Torbay 2032
An Assessment of Future Sewer Capacity in Torbay

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Executive Summary

Background

Torbay Council's proposed submission plan; *Torbay Local Plan, A landscape for success*, defines a pathway for 'growth within environmental limits' to the year 2032 and beyond.

The plan provides the spatial context of this growth as well as examining the potential barriers to its delivery. Infrastructure is highlighted as a potential constraint for Torbay's growth and the plan recognises the need to invest in additional road capacity, rail network improvements, new schools and green infrastructure.

Torbay's sewerage network has also been identified as a potential constraint to growth. AECOM were engaged by Torbay Council and project partners, South West Water (SWW) to assess the impacts of predicted growth on Torbay's sewerage network, including recommendations to resolve potential issues.

This report provides an update on the key findings within the *Interim Technical Advice Note (Issued: 16 July 2014)* for the project; *Hydraulic Modelling of Sewer Capacity in Torbay* and supports the submission of Torbay Council's Local Plan.

Modelling

The scope of the project was to model the effect of predicted foul flow from new development on the combined sewer network serving Brokenbury Quarry Waste Water Treatment Works (WWTW)[1]

Using data provided by South West Water and Torbay Council, AECOM carried out a series of model runs to examine the effect of population growth and water efficiency improvements across the Torbay sewer network.

South West Water have confirmed Brokenbury Quarry WWTW's capacity is considered satisfactory for the AMP6 delivery period (2015-20) and possibly sufficient for AMP7 (2020-2025). However, there are no long term projections for Brokenbury Quarry's treatment capacity beyond AMP7. Treatment capacity at Brokenbury Quarry is outside the scope of this hydraulic modelling project which is focused on flows within the sewerage network.

Findings

Water consumption per capita is predicted to fall from 146 litres per day to 123 litres per day by 2032[2]. Since foul (dry weather) flow generation is approximately in line with mains water usage, this water efficiency improvement can be calculated as an approximate 16% drop in foul flows draining to Brokenbury Quarry WWTW.

Furthermore, Torbay's population growth is predicted to increase by approximately 18% by 2032[3]. When combined with the predicted improvements in water efficiency this equates to an approximate balance in future foul flow generated across the catchment.

The cumulative effects of climate change and urban creep (the addition of new impermeable area caused by local changes, such as patios & conservatories, draining to the sewer network) outside the proposed development areas are highly likely to cause significant detriment to the performance of the combined sewer system. This detriment is

[1] The scope of this project is set within the current regulatory framework and has not taken account of the future legislative changes that are likely to occur

[2] South West Water – Technical Standard Advisory Leaflet (TSAL) No.30. March 2013

[3] Torbay Council, 2010 population projections (released 2012) – These projections are aligned closely with the Torbay Local Plan

in the form of increased flooding risk and increased spills from the combined sewer overflows (CSOs) in the catchment.

Strategic improvements to the sewer network have been highlighted in the draft local plan. These are likely to be necessary in order to maintain the current level of service given the challenges imposed by climate change and urban creep, in addition to the substantial proposed developments.

Conclusions

As outlined above, the effect of predicted increase in population on foul flows is approximately balanced by the predicted decrease in water consumption in the period to the design horizon. Therefore, based on foul only connections, it is unlikely the hydraulic capacity of Torbay's strategic sewer network will limit development before 2032[4]. A strategic sewer is a term used to refer to the core sewerage network, through which the majority of flow will pass. The outlying network of sewers will have been designed for a specific local area and as such will not necessarily have sufficient spare capacity to take additional development.

Whilst this is a generally positive outcome for the future growth of Torbay, it does present a risk in how development is managed across the broader catchment. Namely, surface water runoff from all new development in the Torbay Local Authority Area must be kept out of the combined sewer network. Additionally, this relies on South West Water's customers reducing water usage at the predicted rate.

This is a substantial challenge. Should this predicted reduction in water consumption not materialise, or if surface water runoff from new development cannot be separated from the combined sewer network, measures must be taken elsewhere in the catchment. This is necessary to maintain levels of service to existing downstream customers and help protect the environment. These will be outlined in this report.

To demonstrate the importance of reducing surface water in the combined sewer network, AECOM modelled a range of scenarios that allowed for future urban creep from the predicted new developments around Torbay. This is typical where patios and conservatories are directly connected to the combined sewer instead of through other surface water management measures. These additional flows would create additional sewer spills from CSOs and exacerbate current sewer flooding issues.

The conclusions from this report refer to the overall impact of all development on the major assets within the public sewer network.

Individual developments will require further evaluation to identify suitable connection points and to understand the effects of local topography on drainage solutions. Where local issues are identified, developer contributions may be sought to overcome these via local sewer improvement schemes. The use of planning conditions should also be considered to ensure the sewerage network is not overloaded before alterations can be made.

The effects of urban creep and climate change should not be under estimated. A robust strategy for removing surface water from the existing sewer system will be required in order to maintain the current level of service; to both the public sewerage network and for surface water management.

Promoting sustainable urban drainage systems (SuDS) and water sensitive urban design (WSUD) in all future development, retrofitting SuDS in existing built up areas and working in partnership for improvements in water efficiency are the key practical measures outlined in this report.

[4] An assessment of the process at Brokenbury Quarry WWTW has not been carried out as part of this scope. The effect of increased sewage concentration on the treatment process will need to be considered as a separate exercise.

Development of a Torbay Council WSUD or SuDS strategy may be the next step to achieve these outcomes.

Such a strategy could address Council's interim response for adopting SuDS from all new development, ahead of legislative requirements being introduced across England in 2015[5]. It may also help Torbay Council develop a broader business case that considers the financial, social and environmental benefits of sustainable urban water management. This would ensure any council capital investment in WSUD is delivered in the most cost effective way.

The outcome of widespread implementation of SuDS will not only help maintain sewer serviceability into the future, but it will also provide a significant benefit to the communities that live and work in Torbay.

[5] Schedule 3 of the Flood and Water Management Act 2010 will soon be introduced across England and Wales. This will require all unitary authorities (and county councils where appropriate) to establish a SuDS Approval Body (SAB). This will provide Torbay Council with a mechanism to keep surface water runoff from new development out of the combined sever network.

Background

Capabilities on project:
Water

Background

The Project
This report, *Torbay 2032, An Assessment of Future Sewer Capacity in Torbay*, builds on the findings presented in the Interim Technical Advice Note[i] *(see pg 43 for all references; i-x)* and informs Torbay Council on the possible impacts of growth and development on the local sewerage network. It also presents a range of practicable measures that could be taken to ensure Torbay's sewerage network maintains sustainable levels of capacity long into the future.

These findings will be used to support Torbay Council in their Local Plan submission.

Creating a Local Plan
Every local planning authority (LPA) in the UK must prepare a Local Plan. These set the rules for how an area will develop over time and, along with any neighbourhood plans, form the overall development plan for each local authority area.[ii]

To prepare a local plan, each LPA enters into series of key production stages. These stages ensure the plan reflects the views of local people on how they wish their area to be developed, as well as ensuring compliance with the National Planning Policy Framework.

The key stages include; initial evidence gathering and consultation, a pre-submission publication stage, submission of the document for independent examination and the issuing of the inspector's 'Found Sound' report. Once the inspector's report has been issued, the council must formally adopt the plan so that it can become part of the Development Plan for the local area.[iii]

In February 2014 Torbay Council published the local plan for consultation; *Torbay Council Plan, A Landscape for Success*[iv]. This key stage publicly demonstrated how Torbay Council considered the representations received during the evidence gathering stage.

Planning for Torbay's Growth
The *Torbay Local Plan, A Landscape for Success* is a spatial plan that covers growth and development for the towns and villages within Torbay's local authority area to the year 2032. The plan has been developed in parallel with Neighbourhood Plans for Torquay, Paignton and the Brixham Peninsula. This pioneering approach presents a joined up view of how Torbay's key growth areas should change over time.

From the outset the plan defines a clear objective to ensure the Bay develops within environmental limits; a key consideration for its marine setting and internationally important environmental assets.

Sustainable growth over the long term is defined in the plan as 250-300 net new jobs annually and 400-500 new homes annually. Long term growth under this threshold can have significant economic impacts, whereas growth beyond the upper limits of the bandwidth can cause irreversible environmental damage as well as infrastructure failure.

The Torbay Local Plan was submitted to the Secretary of State on 31st July 2014.

Capabilities on project:
Water

Unlocking growth with infrastructure
A thriving community needs to be supported by appropriate, reliable infrastructure.

The Torbay Local Plan recognises the need to invest in infrastructure across the bay and promotes a range of key projects as 'big ticket' items. These include additional road capacity, rail network improvements, new schools, and additional green infrastructure.

Torbay's sewerage network has also been identified as a potential constraint to growth. In particular, the 'single pipe sewers' to Brokenbury Quarry waste water treatment works (WWTW) is presented in the plan as a possible constraint to the growth of the Paignton North and Western Area (Policy SDP3).

Removing storm water from the combined sewer network is just one of the possible solutions stated for this Policy area (Torbay Local Plan, Sec 5.2.2.3, pg 79).

The following box gives an overview on the types of water and sewer infrastructure in Torbay:

Urban water distribution networks

Potable (mains) water supply
Potable water is water that is fit for consumption. Torbay's potable water supply is largely sourced from Dartmoor's rivers and reservoirs. It undergoes a rigorous treatment process to ensure it meets the required standards. Following treatment, potable water is distributed to customers through a pressurised water supply network.

Foul Sewer
The foul sewer transports wastewater (sewage) from houses and businesses to the wastewater treatment works (WWTW). Torbay's sewers largely rely on gravity; however, some of the larger trunk sewers or sewers in the lower reaches of the catchment require pumping. These are termed rising mains. Nearly all of Torbay's wastewater is treated at Brokenbury Quarry WWTW in Churston.

Surface Water Sewer
The primary function of the surface water sewer is to prevent flooding. It does this by draining rainwater from roads, roofs and other hard surfaces. The surface water sewer discharges directly into local streams or the sea. Under normal operation, the surface water network does not contain wastewater.

Combined sewer
Town centres and older developments typically feature combined sewers. The combined sewer network receives wastewater (foul) and surface water runoff (stormwater) from properties. Road runoff may also drain to the combined sewer in these areas. Combined sewers can overflow to the surface water sewer if they become blocked or if they receive too much rainwater. Torbay has extensive areas of combined sewers throughout Torquay, Paignton and Brixham.

Capabilities on project:
Water

Vulnerability of Combined sewers

When compared to foul drainage networks, the flow rates and volumes in the combined sewer can vary greatly during rainfall events. If they receive too much rainwater, combined sewers can discharge into the environment. This normally occurs via a combined sewer overflow (CSO).

In these occurrences, the CSO acts like a ‘safety valve’ to ensure the system doesn’t back up and cause flooding and pollution at property level. Flooding and pollution at property level can present a health risk to the occupants and on this basis, discharging via CSOs is the least harmful option. The foul and stormwater mixture that spill from the CSO enter the environment during times of peak flow and are largely diluted as they travel downstream.

Climate change and urban intensification will only increase the amount of rainfall that enters the existing combined sewer network. This increase is likely to result in CSO spills occurring more often than at present. The implications of increased CSO discharges could be detrimental to Torbay’s bathing water quality and the broader tourist industry.

Current investment by SWW however, will mitigate the impact of this on a number of key CSO locations discharging to bathing waters. The project horizons of these investment schemes will deal with flows beyond 2032.

To reduce the risk of increased CSO spills, it is important that steps are taken to reduce the amount of rainfall that enters the combined sewer system. A range of possible approaches to improve Torbay’s sewer capacity are presented in this report.

Understanding Torbay's Current Sewerage Capacity

Understanding Torbay's Current Sewerage Capacity

Connectivity and Flows: Torbay Sewer Network Overview
The Brokenbury Quarry WWTW receives nearly all of Torbay's wastewater for treatment. The only area of Torbay that is not served by Brokenbury is Edginswell in Torquay. Wastewater from Edginswell drains into the Aller Valley trunk sewer to the north west of Torquay where it feeds the Buckland WWTW in Newton Abbot[v].

Most of the sewer networks in Torquay, Paignton and Brixham are combined. These convey a mixture of stormwater and foul sewage under gravity to the large trunk sewers around Torbay's coastline. A series of sewage pumping stations (SPS) pump the wastewater to Brokenbury Quarry for treatment through rising mains.

The final treated effluent from Brokenbury Quarry is discharged into the English Channel through a long sea outfall at Sharkham Point in Brixham.

Figure 1 provides an overview of Torbay's sewer system, illustrating the complexity and extent of the Torbay sewer network. It also details the location of the main sewer pumping stations serving each town. The network marked green on the map highlight the extent of the combined sewer network.

It's worth noting that some of the areas served by separate sewers (surface and combined) comprise dual manholes. This means that during high flows, the system can effectively operate as a combined sewer.

Capabilities on project:
Water

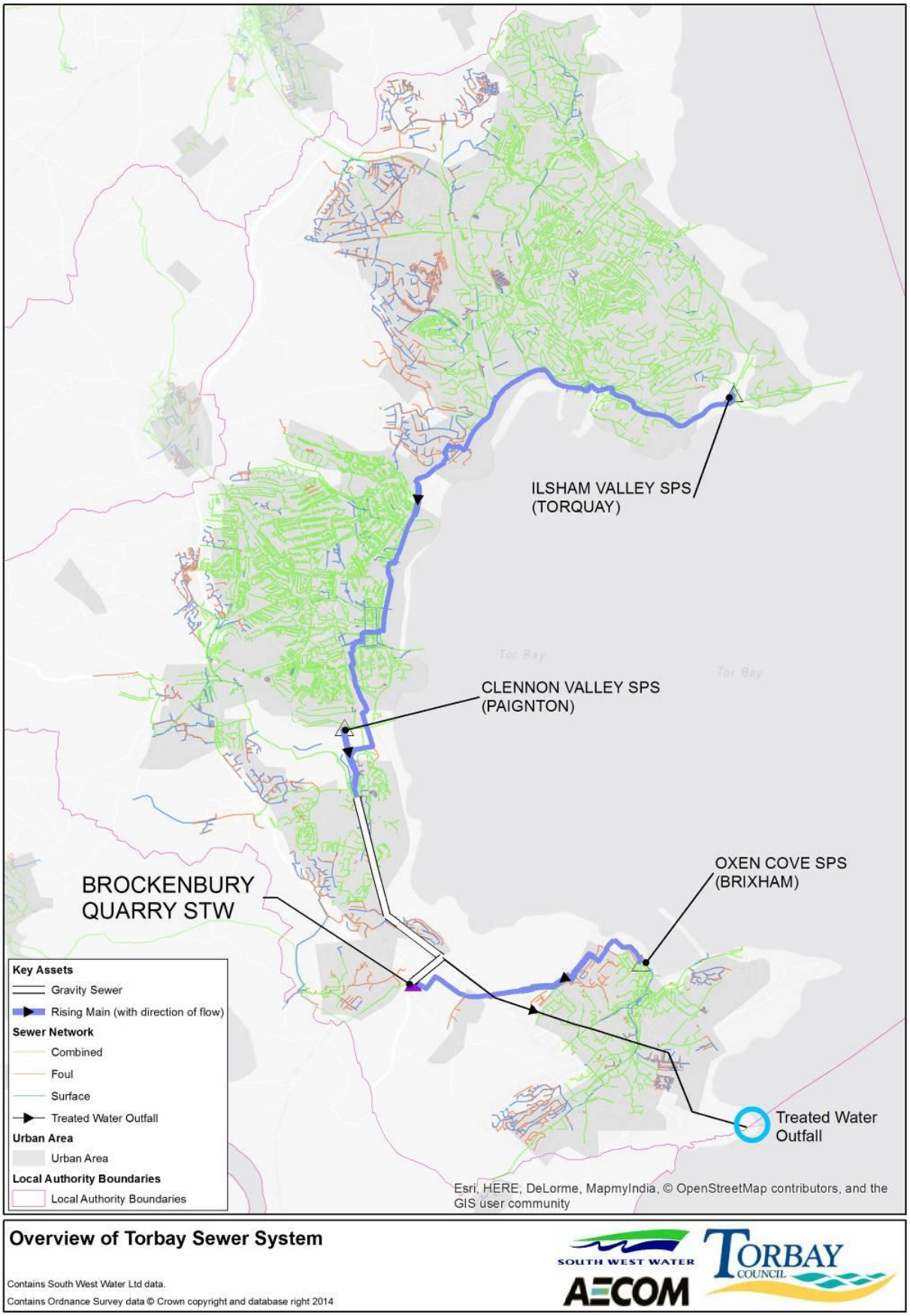


Figure 1: Overview of the Torbay Sewer System

Capabilities on project:
Water

Each major catchment in Torbay (Torquay, Paignton & Brixham) has a separate hydraulic model that has been verified for dry weather and storm flows using data recorded by in sewer flow monitors.

AECOM carried out a series of hydraulic model runs to understand Torbay's current sewer capacity, testing network performance across a range of storm duration and return periods, both with summer and winter rainfall profiles.

The critical duration storm (i.e. the storm duration which produces the worst case – either highest flows or most depth in the sewer system) varies across the catchment. Therefore the results of a 1 in 30 year, summer rainfall events of 120 minutes duration (M30-120S) are presented as they illustrate the points raised in the report with the most consistency. Flood volumes for these events are not necessarily the worst case at all locations.

Existing water consumption has been modelled as 153 l/h/d per person. This is based on recorded flows within the Torbay catchments and is a reasonable correlation to South West Water's regional figures of 146 l/h/d.

The treatment capacity at Brokenbury Quarry is outside the scope of this hydraulic modelling project which is focused on flows within the sewerage network. South West Water confirmed Brokenbury Quarry's treatment capacity is considered satisfactory for the AMP6 delivery period (2015-20) and possibly sufficient for AMP7 (2020-2025). However, there are no long term projections for Brokenbury Quarry's treatment capacity beyond AMP7.

Hydraulic models

In the context of sewerage systems, a hydraulic model is used to simulate the flow of sewage through the sewer network in order to test the effect of various scenarios (e.g. rainfall, development, etc.) on the system.

A hydraulic model can be either a physical model, where a scale model of the system (or more likely a small element) is constructed, or a computer model in which predictions are made using mathematical equations.

The hydraulic models used in this study are computer models. Computer hydraulic models allow water companies to understand how sewer networks perform under a range of conditions from dry weather to extreme rainfall. These have been built to industry standard. The models have been calibrated using physical measurements in the sewer system for a range of rainfall events.

Table 1 below presents a simple summary of the dry weather, foul only flow rates and volumes for each major sewer pumping station in Torbay's network.

Table 1 Torbay sewer pumping station current flow rates and volumes

Principal Sewage Pumping Station (SPS)	**Peak Flow (litres/sec)**	**Daily volume (m^3)**
Ilsham Valley SPS (Torquay)	370	17,776
Clennon Valley SPS (Paignton)	130	6,270
Oxen Cove (Brixham)	110	4,335
Brokenbury Quarry Catchment Total	**610**	**28,381**

Torbay's Sewer Capacity: 2032

Torbay's Sewer Capacity: 2032

New Foul Flows
South West Water (SWW) predicts that water consumption per capita is predicted to fall from 146 litres per day to 123 litres per day by 2032. Since foul (dry weather) flow generation is approximately in line with mains water usage, this water efficiency improvement can be calculated as an approximate 16% drop in foul flows to Brokenbury Quarry WWTW.

Furthermore, the 2010 population projections predicted Torbay's population will increase by approximately 18% by 2032. These figures were adopted for the modelling within this project.

In May 2014, following the commencement of this project, the 2012 population projections were released. These predicted a population increase of 8.3% (11,000 people) by 2032. Whilst this is lower than the projection used in the model, the 2010 population projection is aligned more closely with the Torbay Local Plan. Additionally, adopting the higher projection from 2010 presents a slightly 'worse' scenario in the model output; thereby building-in some degree of insurance against changes in population trends to 2032.

As outlined above, the effect of predicted increases in population on foul flows is approximately balanced by the predicted decrease in water consumption in the period to the design horizon. This means that, based on foul only connections, it is unlikely the hydraulic capacity of Torbay's combined sewer network will limit development before 2032.

Figure 2 presents the key development sites, as identified in the Torbay Local Plan, and their context to the existing sewer network.

Capabilities on project:
Water

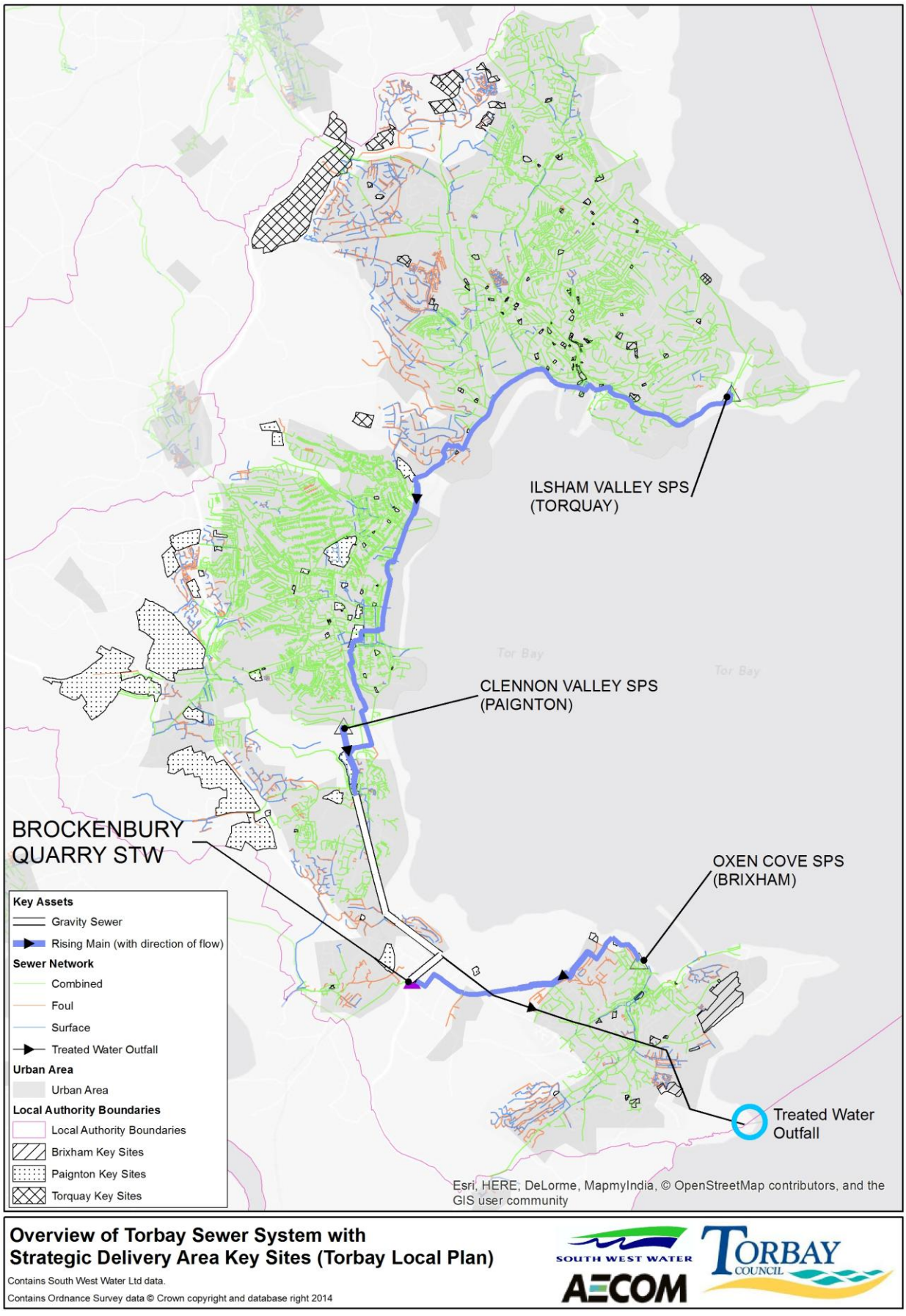


Figure 2 Strategic Delivery Area Key Sites

Urban Creep and Climate Change
The biggest threat to the future capacity of Torbay's sewers is likely to be caused by climate change and urban creep in existing areas (areas outside of the proposed development). Tackling the ongoing challenges of climate change in existing areas will require new, collaborative ways of working as well as investment from all stakeholders.

Urban creep describes the addition of new impermeable areas caused by local changes, such as patios, driveways & conservatories, draining to the sewer network. These additional hard surfaces, combined with the predicted changes in rainfall intensity, due to climate change, can increase the risk of flooding and CSO spills into the environment.

To understand the scale of this impact, the suite of 'present day' model scenarios were run with the new development, plus the added factors for climate change (10% uplift in rainfall intensity) and urban creep (+2.6% of the existing impermeable area)[6]. These model scenarios predicted a widespread impact on sewer performance that exceeded any impacts created by the proposed developments.

Sewer Capacity Assessment
The following scenarios were modelled for each of the Torbay catchments.

1. Impact of new foul flow only, on existing sewerage network

2. Impact of new foul flow plus an allowance for urban creep within new development areas

3. Impact of new foul flow from development plus catchment wide urban creep and increased rainfall due to climate change

Scenario 1 represents a best case, where surface water flows remain separated from the combined sewer network, and only additional foul flows are added to existing flow within the network.

In scenario 2 an allowance of $0.5m^2$ of impermeable area per property has been used to allow for potential urban creep to the foul sewer network within the development area. These values are based on the SWW Urban Creep Guidance for assessment of flows from new developments and are an average of the anticipated values for high and medium density housing. No allowances are usually made for non-residential development. The results from this modelling exercise have been used to assess the impact of development on the sewerage network. It represents the most likely outcome, whilst avoiding the effects of climate change which are far more widespread and affect a far greater proportion of the network.

Scenario 3 is very much a worst case, where an allowance for urban creep across the whole catchment was included as well as rainfall intensities uplifted to allow for climate change. The impacts of urban creep and climate change are discussed in the next section.

[6] These factors were applied using SWW's Urban Creep Guidance

Capabilities on project:
Water

2032 Model Outputs

The findings are presented using the results from the 1 in 30 year, summer rainfall event. The event has a total duration of 120 minutes (M30-120) and is sufficiently extreme to ensure all potential impacts on the sewer network are identified.

Sewers have been identified as being at risk from development flows when the following scenarios are exceeded; when a worsening of sewer flooding is predicted by the model, or when water levels are predicted to reach a critical level. For this assessment, the critical level has been taken as 0.5m below the manhole cover. This is the point where water level may impact upon low lying property by causing flooding or restricted sewer use. It should be noted that the results have been generated from a relatively extreme rainfall event and must be viewed as an indicator of modelled performance, rather than of the likelihood of actual sewer flooding occurring.

These plans illustrate the relative impact of development flows upon the catchment performance within the strategic sewer network. As discussed within the body of this report, it can be shown that there are no significant issues within the strategic sewer network that would lead to South West Water asking for planning conditions to imposed on the strategic network until upgrades had been completed.

However, individual developments will require further evaluation to understand local constraints, to identify suitable connection points and to understand the effects of local topography on drainage solutions. Where local issues are identified, developer contributions may be sought to overcome these via local sewer improvement schemes. The use of planning conditions should also be considered to ensure the sewerage network is not overloaded before alterations can be made.

The outputs presented below comprise a tabulated summary of the planned development (tables 2,3 & 4) and plans showing the locations where additional pressure on the sewerage system is likely to affect the current level of service. The plans represent the outcomes of the Scenario 2 modelling, where foul flows and urban creep have been added to the development areas only.

Capabilities on project:
Water

Torbay Key Development Sites (Torbay Local Plan)

Table 2 Torquay Key Development Sites

Torquay Strategic Delivery Areas	**New Homes by 2032**	**New employment floorspace**
Torquay Town Centre and Harbour SDT2	668	Mixed use regeneration
Torquay Gateway SDT3	746	81,600 sq m
Babbacombe and St Marychurch SDT4	255	Largely spaceless regneration
Elsewhere in Torquay built up area SDT1	2195	Largely spaceless regeneration
Torquay Total	**3864**	**81,600 sq m**

Table 3 Paignton Key Development Sites

Paignton Strategic Delivery Areas	**New Homes by 2032**	**New employment floorspace**
Paignton Town Centre and Seafront SDP2	460	Mixed use regeneration
SDP3 Paignton North and West Area SDP3	2625*	83,000 sq m
Elsewhere in Paignton built up area	1499	Largely spaceless regeneration
Paignton Sub total	**4584**	**83,000 sq m**

*This total includes 836 potential new homes in the Collaton St Mary development area.

Table 4 Brixham Key Development Sites

Brixham Strategic Delivery Areas	**New Homes by 2032**	**New employment floorspace**
Brixham town Centre and waterfront	65	2,500 sq m
Brixham Urban fringe and AONB	247	200 sq m
Elsewhere in Brixham built up area	218	Largely spaceless regeneration
Brixham total	**791**	**2,700 sq m**

Capabilities on project:
Water

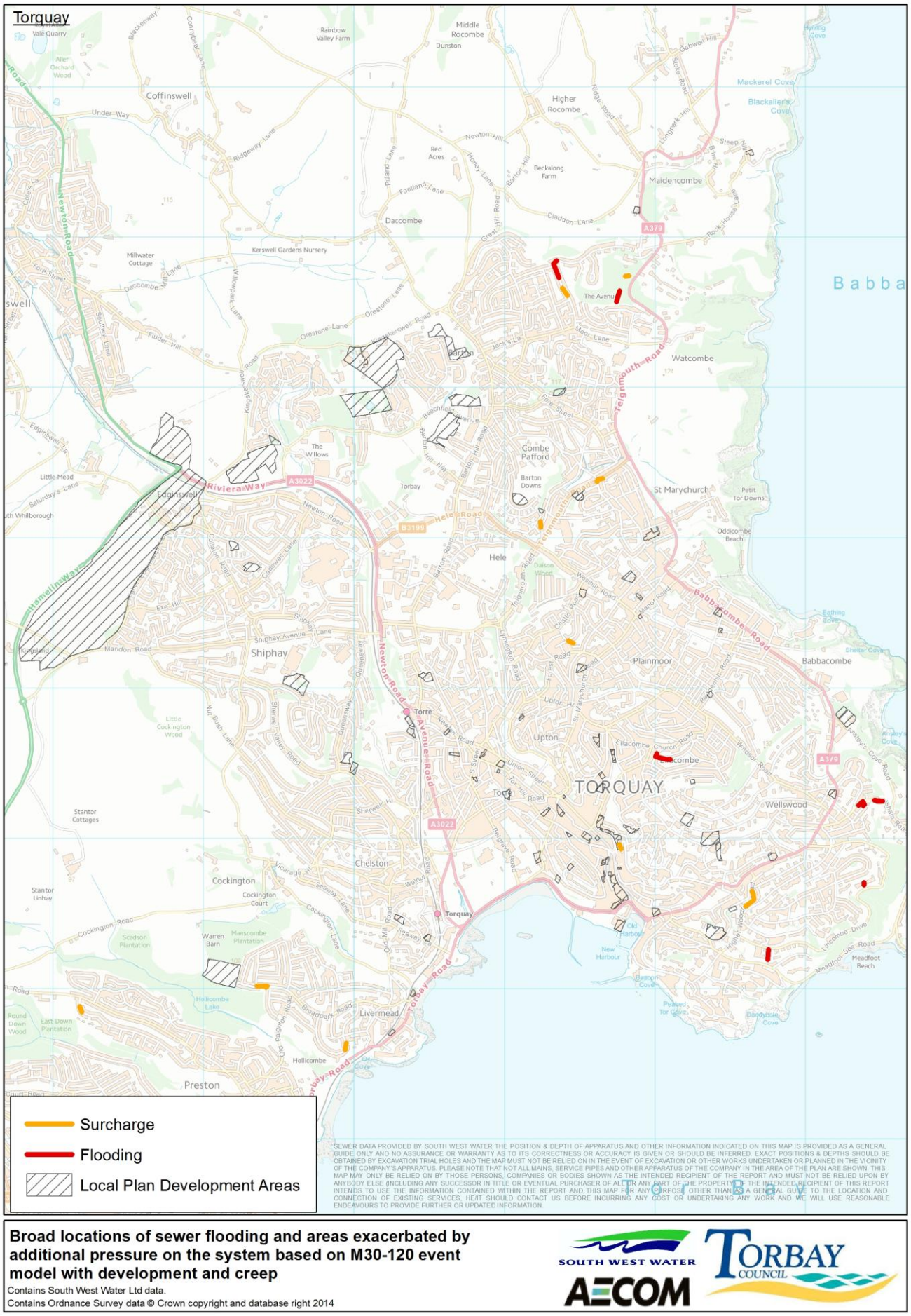


Figure 3 Torquay model output (scenario 2)

Capabilities on project:
Water

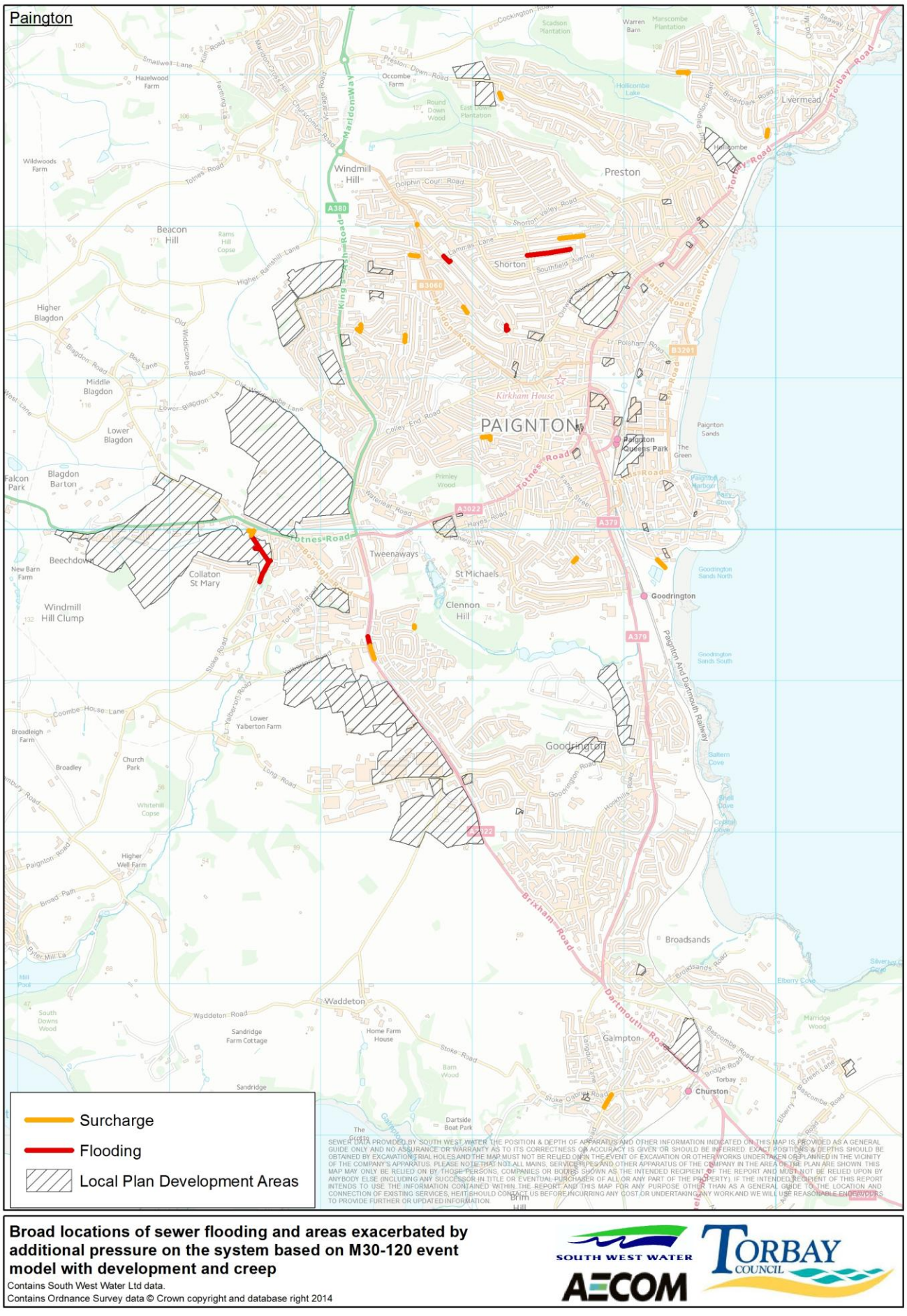


Figure 4 Paignton model output (scenario 2)

Capabilities on project:
Water

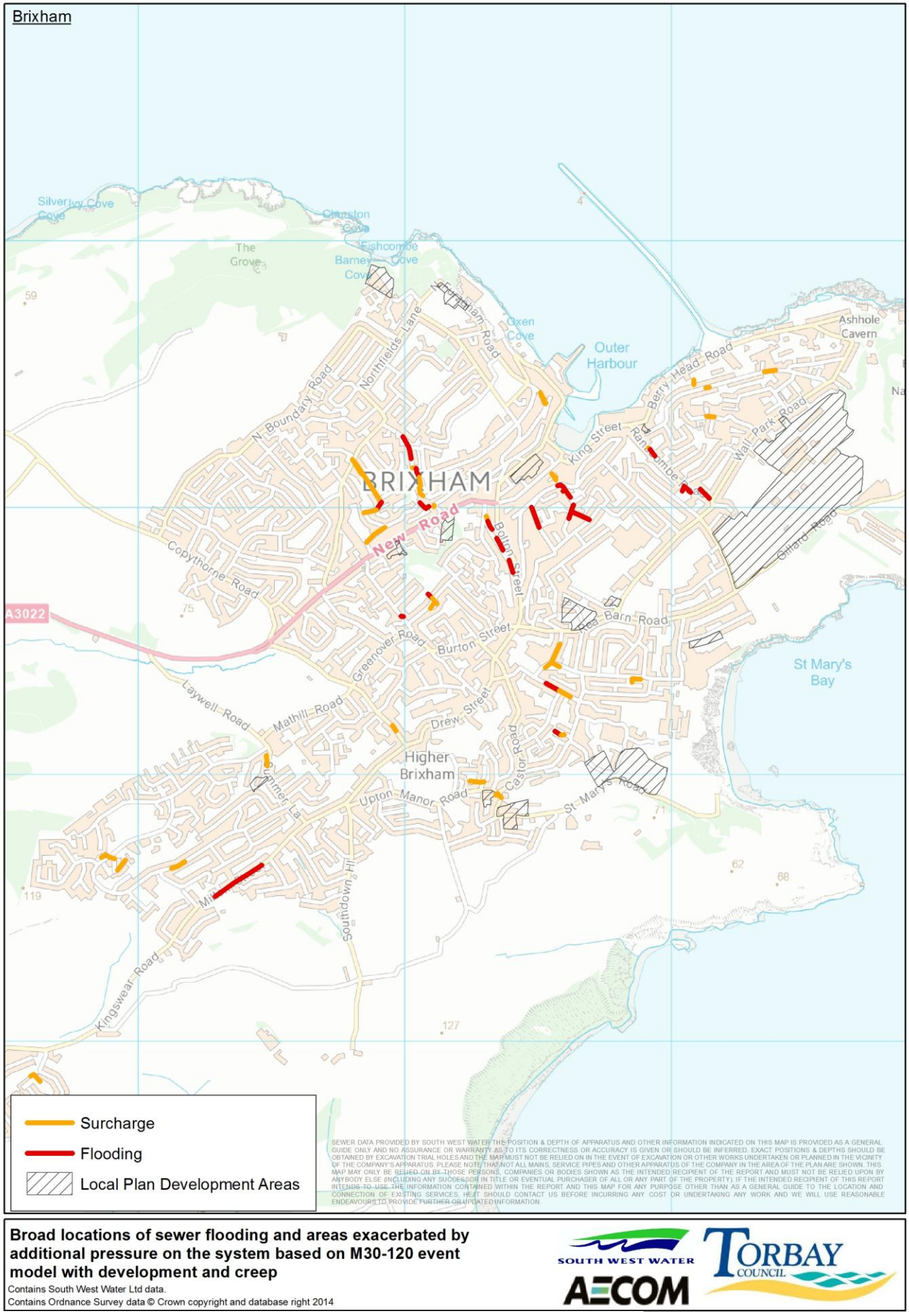


Figure 5 Paignton model output (scenario 2)

Practical measures to maintain and enhance sewerage capacity

Practical Measures to Maintain or Enhance Sewerage Capacity

The need to free up capacity

Projections for urban creep and climate change, are set to increase the volume and flows of surface water in the combined sewers. Such is the effect of these factors that, even without future development, population growth and changes in water consumption, it is likely the combined sewer network in 2032 will suffer from more frequent flooding and CSO spills.

Therefore, to maintain or enhance current operational capacity, steps must be taken to reduce the amount of surface water in the combined sewer, as well as ensuring the predicted reduction in water consumption is achieved.

Tackling runoff from new development

The effect of new hard surfaces draining to the existing combined sewer should not be underestimated. Even with separated surface water runoff, it is highly likely these new developments will, in time, contribute to the issues of urban creep through new extensions and alterations to these properties.

Demonstrating the impacts of urban creep in new developments, AECOM modelled the impacts of additional surface water from the predicted new developments around Torbay. These additional flows increase CSO spills and exacerbate current sewer flooding issues.

To support efforts to maintain or increase capacity in the network, surface water runoff from all new development in the Torbay Local Authority Area must be kept out of the combined sewer network.

This is a substantial challenge; requiring a suite of measures to ensure Torbay's growth does not exacerbate sewer flooding and CSO spills.

Sustainable Drainage of Surface Water
Sustainable drainage systems or 'SuDS' describe a suite of sustainable surface water management techniques. These typically include features such as rainwater harvesting and reuse, infiltration areas, soakaways, porous pavements, attenuation wetlands, and tree pits.

By arranging these features in a SuDS management train[vi], surface water can be managed at source, site and regional scales, to restore surface water runoff rates to pre-development (greenfield) conditions.

It is worth noting that well designed SuDS schemes provide benefits that extend far beyond flood risk management and reduced sewer capacity. They can enhance biodiversity, improve local microclimates and create places that support healthy communities. This is a great outcome for local residents as well as benefitting the wider Local Authority area.

The provision of SuDS and water efficiency is supported by the Torbay Climate Change strategy (sections 9 and 10) and the Local Plan (particularly Policy ER2 Water management and Policy W5 Waste water disposal).

SuDS Approval Body (SAB)
Defra is currently preparing to implement Schedule 3 of the Floods and Water Management Act 2010. Once implemented, every County or Unitary Authority in England will have a SuDS Approval Body (SAB).

The role of the SAB is to approve drainage systems, in accordance with the New Ministerial SuDS Standards, prior to construction. Once approved, the SAB will adopt and maintain the SuDS that serve more than one property[7].

This makes the existing right to connect surface water drainage to the public sewer conditional on the SAB approving the drainage plans.[vii]

As a Unitary Authority, Torbay Council will need to establish a SAB. This is a significant step towards achieving the desired outcome of reducing surface water disposal into the combined sewer network from new development. However, the success of the SAB will depend on the level of engagement and guidance provided to local developers.

SuDS Adoption – An interim response
Recognising the wider benefits of sustainable drainage solutions, Torbay Council is proactively promoting the use of SuDS ahead of the national SAB rollout.

This includes a recommendation that SuDS schemes are designed in accordance with the 'The SuDS Manual' CIRIA C687 and Building Regulation Part H on sustainable rainwater drainage. The latter gives priority to the use of infiltration drainage systems over watercourses and then finally, the sewer network.

With the implementation of schedule 3 still pending, a number of authorities in the UK have made the decision to adopt SuDS that are constructed in public open space. In these examples, each council has produced a set of local SuDS design and adoption guidelines to inform developers of the specific requirements.

Torbay Council should consider adopting a similar interim response ahead of the SAB obligation. These guidelines should outline specific conditions for adoption, ensuring compliance with the relevant legislation.

A preliminary review of Torbay Council's capacity, including development of a business case that considers the financial, social and environmental benefits of SuDS, may help Council develop a strategy to mainstream SuDS across Torbay.

It is likely that drafting of a SuDS strategy for Torbay will also provide Council with an evidence base to support the decision making process for future SuDS applications.

Working with stakeholders such as the Torbay Development Agency will help Torbay Council engage effectively with developers to deliver any subsequent SuDS policies.

SuDS and the Planning Process
As the SAB obligations are phased in, Torbay Council will see an increase in the number of applications for SuDS approval. This is separate to the planning process; however, it is likely SuDS approval applications will be closely aligned with existing planning application timescales and arrangements.

[7] DEFRA propose that during the first 3 years (phase 1) only major applications (more than 10 houses or larger than 0.5 hectares as defined in the Town and Country Planning Order 2010) need to seek SAB approval. Minor and major applications will apply from year 4 (phase 2)

Capabilities on project:
Water

This independent approvals process means that, even with agreed planning permission, a SuDS application refusal can stop a development from going ahead.[viii]

Early engagement is critical in improving the number of successful applications. The SAB, along with other key stakeholders (e.g. the Local Planning Authority, Environment Agency and sewerage undertaker) should participate in pre-application discussions to ensure the proposed SuDS concept satisfies the requirements for each organisation.

From the outset, the applicant should be able to understand Council's requirements and provide a basic level of SuDS information at the outline planning application stage. This should include a description of how drainage from the site will comply with the national standards.

Moving beyond SuDS

The scope of the Torbay Plan extends beyond the year 2032. Consideration should therefore be given to the evolving focus of the water industry and how future developments could deliver even greater outcomes.

For example, an urban extension in North West Cambridge will soon feature one of the world's largest stormwater harvesting schemes. In this case, surface water runoff will be treated by SuDS and redistributed across the site for non potable uses including toilet flushing and garden irrigation. Construction on the 3,000 home development commenced in February 2014 and, once complete; residential potable water use will equate to around 80 l/h/d.[ix]

Major development sites, such as the Paignton North and Western Area (SDP3) presented in the Torbay Local Plan, should be identified for their potential to achieve more than sustainable drainage improvements.

Adopting district scale rainwater harvesting schemes, waste water recycling and more extensive use of green infrastructure will create higher quality developments as well as support targets for sewer capacity improvement. Advocating for more integrated approaches to urban water management will also support Torbay Council's current and future environmental sustainability strategies. It will be necessary to tailor SuDS and water sensitive urban design (WSUD) measures to specific areas, taking into account factors such as their topography and geology.

Figure 6 The £1 billion North West Cambridge development will set a new benchmark in sustainable water management

Capabilities on project:
Water

Separating surface water from existing assets

As described above, keeping surface water runoff from new development out of the combined sewer is not enough to accommodate the expected volume increase caused through climate change and urban creep.

To meet these demands, extra capacity must be gained by reducing surface water runoff in the combined sewers from existing built up areas.

Furthermore, if surface water runoff from new development cannot be separated from the combined sewer network, surface water separation in the existing built up areas can provide an opportunity to secure additional network capacity. The following sections highlight a range of possible techniques that could be applied in Torbay.

Retrofitting Water Sensitive Urban Design (WSUD)
For existing sewer networks, the conventional engineering response to climate change and increased urbanisation is generally focused on expansion. While investing in larger, 'traditional' engineering schemes are an effective solution for hydraulic constraints, continually increasing capacity is not sustainable in the long term.

Retrofitting water sensitive urban design (WSUD) measures in existing areas can reduce flows into the combined sewer network, as well as provide improvements for the environment and local community.

The Torbay Local Plan states the Paignton Town Centre (Policy SDP2) will be regenerated to bring about improvements to its economy, built and natural environment. The Plan also adds; 'Paignton town centre is a highly sustainable location for development due to its established setting and good public transport links'.

Key focal points for Paignton's redevelopment include the improved connectivity between the town centre, seafront, harbour and surrounding parks, as well as critical infrastructure upgrades to flood defences. This incorporates measures to protect Paignton from upstream flooding.

WSUD

Water sensitive urban design (WSUD) describes a holistic approach that integrates water cycle management with the built and natural urban landscape.

It recognises all elements of the water cycle are linked and manages surface water, wastewater, potable water and groundwater for the benefit of the environment as well as the health and wellbeing local communities.

SuDS, green infrastructure, rainwater harvesting, wastewater treatment, place making and community engagement are just some of measures considered in WSUD

The potential for adopting a water sensitive approach for Paignton's town centre re-development is immense. WSUD can be used to aesthetically link places of social importance, as well as mitigate local flooding issues.

Visual, green infrastructure linkages between Crossways, Hyde Road, Victoria Park, Victoria Square, Torbay Road and eventually, the seafront could support Council's objective to re-activate Paignton's town centre.

The plan also emphasises the ambitions of Torquay and Brixham town centres to become modern, prosperous towns with a strong focus on their natural setting and biodiversity.

Similar to Paignton, the towns of Torquay and Brixham also lend themselves well to WSUD. Their valley settings, outlying green areas and harbour facing town centres present good opportunities to enhance biodiversity linkages through surface water management structures.

Brixham's Fore Street and Torquay's Fleet Walk could provide the central focus for these WSUD schemes.

Clearly transitioning towns, even in part, into water sensitive places is a considerable challenge. Nevertheless, opportunities to provide smarter, more sustainable water management outcomes in existing places must be sought if issues of sewer capacity are to be addressed.

Scales of Intervention

Delivering more holistic, integrated water management outcomes requires buy-in and commitment from a range of stakeholders including councils, water companies, regulators and the private sector. Working together creates better opportunities to deliver schemes closer to where they are more effective. For example, Council's capacity to retrofit street scale SuDS may be limited by the availability of useful space. Therefore, controlling surface water at source would need the support of the local community, private sector or regulators.

Retrofitting WSUD and SuDS into the existing landscape will demonstrate Torbay's Council's commitment to environmental sustainability and help lead the necessary change amongst the community.

A range of scales and SuDS techniques, typical to local authority retrofits, are presented in table 5 below. Some of these approaches are also presented as examples for Torbay Council in this report.

Table 5 Typical scales and techniques for Council SuDS Retrofit Schemes

Scale	Household and Building	Street	Public/Communal Space
Treatment	*Water butts and storage* *Change of surfaces to permeable surfaces* *Raingardens and raingarden planters* *Green Roofs* *Rainwater harvesting and reuse*	*Raingardens and raingarden treepits* *Permeable paving* *Underground storage*	*Raingardens* *Micro-ponds, micro-wetlands and water features* *Rills and swales* *Change of surfaces to permeable surfaces*

The following section provides examples of street and public space interventions that are typical of the SuDS retrofit scenarios available to Torbay Council. It should be noted, these are for illustrative purposes only and more detailed investigations would be required to understand the feasibility of such schemes in Torbay.

Capabilities on project:
Water

Example 1: Existing Town Centre

Concepts

Rejuvenation of public realm

Celebrating Torbay's connection to environment and water

Surface water attenuation and infiltration to improve sewer capacity (combined and surface)

Strong architectural design in water management

Bringing water to the surface

Formal rills and water ladders to convey roof and surface water to the harbour

Focal point during rain events

Water treatment through micro-wetlands and raingardens

Enhanced urban biodiversity and wildlife linkages

Street trees and raingardens providing summer shade and improved microclimate

Water features encourage interaction and play (e.g. rills)

Opportunity for rainwater harvesting

Integrated street furniture

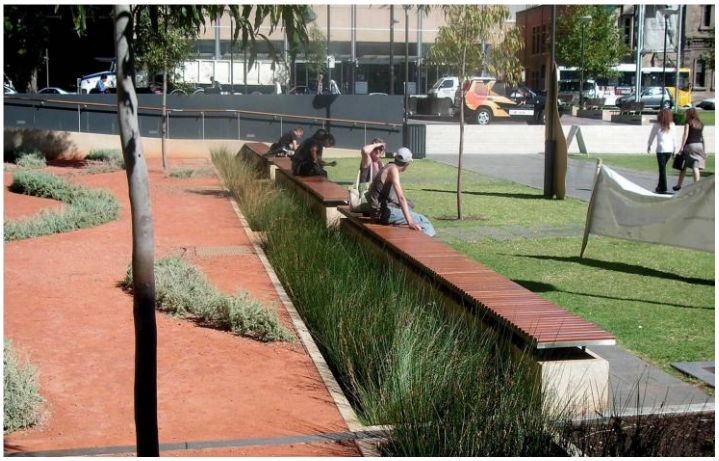
Complementing local flood alleviation schemes

Capabilities on project:
Water

Concept visualisation: existing town centre (example 1)

Capabilities on project:
Water

Elements: existing town centre (example 1)



Capabilities on project:
Water

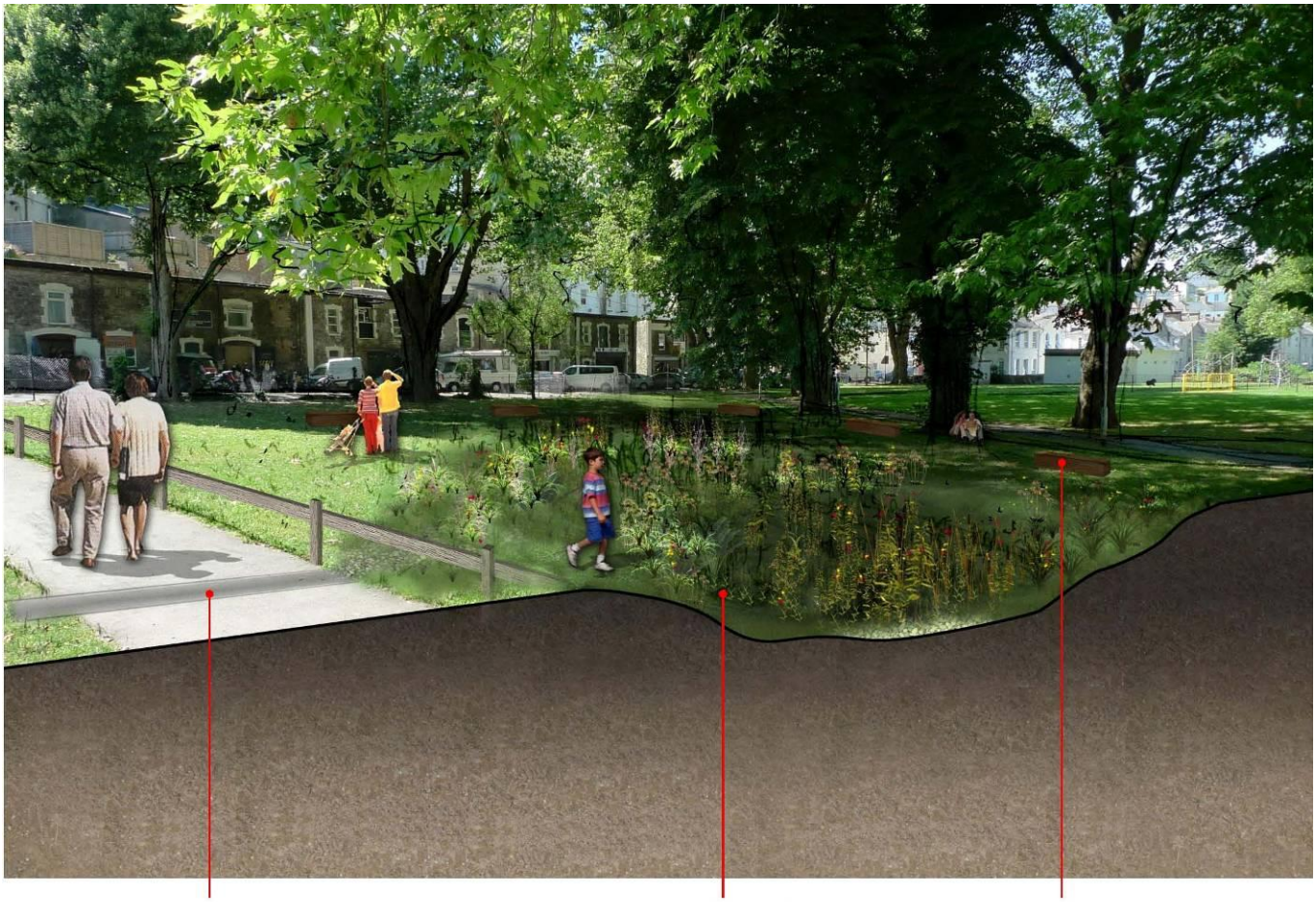
Example 2: Existing Public Park

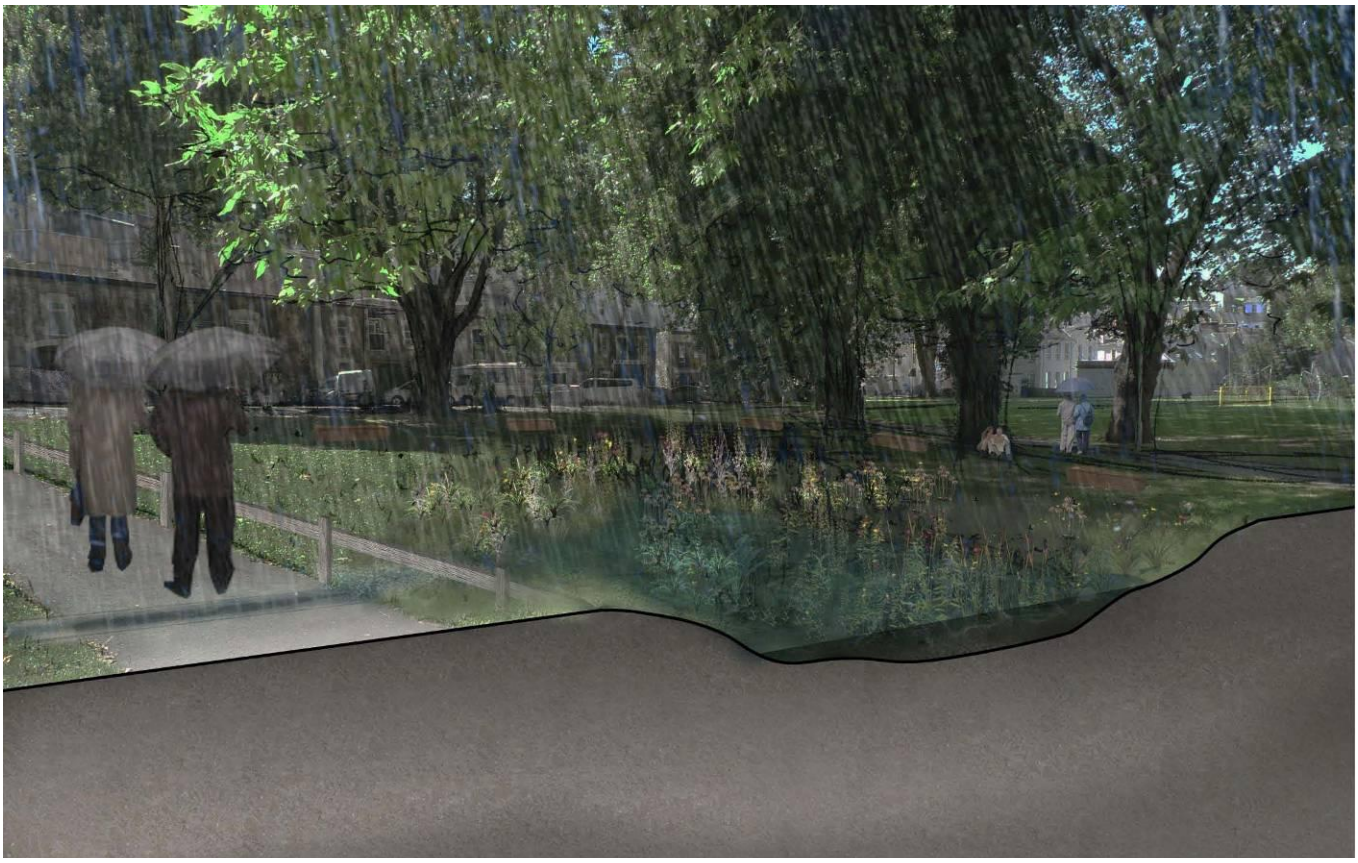
Concepts

Strong architectural design in water management
Surface water attenuation and infiltration to improve sewer capacity (combined and surface)
Water features encourage interaction and play (e.g. rills, stepping stones)
Significant biodiversity outcomes (e.g. micro-wetlands and indigenous planting)
Wet and dry characteristics with ephemeral, seasonal performance
Community focus with engagement opportunities
Linked to other elements in the park by a common theme (e.g. local playground)
Bringing water to the surface
Water conveyance in open water channels
Water treatment opportunity for rainwater harvesting
Integrated park furniture
Complementing local flood alleviation schemes

Capabilities on project:
Water

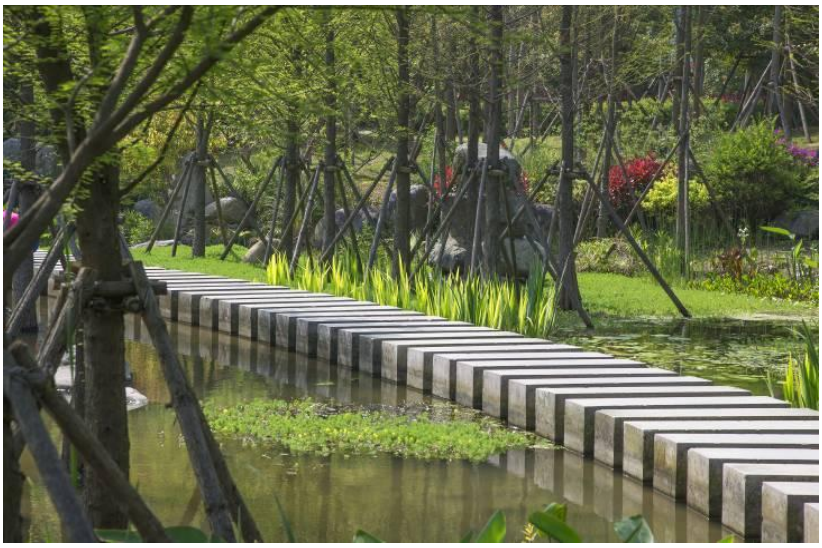
Concept visualisation: existing public park (example 2)





Capabilities on project:
Water

Elements: existing public park (example 2)



Capabilities on project:
Water

Example 3: Existing Compact Streets

Concepts

Rejuvenation of public realm

Softening of hard urban streetscapes

Enhanced urban biodiversity and wildlife linkages

Street trees and raingardens providing summer shade and improved microclimate

Strong architectural design

Bringing water to the surface

Surface and roof water attenuation

Water treatment through micro-wetlands, raingardens and raingarden street trees

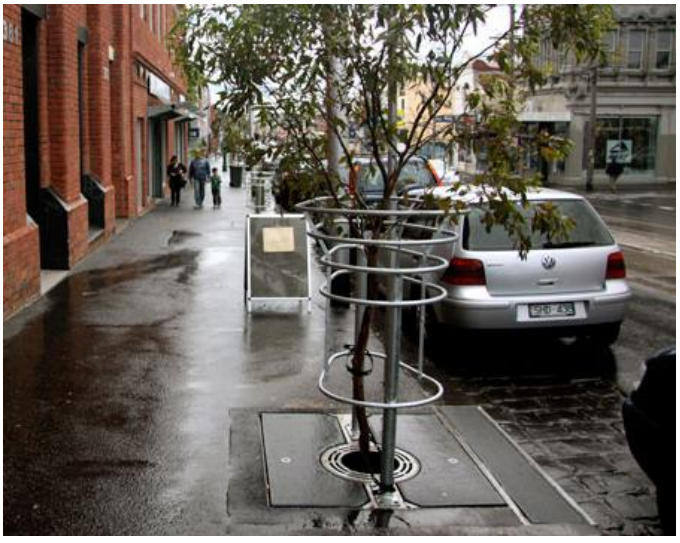
Familiarisation of sustainable urban drainage

Capabilities on project:
Water

Elements: existing compact streets (example 3)





Capabilities on project:
Water

Broader Opportunities: Existing nature strips and verges

Concepts

Use of existing footprint to install infiltration, attenuation and biofiltration features

Surface water attenuation and infiltration to improve sewer capacity (combined and surface)

Reduced maintenance costs over other retrofit schemes due to existing verge maintenance programme

Wider community acceptance due to utilisation of existing footprint (e.g. no loss of parking)

Strong community focus with education opportunities

Enhancing neighbourhood character and liveability

Capabilities on project:
Water

Broader Opportunities: Neighbourhood and pocket parks

Concepts

Use of existing footprint to install infiltration, attenuation and biofiltration features

Surface water attenuation and infiltration to improve sewer capacity (combined and surface)

Good potential for district scale solutions

Strong community focus with education opportunities

Significant biodiversity outcomes (e.g. micro-wetlands and indigenous planting)

Wider community acceptance due to utilisation of existing footprint (e.g. no loss of parking)

Capabilities on project:
Water

Broader Opportunities: Torbay Council property portfolio

Concepts

Use of existing footprint to install infiltration, attenuation and biofiltration features

Surface water attenuation and infiltration to improve sewer capacity (combined and surface)

Large number of opportunities across Torbay

Opportunity to increase the capital value of Council's property portfolio through site improvement

Reduced maintenance costs over other retrofit schemes due to existing maintenance programmes

Strong community focus with education opportunities

Creation of community assets (e.g. create a vegetable raingarden)

Capabilities on project:
Water

Community SuDS
When taking the SuDS management train into consideration, managing surface water at source is an exceptional way to improve urban hydrology. Source control also presents greater opportunities to capture rainwater for localised use.

Like most built up areas, source control measures for Torbay, require intervention at property level. Whilst there are a number of ways to approach this, the objective is largely the same for all properties. This is; surface water runoff from the property should be slowed, infiltrated (where appropriate) or stored and reused to add greater value.

SuDS techniques at property level are much the same as those retrofitted in streetscapes, only at different scales. Examples of source control SuDS include infiltration raingardens, raingarden planter boxes, green roofing and even vegetable raingardens. Each of these techniques relies on biofiltration, the process of stormwater being slowed and treated as it passes through a layer of plants, soil and sand.

Other, less ‘green’, source control methods include porous paving, water tanks, water butts and down pipe diversion kits where the householder directs rainwater into their garden from the guttering downpipe.

Motivating the community to retrofit their own surface water controls is a great challenge. Yet, despite this challenge, some international partnership programmes have achieved significant success in winning broad participation in community retrofit schemes. For example, Melbourne Water’s 10,000 Raingardens programme, in partnership with local authorities, has managed to achieve their target of disconnecting 10,000 raingardens within 5 years. This means that there are 10,000 less roof tops draining into the sewer across the city.

Improving Water Efficiency
The findings of this report state that, from a wastewater generation perspective, the predicted increase in population is approximately balanced by the improvements in water efficiency. This may good news from the view of future capacity, however, it does present a risk if the water efficiency targets are not achieved.

Water consumption is currently trending down in the South West. The reasons behind this are broad and may include evolutionary improvements in white goods (e.g. washing machines and dishwashers), dual flush toilet cisterns, low-flow showerheads and tap aerators as standard in house renovations.

The migration of South West Water Customers onto water meters is also partially responsible for the improvements as households consider the cost of their water usage.

Partnership Opportunities for water efficiency
Torbay Council actively promotes the benefits of water efficiency in a number of initiatives (e.g. Energy and Climate Change Strategy 1014-19). This is an important stance to adopt when advocating for a sustainable Bay.

By working in partnership with South West Water, Torbay Council may be able to win even more improvement in water efficiency. International examples demonstrate that, in areas of water stress, partnership pogrammes between local authorities and water companies can be extremely effective in reducing water consumption.

Water Reduction Strategies
Some of these initiatives include; showerhead exchange programmes, free waterbutts, even heavily subsidised dual flush toilets. Other successful campaigns have centred on targets of sustainable water use where every community member knows how much water they should be using each day, and how they are performing against the target.

For example, a Torbay ‘Target 125’ partnership campaign could prove effective in educating the community on the desired level of water use.

Naturally, Torbay Council should continue to implement water efficiency measures in their own buildings and properties. To date, the Torbay Development Agency’s Property Services and Asset Management teams monitor water consumption from Council's buildings, including schools, libraries, and offices.[x] Torbay Council is also piloting the use of water-less public toilets.

These council led initiatives provide a powerful demonstration of community leadership and a commitment to sustainability.

Sewer rehabilitation
Sewers constructed with traditional materials can, over time, become infiltrated by water in the ground. The most common cause of this infiltration is the gradual movement of pipes causing the joints to separate, albeit slightly, from the pipe sections. Further defects such as cracks and holes in the pipe can also exacerbate the problem.

For most sewers, the volume of groundwater ingress is relatively small. However; the cumulative effect can impact on sewers in the lower reaches of the network.

South West Water’s sewer rehabilitation programme addresses the risks caused by defects or ageing sewers. By addressing these defects, this strategic delivery programme will reduce the amount of infiltration in the sewer, thereby optimising the network’s design capacity.

Conclusion

Conclusion

This assessment found the effect of predicted increase in population on foul flows is approximately balanced by the predicted decrease in water consumption in the period to the design horizon. Therefore; considering foul only connections, it is unlikely the hydraulic capacity of Torbay's strategic sewer network will limit development before 2032.

Whilst this is a generally positive outcome for the future growth of Torbay, it does present a risk in how development is managed across the broader catchment. Namely, surface water runoff from all new development in the Torbay Local Authority Area must be kept out of the combined sewer network. Additionally, it relies on water efficiency improving at the predicted rate.

This is a substantial challenge. Should this predicted reduction in water consumption not materialise, or if surface water runoff from new development cannot be separated from the combined sewer network, measures must be taken elsewhere in the catchment to secure additional capacity.

To demonstrate the importance of reducing surface water in the combined sewer network, AECOM modelled a range of scenarios. This considered the impacts of increased rainfall caused by climate change, as well as the impacts of urban creep; where new alterations such as patios and conservatories are directly connected to the combined sewer instead of through other surface water management measures. These additional flows would create additional CSO spills and exacerbate current sewer flooding issues.

It should be noted that permitted connection points for some developments may be a significant distance from the development due to lack of capacity in the local sewer network. Detailed modelling must be carried out to determine the impacts for the key development sites within Torbay.

Separating surface water from the existing sewers can help maintain current levels of service; however, a robust strategy will be needed to ensure this.

Advocating for SuDS (and WSUD) in all new development, retrofitting SuDS in existing built up areas and working in partnership for improvements in water efficiency are the key practical measures outlined in this report.

A WSUD or SuDS strategy for Torbay Council may be the natural next step in delivering these outcomes. The strategy could address Council's interim response for adopting SuDS from all new development ahead of the Schedule 3 roll out. It may also help Torbay Council develop a business case and plan for SuDS retrofits across the Bay.

The outcome of widespread implementation of SuDS will not only help maintain sewer serviceability into the future, it will also provide a significant benefit to the communities that live and work in Torbay.

References

References

[i] AECOM Interim Technical Advice Note; Hydraulic Modelling - Sewer Capacity in Torbay (16 July 2014)

[ii] Department for Communities and Local Government: https://www.gov.uk/government/policies/giving-communities-more-power-in-planning-local-development/supporting-pages/local-plans

[iii] The Planning Inspectorate: http://www.planningportal.gov.uk/uploads/pins/local_plans/LPA_Core_Strategy_Progress.pdf

[iv] Torbay Council. The Torbay Local Plan, A Landscape for Success. Proposed Submission Plan (February 2014)

[v] Torbay Council. Water Cycle Study Final Report, March 2012

[vi] CIRIA (Susdrain) SuDS Management Train http://www.susdrain.org/delivering-suds/using-suds/suds-principles/management-train.html

[vii] DEFRA Flood and Water Management Act 2010, Schedule 3 - Sustainable Drainage Systems (SuDS) Approving Body - Information for Local Government (County and Unitary Authorities)

[viii] UK Legislation - http://www.legislation.gov.uk/ukpga/2010/29/schedule/3?view=extent Section 32, Schedule 3, *Requirement for Approval*, 7 (Sub-paragraph 1).

[ix] AECOM – North West Cambridge Masterplan http://www.aecom.com/Where+We+Are/Europe/Design+Planning/_projectsList/North+West+Cambridge

[x] Torbay Council. Energy and Climate Change Strategy 2014-2019 http://www.torbay.gov.uk/index/yourservices/environment/climatechangestrat2014-19.pdf