface water drainage into the ground are permitted other than with the express written consent of the Local Planning Authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to controlled waters. The development shall be carried out in accordance with the approved details.*

Reason: *The site lies on a principal aquifer and in Source Protection Zones 2 and 3.*

Existing Surface Water Drainage Patterns - The catchment characteristics for the site have been obtained from the Flood Estimation Handbook (FEH) Web Service. The site slopes from northeast to southwest at a gradient of approximately 1 in 40. The site is part of a wider catchment that drains to the south, Figure 10. There are no drainage ditches in the vicinity of the site and natural drainage to the south is constrained by a bund constructed around the Manston Golf Centre to the south of the site.

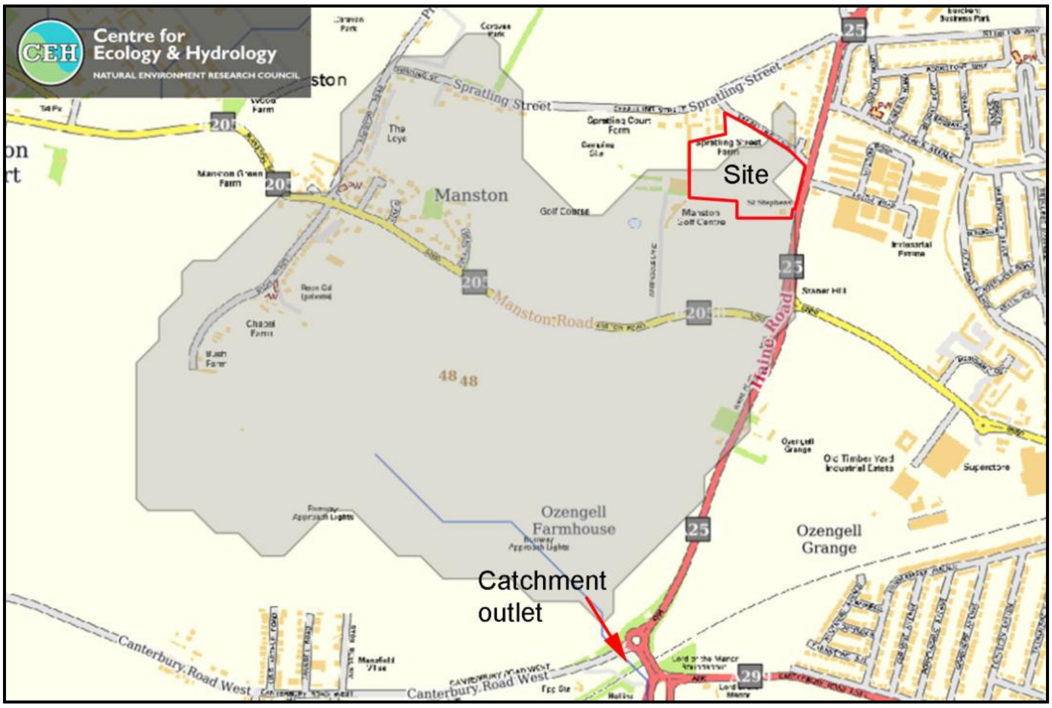

Figure 10. Local drainage catchment. (© Flood Estimation Handbook)

The British Geological Survey Hydrogeology map shows that the site lies over an area of low permeability, pale blue in Figure 11.

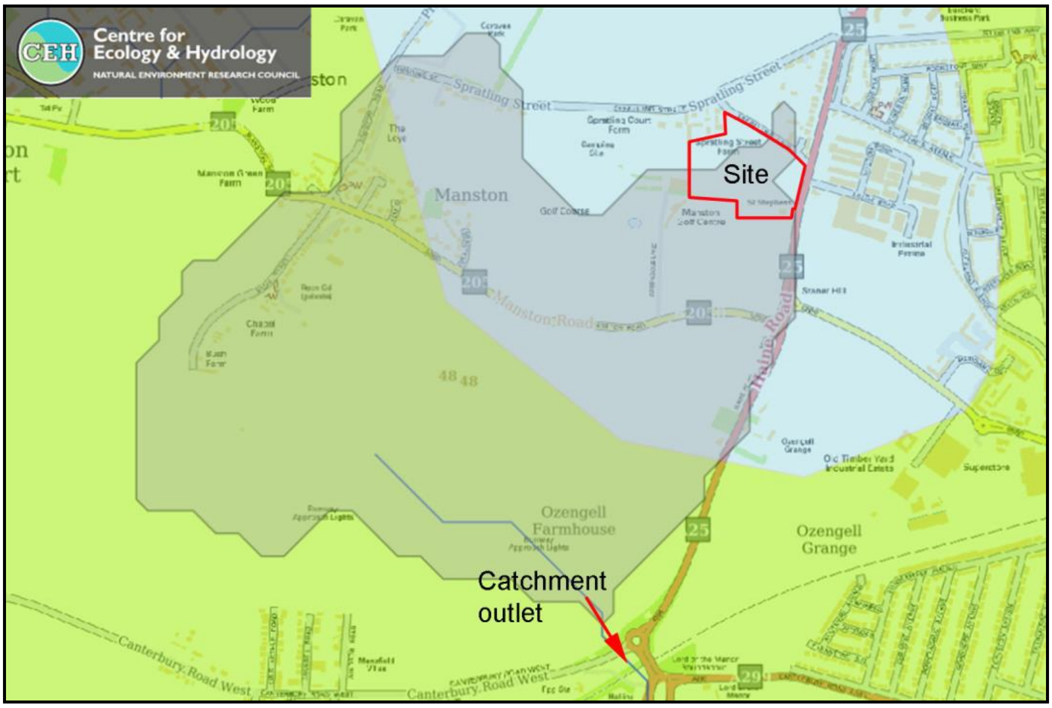

Figure 11. Hydrogeology map. (© Flood Estimation Handbook)

The FEH 2013 XML rainfall data has been used in the design. This provides rainfall data for return periods greater than 2 years.

Surface Water Sewers - The area is served by combined public sewers. A 150mm diameter combined public sewer runs south to north along Haine Road. A 150mm diameter combined public sewer runs along the Spratling Street from southwest to northeast, Figure 12.

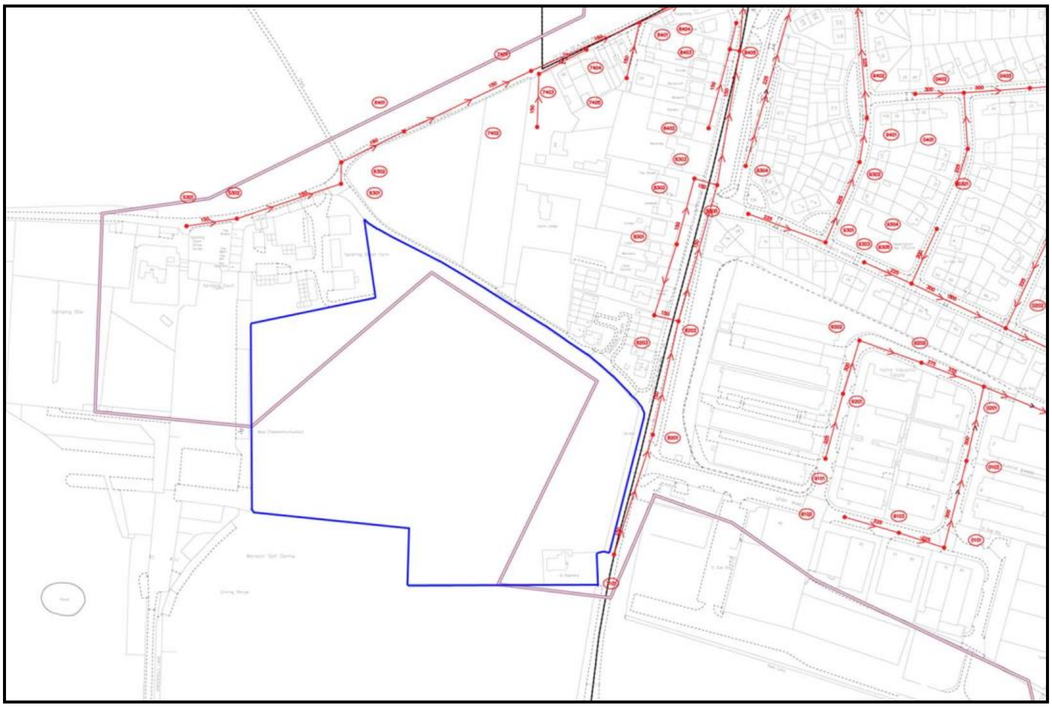

Figure 12. Public sewer record with site edged blue. (© Southern Water)

Existing Site - The site is partially developed with a single dwelling in the southeast corner although the majority is greenfield.

The peak rate of runoff and volume of runoff for the critical storm duration for the pre-development site for an impermeable area of 120m^2, is shown in Table 2.

Storm Return Period (years)	Peak Runoff (Q l/s)	Volume of Runoff 360 minute duration storm (m^3)
2	1.5	2.8
30	3.4	5.4
100	4.3	7.4
100 + 20%	5.2	8.9
100 + 40%	6.1	

Table 2. Peak rate of runoff and volume of runoff from the existing site.

Greenfield runoff - The peak greenfield runoff rate for the critical storm duration has been calculated using the IH124 method from the greenfield runoff rate estimation tool published online by HR Wallingford at uksuds.com, Table 3. The Standard Percentage Runoff (SPR) and SOIL type have been adjusted to reflect the superficial Head deposits using values from the Flood Estimation Handbook. A SOIL value of 3 has been used.

Return Period	Runoff Rate Q l/s	
	per ha.	Site (4.25 ha)
QBar	2.3	9.8
1	2.0	8.5
30	5.4	23.0
100	7.4	31.5

Table 3. Greenfield runoff rate for the site.

5. Flood Risk Assessment

The NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change by applying the Sequential Test.

Flood zones are the starting point for the Sequential Test. These zones are a broad assessment of flood risk as given below.

Zone 1 Low Probability - land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Zone 2 Medium Probability - land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Zone 3a High Probability - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3b The Functional Floodplain - land where water has to flow or be stored in times of flood, land which would flood with an annual probability of 1 in 20 (5%) of greater in any year or designed to flood in an extreme flood.

The site lies within flood zone 1 and therefore residential development is appropriate.

Surface Water - The Environment Agency has published surface water flooding maps. These show the majority of the site to be at very low risk of surface water flooding. There are areas along the southern boundary at low to high risk of surface water flooding, Figure 13. The definition of each category is given below:

Very Low (white) a chance of flooding of less than 1 in 1000 (0.1%)
Low (pale blue) a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%)
Medium (mid blue) a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%)
High (dark blue) a chance of flooding of greater than 1 in 30 (3.3%)

The depths of water associated with each flood risk event are shown in Figures 14 to 16. The definition of each colour is given below:

Below 300mm (light blue)
300-900mm (medium blue)
Over 900mm (dark blue)

Areas on the southern boundary of the site flood to a depth of below 300mm under the low risk flood event with a small area to a depth of between 300mm and 900mm.

The surface water flood maps also give an indication of velocity and direction of flow, Figure 17. The definition of each colour is given below, the arrows indicate the direction of flow.

Over 0.25 m/s (dark blue)
Less than 0.25 m/s (light blue)

Figure 13. Environment Agency's surface water flood risk map with the site edged red. (© Environment Agency)

Figure 14. Surface water flood depth map for low risk of flooding category with the site edged red. (© Environment Agency)

Figure 15. Surface water flood depth map for medium risk of flooding category with the site edged red. (© Environment Agency)

Figure 16. Surface water flood depth map for high risk of flooding category with the site edged red. (© Environment Agency)

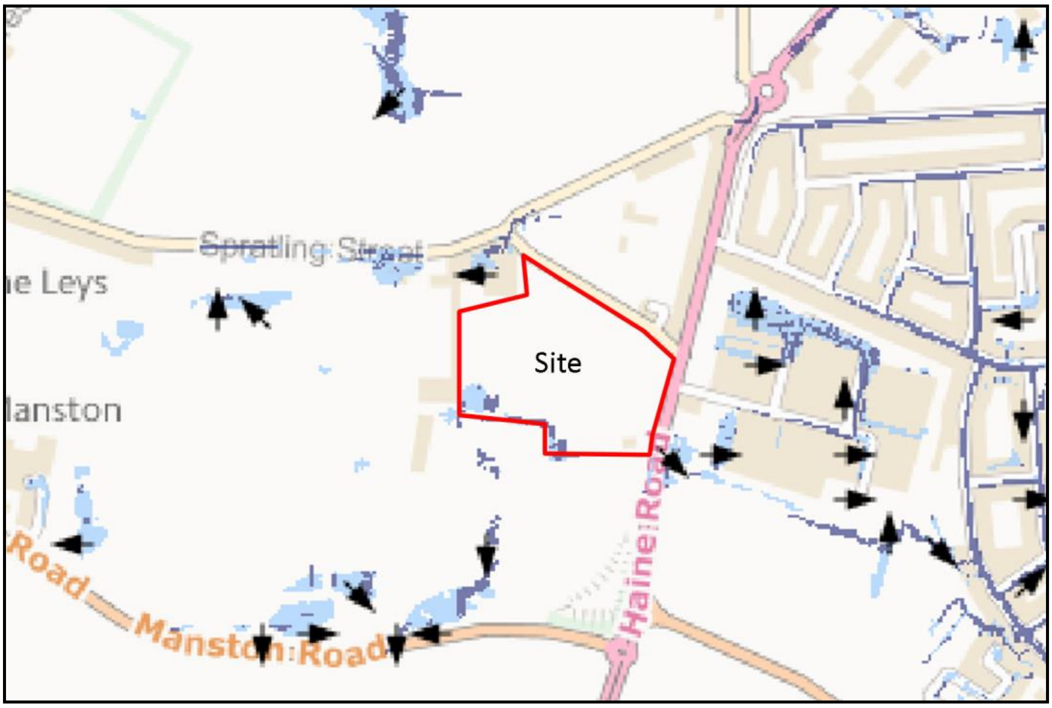

Figure 17. Surface water flood velocity map for low risk of flooding category with the site edged red. (© Environment Agency)

The southern boundary is at increased surface water flood risk because the whole site slopes towards this boundary. There is an existing bund along this boundary between the site and the Manston Golf Centre. This prevents surface water following the natural flow path to the south.

Developing the site will interrupt and alter the surface water flow paths. Surface water runoff will be formally dealt with and will not simply flow to the lowest part of the site and pond. The flood risk from surface water runoff from the development will be managed through the implementation of this surface water management strategy. The southern boundary of the site will be gardens or open space. Any flood water collecting here will not cause internal flooding to buildings.

Groundwater - Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in ‘bournes’ (streams that only flow for part of the year). Where land that is prone to groundwater flooding has been built on, the effect of a flood can be very costly, and because groundwater responds slowly compared with rivers, floods can last for weeks or months.

The SFRA states that the risk of groundwater flooding in Thanet is negligible.

Infrastructure - The SWMP identifies localised flooding incidents reported in Thanet, Figure 18.

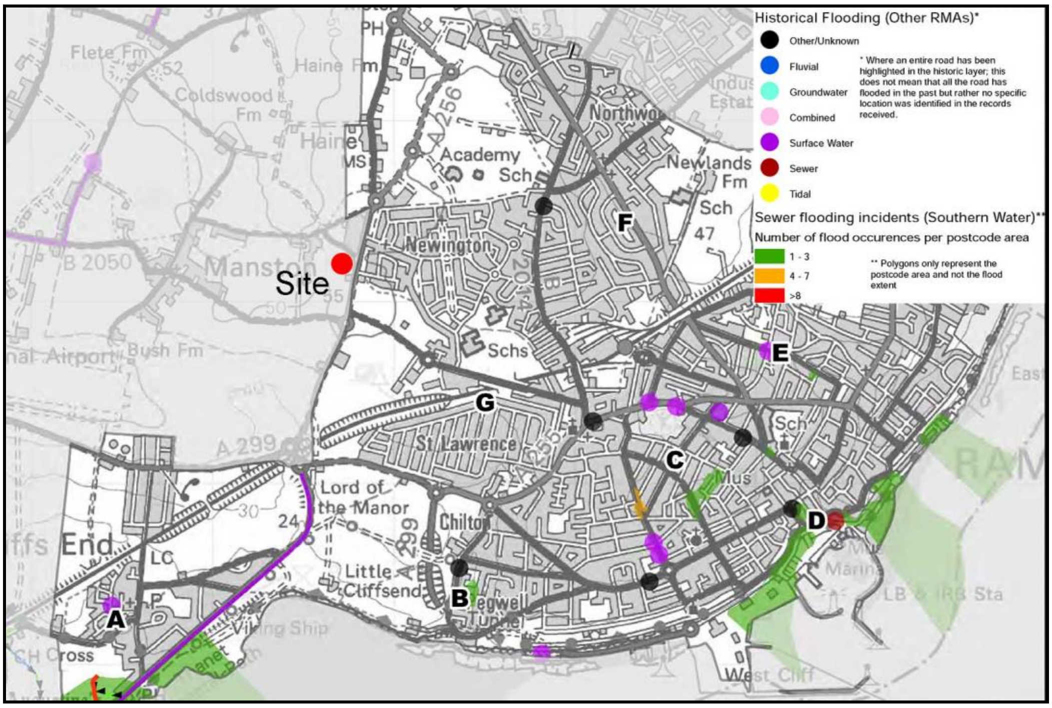

Figure 18. Historic flooding incidents showing sewer flooding (green shading) and surface water flooding (purple circle). (© Kent County Council).

The site lies within an area where no flooding incidents have been recorded. The risk of infrastructure flooding at the site is considered to be low.

6. Climate Change

The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Climate change will result in an increase in sea levels, rainfall intensity and river flows.

The impact of climate change will be to reduce the standard of protection provided by current defences with time and increase the risk of flooding in undefended areas. The Planning Practice Guidance to the National Planning Policy Framework (NPPF) recommends using the following range of increases in peak rainfall intensity due to climate change to 2115 in any assessment:

Upper End	+40%
Central	+20%

The range is based on percentiles. The 50th percentile is the point at which half of the possible scenarios for peak rainfall intensity fall below it and half fall above it. The Central allowance is based on the 50th percentile whilst the Upper End is based on the 90th percentile.

The Central allowance is 20% and scientific evidence suggests that it is just as likely that the increase in rainfall intensity will be more than 20% as less than 20%. The Upper End allowance is 40% and current scientific evidence suggests that there is a 90% chance that peak rainfall intensity will increase by less than this value, but there remains a 10% chance that peak rainfall intensity will increase by more.

The Planning Practice Guidance suggests that flood risk assessments and strategic flood risk assessments should assess both the Central and Upper End allowances to understand the range of impact.

The surface water calculations include an increase of 20% in peak rainfall intensity for the sizing of structures. The structures are then tested with a 40% increase in peak rainfall intensity. If this results in any flooding, the extent of this flooding and its impact on the development is then considered.

7. Detailed Development Proposals

The proposed development consists of 100 dwellings. The main part of the application is for outline planning approval and therefore a detailed layout has not been designed. Analysis of the illustrative layout indicates that the development area will be approximately 4.25ha and that potentially impermeable surfaces will cover approximately 40% of this, 16,950m^2. The nature of the impermeable areas has been estimated from the indicative layout, Figure 19 and Table 4.

Figure 19. Proposed impermeable areas.

Type	Area (m^2)
Roof Area	7,100
Paved Drive Area	4,950
Paved Road Area	4,900
Total	**16,950**

Table 4. Potential impermeable development areas.

The peak rate of runoff and volume of runoff for the critical storm duration for the post-development site for an impermeable area of 16,950m^2, is shown in Table 5.

Storm Return Period (years)	Peak Runoff (Q l/s)	Volume of Runoff 360 minute duration storm (m^3)
2	165	389
30	367	762
100	473	1,042
100 + 20%	569	1,250
100 + 40%	669	

Table 5. Peak rate of runoff and volume of runoff from the proposed site.

8. Surface Water Management Strategy

Objectives

Surface water currently pools at the southwest corner of the site due to the earth bund constructed on the Manston Golf Centre which prevents water flowing along its natural path to the south. Surface water is currently lost through infiltration and evaporation.

Given the negligible infiltration rate obtained from shallow soakage tests and the very poor infiltration rate obtained from borehole tests the only feasible method for the disposal of surface water runoff is to discharge to the existing combined sewerage network which runs along Haine Road and serves the wider area. More comprehensive site investigation should be carried out as part of the detailed design to establish whether or not disposal via infiltration is feasible, even over a limited extent.

The surface water management strategy seeks to discharge surface water to the combined sewer within Haine Road at a controlled rate.

KCC's Drainage and Planning Policy Statement states:

Low permeability soils - areas underlain by largely impermeable soils (e.g. Weald Clay and London Clay) will require staged discharge to mimic existing greenfield runoff rates from corresponding storm events, with long-term storage provided for any additional volume above the pre-development volume.

The peak greenfield runoff rate from the development impermeable area of 1.7ha is shown in Table 6.

Return Period	Runoff Rate Q l/s	
	per ha.	Site (1.7ha)
QBar	2.3	3.9
1	2.0	3.4
30	5.4	9.2
100	7.4	12.6

Table 6. Allowable discharge from the site at greenfield runoff rates.

Drainage Elements

The appropriateness of different SuDS is considered in Table 7.

SuDS Type	Appropriate to site	Comment
Permeable paving (Infiltration)	No	Geology means that infiltration at shallow levels is limited
Permeable paving (Attenuation)	Yes	Permeable paving can be used for storage over drives and parking areas
Green roof	No	Traditional pitched roofs proposed
Filter strips	Possible	Possible for areas where roads/paved areas are adjacent to landscapes areas
Swales	No	Insufficient space
Infiltration devices	No	Geology means that infiltration at shallow and deeper levels is limited
Filter drains	No	Geology means that infiltration at shallow levels is limited
Infiltration basin	No	Geology means that infiltration at shallow levels is limited
Detention pond	Yes	Detention ponds can provide storage for extreme rainfall events
Wet pond	Yes	Wet ponds can provide storage for extreme rainfall events
On/offline storage	Yes	Appropriate if additional attenuation required

Table 7. SuDS suitability for development.

The following drainage elements are identified as being appropriate to the site;

- water butts,
- permeable paving (attenuation),
- detention basins/wet ponds,
- on/offline storage.

Water Butts

The expectation is that all individual properties will have water butts. Water butts act as source control devices intercepting rainfall early in the management train. Water butts will be provided on all residential units. It is recognised that water butts may be full during critical rainfall conditions and not provide storage. They are not included in the surface water drainage calculations.

Permeable Paving (Attenuation)

Permeable paving allows water to infiltrate through the surface into a coarse graded sub-base which can store runoff. The base of the pavement is lined and the paving provides water storage only. For the sub-base storage to operate effectively the system requires flow controls. These are generally small orifice plates in a control chamber and can be very small, minimum 20mm, because the risk of blockage is low since the water has been filtered through the sub-base. The frequency of runoff from permeable paving is significantly reduced when compared to gully and pipe systems draining impermeable surfaces. Permeable paving acts as interception storage and runoff typically does not occur from permeable paving for rainfall events up to 5mm even without infiltration, due to evaporation.

Permeable paving is proposed in parking areas and drives.

Detention Pond/Wet Pond

Detention ponds are depressions that are usually dry but can accommodate water during extreme rainfall events. They provide temporary storage for storm water runoff. Wet ponds have a permanent pool of water and provide storage above this level.

On/offline storage

Pipes will be used for conveyance and connections between SuDS elements where necessary. Pipes can be oversized to provide additional attenuation storage. Attenuation tanks or storage crates can be used to provide additional storage if required.

Surface Water Management Strategy

The surface water management strategy is to dispose of surface water runoff to the existing combined sewer within Haine Road at the equivalent of the greenfield runoff rate on a staged discharge basis. The combined sewer within Hain Road has an invert level of 44.88mAOD. There is therefore ample depth to accommodate underground storage.

The Strategy has been modelled using MicroDrainage software published by XP Solutions.

The Quick Storage Estimate from Source Control has been used to determine the range of storage volumes required for each storm scenario, Table 8. Storage varies with different configurations of controls and storage structures. The program looks at two extreme cases to provide an estimate of the range of storage required. This analysis includes runoff from roofs, impermeable paved areas and permeable paved areas as the later will provide storage only and not allow infiltration into the ground. Storage using crates or tanks with an orifice control tends to lead to the average storage requirement.

Return period	Storage Range Required m^3	Average Storage Required m^3
2	324 - 472	398
30	377 - 960	769
100	836 - 1,360	1,098
100+20%	1,099 - 1,722	1,411
100+40%	1,386 - 2,087	1,737

Table 8. Quick storage estimate for various scenarios based on a staged discharge.

The storage will be provided within permeable paving and attenuation crates for lower storm return periods. Storage for larger return periods is augmented by open storage in detention basins.

The areas identified for potential storage are shown in Figure 20.

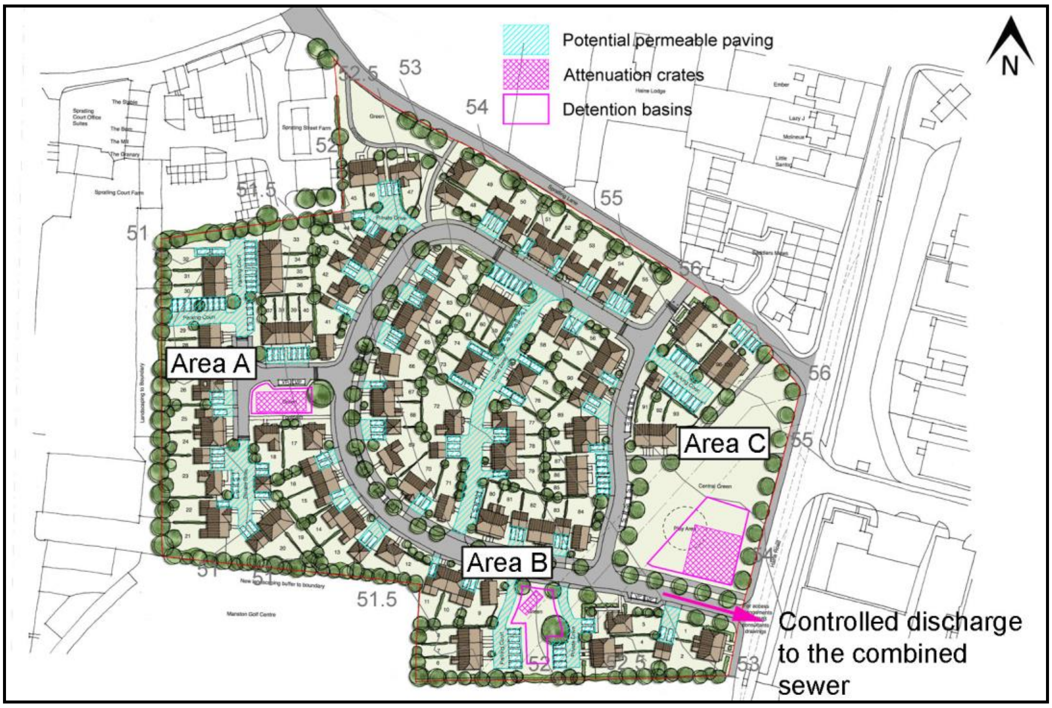

Figure 20. Potential locations of surface water storage structures.

The potential storage from each SuDs element is shown in Table 9.

SuDS element	Potential Storage (m^3)
Permeable paving based on 80% of 4,950m^2 with 30% voids and water depth of 350mm	475
Storage Crates A (8m x 20m x 2m x 95% voids)	304
Storage Crates B (4m x 10m x 2m x 95% voids)	76
Storage Crates C (20m x 20m x 2m x 95% voids)	760
Detention Basin A (based on 245m^2 at average 0.3m deep)	74
Detention Basin B (based on 378m^2 at average 0.3m deep)	113
Detention Basin C (based on 830m^2 at average 0.3m deep)	249
Total surface water storage for development runoff	**2,051**

Table 9. Potential surface water storage.

The above demonstrates that there is sufficient space available within the development for surface water storage. Potential storage of 2,051m^3 has been identified against a requirement for 1,737m^3 for all rainfall events up to the 100 year event allowing for a 40% increase in rainfall intensity due to climate change.

The application is an outline planning application and the layout has been produced for illustrative purposes only. The actual balance of storage will be determined once a detailed layout has been produced. This analysis shows that there is sufficient space on site to provide the storage required to allow all surface water runoff from the development to be discharged to the combined sewer at greenfield runoff rates.

The development offers scope for providing additional storage in the following areas:

- The main access could be laid as permeable paving.
- Sub-base replacement cellular storage could be used to increase storage under permeable or impermeable paving.
- Cellular storage crates can be provided to a greater depth.
- Ponds and detention basins could be provided in additional locations as part of the detailed layout design.

9. Water Quality

The SuDS Manual gives the following as standards of good practice for water quality:

Water quality standard 1: Prevent runoff from the site to receiving surface waters for the majority of small rainfall events.

No runoff should be discharged from the site to receiving surface waters or sewers for the majority of small (eg < 5 mm) rainfall events. This is termed Interception.

Water quality standard 2: Treat runoff to prevent negative impacts on the receiving water quality.

Runoff should be adequately treated to protect the receiving water body from:

1. Short-term acute pollution that may result from accidental spills or temporary high pollution loadings within the catchment area.
2. Long-term chronic pollution from the spectrum of runoff pollutant sources within the urban environment.

Water Quality Standard 1 - Interception

Extensive use of permeable paving will reduce water discharging from the site for rainfall events of less than 5mm.

Water Quality Standard 2 - Treatment

The extent of treatment required depends on the land use, the level of pollution prevention in the catchment and for groundwater the natural protection afforded by underlying soil layers. High hazard sites will have a higher potential pollution load and higher potential maximum pollution concentrations. They therefore tend to require more treatment than low hazard sites in order to deliver discharges of an acceptable quality.

The SuDS Manual sets out minimum water quality management requirements for discharges to receiving surface waters and groundwater for various land use types, Table 10. The only option available at present is to discharge surface water to existing combined sewers. This water will be treated before discharge to a surface water body and therefore onsite water quality treatment required is limited to the removal of gross solids. This will be achieved through the provision of silt traps.

Land use	**Pollution hazard level**	**Requirements for discharge to:**	
		surface waters	groundwater
Residential roofs	Very low	Removal of gross solids and sediments only	
Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (eg cul de sacs, home zones, general access roads), non-residential car parking with infrequent change (eg schools, offices)	Low	Simple index approach Note: extra measures may be required for discharges to protected resources	
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	Simple index approach Note: extra measures may be required for discharges to protected resources	In England and Wales, Risk Screening must be undertaken first to determine whether consultation with the environmental regulator is required.
Trunk roads and motorways	High	Follow the guidance and risk assessment process set out in HA (2009)	
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence or permit. Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required.	
Note 1. Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan. Note 2. Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water. Note 3. Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.			

Table 10. Indicative SuDS mitigation indices for discharge to surface waters and groundwater.

10. Conclusion

This Surface Water Management Strategy accompanies a planning application submitted to Thanet District Council. The planning application is for residential development on land at Haine Road, Ramsgate, CT12 5ET. As the site is greater than 1 ha the report also assesses flood risk in accordance with the National Planning Policy Framework (NPPF).

The site lies in flood zone 1, land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year.

The majority of the site is at very low risk of surface water flooding. There are areas along the southern boundary at low to high risk of surface water flooding. These areas are at risk of flooding to a depth of below 300mm under the low risk flood event with a small area to a depth of between 300mm and 900mm.

The southern boundary is at increased surface water flood risk because the whole site slopes towards this boundary. There is an existing bund along this boundary between the site and the Manston Golf Centre. This prevents surface water following the natural flow path to the south.

Developing the site will interrupt and alter the surface water flow paths. Surface water runoff will be formally dealt with and will not simply flow to the lowest part of the site and pond. The flood risk from surface water runoff from the development will be managed through the implementation of this surface water management strategy. The southern boundary of the site will be gardens or open space. Any flood water collecting here will not cause internal flooding to buildings. The flood risk from surface water following the development will be low.

The site is at low risk from other sources of flooding.

The site is partially developed with a single dwelling in the southeast corner although the majority is greenfield. The proposed development will include 16,950m^2 of potentially impermeable surfaces.

Surface water currently is lost through infiltration and evaporation.

Given the negligible infiltration rate obtained from shallow soakage tests and the very poor infiltration rate obtained from borehole tests the only feasible method for the disposal of surface water runoff is to discharge to the existing combined sewerage network which runs along Haine Road and serves the wider area. More comprehensive site investigation should be carried out as part of the detailed design to establish whether or not disposal via infiltration is feasible, even over a limited extent.

The surface water management strategy seeks to discharge surface water to the combined sewer within Haine Road at a controlled rate.

The storage will be provided within permeable paving and attenuation crates for lower storm return periods. Storage for larger return periods is augmented by open storage in detention basins.

There is sufficient space available within the development for surface water storage. Potential storage of 2,051m^3 has been identified against a requirement for 1,737m^3 for all rainfall events up to the 100 year event allowing for a 40% increase in rainfall intensity due to climate change.

The application is an outline planning application and the layout has been produced for illustrative purposes only. The actual balance of storage will be determined once a detailed layout has been produced. This analysis shows that there is sufficient space on site to provide the storage required to allow all surface water runoff from the development to be discharged to the combined sewer at greenfield runoff rates.

The development offers scope for providing additional storage in the following areas:

- The main access could be laid as permeable paving.
- Sub-base replacement cellular storage could be used to increase storage under permeable or impermeable paving.
- Cellular storage crates can be provided to a greater depth.
- Ponds and detention basins could be provided in additional locations as part of the detailed layout design.

Extensive use of permeable paving will reduce water discharging from the site for rainfall events of less than 5mm.

The only option available at present is to discharge surface water to existing combined sewers. This water will be treated before discharge to a surface water body and therefore onsite water quality treatment required is limited to the removal of gross solids. This will be achieved through the provision of silt traps.

The proposed development is considered acceptable from a flood risk and surface water management perspective.