love every drop
anglianwater

WATER RECYCLING LONG-TERM PLAN

September 2018

FOREWORD

The Anglian Water region is one of the fastest growing in the UK, which presents unique challenges for us as a water company. We therefore recognise the value in understanding our capacity to support this growth, to create sustainable environments to live and work.

Drawing on our experience of long-term planning for water resources (our Water Resources Management Plan – WRMP), this document is our first equivalent long-term plan for managing the supply of water recycling services to meet the demands of a growing population.

This Water Recycling Long-Term Plan (WRLTP) is framed by our Strategic Direction Statement, our 25 year forward vision for the region. It also complements our Water Resources Management Plan (WRMP) to provide transparency of our business planning processes, and allows us to respond to and influence the external market.

But we want it to be adaptive to change. It is not a stand-alone document but one that will be used to inform our investment, identify key indicators for change and transform our 'business as usual' practices, to understand our risks and realise opportunities.

For this approach to be effective we must work with others. This plan has been prepared in collaboration with our partners and customers so it can be used to help inform the spatial distribution and timing of growth. Many of the solutions, such as surface water management (SWM), require working in partnership to deliver effectively.

We hope you find this of interest and welcome your feedback.

Paul Gibbs
Director of Water Recycling
Anglian Water

Alex Plant
Regulation Director
Anglian Water

VISION

Water is our business. We handle with care and we don't cost the earth.

Our company vision is for a fully integrated water and water recycling system that provides reliable, affordable and sustainable levels of service for customers and business, while fully protecting the environment. We want this system to be resilient to the effects of growth, climate change and severe drought; to minimise our water and carbon footprints; to enhance biodiversity and to increase the resilience of natural systems in our region, upon which we depend.

We believe this WRLTP helps us to achieve this vision and informs the overall strategy set out in our Strategic Direction Statement, our PR19 Business Plan and our outcomes for customers and the environment.

EXECUTIVE SUMMARY

The investment needed over the next 25-years to balance the supply and demand for water recycling services is described in this WRLTP. The plan considers risk from growth, climate change, severe drought, and customer behaviours. It promotes sustainable solutions for maintaining reliable and affordable levels of service, and facilitates working in partnership to mitigate flood risk.

The timing of necessary investments involves trade-offs of cost and risk between current and future customers and we have a responsibility to ensure services are provided for both. We must reconcile the need to keep current bills affordable with the need to plan for future challenges. The timing and scale of these needs are inherently uncertain, so we have developed long-term strategies that are adaptive to change and respond to the key indicators we monitor. This long-term view enables us to identify solutions of least regret that are phased according to our confidence of the need for investment, and include opportunities to reduce the risk to the services we provide for customers in the long term.

Our plan at a glance

We will:

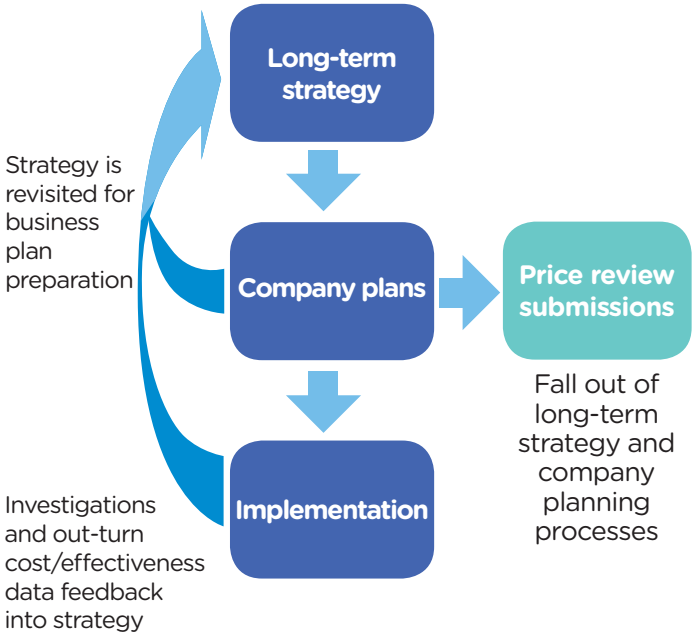
- invest in 'least regret' solutions that adhere to long-term strategies and help to manage the impacts of growth on our service
- manage a transformational adaptive programme of delivery using intelligence from key indicators, live modelling tools and relationships with local authorities and developers to determine the optimal timing of solution delivery, and
- integrate the frameworks and tools developed by the 21st Century Drainage Programme, notably the Drainage and Wastewater Management Plan, into business as usual and PR24 Business Planning.

21st Century Drainage – driving long-term plans

We are fully engaged in the vision and delivery of the Water UK-led 21st Century Drainage Programme that is identifying the major risks for drainage in the future and providing options for how these risks could be addressed. This includes a recent study that seeks to develop a long-term planning framework for the production of Drainage and Wastewater Management Plans (DWMPs) by autumn 2018. The approach we have taken to develop our WRLTP is aligned with aspirations of the DWMP study.

UKWIR Wastewater Supply–Demand Planning Framework

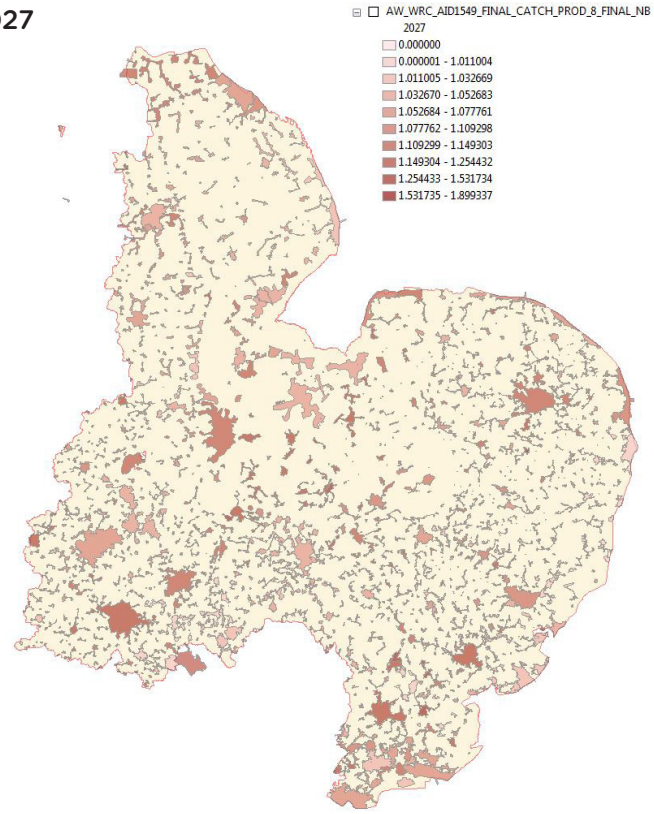
UK Water Industry Research (UKWIR) updated the Wastewater Supply–Demand Framework in 2014, incorporating the Drainage Strategy Framework, and broadened its scope beyond business planning to the wider decision-making process. Our WRLTP approach is aligned to this three-stage process, in which company planning and implementation sit within a long-term strategy framework;



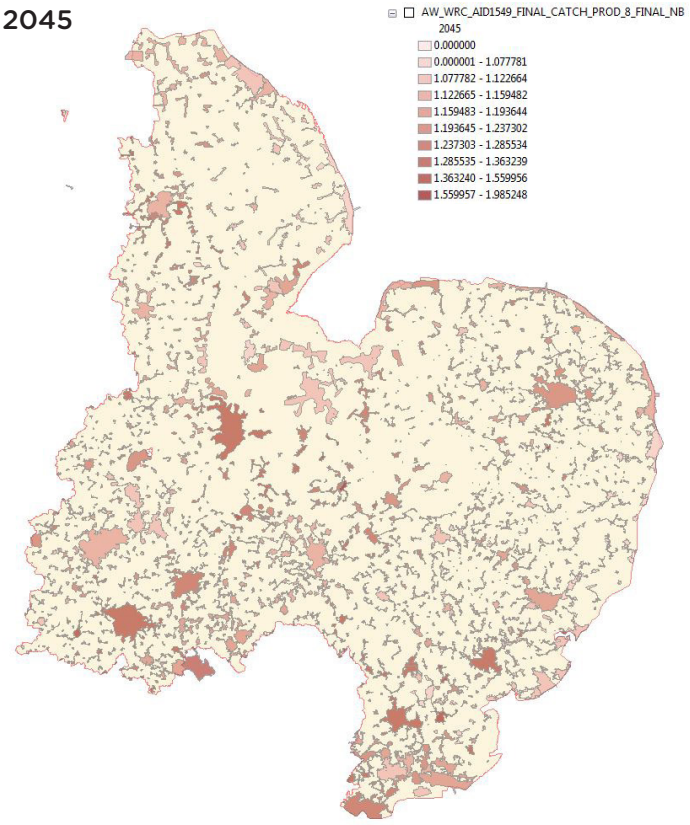
Enabling housing growth

We know growth is one of the biggest challenges for us – and one of the areas where we can do most to support our customers and our region. That's why we've taken up the ambition to enable sustainable economic and housing growth. The heat maps below illustrate the growth in our region to 2027 and long-term to 2045.

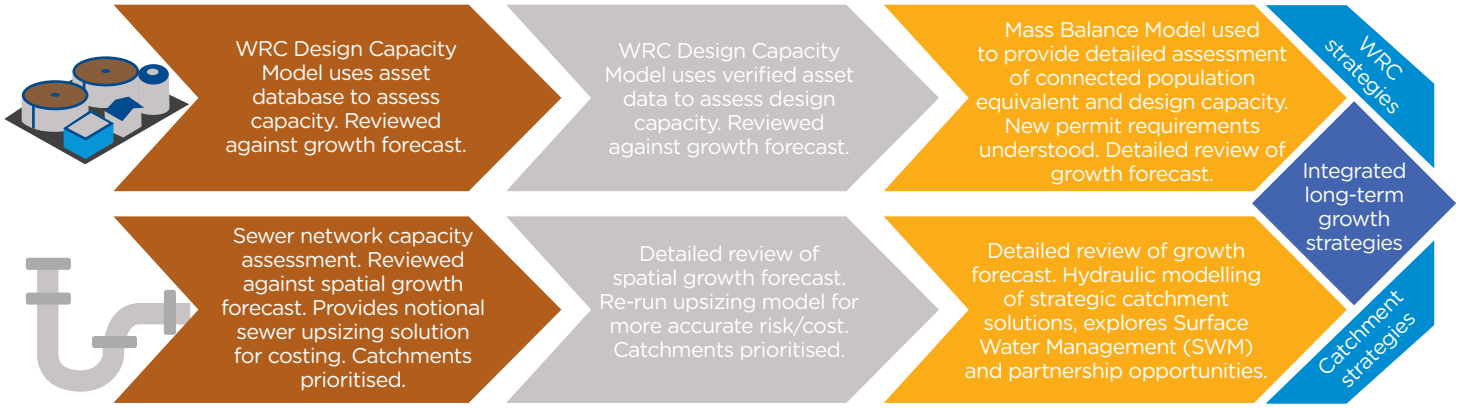
2027



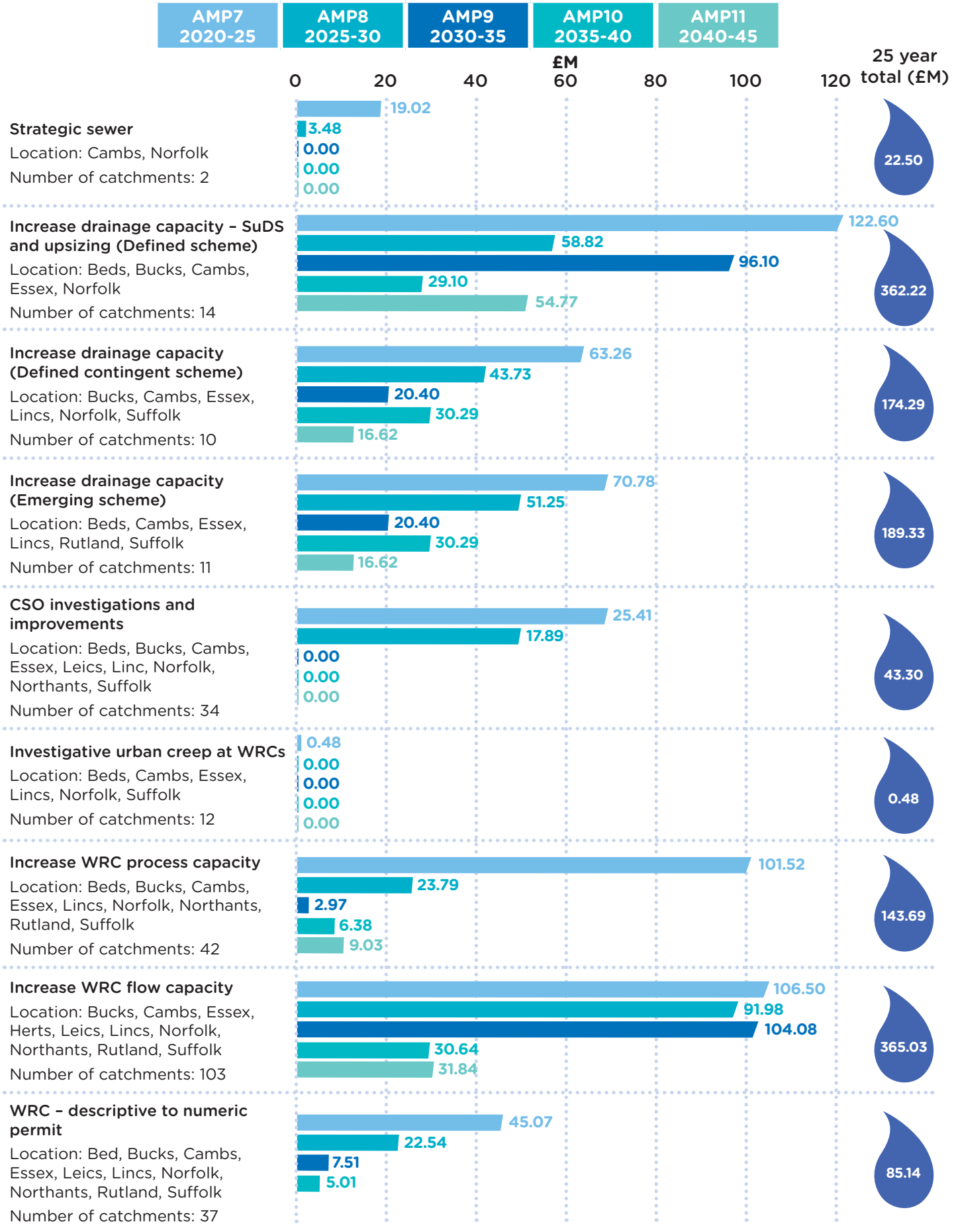
2045



However, the pace and exact location of housing growth is uncertain, so we have taken a risk-based approach to developing an appropriate investment strategy. We have followed a Bronze, Silver, Gold risk-based process to assess risk of detriment and to prioritise investment for over 1000 catchments and Water Recycling Centres (WRCs) to give us an integrated long-term growth strategy.



This gives us a long-term view of the investment we will need, as shown in the table below.



We are proud of our Water Recycling Long-Term Plan, which we believe leads the industry as an innovative means of providing more certainty and effectiveness in securing environmental protection while accommodating growth.

CONTENTS

PART 1 – CONTEXT

1.1 Our integrated services

Our vision is for a fully integrated water and water recycling system that provides reliable, affordable and sustainable levels of service for customers and business, while fully protecting the environment. We want this system to be resilient to the effects of growth, climate change and severe drought; to minimise our water and carbon footprints; to enhance biodiversity; and to increase the resilience of natural systems in our region, upon which we depend.

The investment needed over the next 25 years to balance the supply–demand for water and water recycling services is described in our Water Resource Management Plan (WRMP) and our Water Recycling Long-Term Plan (WRLTP). We have a statutory duty to produce a WRMP, and to show how we will meet the future demand for water supplies. This WRLTP shows how we will meet the equivalent demand for sewage collection and water recycling services, while preventing environmental detriment and sewer flooding. Both plans consider risk from growth, climate change, severe drought and customer behaviours and both promote sustainable solutions for maintaining reliable and affordable levels of service.

1.2 What is water recycling?

Our drainage systems serve people and industry by taking used water and rainfall runoff, treating it and discharging it to ground, rivers or the sea. This water recycling infrastructure comprises a number of different types of systems.

- **Surface water (SW) sewers** form 25% of our network, convey rainwater drained off our roads, roofs and other hard surfaces, releasing the water directly into rivers and streams, the sea, the ground (via soakaways) or to combined sewers.
- **Foul sewers** make up 52% of our network, carry used water from homes and businesses to water recycling centres.
- 23% of our sewer network is **combined**, carrying both rainwater and used water to water recycling centres.
- **Combined sewer overflows (CSOs)** are points in a combined sewer network where excess water can be released from the network to prevent flooding, designed to operate only when there is a large amount of rainwater in the system to dilute the used water.
- We are a flat region and have 5200 **pumping stations**, with around 40 added each year. These often have overflows to allow excess water to be released and prevent flooding elsewhere, either due to extreme rainfall or in an emergency.
- **In-line storage tanks** provide additional capacity within a sewer network, designed to operate in wet weather conditions.
- Our 1130 **water recycling centres (WRCs)** treat the used water before it is returned to our rivers or the sea.
- A **sewer catchment** is made of the sewer network, storage and pumping stations that are served by one WRC. We have over 1000 discrete catchments. Nearly 80% of our population lives in the 100 largest catchments, with the remaining 20% served by discrete sewerage systems.

Water recycling?

From the moment you flush or pull out the plug, to the time it goes back to the environment, we look after the water you've used. It arrives non-stop through our 76,335 kilometre long sewer network and gets treated at over 1000 water recycling centres. We treat almost a billion litres a day and we test it to make sure it is clean enough to keep the environment, and the Environment Agency (EA), happy. We have permits agreed with the EA to ensure standards of flow and quality discharges of this treated final effluent.

1.3 Why a Water Recycling Long-Term Plan?

This WRLTP will:

- provide transparency of our long-term strategy to enable sustainable growth
- promote working together to facilitate the delivery of new homes and jobs
- provide opportunities to deliver least regret efficient and affordable long-term catchment-based solutions, such as surface water management (SWM) solutions delivered in partnership
- transform our business processes to deliver an adaptive growth programme that responds to changes in the key indicators we monitor
- increase our resilience to exceptional events, such as flooding and pollution, and
- help us to meet our SDS ambitions.

Within AMP7 we will explore further opportunities to join up with the WRMP to ensure an integrated approach to long-term planning that provides resilient catchments, such as joint partnership working groups.

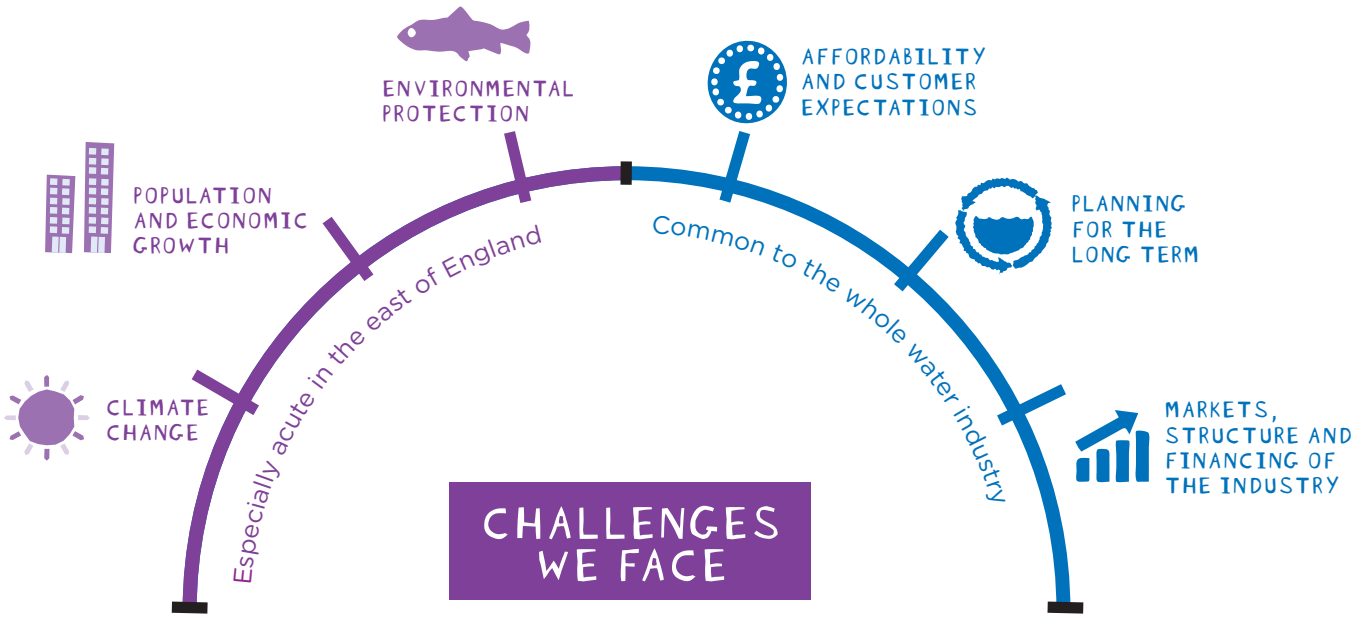
When we published our Strategic Direction Statement (SDS) in 2007, we set out what we believed to be the main challenges facing the company in the years to 2035, of which the most significant were climate change and growth.

That assessment has since been borne out by events such as the East Coast surge and extreme inland flooding, as well as increasing rates of growth in our region. Our SDS called for a radically different approach to that traditionally taken by water companies. Maintaining a reliable, safe and affordable service in the face of these challenges requires a much broader strategy, a truly collaborative approach with our customers and a wide range of other stakeholders. Our 2017 SDS Refresh recognises the same key challenges we identified ten years ago, climate change and growth, as well as increased pressures from environmental protection.

We recognise and embrace the crucial role we have in facilitating economic and housing growth across our region, through timely and efficient provision of vital infrastructure. We have legacy issues with our water recycling systems that have been designed to operate passively, with intervention only required to address problems as and when they occur. We want to change this approach to provide a proactive service to our customers to ensure we address our long-term pressures outlined below. This WRLTP is an integrated approach to the management of sewerage drainage systems and water recycling centres, where we actively assess risks and opportunities at a whole catchment level. We will consider the interaction with the provision of water services. If we fail to take a fully integrated approach, there is an increased risk of sewer flooding and pollution, as well to delays in delivery of the development sites in general.

The challenges include:

- climate change and urban creep causing surface water flows to increase year on year, potentially beyond the capacity of the systems
- a region with one of the highest and fastest rates of planned economic and housing growth in the country
- an expectation of resilient services for our customers that protect the water quality and biodiversity of our environment
- pressure on budgets from the financial climate in which customers are no longer prepared to accept rising bills, and
- a need to reduce the environmental footprint of our services by reducing both embodied and consumed carbon and water.



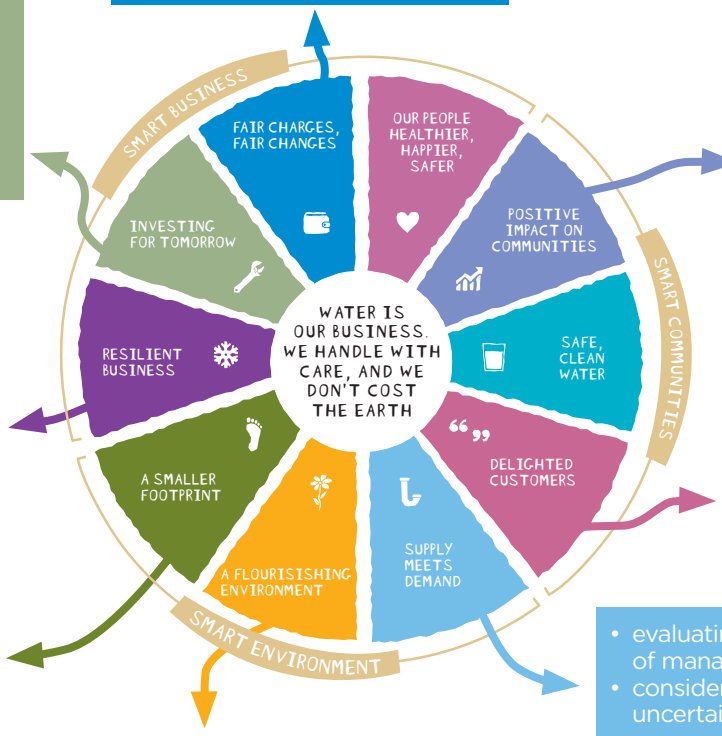
1.4 Benefits to customers and stakeholders

Our overall company strategy is set in our recently refreshed SDS and our Love Every Drop business goals. During planning for AMP7 we agreed outcomes with our customers that summarise our areas of focus and benefits, with Outcome Delivery Incentives (ODIs) introduced that will reward or penalise us depending on how we meet, exceed, or fall short of our targets.

The Water Recycling Long-Term Plan will help us achieve our outcomes by...

- providing evidence to drive long-term phased sewerage investment to address future challenges and manage future uncertainty
- considering implicitly in all AMP6 solutions climate change and flood risk, and
- monitoring of key indicators to trigger investment phases.

- identifying and planning large expenditure early to ensure customers bills are fair.



- reforming developer charges, and
- driving efficiency, value for money and affordability.

- Support partnership working with local approaches to reducing current and future risk of flood, erosion and pollution, and
- providing economic support through amenity improvement through SuDS

- integrating management of flood risk and growth
- reducing impact of construction on our customers, and
- providing opportunity to deliver customer education and promote behavioural change.

- finding efficient methods of expanding our infrastructure and delivering service to a growing customer base, thereby reducing demand on scarce resources and limiting both embedded and operational carbon as far as possible.

- noting that housing and population growth will increase the biological loading of influent to water recycling centres. In high-growth areas, we may need to expand treatment capacity at our water recycling centres to minimise impact on receiving watercourses.

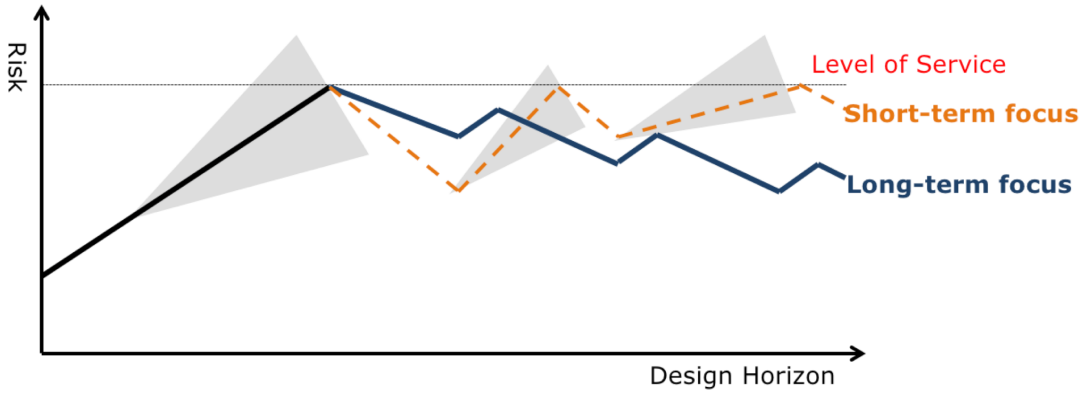
- evaluating and delivering methods of managing surface water better
- considering rate of change and uncertainty of growth and urban creep
- incorporating sustainable solutions, and
- extending the sewerage system to serve new development and existing properties that don't have the benefit of sewerage.

1.5 Where it fits...

1.5.1 A long-term view

Water is a long-term business. Our ability to provide excellent services for our customers in the future depends on making the right choices now. Of course, no one can know precisely what the world will be like in 25 years' time: how the needs of customers and society more broadly will develop; what future technology and markets will be like; exactly how the climate and environment will change; or what new challenges will emerge. The impacts of population growth, climate change and environmental pressures will take time to manifest, but we need to be preparing now for an uncertain future.

The timing of necessary investments involves trade-offs of cost and risk between current and future customers and we have a responsibility to ensure services are provided for both. We must reconcile the need to keep current bills affordable with the need to plan for future challenges. The timing and scale of these needs are inherently uncertain, so we have developed long-term strategies that are adaptive to change and respond to the key indicators we monitor. This long-term view enables us to identify solutions of least regret that are phased according to our confidence of the need for investment, and include opportunities to reduce risk to service to our customers in the long term. The figure below helps illustrate our challenge to deliver short-term five-year AMP cycles, and the benefits of long-term strategic plans in reducing risk.



1.5.2 Our vital role

The National Infrastructure Commission found that a "lack of sufficient and suitable housing presents a fundamental risk to the success" of the corridor connecting Cambridge, Milton Keynes and Oxford. While the primary cause was identified as a lack of joined-up planning and a shortage of available land, the report noted that "utility companies, local authorities and developers are not always effectively coordinated".

We want to enable sustainable economic and housing growth here in the UK's fastest growing region. This document aims to help coordinate planning with local authorities and developers, to identify areas where demand for our services will increase, and ways of incentivising developers to build in a way that minimises the impact on our services.

1.5.3 21st Century Drainage

In 2013, the UK government challenged the water industry to consider the performance and capacity of the drainage system and consider better the links to drainage planning and the environment. This arose from concern about the impact of combined sewer overflows (CSOs) and the risk that frequent discharges could have a detrimental effect on the environment, and means that we fail to deliver the standards set out in the EU Urban Waste Water Treatment Directive. Changing climates, population growth and the spread of towns and cities all put greater pressure on drainage systems. The ownership and governance of drainage systems is complex. They are also vulnerable to misuse and abuse.

The vision of the Water UK-led 21st Century Drainage Programme is to enable the UK water industry, in partnership with the UK's government and regulators, to make plans now that will ensure the sustainability of our drainage infrastructure in the future. It seeks to identify frameworks to: define and manage drainage capacity; address CSOs that operate frequently; sewer misuse; groundwater inundation of drainage systems; drainage infrastructure deterioration; and flood resilience of assets. A further workstream drives communication, engagement and enablers of progress.

A more recent 21st Century Drainage study seeks to develop a long-term planning framework for the production of Drainage and Wastewater Management Plans (DWMPs) by autumn 2018.

This will build on the Drainage Strategy Framework and incorporate tools and frameworks being completed as part of the wider 21st Century Drainage Programme. The approach we have taken to develop our WRLTP is aligned with aspirations of the DWMP study. We continue to support this programme and will start to implement the DWMP framework as soon as it is published.

Everyone in the water sector realises the scale of the challenges facing the industry and that is why more than 40 organisations from across the UK have joined Water UK for this 21st Century Drainage Programme.

UKWIR

WATER UK

PART 2 – APPROACH

This WRLTP outlines expenditure due to growth and climate change. It does not consider investment that may be required to meet our regulatory no deterioration water quality obligations where not driven by growth. Investment to meet these quality drivers are outlined in our AMP7 Business Plan. Where there is a growth driver for investment, these factors are considered and costed to ensure a holistic approach to risk management.

Part 2 outlines our approach to assessing risk and uncertainty scenarios in order to determine the most appropriate strategy, investment need and options. We consider risk to be an assessment of impact and likelihood, and use a risk-based decision-making (RBDM) approach.

2.1 Geographic breakdown

For the purposes of this plan, the region served by Anglian Water has been divided into individual counties, with the population served summarised below. We have prepared County summaries (Part 6) for all that have investment identified in AMP7 and longer term. The three counties shown in italics do not have County summaries as they have capacity to serve growth to 2027.

This data has been prepared using our water recycling growth forecast model.

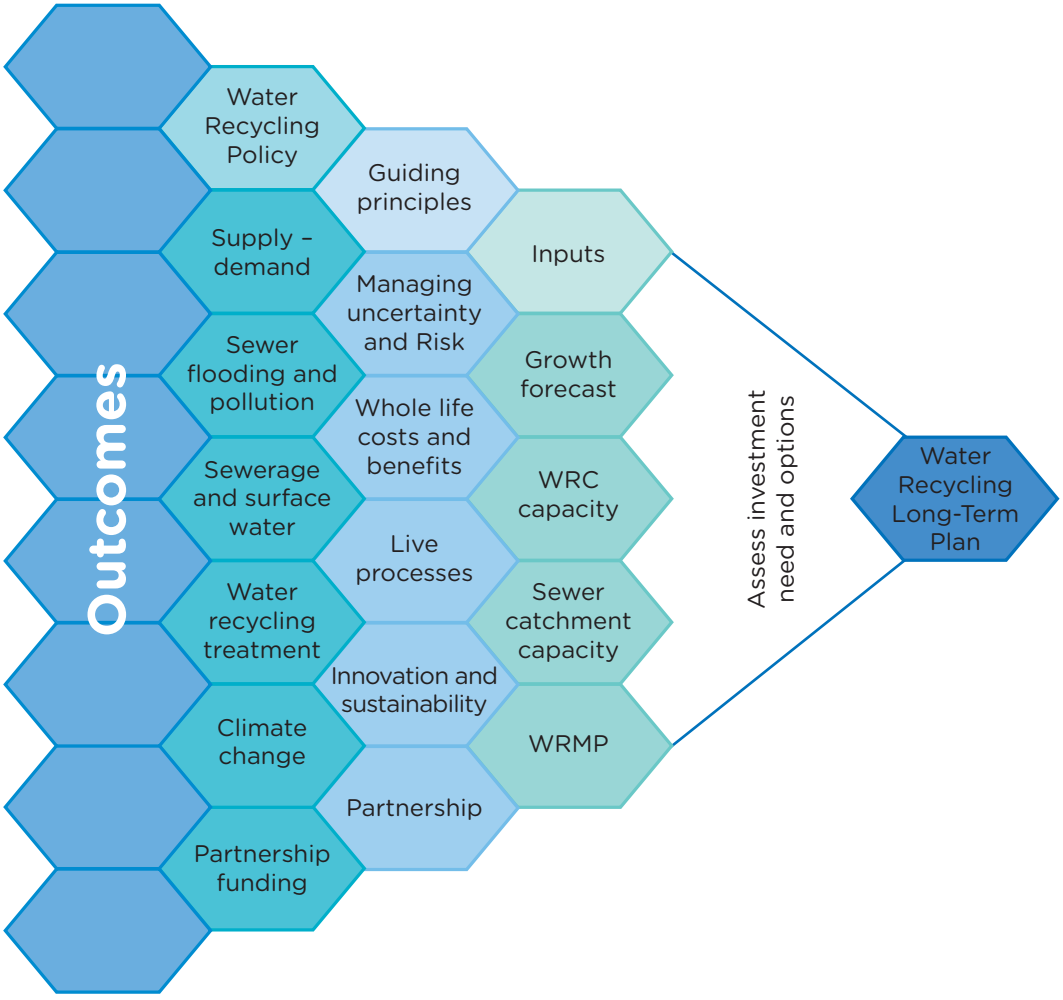
County	Number of WRCs	Household population served	Population equivalent served	Homes planned 2020-2025 AMP7	+ new people 2020-2025 AMP7	% increase people 2020-2025 AMP7	Homes planned 2020-2045 25yrs	+ new people 2020-2045 25yrs	% increase people 2020-2045 25yrs
Bedfordshire	52	394,951	451318	9,018	17,857	5	23,985	34,122	9
Buckinghamshire	48	322,205	376,243	17,312	39,569	12	46,000	91,321	28
Cambridgeshire	99	776,833	891,211	30,423	64,844	8	89,153	166,108	21
Essex	123	1 ,395,935	1,493,743	46,871	97,936	7	144,549	274,684	20
Hertfordshire	9	95,283	100,658	5,142	11,176	12	16,942	31,433	33
Leicestershire	23	35,258	35,928	1,179	2,395	7	2,460	4,293	12
Lincolnshire	198	821,734	1,063,400	21,083	42,207	5	79,493	144,506	18
Norfolk	247	726,794	896,464	31,595	65,015	9	73,256	133,745	18
Northamptonshire	92	670,831	866,699	25,105	51,821	8	67,042	115,205	17
Nottinghamshire	*3*	*698*	*753*	*17*	*33*	*5*	*69*	*127*	*18*
Oxfordshire	*7*	*2,410*	*2,440*	*30*	*43*	*2*	*158*	*219*	*9*
Rutland	22	29,120	30,507	772	1,683	6	2,302	4,647	16
Suffolk	202	668,350	790,580	18,527	34,300	5	50,162	76,933	12
Yorkshire	*1*	*1,148*	*1,158*	*27*	*49*	*4*	*59*	*74*	*6*
Total	**1,130**	**5,941,550**	**7,001,102**	**207,101**	**428,928**	**7**	**595,630**	**107,7417**	**18**

Notes: household population is domestic population served by public sewerage, population equivalent includes domestic population, non-household population and an equivalent population for trade effluent.

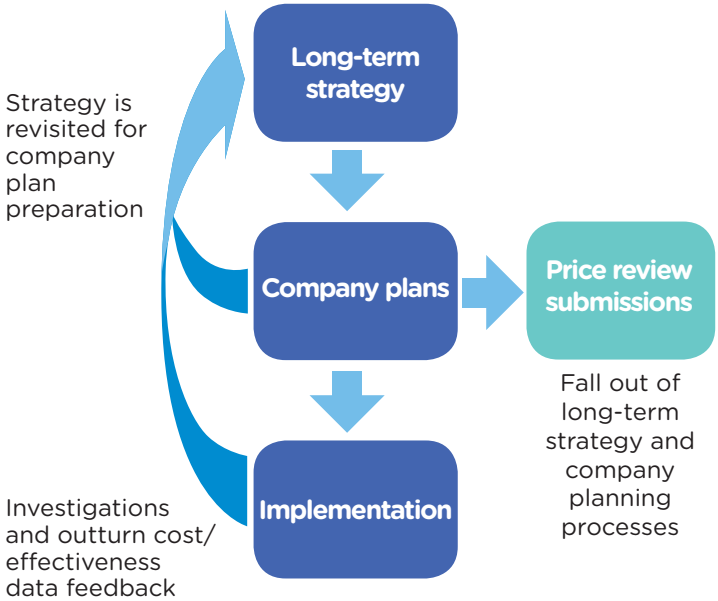
2.2 Approach overview

The development of the WRLTP starts with our company ODIs (see 1.4) and Water Recycling Policy, and is further supported through the guiding principles of the Drainage Strategy Framework (DSF). The DSF was commissioned by Ofwat and the Environment Agency (EA) to provide good practice guidance, (DSF, May 2013). Where applicable, in sewerage capacity assessment, we have also applied recent guidance from the 21st Century Drainage Programme.

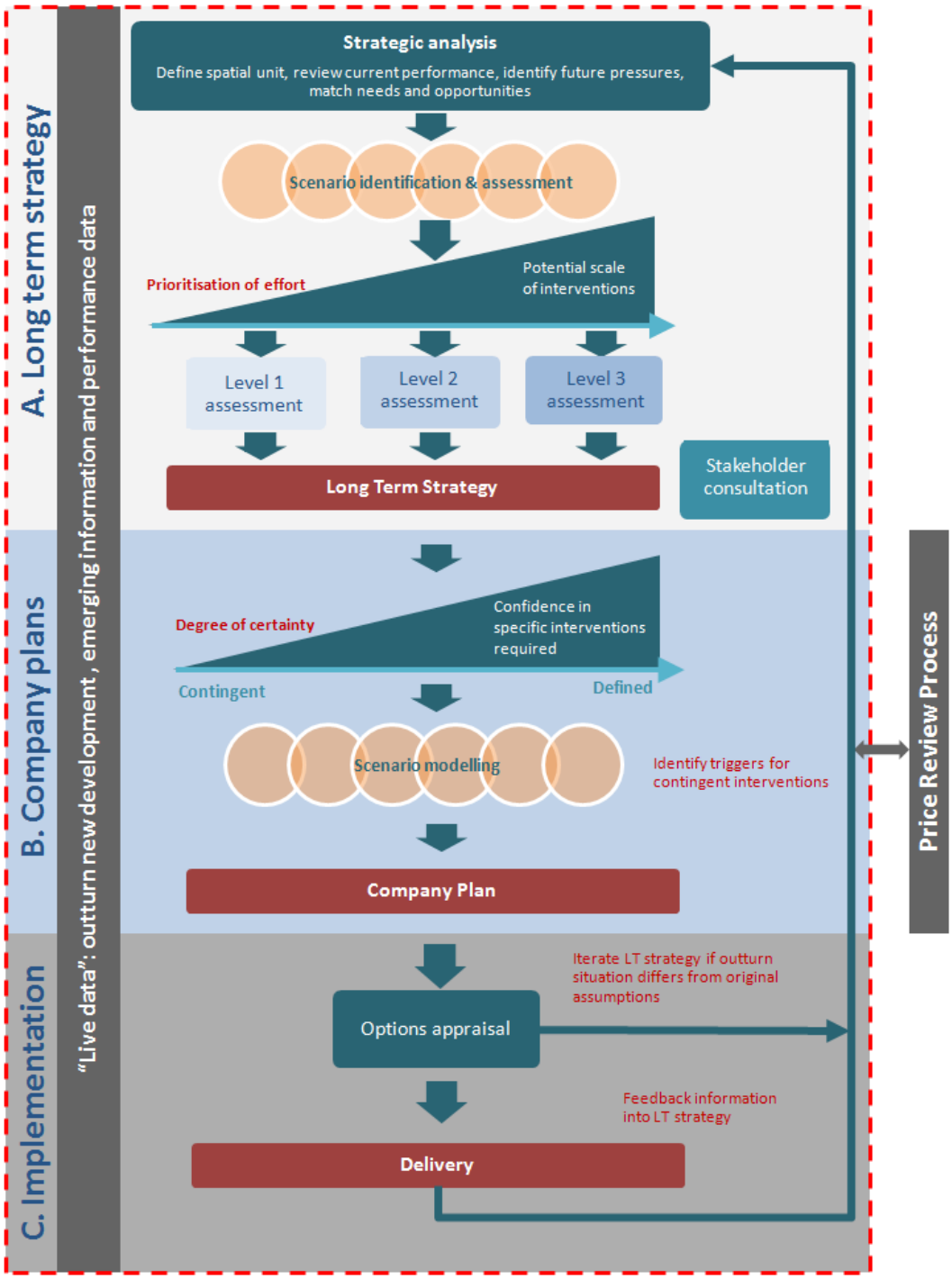
Illustrated below is the framework that supports the development of the WRLTP.



UKWIR updated the Wastewater Supply–Demand Framework in 2014, incorporating the DSF, and broadening beyond price review business planning to the wider decision-making process. We follow the recommended three-stage process in which company planning and implementation sit within a long-term strategy framework.



UKWIR's Wastewater Supply–Demand Framework provides further guidance for the steps involved, which has supported us in developing the approach to our Water Recycling Long-Term Plan.



The approach considers our experience and learning from the WRMP. The WRMP is a regulated statutory document with explicit technical guidance. The WRLTP does not have a predecessor in the water industry nor statutory regulatory guidance, but we can draw on our experience of developing the WRMP.

Our approach is aligned with the principles of integrated water resources planning. Specifically this includes:

1. Promoting dynamic and adaptive approaches
2. Planning for the sustainable and rational utilisation of resources
3. Designing and implementing projects that are both economically efficient and socially appropriate, and
4. Developing the appropriate institutional, legal and financial mechanisms to ensure that wastewater policy is a catalyst for sustainable social progress and economic growth.

2.3 Growth forecast

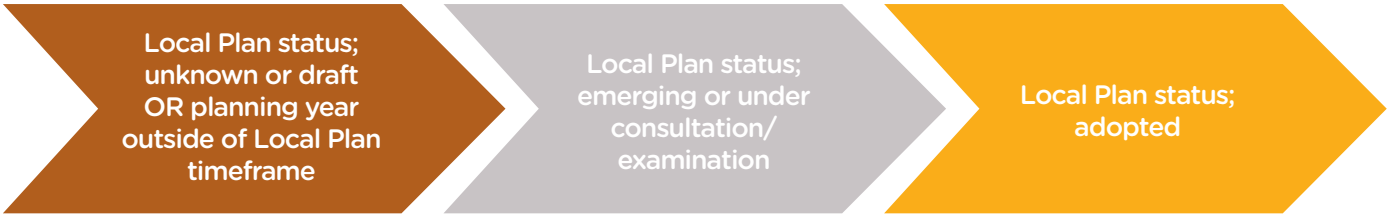
2.3.1 Confidence assessment of the growth forecast

Our Growth Demand Forecast Model produces a modular, unified Water and Water Recycling growth forecast to support investment planning and capital delivery decisions. It utilises spatial data systems geographical information system (GIS) to facilitate data management, apportionment, reporting and visualisation in a spatially flexible manner for various geographies. It allows for:

- the production of trend and plan-based forecasts for comparative analysis, based upon ONS, Local Authority Planning and internal Anglian Water datasets; additionally forecasts are segmented according to EA guidance e.g. household (HH), non-household (NHH)
- assessments for influences on demand, and outputs including:
  - population/household changes
  - water use; changes in behaviour (in both HH and NHH customers)
  - metering and meter opting effects
  - increasing water efficiency and sustainability practices
  - changing design standards of devices that use water
  - changes in technology and practices for leakage detection and repair
  - climate change and weather patterns
  - transient holiday population holiday
  - Non-HH (industrial) usage and forecasts for both water, trade and tankered effluent
  - population equivalent (biological load), and
  - dry weather flow.

Due to the large number of discrete sewer catchments we serve, changes to growth site locations have significant impact on the solutions we consider. This is of greater risk than within the WRMP due to the connectivity and larger scale of water resource zones.

The demand forecasts at catchment level have been assessed in terms of confidence across a number of AMP periods, being categorized as Bronze, Silver or Gold, based on the Local Planning Authority (LPA) Local Plan status.



Where confidence in the growth forecast is low, (Bronze) we limit the design horizon to 2027. Where we have high confidence (Gold) we also consider longer term design horizons and use the last year of the LPA Local Plans to determine the design horizon. LPA Local Plans are based on a 15-year horizon, which means a low level of confidence for planning beyond this period. This confidence assessment enables selection of an appropriate design horizon for the solutions to manage growth and identifies where we need to monitor future growth closely to gather more intelligence.

2.3.2 Emerging growth areas and sites

Due to the scale of growth proposed across the east of England, the government and local authorities are working on initiatives to bring forward large-scale development. This involves the use of public sector land through developing new communities, the Garden Village and Town Programme and the exploration of the housing potential of economic corridors. While many of these schemes are at an early stage and, therefore, not included in adopted Local Plans, it is important to consider their impact on the long-term strategy, should they come forward.

In these locations it will be important to have close liaison with the Local Planning Authorities and developers. This WRLTP, supported by Water Cycle Studies, provides a forum where these issues can be resolved before development plans are finalised. Working in partnership with our stakeholders, including local authorities, and the National Infrastructure Commission, we will be better equipped to meet the expectations of our growing community.

Where information is available these sites have been included in the growth forecast to understand the risk, triggers and potential lead in time for investment. The sites will be closely monitored to understand when and where additional demand will impact. Our adaptive investment programme for emerging growth will use this intelligence to assess risk during AMP7 to prioritise investment delivery.

2.4 Water Recycling Centre capacity

The risks that growth and development present for our water recycling services, should we fail to make sufficient investment in growth schemes, are:

- increased flows and load due to growth, urban creep and climate change
- breach of discharge consents set to control flow and quality of treated sewage
- increased sludge to manage, (which may also present opportunities in the new markets)
- more housing being situated near Water Recycling Centres (WRCs), leading to an increased likelihood of nuisance complaints, such as odour.

We consider WRC capacity in two ways:

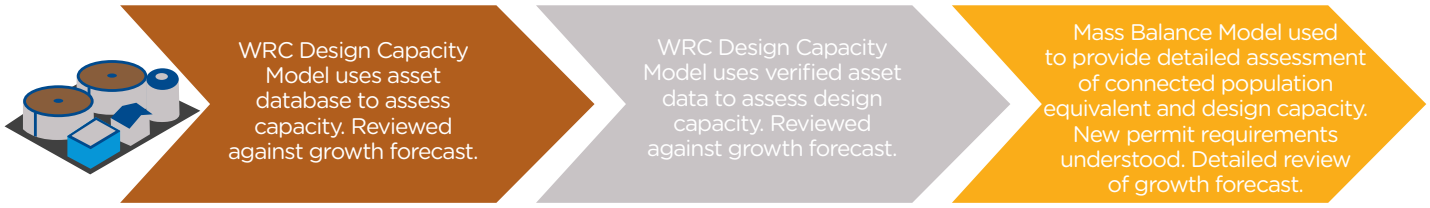
1) flow capacity – the amount of headroom available within the permit

2) biological capacity – the ability to treat load as designed.

Investment will be identified under both requirements to meet increased demand generated by population growth, and will be prioritised at sites where it will provide greatest benefit in terms of mitigating risk to compliance with our discharge consents.

We have used a three-stage risk assessment process to assess capacity deficit – this Bronze, Silver and Gold process is outlined below and further detail can be found in Part 3.

WRC Capacity Deficit Risk Assessment Process



All of our WRCs are taken through the Bronze capacity deficit risk assessment. Those at high risk are promoted to Silver, and those at high risk after Silver assessment, are promoted to Gold assessment. The Gold assessment provides us with greater confidence in the capacity deficit, and provides valuable data to assist in the next stage of preparing solution options. This process will be repeated annually to review the risk, and reprioritise investment where required, as an adaptive strategy to manage growth uncertainty.

2.4.1 Flow capacity

Growth, urban creep and climate change increase flows in our catchments and at the receiving WRCs. At the WRC, flow capacity is assessed against the consent to discharge permit, which states a Dry Weather Flow (DWF). This is derived from an assessment of the probability of impact on a watercourse; it is not a physical limitation. The DWF of a WRC is calculated and reported to the EA annually. The Q80/20 percentile is assessed to be the accurate measure of DWF, which is the average value in which 20 per cent of all daily measured flows fall within. To allow for random weather variations, the Q90/10 percentile is the compliance measure against the permitted DWF. Any non-compliant sites are investigated to identify the cause and remedial actions are highlighted where required.

2.4.2 Biological capacity

WRC's are designed based on an expected flow and load for a relevant catchment population equivalent (PE). The ability of a WRC to meet this design capacity requires review and analysis to understand whether it can accept the additional demand from an increasing catchment population.

Using our risk-based approach we will provide additional capacity where there is greatest need – if a WRC in a catchment of high growth can accept the additional population without additional risk, then investment may be better suited in a neighbouring struggling WRC to address historical growth.

2.4.3 Descriptive WRCs

Where a WRC has a PE <250, no trade and an expected flow <50m^3/d it is likely to hold a descriptive permit. These permits require discharges from these sites to be of good visual quality and we are to monitor when the descriptive permit conditions are breached.

When we predict the PE is going to increase above 250PE in a catchment with a descriptive permit, we review the permit and instigate a two-year sampling programme if required. Following this, we invest in the change from a descriptive to numeric

permit, which will often involve more onerous conditions on the quality and monitoring of the discharge.

2.4.4 Urban creep

620 of our WRCs are 'treat all flow' sites with no storm tank to relieve the pressure during high rainfall periods. These sites are particularly susceptible to breaches of compliance during rainfall events. Where the catchment has seen significant urban creep, the increase in non-permeable paving and/or misconnections of surface water to foul sewers, can cause the WRC to receive more flow than is was designed for.

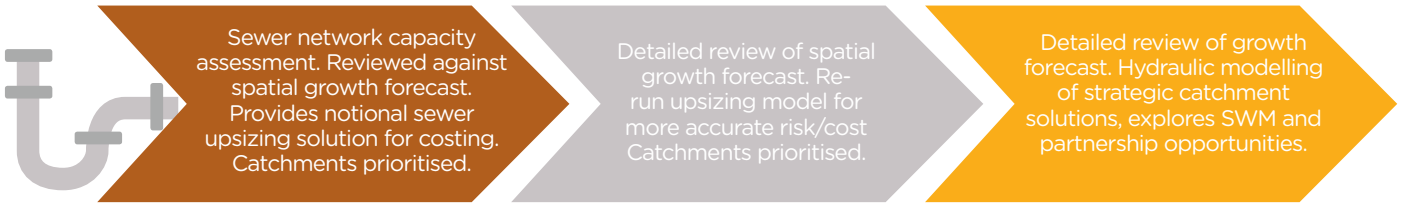
2.5 Sewer catchment capacity

Our overall aim for our water recycling network is to manage flows within our sewerage network to provide a reliable service to customers. This will: reduce incidents of flooding; reduce pollution events; minimise our impact on communities; and reduce reactive total expenditure (Totex) costs.

The capacity of our sewers has a variety of influencing factors, such as flow rates, root ingress, misconnections, infiltration, silt and FOG (fats, oils and greases) build up. Although the locations of sewers and their sizes are usually known, other information such as pipe gradients, connectivity, dry weather flows (DWFs) and surface water runoff is not always available. Data has to be inferred at early stages of risk assessment, and verified at later stages. Developing our knowledge of where we need to improve our data on assets is important to the implementation of the long-term plan. We use detailed investigations and local knowledge of asset performance to help enhance the data that we hold.

We have used a three-stage risk assessment process to assess capacity to serve growth, urban creep and climate change. This Bronze, Silver and Gold process is outlined below and detailed in 2.5.1. All of our catchments are taken through the Bronze capacity deficit risk assessment. Those at high risk are promoted to Silver, and those at high risk after a more confident Silver assessment, are promoted to Gold assessment. The Gold assessment provides us with greater confidence in the capacity deficit and provides valuable data to assist in the next stage of developing catchment growth strategies. This process will be repeated annually to review the risk, and reprioritise investment where required, as an adaptive strategy to manage growth uncertainty.

Sewer Catchment Capacity Deficit Risk Assessment Process



2.5.1 Sewer capacity assessment

The capacity of the sewerage system can be defined in terms of flow rate (l/s) either without surcharge or without surcharge level reaching ground level. However, such a measure has no relationship to the performance of the system, which is dependent on pipe capacity, the amount of surface or groundwater entering the system and the consequence of escape. Hence, it is considered that the only effective measure of sewerage system capacity is in terms of flood risk, explained further in part 2.5.2. Our assessment of capacity to serve growth is based on avoiding increases in flooding detriment.

A programme of modelling is underway to provide coverage of all catchments across our region to a uniform modelling standard by 2020. Models do not currently extend to transferred sewers which, being closest to properties, are where greatest flood risk is probable. In addition they do not, at present, cover basements, an area of significant flood risk. As a consequence, there is a high degree of uncertainty inherent in sewer modelling. We use a risk-based decision-making process to reduce uncertainty through survey and monitoring of key indicators, such as flow.

We used a three-stage risk assessment process (above) to assess our capacity to serve growth, urban creep and climate change, using hydraulic models. Our hydraulic models are built and run according to our internal Anglian Water Services Urban Drainage Modelling Specification, using InfoWorks ICM.

Initially, all of our 1000+ catchments were taken through the first stage Bronze assessment of capacity deficit in InfoNet to provide upsizing requirements from the nearest connection point. The results are considered alongside predictive detriment analysis, developed using Flood Risk Modelling, to identify those at highest risk to promote to the next stage. The second stage Silver assessment involved a detailed review of

the growth data in the promoted catchments to improve confidence, using known appetite for development and review of the specific connection locations for the growth into the existing sewer network. This was followed by a re-run of the InfoNet based tool for these high-priority catchments using the revised data, promoting those at highest risk to the final Gold stage.

Gold risk assessment and strategy development

Phase 1

- Model solutions to mitigate impact of growth (including urban creep from the development sites), serving each individual development site
- Solutions assume development site connects to nearest sewer
- Solutions for storage at each individual detriment location and removal of 25% connected area in the targeted zones through SuDS features
- Scenarios for inclusion and exclusion of climate change at 10% to 2027 and 20% to long term
- Scenarios for design horizon of 2027 and longer term (last year of Silver or Gold growth forecast)

→ **4 solution options**

Phase 2

- Model strategic solutions to mitigate impact of growth, considering all development sites together
- Solutions assume development site connects at nearest sewer
- Solutions consider conveying flows to areas where capacity is available, or downstream rather than local storage. A more confident assessment of connected area removal in targeted zones using SuDs studio outputs
- Scenarios for inclusion and exclusion of climate change at 10% at 2027 and 20% to long term
- Scenarios for design horizon of 2027 and longer term (last year of Silver or Gold growth forecast)

→ **4 solution options**

Phase 3

- Model run every year up to our minimum design horizon of 2027 with growth only – no urban creep or climate change – to determine first year of detriment in the catchment and cumulative impact over time
- Identification of trigger point locations suitable for flow monitoring
- Model run with and without SuDS solutions to determine flow and PE served by SuDS solution
- GIS mapping query to identify any overlaps of growth detriment with sewer flooding locations and CSO growth investments to determine investment strategy

→ **Delivery strategy and profile**

For all phases of the Gold assessment we used InfoWorks ICM hydraulic modelling to consider a strategic approach to catchment growth, assessing future growth scenarios against the existing sewer networks to predict increases in flooding risk and then potential solution options (SWM wherever possible) to mitigate this. This assessment gave greater confidence in the capacity deficit and provided a range of modelled options from targeted surface water removal supplemented by localised storage to wider scale upgrade of existing sewerage infrastructure.

Solutions developed seek to avoid a detriment of an increase in predicted volume of flooding by 25 m^3 or 10 per cent at any individual location, for a 1 in 30 year rainfall return period (FEH99). For assessment of detriment at sewer overflows it was considered that any increase in predicted spill volume >1m^3 is not permissible, using a 1 in 5 year rainfall return period. Assessments for catchment needs and any solutions derived are modelled both with and without the impact of climate change by 20 per cent uplift in rainfall intensity (CIWEM UDG, 2015). This gives an understanding of level of risk climate change may present and enables the business to make a judgement on cost versus benefit.

Gold phase one and two provided up to eight solution options per catchment, costed and benefit-assessed at high level. To ensure customer bills remain affordable only the two lowest cost solution options were taken forward for full assessments of benefits, including natural capital assessment of SuDS. Following this, the solution of greatest cost benefit is promoted for investment in AMP7.

An example of the two lowest cost solutions produced for one particular catchment is shown below. In this case the chosen solutions were both produced from phase two. The solution of greatest cost benefit was promoted for investment in AMP7 and here it is shown that the inclusion of climate change rainfall resulted in a small amount of further upgrade requirement. For this catchment, the scenario 2027 without climate change was selected as being the most affordable cost/benefit balance.

1. Phase 2 strategic solution – 2027 design horizon, without climate change

Sustainable drainage systems (SuDS)	
Tree pit	1 unit
Bioretention	41m^2
Swales	356m^3
Attenuating rain gardens	21m^2
Disconnect downpipes	11m^3
Filter drains	23m^3
Permeable block paving	24m^2
Attenuation pond	1m^3
Green roof	24m^2
Rain gardens (surface)	1353m^2
Soakaway	22m^3

Catchment upsizing
1777m gravity sewer upsizing
Upsize three pumping stations and associated rising mains
958m^3 offline storage (within 9 locations)
Sealing 15 manholes

2. Phase 2 strategic solution – 2027 design horizon, with climate change (20%)

SuDS	
Tree pit	1 unit
Bioretention	41m^2
Swales	356m^3
Attenuating rain gardens	21m^2
Disconnect downpipes	11m^3
Filter drains	23m^3
Permeable block paving	24m^2
Attenuation pond	1m^3
Green roof	24m^2
Rain gardens (surface)	1353m^2
Soakaway	22m^3

Catchment upsizing
1853m gravity sewer upsizing
Upsize three pumping stations and associated rising mains
1036m^3 offline storage (within nine locations)
Sealing 15 manholes
Increase sluice opening height

Phase three of Gold considered the first year of detriment caused by growth, as well the capacity created within the network from surface water removal alone. This information has helped us to prioritise individual elements of the solution to develop the delivery strategy for the catchment. With this we have greater confidence in opportunities for phasing, delivery of SuDS early with the deferral of the construction of more traditional upgrades or storage solutions wherever possible.

Phase three of Gold also identified locations of 'trigger' points in the catchment, where we will monitor flow as an indicator of growth. This information will feed into live modelling to enable us to review the risk, and reprioritise investment where required, as an adaptive strategy to manage growth uncertainty. As we promote investment in growth strategies, we will also consider integrating solutions with existing flood risk and maintenance requirements within the catchment to gain further delivery efficiencies and reduce impact of construction on our customers.

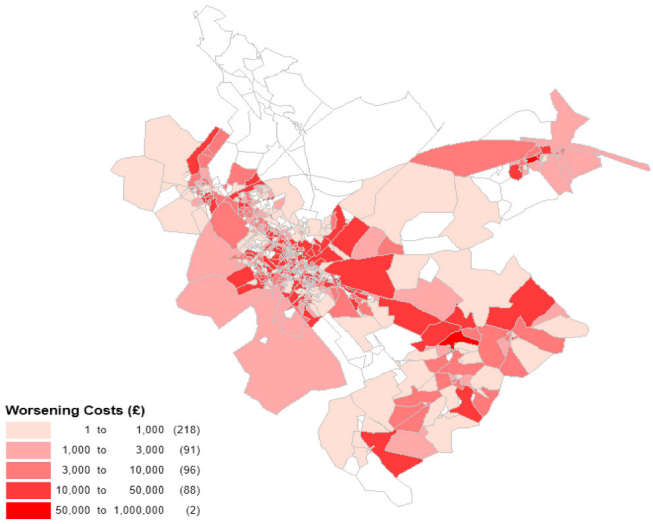
2.5.2 Flood risk from sewers

The large majority of flooding from sewers are caused by blockage or pump failure. Every year we resolve ~36,000 blockages spending around £7million, removing sanitary products such as wipes, tonnes of sticky cooking fat and oil, as well as rubbish. More than two thirds of all sewer blockages are caused by sewer abuse, so we have developed effective customer behaviours initiatives, such as "Keep It Clear", and have also improved our response to customers concerning blockages.

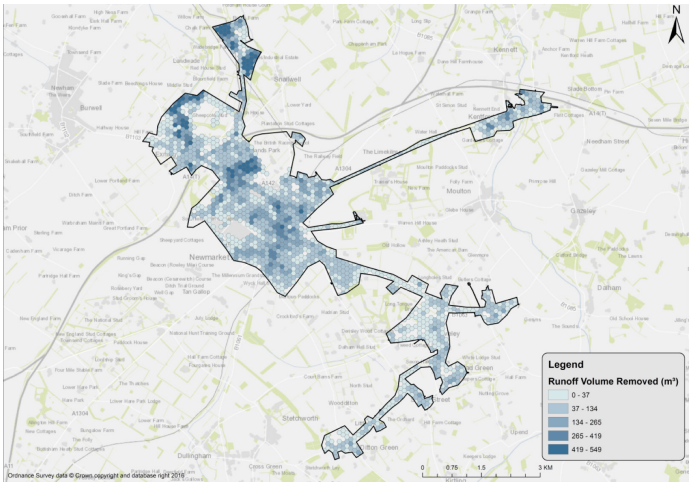
Where flooding has been reported downstream of the connection point of planned development, options are developed through hydraulic modelling to ensure the development does not cause deterioration in performance. We also consider strategic catchment solutions to increase capacity to resolve existing and future flooding, and pollution. Where a recent Local Plan is not available, large sites (>200properties) are assessed individually and planning application data is used. The assessment is carried out in accordance with the Modelling Specification.

Flood risk of all types, including coastal, is increased by climate change predictions of warmer summers with lower rainfall and more intense rainfall events. We have carried out a high-level assessment of increased flood risk to identify which catchments within our region are likely to be most affected by growth, urban creep and climate change by 2045. It is based on a sample of detailed catchments, with results extrapolated to the rest of the Anglian Water region.

This heat map (below) shows typical results for a detailed flood risk assessment for a single sewer catchment: these can be found in Part 6 County Summaries.



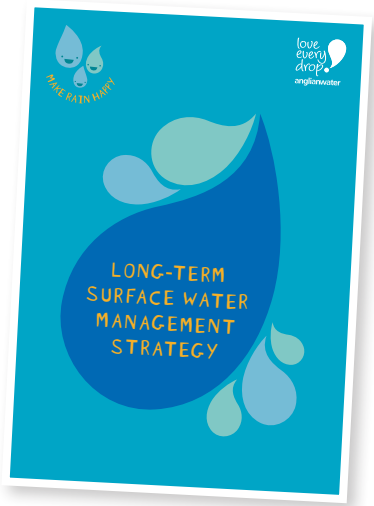
The assessment also estimates the cost for the mitigation of the increased flooding based on either storage required or surface water removal. The map (below) shows an example of opportunities for surface water removal in the same catchment.



As models become available through our Urban Modelling Programme, each catchment will have a detailed assessment to consider the impact of growth, urban creep and climate change. This ensures re-prioritisation can happen quickly and allows detailed solutions to be adapted or created where necessary.

Highest risk catchments will have flow meters installed at trigger points in the catchments. Close liaison with the local authority and developers brings further intelligence into these live modelling systems. This modelling technique enables us to test the impact of revised growth rates and development sites, and make adaptive plans that accommodate the catchment strategy, or alert us to when the strategy needs reviewing.

2.5.3 Surface water management



Our AMP6 programme of surface water management (SWM) studies covered five exemplar catchments, which are extrapolated across our region to help us to understand where SWM opportunities exist, to facilitate growth and reduce flood risk. It has also driven development of our Surface Water Policy and our Programme for Long-Term Surface Water Management, which support this WRLTP.

The analysis undertaken has focused on towns or cities with significant areas of hard standing that is connected to the public sewer, such as schools, industrial estates and retail areas. The existing impermeable area per head ranges between 10 and 66 m^2 and the percentage of combined sewer range from >1% to 75% of the total length of public sewer in each catchment. The correlation coefficient indicates a very strong correlation of the length of combined sewer and m^2 per head of impermeable area.

The SWM study predicts a wide range of increase in flood volumes due to population increase, climate change and urban creep, during future storm events. The correlation coefficient between percentage flood increase and population growth across the catchments indicates a direct relationship between growth and increase in flood volumes.

The SWM study outputs have been used to assess and identify SWM investment options following the Gold stage of infrastructure capacity deficit assessment. The results help us identify opportunities for working in partnership with Flood Risk Management Authorities.

Our Programme for Long-Term Surface Water Management runs from 2020 (AMP7) to 2045 (AMP11) and will look beyond just our own water recycling systems. We will work closely with our customers and partners to manage surface water at every opportunity, e.g. by contributing to highway improvement schemes, working within the community and at a household level. This will expand to water conservation through the capture, recycling and reuse of rainwater. This approach could help us meet the water supply demand, e.g. water butts and rainwater harvesting, and surface water retention for crop irrigation.

2.5.4 Long-term strategic sewer improvements

We identify the need for enhancement or new strategic sewers through our Bronze, Silver, Gold capacity deficit assessment process. Strategic sewers are required when there is large-scale growth or complex infrastructure requirements. We have identified investment requirements for two new strategic sewers in AMP7 to serve significant new development in Alconbury Weald (Huntingdon) and the Yare Valley (Norwich). Further detail can be found within Part 6 County summaries.

2.5.5 Overflows

To ensure that new development does not cause Combined Sewer Overflows (CSOs) to operate unnecessarily and cause environmental detriment, we assess probable development upstream. Where the increase is significant we carry out a detailed study of the discharge. Where needed, we develop projects to mitigate the impact and promote investment at a suitable time to avoid increasing detriment.

2.5.6 Developer charging

Currently, around 85 per cent of sewerage is laid and funded by developers and either offered for adoption or retained as private sewers. The proportion funded by Anglian Water Services Limited has increased in recent years and this trend is expected to continue in the short term.

The expenditure to meet sewerage requisitions is complicated by a number of factors.

- It is generally large, urban extensions that require major sewerage which use the requisition process.
- Large development sites can take 20 years or more to build and hence there is a pattern of high initial expenditure on off-site works followed by steady expenditure on on-site works.
- The use of requisition by developers depends on their understanding of the process and their view of its benefits.
- Competition will lead to some sites being served by other sewerage companies as inset appointments.

Overestimation of demand for requisitions carries a risk of raising customer bills by more than necessary and underestimation carries a risk of not being appropriately funded. We fully recognise the importance of getting the balance of risk correct.

The Water Act 2014, enables greater competition for non-household customers and gives Ofwat new powers to make rules about charges and charges schemes, as well as making provisions for flood insurance and drainage boards. Following the Water Act 2014, Ofwat conducted a comprehensive review to identify improvements to the way developers procure sewerage for new development. This new methodology (Zonal Charge) came into force in April 2018. The zonal charge is designed to reflect the cost of network reinforcement. The charge is not set by reference to network reinforcement necessitated by a particular development, but by reference to the estimated overall cost of network reinforcement over a relevant charging period. It is a charge of the type set out in section 146(2) of the Water Industry Act.

The zonal charge consists of two elements. The first ("fixed element") is a figure that is applied wherever the development is situated. It is the same in nature to the infrastructure charge that applied prior to April 2018.

The second ("variable element") will vary according to any criteria that we may introduce in the future. In 2018/19, we do not intend to introduce any such criteria, so there will be one single variable element applied in all cases. However, in future, we may introduce, for example, charging divergence between zones where there are differing water scarcity levels.

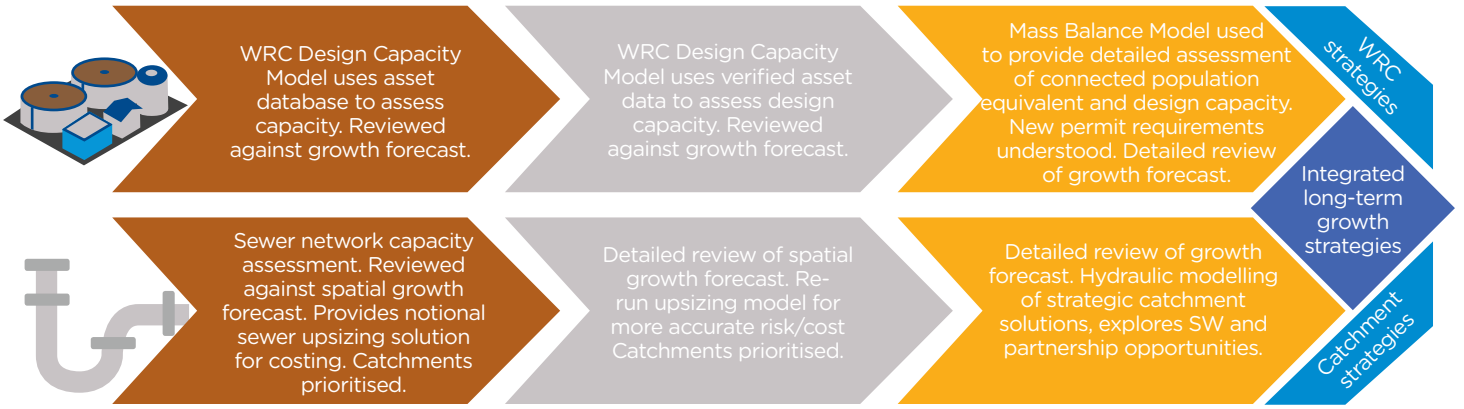
Changes to the developer charging mechanism has enabled us to consider longer term catchment-wide strategies to serve multiple development sites, a much more efficient delivery mechanism and one which provides the least disruption to our customers.

Pressure to reduce potable water consumption has led to developers considering local treatment and recycling at a development site level. The removal of Code 6 Standard for Sustainable Homes has reduced the take up but we continue to work with developers to promote higher standards. Recycling facilities might be operated by a management company or offered to the sewerage undertaker. To date, no such schemes have been built but the existence of this option increases the uncertainty with respect to long-term planning.

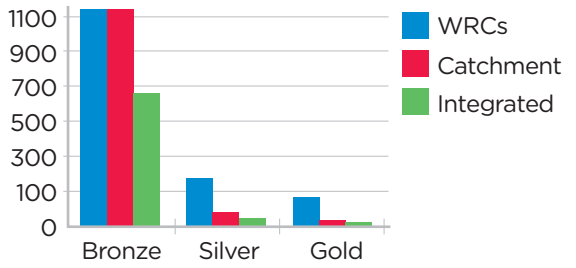
2.6 Integrated approach

We consider both the WRC and the catchment when assessing growth opportunities and risk, with integrated least regret solutions developed to serve them both. Where independent sewer solutions are required to serve growth, we have considered impact to the WRC, to ensure a smooth delivery process. Where independent WRC solutions are required, we have considered demand management options in the catchment.

The sequential Bronze, Silver, Gold risk assessment process to assess capacity deficit is followed by the development of growth strategy options that are optimised to develop the investment requirements for AMP7 and longer term. This process is summarised below.



The graph below shows the number of catchments taken through each stage of the Bronze, Silver, Gold capacity deficit risk assessment process.



There are some pressures factors that affect both WRCs and sewer catchment capacity, considered through this integrated approach, e.g. our aim to achieve 'good ecological status' compliance according to the Water Framework Directive.

Environmental pressures	Land availabilty	Seasonal variation
• Increased flood risk • River water quality • CSO spills	• Extend in existing site • Purchase and planning for new site	• Variation in flow and load: holiday and trade • Impact to asset performance

2.7 WRMP – Per capita flow (pcf)

Forecasting the need for Dry Weather Flow (DWF) permit revisions at WRCs is heavily influenced by our forecast of average per capita returned flow (pcf). This value for pcf is used to calculate DWF and our forecast in flows. The per capita returned flow (pcf) has been derived from WRMP per capita consumption values, and is forecast to reduce from 152 l/h/d in 2013 to 122 l/h/d in 2040. This is based on a forecast of average per capita consumption (PCC) of household water and forecast domestic non-household consumption.

There are currently significant uncertainties in both the forecast PCC values (due to the variation in unmeasured PCC) and the relationship between PCC and pcf. Forecast PCC is based upon an increasing level of meter penetration (from our already high baseline of 80 per cent) and the assumption that water use reduces when properties become metered and 'bills measured'. Our forecast of pcf assumes that 90 per cent of PCC and of non-household domestic consumption is returned to the water recycling system. The future relationship between pcf and PCC will vary depending on the way in which reductions in PCC are achieved.

PCC has been locally modelled to reflect the current meter penetration at WRC level and the weighted average value for both measured and unmeasured PCC values. Forecast PCC values are adopted from the WRMP 2019 'Consumption Forecast Model'. As meter penetration increases, aggregate PCC values should decline (i.e. metering and billing on measured values reduces consumption and PCC). Thus the current growth forecast, based upon the baseline pcc values, currently offers a 'worst case' scenario for future pcf evaluation.

Declining PCC is a key variable in assessing whether a new DWF permit or demand management is required. As new permits drive significant investment there is a risk that we may underestimate future investment if pcf does not fall as expected.

2.8 Climate change

The world's climate is changing and national risk assessments reveal this poses a serious threat to the water sector. A drier climate in future would mean reduced water availability for public water supply, agriculture, industry and the environment. Our region is particularly vulnerable to climate change impacts because it has low rainfall, is low lying and has a long coastline.

2.8.1 Flood risk

For water recycling, climate change predictions of warmer summers with lower rainfall and more intense rainfall events, manifest in an increase in flood risk of all types, including coastal. This can lead to increased damage caused by overflows of polluted water affecting customers and the environment. Basing extreme weather risk analysis on past experience is no longer sufficient. Climate change scenarios form part of our hydraulic modelling standards for assessing growth risk to service from our sewerage infrastructure, and have been included in every stage of the Bronze, Silver, Gold risk assessment process: refer to 2.5.1. Our AMP6 flood risk project modelled future flood risk in our region due to urban creep and climate change: this has directly fed into the benefits assessment of the infrastructure growth catchment strategies planned for AMP7.

Our AMP6 flood risk project also considered the impact of sea level rise as a result of climate change. We have completed investigations, including flow and outfall surveys, for those catchments with worsening risk over a 25-year period, and included those with the highest risk within our Community Resilience investment portfolio for AMP7.

2.8.2 Impact to WRCs

It is not sustainable to continue to rely on energy intensive water recycling transfer and treatment, from a carbon and financial perspective. Climate change predictions drive us to effectively manage surface water to reduce the risk of an increase in flooding, pollution and WRC flow and quality permit compliance. This provides opportunity to consider investment that addresses growth, existing and future flood risk, when considering appropriate solution strategy, driving partnership opportunities that will benefit the wider community.

Reducing the volume of surface water runoff will recharge the groundwater; this can provide the additional benefit of helping to mitigate the impact of climate change on water resources.

2.8.3 Climate change guidance

We have considered and applied the guidance below in our approach to the development of our investment strategies:

"Planning for Climate Change – Guidance for Local Authorities" produced in 2012 has recommendations for local authorities;

"iv) ensure that, when new development is brought forward in areas with significant vulnerability to impacts arising from changes in the climate, risks can be avoided or managed through suitable and sustainable adaptation measures so as to provide sufficient resilience – in areas of water stress, and in order to secure development that would otherwise be unacceptable for its proposed location, resilience could be provided by setting standards for water usage in new development (any proposed standard should comply with Section 3.9 of this guidance);

v) plan green infrastructure in order to optimise its many benefits and, as part of wider green infrastructure networks, in order to support local biodiversity and healthy living environments, including through providing urban cooling, local flood risk management, carbon sequestration and local access to shady outdoor space. The TCPA and The Wildlife Trusts planning guide to green infrastructure provides more detail."

2.9 Making the right investment

We have a responsibility to keep customer bills affordable, so ensuring confidence in our investment decisions during our AMP business planning cycles is a key priority. Water recycling infrastructure is complex, costly to construct, has long lead times to deliver and the assets delivered have long life spans. Making the right investment requires an integrated, long-term and adaptive approach to planning. Our adaptive investment plans have been structured to cater for varying levels of confidence.

We are seeking to maximise the use of innovative technology through our long-term arrangements with our supply chain alliances, to speed up build times and utilise modular build technology so that new infrastructure can be in place when it is needed. Some examples include off site design and build which can reduce the time on site, and potential customer impact, by 50%. We will also use virtual reality technology with communities so they can influence scheme design to minimise disruption to them.

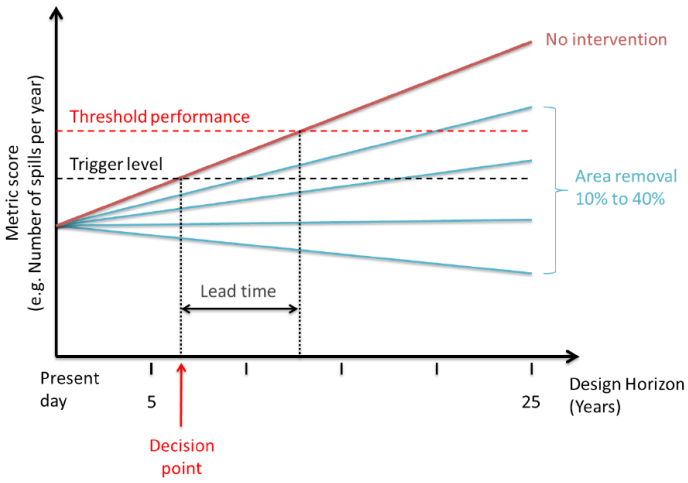
Our company has ambitious targets for removing and managing surface water in our drainage network, so for the first time, we have explored SuDS opportunities to provide capacity for growth in our catchments in a sustainable manner as far as possible, as well as traditional upsizing or hybrid solutions of the two. To our knowledge, this is the first time this had been attempted within the UK.

All of our solution options are considered in our Investment Manager system that assesses whole life cost and benefit. The costs and benefits include those associated with Anglian Water and the society we serve, and take into account feedback from our programme of customer engagement activities. Natural capita is included in this benefit assessment for the first time, and helps us to understand the wider benefits of some types of SuDS features, such as landscaped attenuation basins. Further detail of the approach to consistent investment management can be found in our AMP7 Business Plan.

The development of long-term adaptive plans allows us to defer investment until we know where growth deficits are going to manifest and which investment option will resolve the deficit most effectively. This approach also reduces the risk of stranded assets built for growth that does not happen.

This new approach to timing delivery and planning investment design horizons requires us to develop and monitor key indicators. Monitoring indicators will enable us to trigger investment in new infrastructure at the right time to meet increases in demand. This avoids 'shocks' of unfunded investment needs appearing during an AMP period that affects our capacity to deliver remaining investment or to meet our obligations.

To achieve this, where we have less confidence in the need, we will invest in investigations in one AMP, and deliver the optimal solution in the following AMP. Where risks are so significant that investment cannot be deferred, we will look for minimum-regret solutions to resolve supply–demand deficits in our water recycling systems. The figure below provides an example of this to demonstrate how the risk of sewer flooding or CSO spills can be mitigated by an optimally timed solution to remove areas of surface water.



Source: 21st Century Drainage Programme – Workstream 2 – Capacity Management: Guidance Document, Water UK, April 2017

To manage this uncertainty we have identified a number of key indicators that will trigger investment for each phase of our long-term growth strategies. These key indicators will be monitored during AMP7 to ensure optimal timing of investment to facilitate growth, without detriment to the environment or service to our customers. We have used lead in times typical for the individual solutions to determine the timing of growth investment. The real-time monitoring of key indicators will ensure we can flex the programme delivery as external conditions change.

The bespoke key indicators below will be monitored for highest risk catchments and WRCs via a Growth dashboard.

1. Number of new connections to water supply
2. Flow in strategic 'trigger points' of our sewers
3. Risk of flooding from sewers
4. Incoming sewage flow at WRCs
5. Incoming sewage load at WRCs
6. WRC final effluent quality

In order to deliver an adaptive investment programme, we will review the risks and uncertainties annually.

To reduce costs and the impact of construction on our customers, we will consider other investment drivers for the WRC or catchment, e.g. large maintenance investment or enhancement to meet new quality obligations, to determine opportunities for integrated solutions or when planning the timing of individual investments.

2.10 Phased investment

We have taken a phased approach to delivery of our AMP6 growth investment programme where the development sites are continuing to build into AMP7. Modular or temporary connections can offer build solutions to serve developments, while we gain confidence in further growth. Close monitoring of our AMP6 delivery programme ensures we consider the need for later phases of investment in AMP7.

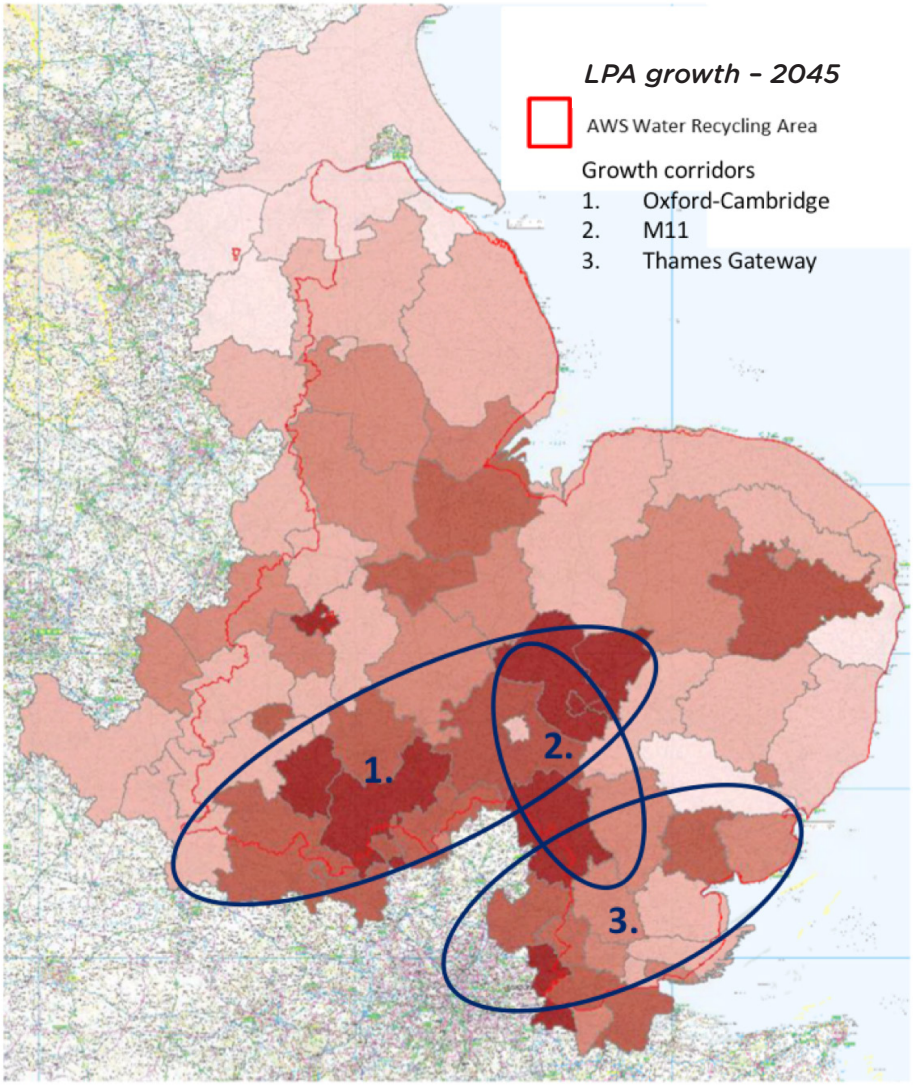
For each catchment and WRC considered for AMP7 investment, we have modelled the year in which we expect to see detriment occur and plan to deliver the scheme in advance of this. Where SuDS have been identified, we have completed further hydraulic modelling to understand the growth that could be catered for by SuDS alone. This information has helped us to prioritise individual elements of the solution to develop the delivery strategy for the catchment and WRC. With this we have greater confidence in opportunities for phasing, delivering SWM phases early and deferring construction of more traditional upsizing. Where the detriment is predicted to be late in AMP7 or late in the proposed design horizon, we phase investment across AMP7 and AMP8. Phasing enables us to deliver schemes when they are most needed and ensures affordability.

PART 3 – INVESTMENT NEED

3.1 Growth forecast

Looking at the future economic role of our region shows that it is likely to remain a key engine of the UK economy over the next 25 years, with ambitious plans for new homes, the development of key economic corridors like London–Stansted–Cambridge–Peterborough, Oxford–Milton Keynes–Cambridge, and Norwich–Cambridge.

Regional Heat Map Showing Growth per Local Planning Authority LPA to 2045 and the emerging growth corridors that require close monitoring.



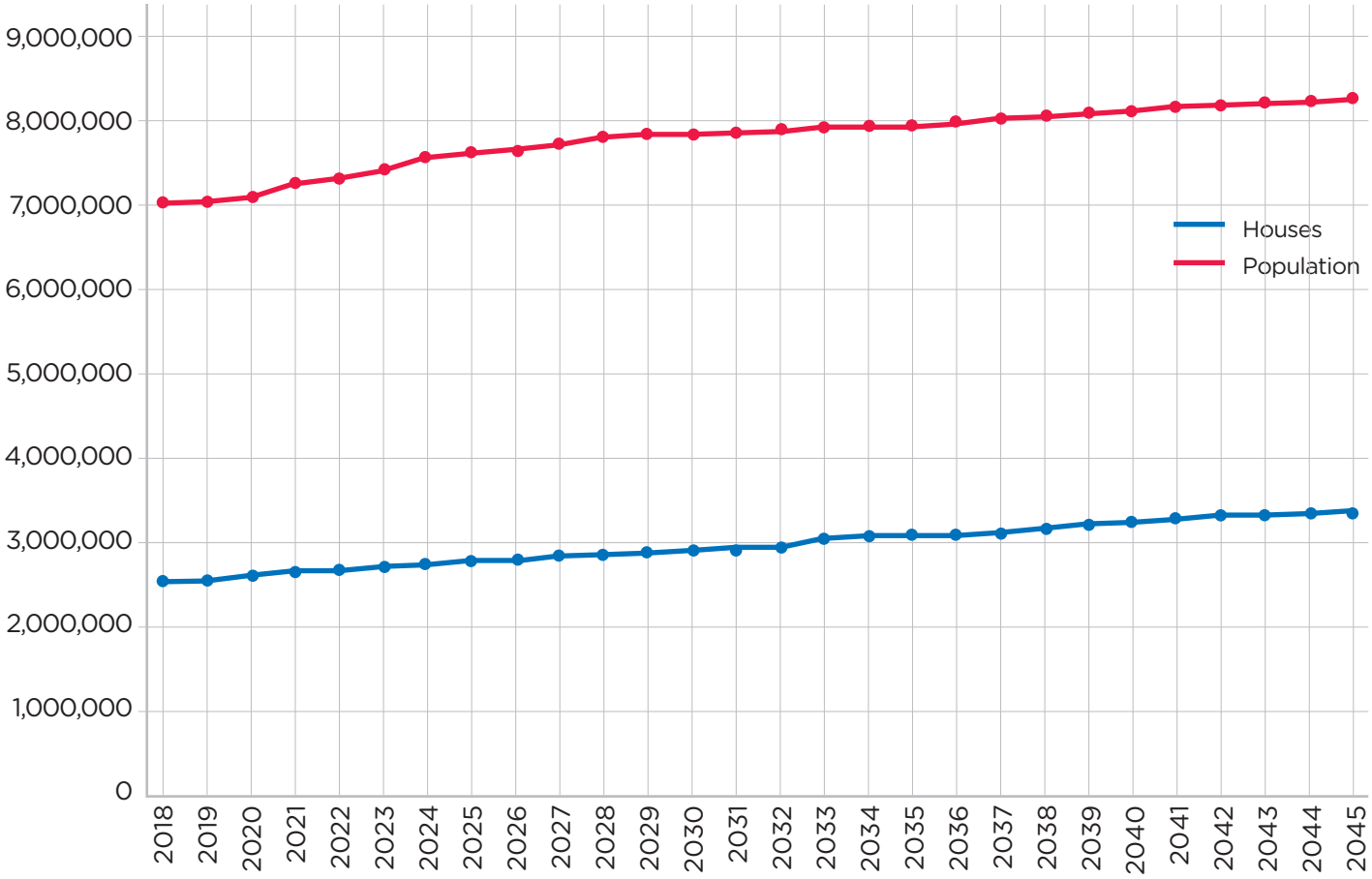
Our region has historically seen an above average rate of growth and has two of the five fastest growing cities, by housing growth in the UK, as classified by the Centre for Cities. We are more affected by new development than other Water and Sewerage Company (WaSC). The regional population is expected to increase by 20 per cent (around one million) over the next 25 years compared with population levels in 2015–2016. This would mean around 500,000 new properties for us to serve.

These forecasts are sensitive to local factors and regional and global trends, particularly when it comes to migration, where issues such as the UK's exit from the EU may have an impact. For example, the ONS principal UK projection is for an increase in population from 64.6 million in 2014 to 74.3 million in 2039. Of this growth, about half is due to migration, and half due to more births than deaths. The main variants range between 73.7 million (low migration) to 81.3 million (high migration) by 2050.

Our region is particularly impacted by new development due to the relatively less densely populated nature of the area and its good communication links, however, it is uneven. Growth rates in coastal Suffolk and rural Norfolk are expected to be low. Other areas, particularly Cambridgeshire, show much higher than average rates.

Growth often coincides with areas where water and water recycling services are already under pressure and environmental resilience is low; where rivers are at or close to limits of environmental capacity for effluent discharge; where there are elevated risks of flooding; where water catchments are over licensed or over abstracted for water resources; and where water and water recycling infrastructure is at or close to capacity.

Population and housing forecast for our water recycling region.



LPA plans, within our region, currently include the provision of housing in large-scale developments, as detailed in the table right for the period 2016 to 2030. Table shows all large developments proposed during period of 2016-2030. We forecast around 28% of the total properties constructed between 2016 and 2030 (393,000) will be built on large (>200 properties) sites, with the remainder on smaller sites and infill.

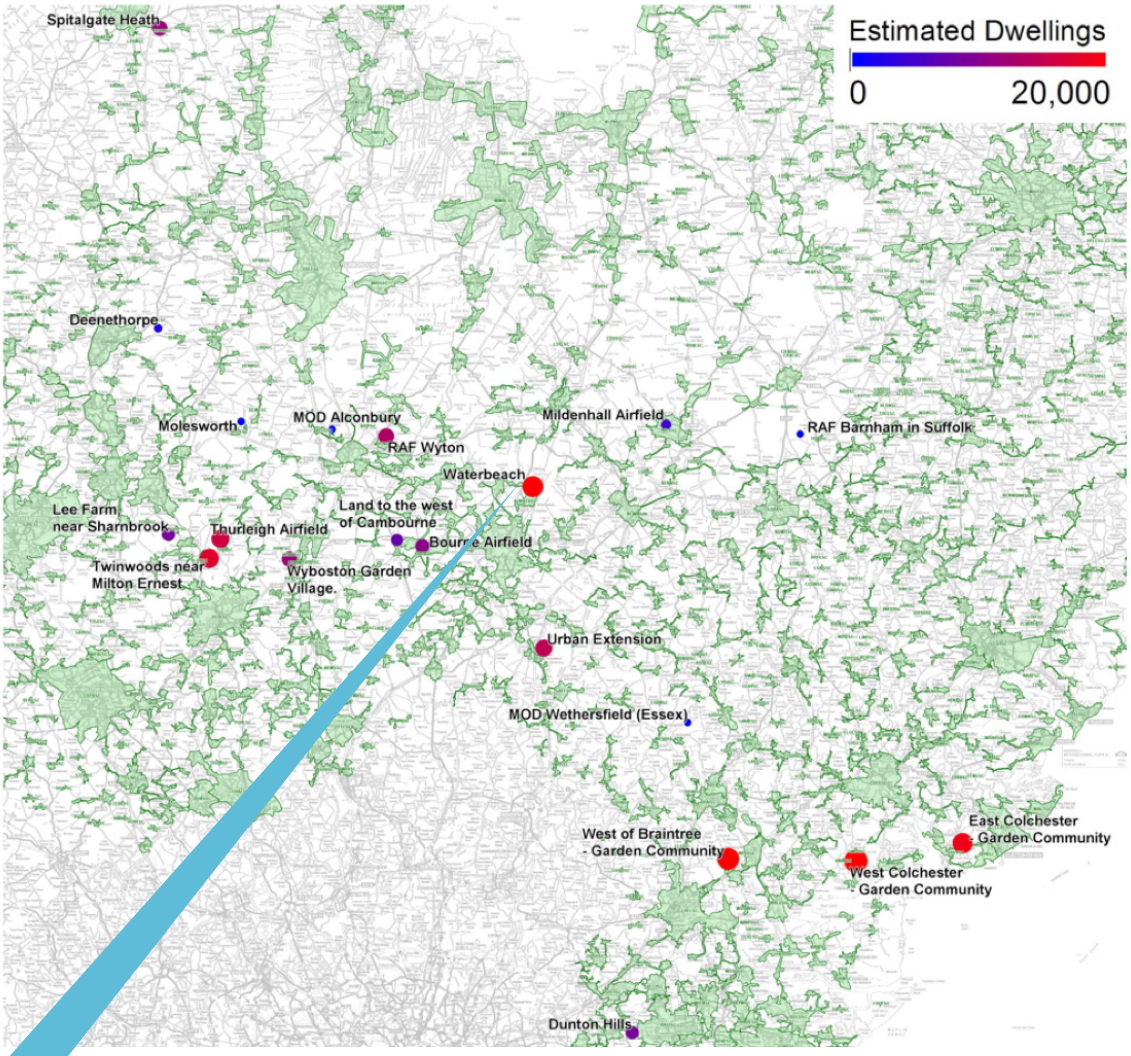
	No sites	No houses	% all new homes planned
>100 properties	303	130,865	33%
>200 properties	167	111,963	28%
>2000 properties	10	31,025	8%

Note: (sites>2000 properties) are a (subset of sites>200) properties and are a subset of (sites>100 properties).

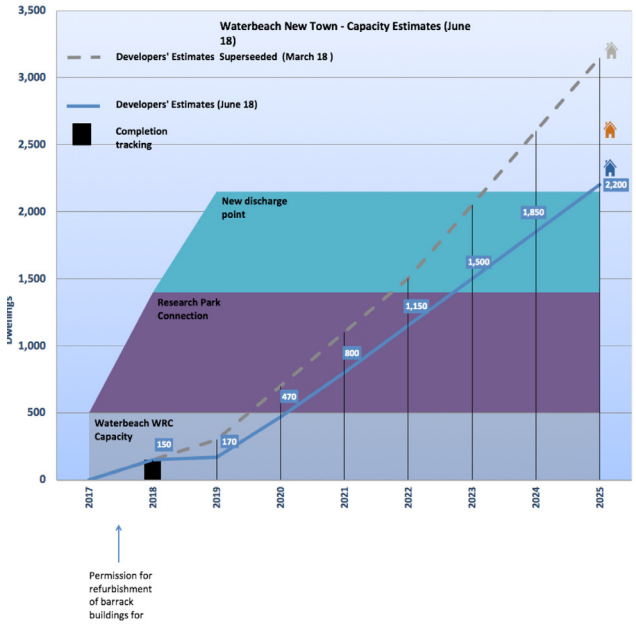
3.1.2 Emerging growth

Emerging sites may not have planning permission or be included in local plans. Our investment needs are driven by intelligence through collaborating with our external stakeholders. We have allocated funding for emerging sites based on predicted build rates.

The map below identifies the location and scale of emerging growth sites in our region.



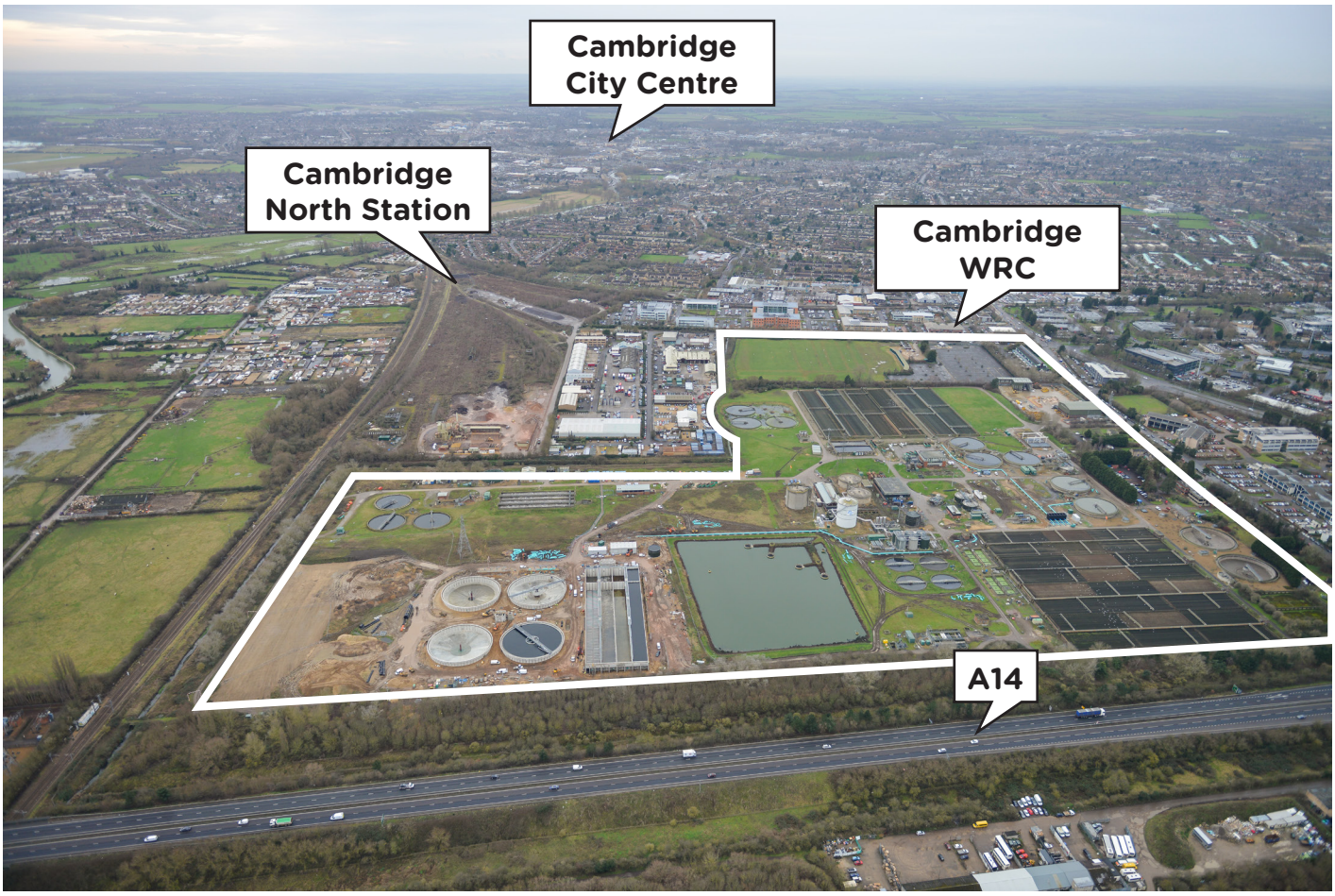
Waterbeach is an example of working in close collaboration with developers and the Environment Agency (EA) to agree the growth strategy to serve this site. We have estimated the timing of investment by using historic build rates from development sites of a similar size. We continue to explore catchment opportunities to meet the developer needs of the early phases of the development.



3.1.3 Cambridge WRC

In some cases, as settlements have grown our WRCs are now located close to the urban area. In such cases, we seek to maintain a reasonable distance from potential receptors to avoid odour issues. In Cambridge the WRC site provides the potential opportunity to release an area for development close to the city centre and internationally recognised science park. The development of this area would be dependent on the relocation of the operational Cambridge WRC.

We recognise the value of such a redevelopment to the economy, and are supportive of the proposal to relocate Cambridge WRC providing the solution maintains the same quality of service and represents best value for our customers. We have been working with the combined authority Cambridge City and South Cambridgeshire councils to explore the relocation of Cambridge WRC. We will continue to work with the councils as they consider the options for the future.



3.2 WRC capacity deficit

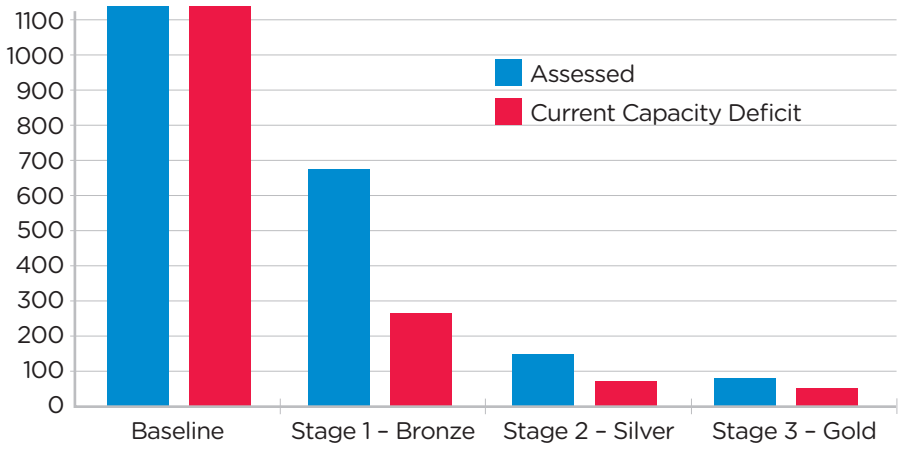
WRC capacity is measured in terms of flow compliance against permitted DWF and biological capacity in terms of population equivalent treated against the design capacity of the WRC.

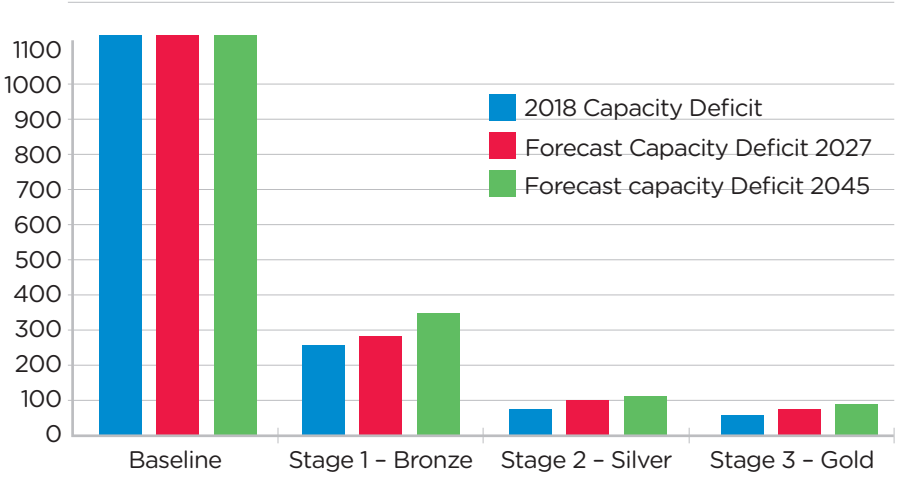
Sites can become non-compliant with their flow (DWF) or load permits due to a variety of reasons.

- Increased flows from climate change and urban creep.
- Increased flow and load from new development.
- Improved flow measurement.
- Increased infiltration.
- Increase and changes in seasonality in trade loads.
- Holiday migration.
- Increases in per capita flows - unlikely given our drive to reduce pcc.

Often it is a combination of the above that can trigger non-compliance.

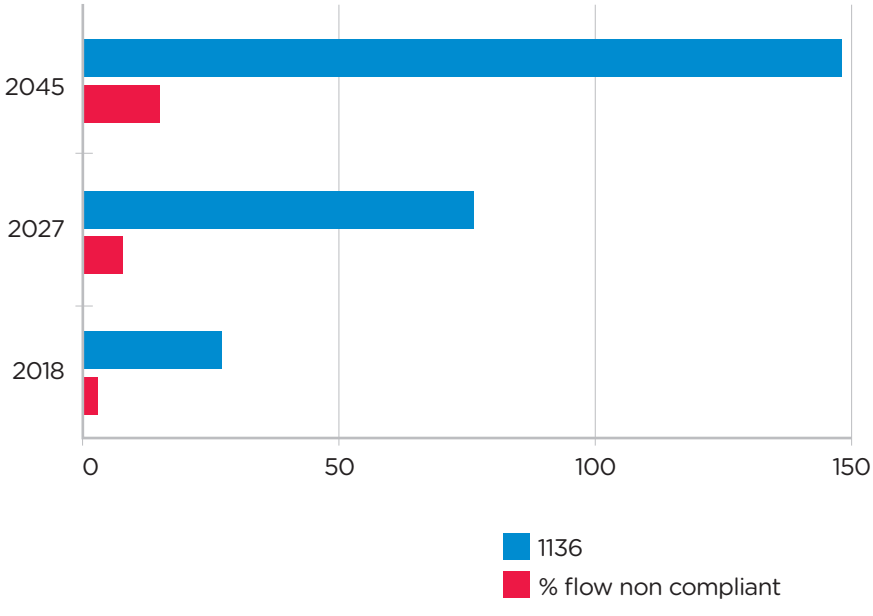
Following the Bronze, Silver, Gold process of capacity deficit assessment, a number of WRCs were assessed as currently treating a population equivalent greater than their design capacity. The graph right shows how the number of WRCs assessed as biologically overloaded changed as we progressed through our deficit assessment process, with the left bar showing how many we assessed at each stage and the right bar showing the number of WRCs identified with a capacity deficit at the present time.





Additionally the number of WRCs forecast to be in a biological design capacity deficit was assessed. Our confidence in these numbers improves as WRCs with the highest level of risk proceed to Silver and Gold assessments, as the graph left demonstrates.

The graph below shows the increased risk of DWF non-compliance, assessed at Q90. This includes taking into consideration the water efficiency planned through demand management in our WRMP19. It does not take into account any planned investment to address flow non-compliance and compares all future forecast flows against the current permitted DWF.



The graph left shows the expected flow compliance assessment at a single year point. The Environment Agency are moving to a 3 out of 5 year fails for a WRC to be classed as flow non-compliant. Investment is proposed where there are three years of expected flow non-compliance.

New DWF permits, due to flow non-compliance, drive tighter sanitary standards to maintain the quality of effluent the watercourse receives.

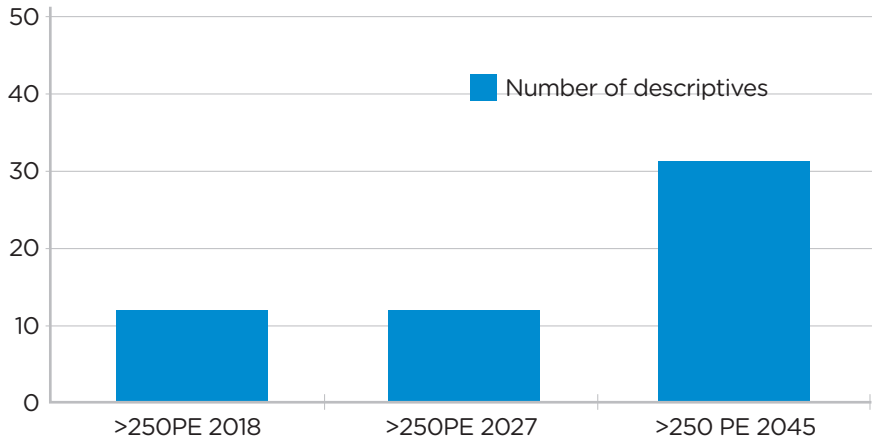
For all WRCs identified with a capacity deficit, flow or biological, the risk of non-compliance increases without investment. Addressing this risk is managed through an assessment of confidence in the growth, as outlined in section 2.3.1, and an understanding of the implications of the capacity fail.

3.2.1 Descriptive WRCs

As outlined in section 2.4.3 most descriptive permits state a condition of <250PE. All 371 WRCs with descriptive permits were reviewed against the current and future PE. The graph below shows the numbers of descriptive sites breaching 250PE, where this was stated within their permit.

3.2.2 Urban creep

Not all 620 'treat all flow' WRCs will struggle with compliance during rainfall events, and for those that do it is often hard to pinpoint urban creep as the root cause. A review of historic performance and action plans and discussions with operators led to six WRCs needing investigating further for the risk of urban creep.

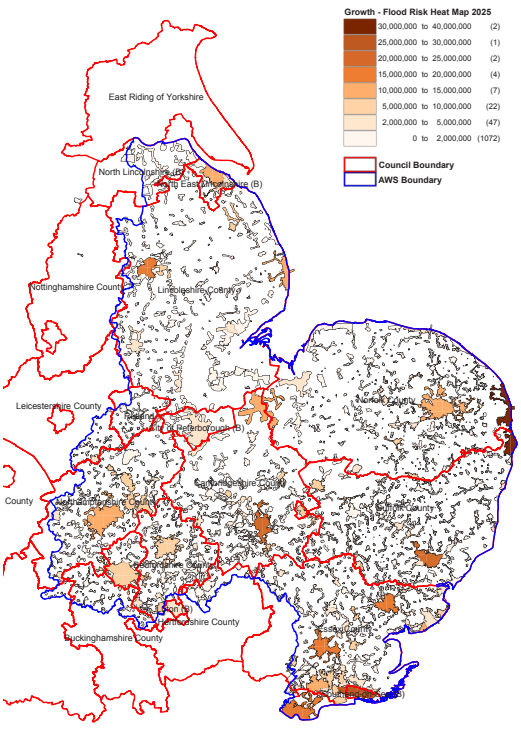


3.3 Sewer catchment capacity deficit

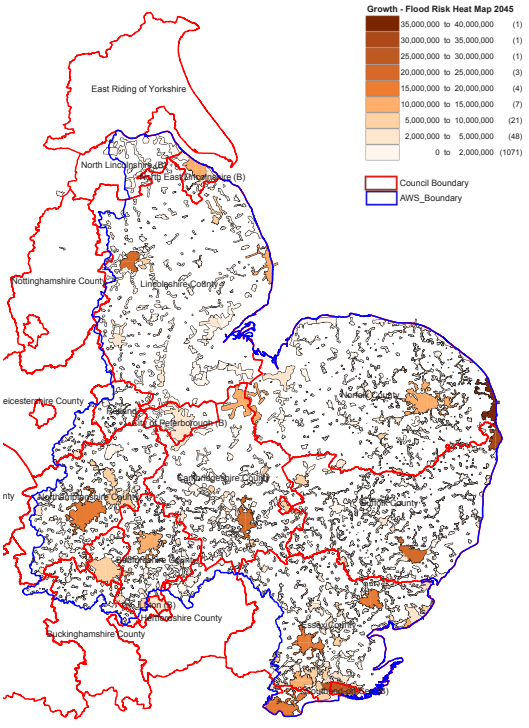
3.3.1 Flood risk heat maps

Climate change, growth and a larger area of impermeable surfaces (urban creep) all increase the risk of overloading sewers, posing capacity challenges. The water either spills via CSOs into our rivers and onto our beaches or, in extreme circumstances, appears as flooding (often on roads and occasionally in our homes and other buildings). Under a 'do nothing' scenario, the impact of growth only is shown on heat maps below. This is represented as flood risk as an indicator of sewer capacity deficit, in 2025 – at the end of AMP7 – and in 25 years time.

Growth – FLOOD RISK HEAT MAP 2025

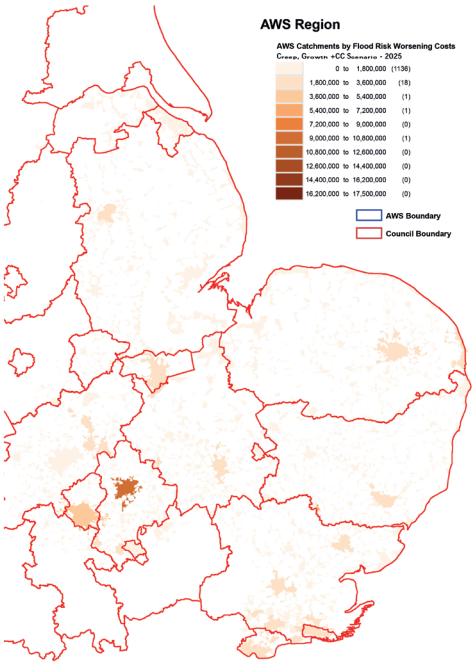


Growth – FLOOD RISK HEAT MAP 2045

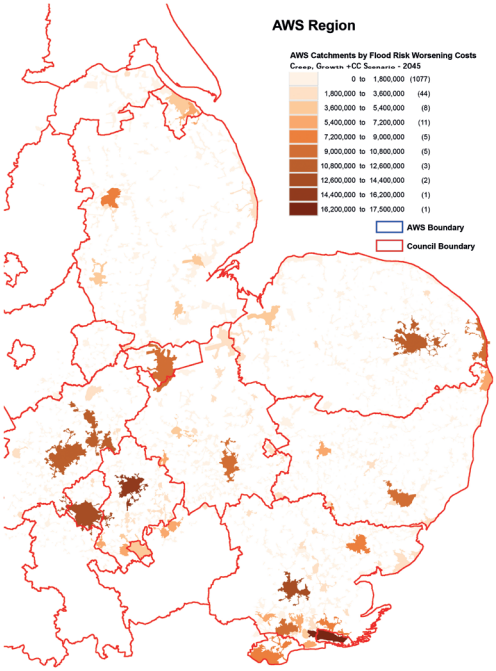


Climate change and urban creep increases this risk further over the long term. Under a 'do nothing' scenario, the heat maps below provide an indication of sewer capacity deficit including the impact of climate change and urban creep, represented as flood risk in 2025 – at the end of AMP7 – and in 25 years time.

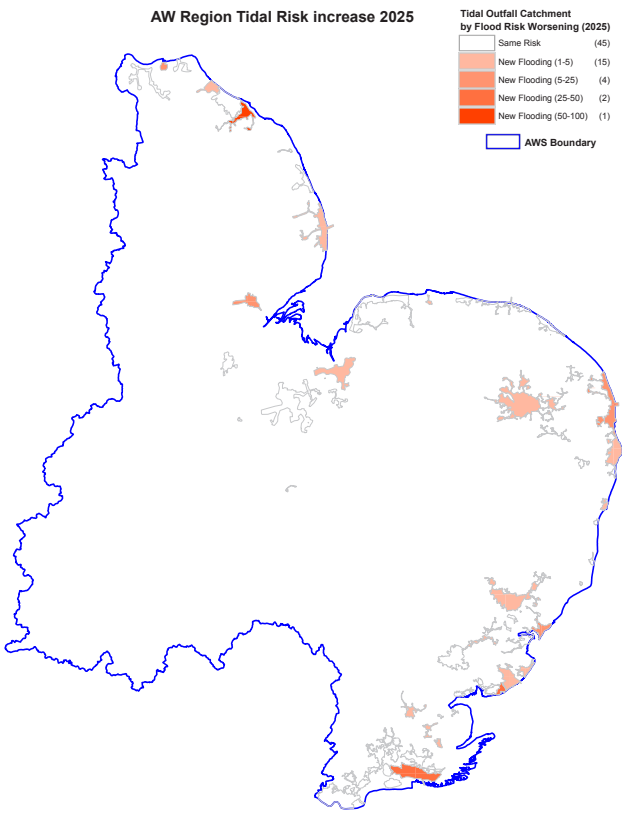
Growth, urban creep and climate change 2025

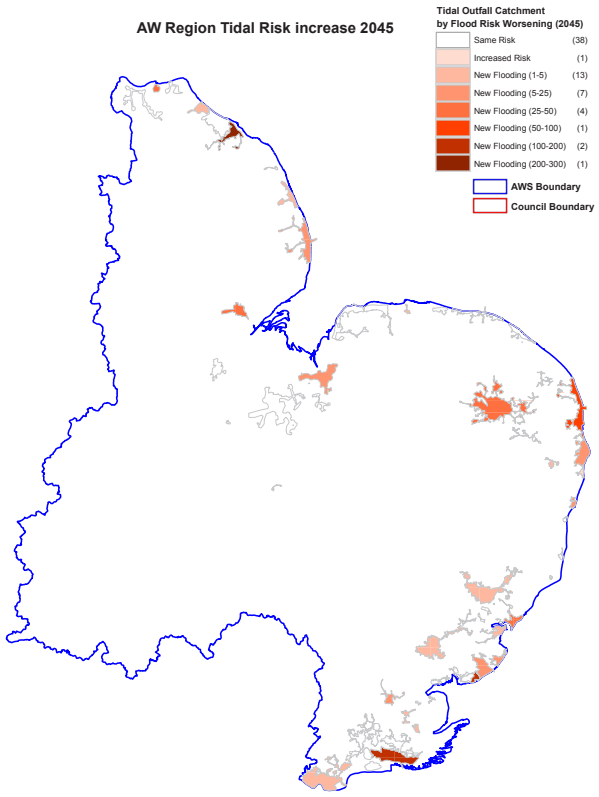


Growth, urban creep and climate change 2045



From our flood and capacity risk assessment, we have identified 10 catchments with worsening impacts over a 25-year period due to sea level rise as a result of climate change. The heat maps below demonstrate this.





3.3.2 Outputs from our risk-based approach

The table below provides the number of catchments that have been taken through each stage of our Bronze, Silver, Gold risk-based approach to assessing sewer capacity deficit. This process is described further in Part 2.

Level of capacity deficit assessment	No of catchments		
	Deficit assessment completed	AMP7 investment promoted	Investment type
Bronze	1,136	11	Emerging scheme
Silver	38	Top 10	Defined contingent scheme
Gold	19	16	Defined scheme

Please refer to 4.3.1 for further details of investment type

3.4 Integrated strategies

Through our risk-based approach to capacity deficit assessment, we have identified five catchments where both the WRC and the catchment have been identified as requiring growth investment in AMP7, and an integrated growth strategy is needed.

1. Braintree
2. Ipswich-Cliff Quay Raeburn
3. Huntingdon (Godmanchester)
4. Maldon
5. Peterborough (Flag Fen)

We have identified seven catchments where modelled growth detriment areas overlap existing flooding detriment areas, and 35 WRCs where investment for both and WINEP drivers are planned. This demonstrates there is the potential to deliver solutions that meet multiple investment drivers in AMP7.

As we review risk on an annual basis, further catchments and WRCs that require integrated strategies will be identified. Where investment is planned in the catchment, an assessment on the management of flows at the WRC will be undertaken, to mitigate any impact to the hydraulics at the receiving WRC.

PART 4 – OPTIONS

Following identifying the need to invest, this part explains the solutions options available and a regional summary of our investment planned for AMP7. All the proposed investments have been reviewed as part of our investment planning process but could be subject to change according to subsequent changes in risk and Ofwat determination of our AMP7 Business Plan.

4.1 Available Options

No one can be sure what the future will hold, so we need solutions that are resilient and flexible to change and bring benefits in a number of different scenarios. We refer to these as minimum regret solutions; ones that will leave us with the best possible outcome we can hope for in the worst case scenario. The table below provides a hierarchy of solution options we consider where growth can not be accommodated within our existing asset base. Options considered start from the top of the hierarchy, as lowest cost options or options that will not leave us with stranded assets. Hybrids of options can be selected to develop a phased approach of least regret over the long term. A regular review of risk will check the validity and timing of the solution strategy.

Solution strategy hierarchy

SOLUTION STRATEGY HIERARCHY Sewer catchment	SOLUTION STRATEGY HIERARCHY Water recycling centres
Investigate, monitor and model impacts of catchment key indicators – flow and growth intelligence	Investigate, monitor and model WRC key indicators – incoming flow and load, final effluent flow, and quality and growth intelligence
Partnership – Surface Water Management	Demand management: reduce catchment flows (surface water, misconnections and infiltration) in partnership
Anglian Water only – Surface Water Management	Demand management: reduce catchment flows (surface water, misconnections and infiltration)
Optimise existing assets in catchment e.g. real time control of pumping stations	Optimise existing assets at WRC
Relining – address infiltration	Extend process units (flow) – existing permit
Disconnection – address misconnections	Extend process units (load) – existing permit
Extend existing	Extend process units (flow) – new permit
Reroute existing	Extend process units (load) – new permit
Storage	Convert WRC to PS
Address intermittent discharges	Create 'Super' WRCs (new or exisiting), close small WRCs
New strategic sewer	New or relocated WRC

Where growth is significant and long term, we require an integrated approach that considers the catchment and receiving WRC, with investment phased across a number of AMP periods to improve affordability. All investments are subject to whole life cost–benefit and affordability analysis, which considers private and societal costs and benefits.

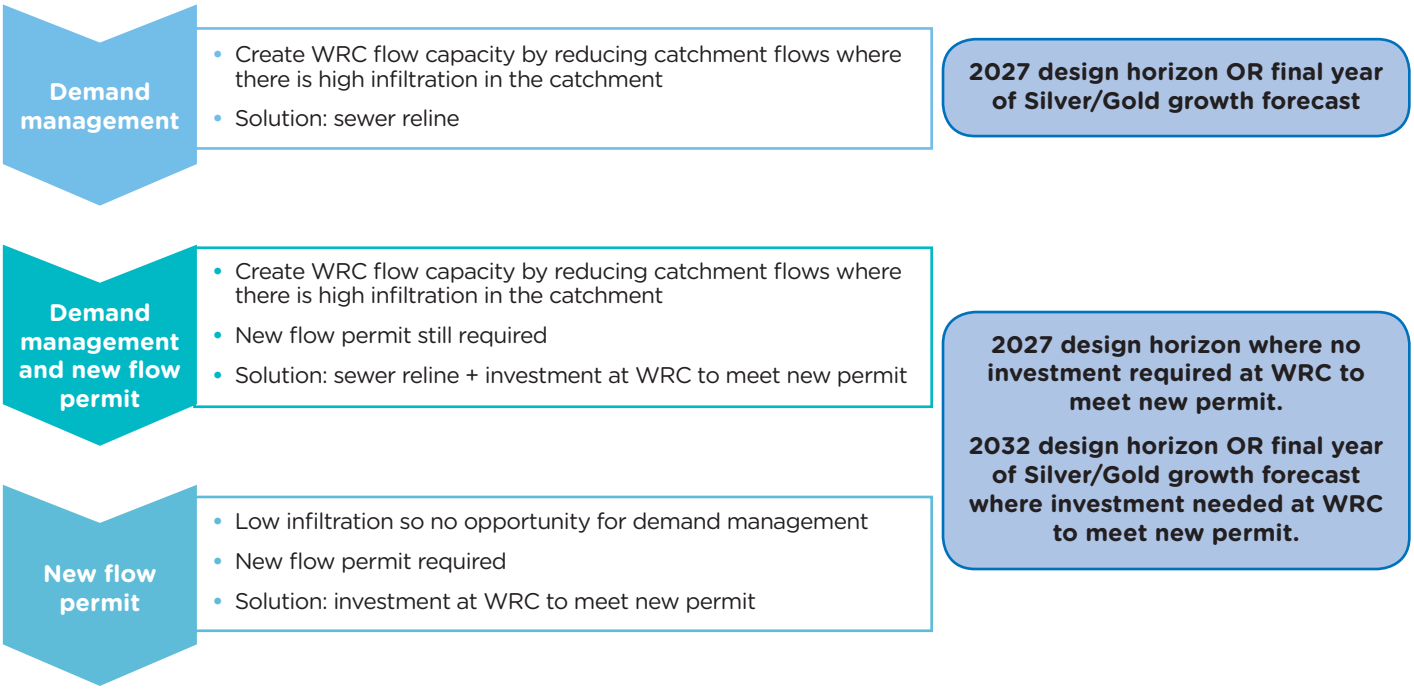
4.2 WRC capacity deficit options

Where we identify a need to invest, we use a framework to select the most appropriate solution strategy. The design horizons selected recognise our business planning AMP cycles, the lead time for solutions to be delivered and the confidence of the growth forecast. We aim to ensure we are resilient to a change in growth rate by using a design horizon minimum of two years into the following AMP cycle, 2027.

4.2.1 Flow deficit

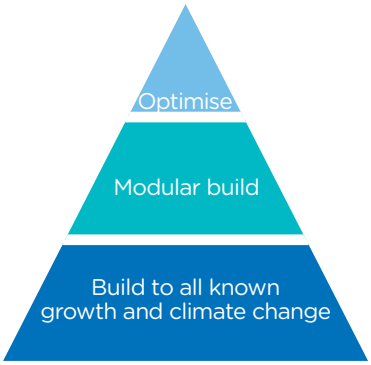
The risk-based solution strategy selection process for WRCs that will be flow (DWF) non-compliant by 2027 has been agreed with the Environment Agency (EA);

The below framework still applies where a WRC has both flow and biological capacity deficit.

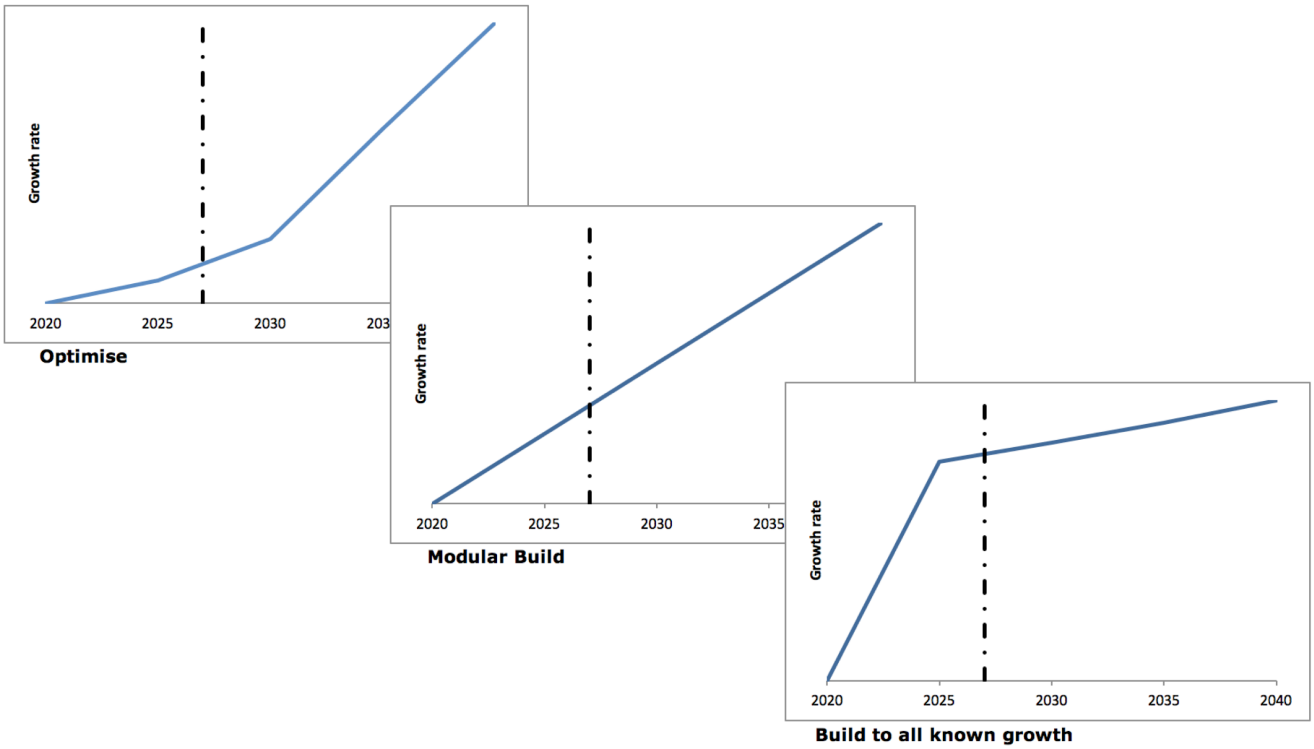


4.2.2 Biological capacity deficit

If needed, the investment to manage a deficit in biological process capacity is based on a risk-based solution strategy as shown below, which we have experience of delivering in AMP.



If by 2027 the connected PE is greater than WRC capacity, but not greater than 105% of the capacity	When the connected PE will be marginally above WRC capacity we identify opportunites to deliver extra treatment capacity by optimising the performance of existing assets.
If by 2027 the connected PE is 105% greater than WRC capacity AND less than 75% of the Silver/Gold growth will occur by 2027	Where there is significant growth over the long term we identify modular solutions of least regret that can be extended in future AMP planning periods.
If by 2027 the connected PE is 105% greater than WRC capacity AND more than 75% of the Silver/Gold growth will occur by 2027	Where the majority of growth will be required by 2027, we develop long-term solutions that accommodate all known growth, designed to the last year in which the growth forecast is Silver/Gold.



4.2.3 Descriptive to numeric permit

Where a descriptive permit is predicted to be breached by the end of AMP7, we investigate the root cause. WRCs with descriptive permits are not regularly sampled under Operator Self Monitoring (OSM) and therefore our understanding of their performance is not as well documented. We have planned a two-year sampling programme in AMP7 for descriptive sites >250PE to provide the data to understand their current impact on the watercourse and allow us assess our ability to meet the new numeric permit without any investment. When numeric permits come into place we then have three options:

1. Meet the permit with no further investment.
2. Upgrade the WRC to meet the new conditions.
3. Close the WRC and pump effluent away to another WRC locally.

4.2.4 Urban creep

We will investigate where it is thought urban creep is the cause of WRC compliance fails in wet weather. Following the investigation, if we are confident that urban creep is the route cause, then where possible surface water removal schemes are promoted, including partnership working with local councils if appropriate. Investigation projects are promoted where urban creep cannot immediately be confidently identified.

4.3 Sewer catchment capacity deficit options

4.3.1 Defining investment type

We have applied a three-tiered approach to developing an appropriate investment strategy for the highest risk catchments, which is aligned with the WWSDF (UKWIR, 2014).

UKWIR investment category	UKWIR infrastructure investment definition	WRLTP application of infrastructure investment definition
Defined scheme	High certainty that investment is required and it is possible to identify the appropriate solution at the time of business plan preparation.	18 catchments with Gold deficit assessment (hydraulic modelling of spatial growth forecast with Silver/Gold confidence), resulted in 16 requiring investment in AMP7.
Defined contingent	Preferable to wait for the outcome of a key uncertainty before deciding which of the identified (and costed) investment options should be undertaken.	36 catchments to be assessed at 'Gold' during AMP7 – hydraulic modelling of growth risk. Solutions to address deficit to be promoted. Treated as a separate flexible ring fence in order to respond to uncertainty. Business Plan based on upsizing requirements for the top 10 catchments at risk, based on Silver deficit assessment completed Feb 2018.
Emerging	Not possible to pre-define or allocate investment to specific assets or low confidence in risk assessment.	Treated as a separate flexible ring fence in order to respond to emerging growth. Business Plan based on Bronze deficit assessment completed Feb 2018, identifying 11 catchments susceptible to emerging growth outside of local plans, such as garden towns and villages. AMP7 delivery will differ as our adaptive delivery programme will respond to an annual review of risk.

During AMP7, the live modelling and monitoring of key indicators, such as flow meters, will improve confidence of the investment prior to deciding on the timing of delivery.

4.3.2 Surface water management (SWM)

4.3.2.1 Our Programme for Long-Term Surface Water Management

We recognise that SWM is vital to the water industry's long-term approach to manage the impact of growth, climate change and urban creep. Our Programme for Long-Term Surface Water Management builds upon development of our surface water policy in AMP6, and seeks to improve our resilience to these increasing risks, to the benefit of our customers and the environment. We aspire to be the leading WaSC in surface water management and removal, with our ambition to reduce unwanted flows to water recycling centres and pumping stations by 100 per cent by 2045 (where is it appropriate, sustainable and cost effective to do so). We also want to significantly enhance the communities we work with by delivering substantial environmental benefits.

Local authority planners have a responsibility for ensuring new developments are drained in a sustainable way, following the non-statutory guidance provided by government. In 2019 Sewers for Adoption 8 will be published, and for the first time it will include certain SuDS components that will be adopted by us (building on our approach to adopt SuDS on new developments since 2012).

Within existing urban areas, sewerage undertakers and local authorities continue to work together to reduce the amount of hard surfaces that drain into the sewers. This often involves finding ways to divert the rainwater from those hard surfaces into the ground or to an alternative (separate) system where the rainwater is not mixed with wastewater; and storing and treating the water locally so that the downstream drainage system does not have to accommodate large amounts of polluted rainwater.

4.3.2.2 SuDS features

SuDS are generally surface-based vegetation features that are designed to slow down and reduce the quantity of rainwater that enters our sewers. They include large attenuation ponds, wetlands and swales, as well as smaller scale features, such as tree pits, water butts and raised planters.

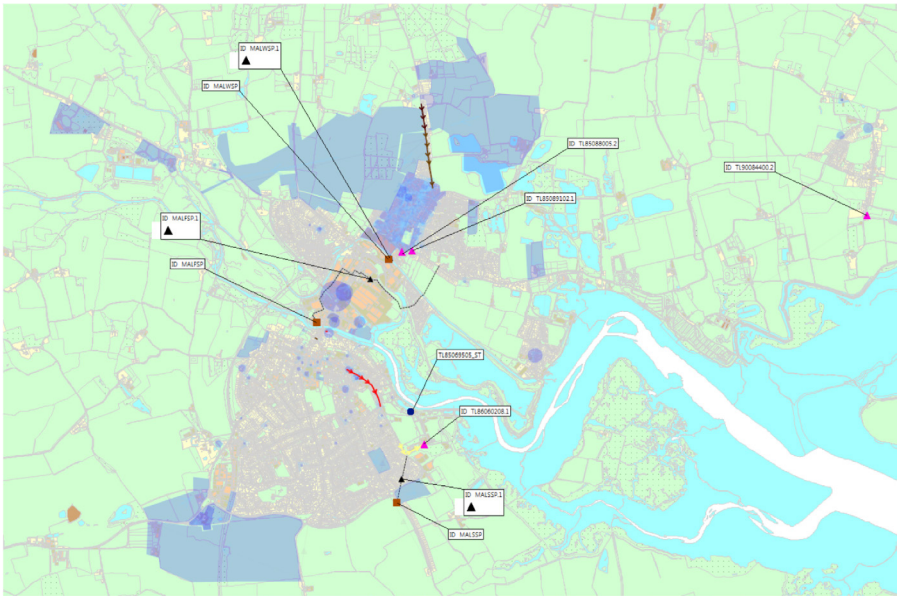
This helps us to manage flood risk, reduce the effects of urban pollution, while also making our urban areas more pleasant to live in and attractive for wildlife. SuDS have the advantage that, when they are full, failure is more gradual, easier to anticipate and manage than traditional drainage systems; thus allowing our communities and urban areas to prepare, recover and adapt.

4.3.2.3 Results of our SWM study

Our SWM study has found that SuDS have the greatest potential for impact in combined sewer catchments, however, separated systems can still benefit from SuDS due to the capacity of SuDS to address creep and urban growth when the catchment is assessed in its entirety. This aligns with our Surface Water Management Long-Term Strategy, which will endeavour to effectively manage surface water in all of our sewers, not just combined systems. This programme will take a proactive approach to managing risk within catchment, focusing on those catchments where most benefit will be delivered to meet the challenges of growth, climate change and urban creep.

The results of our study and the SuDS Studio opportunity mapping has been used directly to identify viable SuDS features for SWM options for growth.

An example of how SW and upsizing options can work together to deliver sewer capacity for growth is shown below.



Maldon – growth modelled to 2027 design horizon – Strategic Options, Scenario 1

4.3.2.4 SWM communication campaign

We are developing a communication campaign centred around the question 'If a rain drop could choose, where would it land?' The strapline therefore is 'Make Rain Happy' and will explain how surface water management does just that! Successfully delivered, the campaign will go beyond factually informing our customers, educating and raising awareness of sustainable drainage and onto inspiring people to want to get involved and perhaps even take action themselves. By also targeting schools and schoolchildren, who have huge parental and community influence, we aim to create a demand in the local areas at risk and bring the whole community on board to maximise our impact of a SuDS for Schools community programme. We are aiming to introduce 'Make Rain Happy' to half a million school children by 2045.

Further examples of where we will implement our communication campaign over the next 25 years include;

- Collaborating with our partners and customers to plant 1 million trees, shrubs or hedging plants

- Providing 1 million water butts/ rainwater harvesting units for installation at residential and commercial properties across the region.

4.3.2.5 Integrating SWM with Water Resources Planning

There is a need to look beyond our water recycling systems to water conservation through the capture, recycling and reuse of rainwater. This approach could help us meet the water supply–demand, e.g. surface water retention for crop irrigation. We will continue to work with developers to encourage effective surface water management, grey water options, rainwater harvesting, and water efficient devices.

Surface water also provides a potential source of water for non-potable purposes, or with treatment, as a potable source. Working with the WRMP option selection process, we will identify water reuse options with benefits across water and water recycling. More sustainable supplies of potable water can be achieved through the capture, recycling and re-use of surface water.

4.3.2.6 Investing in SuDS

Eleven of our highest risk catchments (Defined Schemes) have SuDS investment identified for AMP7 to manage growth risk – this the first time SuDs have been planned for growth and forms part of our transformation to an effective SWM strategy. These are retrofit measures at various points in combined sewer catchments, to provide capacity for development sites to connect. They range in type and include permeable paving, green roofs, tree pits and attenuation ponds. We seek to work in partnership with Flood Risk Management Authorities to identify opportunities to enhance schemes to address existing flood risk, while on-site for a growth-driven scheme.

The BeST Toolkit

CIRIA has developed Benefits of SuDS Tool (BeST) to provide a structured approach to evaluating a range of benefits associated with overall drainage system performance. It is a framework to screen and identify the potential benefits to evaluate, before supporting the quantification and monetisation of each benefit.

The BeST tool distinguishes between three different benefits categories.

- The table below represents the benefits that CIRIA have monetised with confidence (indicated by the tick mark);
- Other benefits can be qualified by the user based on local information from surveys.
- The tool leaves space for further user-defined benefits to account for categories not included in the BeST tool.

Benefit category included in the tool	Ability to monetise
Air quality	✓
Amenity	✓
Biodiversity and ecology	✓
Building temperature	✓
Carbon reduction and sequestration	✓
Crime	✗
Economic growth	✗
Education	✗
Enabling development	✓
Flexible infrastructure/climate change adaptation	✓
Flooding	✓
Groundwater recharge	✓
Health	✓
Pumping wastewater	✓
Rainwater harvesting	✓
Recreation	✓
Tourism	✗
Traffic calming	✗
Treating wastewater	✓
Water quality	✓

The monetised values included in the tool (recorded in the 'Values Library') were selected following a review of 500 values from more than 100 valuation studies of potential relevance to SuDS in the UK. The user determines the scale of the monetised benefit (for example, the monetised amenity benefit of a city park versus increased waterbody area) by inputting the spatial area to be considered for the assessment.

The economic analysis is conducted based on Net Present Value and Benefit-Cost Ratio.

Information based on W045c BeST – Technical Guidance. Available: http://www.susdrain.org/resources/best.html

The benefit assessment of SuDS includes the use of a natural capital framework based on the CIRIA BeST tool. This analyses the impacts and dependencies on natural capital assets and the ecosystem services they provide.

For new developments, the publication of Sewers for Adoption 8 in 2019 will include, for the first time, certain SuDS components that will be adopted by water companies, will provide certainty to developers on SuDS adoption.

In retrofit situations, liaison during scheme design will determine the best route for future ownership and maintenance. Although we may invest in creating SuDS assets, future ownership and maintenance of many features may become the responsibility of ourselves or the riparian owner, the Highways Agency or the local authority.

Based on the ambitions of us and our partners and local communities, it is clear that there could be a significant amount of work undertaken in a single catchment. It is therefore imperative that good planning is undertaken, in conjunction with all partners, to identify both the risks and the opportunities that exist for SWM within a catchment before any work is undertaken. Due to these additional external considerations and the consultation involved, we have planned a long lead in time for delivery of SuDS options.

4.3.3 Partnership funding

The Flood and Water Management Act 2010 introduced Lead Local Flood Authorities (LLFAs) (Upper Tier or Unitary Local Authorities) and gave them overall responsibility for surface water management in their area. Since then LLFAs have been active in identifying areas at risk from surface water flooding and developing Surface Water Management Plans (SWMPS) to address identified risks.

Following changes to the mechanisms for government funding of coastal and inland flood and erosion defences, we have a programme of Partnership Funding investment to support the Environment Agency (EA) and LLFAs to deliver schemes that are beneficial to our service to customers. As our assets interact with assets owned and operated by others, partnership working is critical to effective drainage management.

The Partnership Funding investment programme is designed to reduce existing flood and erosion risk, and is not to support growth. However, the programme includes sustainable solutions that reduce surface water in our network, and has the

potential to provide capacity for growth or/and address urban creep in combined (foul and surface water) sewerage catchments. When considering solution options, we have worked with our flood risk partners to identify opportunities for working in partnership, with Anglian Water or an external partner leading the scheme. We proceed with the partnership scheme when it is the most cost beneficial option.

Eleven of our highest risk catchments have SuDS investment identified for AMP7 and we plan investigations into urban creep at six WRCs. We are starting to liaise with our local flood risk partners for these catchments and will progress opportunities for partnership where mutual benefits exist. Part 6 County summaries provides details of catchments where SuDS partnership opportunities have been identified.

Part 5.5 provides ways to get in touch with us to explore opportunities for partnership funding, joint flooding alleviation and surface water management schemes.

4.3.4 WRI Option selection

We have considered bill affordability and have selected the lowest cost options for AMP7 delivery, while still ensuring our long-term strategy is met. As growth risk changes due to external factors, our AMP7 delivery is likely to be different to the business plan. We will monitor our highest risk catchments through live hydraulic modelling, taking inputs from flow monitors placed at strategic 'trigger points' in the catchments. This information, coupled with growth intelligence, will enable us to annually review risk to catchments, and reprioritise investment delivery accordingly.

The table below presents a summary of the options selected for investment in infrastructure to deliver sustainable growth AMP7.

Long-term growth strategy	Strategy summary
Water Recycling Long-Term Plan	Annual review of risk, monitoring of key indicators, review and development of WRLTP at PR24.
Strategic sewers	Strategic sewers to serve Yare Valley, Norwich, and Alconbury Weald, Huntingdon.
Increase drainage capacity (Defined Schemes)	Increase drainage capacity through surface water management and upsizing, in 16 catchments with high confidence in growth and capacity deficit. Whitlingham Trowse (Norwich), Bedford, Chelmsford, Caister – North, Tilbury, Colchester, Cotton Valley (Milton Keynes), Maldon, Benfleet, Whittlesey, Ramsey, St Ives, St Neots.
Increase drainage capacity (Contingent schemes)	Increase drainage capacity through surface water management and upsizing, in top 10 priority catchments, following modelling of risk. Top 10 at risk, as assessed February 2018: Peterborough (Flag Fen), Ipswich-Cliff Quay Raeburn, Kings Lynn, Braintree, Soham, Buckingham, Tetney-Newton Marsh, Littleport, Stowmarket, Upminster.
Increase drainage capacity (Emerging schemes)	Increase drainage capacity in catchments susceptible to emerging growth, e.g. garden towns. Those at risk, as assessed February 2018: Little Ponton, Mildenhall (airfield), Thurleigh (airfield), Uttons Drove, Bourne, Wyton (airfield), Witham, Biggleswade, Marston Moretaine, Empingham, Wisbech/West Walton.
Flow monitoring for growth	559 flow monitors installed at strategic trigger points in our catchments and at large development sites, to provide growth intelligence: key indicator for growth.
CSO investigations and improvements	Investigate 54 CSOs where we predict more than 50% increase in flow upstream. Improve highest priority CSOs.
Live modelling for growth	Live hydraulic modelling of growth strategies using intelligence from key indicators for growth.
Increase vacuum station capacity	Increase vacuum station capacity – install 65 vacuum stations, driven by infill development.

4.4 Integrated solutions

The solution design in the catchment considers the impact on the receiving WRC, e.g. hydraulic effects at the inlet works from peak flow from a new pumping station. Delivery of works is scheduled to mitigate any adverse affect at the WRC. Where there is existing flood risk in the catchment, we will seek to integrate growth and flooding solutions to drive efficient delivery and mitigate impacts of construction on customers.

4.5 Selected options – regional summary

This investment is for solutions of least regret that support the long-term strategy, or provide a short-term solution where long-term growth is not a high risk. Costs are based on the investment needed to meet growth drivers.

207,132
homes planned to 2025

428,982
new people to 2025

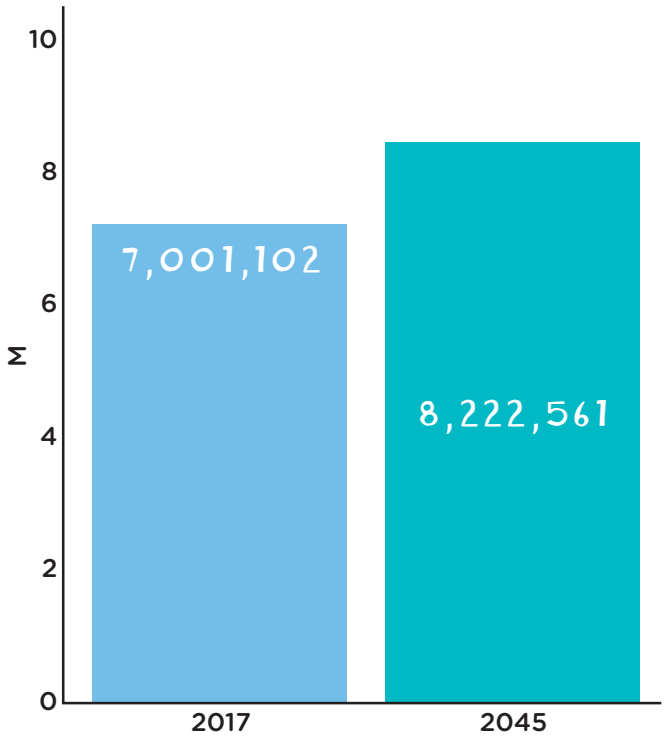
£468.45m
investment to 2025

595,734
homes planned to 2045

1,078,503
new people to 2045

£1,176.52m
investment to 2045

Increase in PE from 2017 to 2045

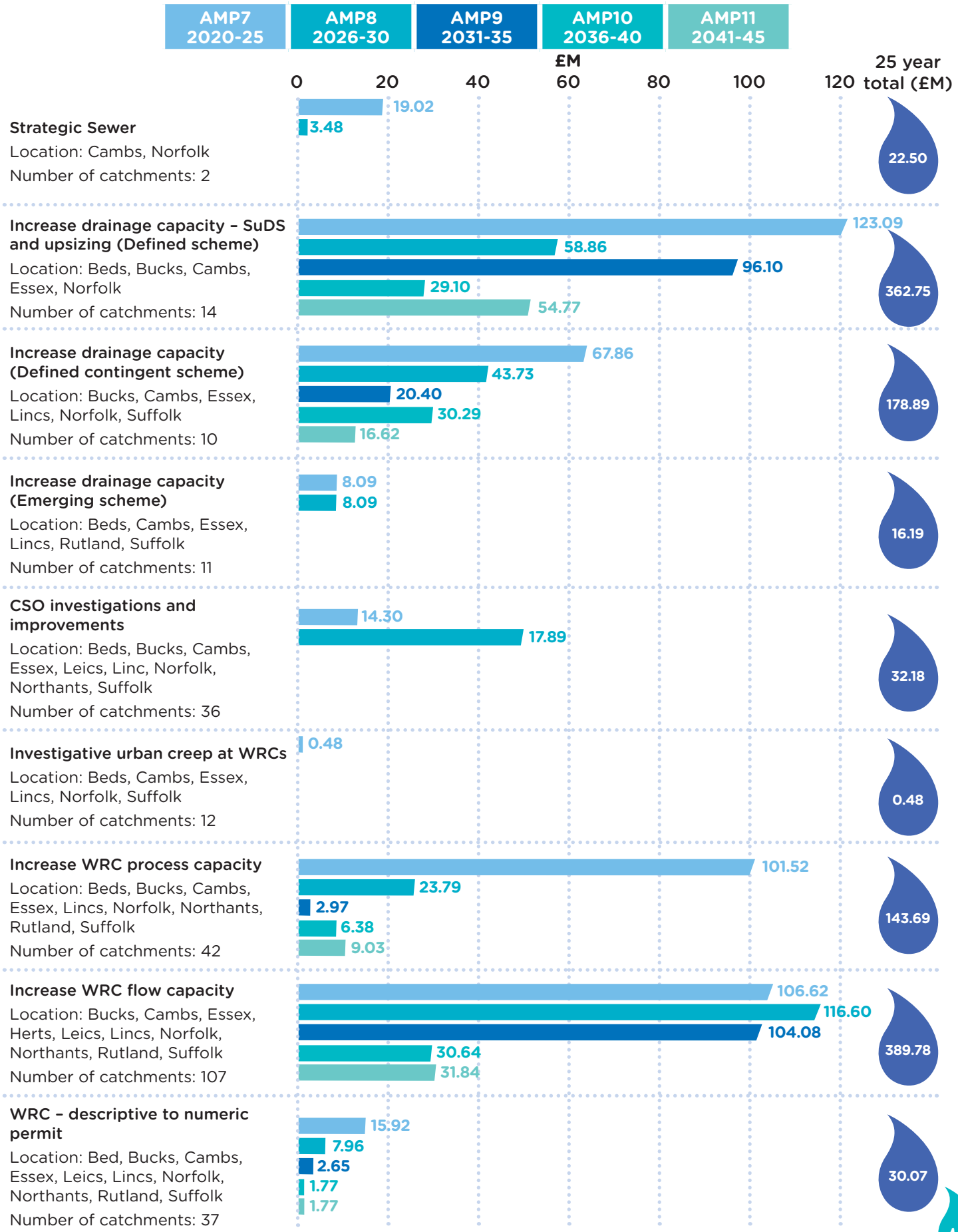


County	Number of WRCs	Household population served	Population equivalent served	Homes planned 2020-2025 AMP7	+ new people 2020-2025 AMP7	% increase people 2020-2025 AMP7	Homes planned 2020-2045 25yrs	+ new people 2020-2045 25yrs	% increase people 2020-2045 25yrs
Bedfordshire	52	394,951	451318	9,018	17,857	5	23,985	34,122	9
Buckinghamshire	48	322,205	376,243	17,312	39,569	12	46,000	91,321	28
Cambridgeshire	99	776,833	891,211	30,423	64,844	8	89,153	166,108	21
Essex	123	1 ,395,935	1,493,743	46,871	97,936	7	144,549	274,684	20
Hertfordshire	9	95,283	100,658	5,142	11,176	12	16,942	31,433	33
Leicestershire	23	35,258	35,928	1,179	2,395	7	2,460	4,293	12
Lincolnshire	198	821,734	1,063,400	21,083	42,207	5	79,493	144,506	18
Norfolk	247	726,794	896,464	31,595	65,015	9	73,256	133,745	18
Northamptonshire	92	670,831	866,699	25,105	51,821	8	67,042	115,205	17
Nottinghamshire	*3*	*698*	*753*	*17*	*33*	*5*	*69*	*127*	*18*
Oxfordshire	*7*	*2,410*	*2,440*	*30*	*43*	*2*	*158*	*219*	*9*
Rutland	22	29,120	30,507	772	1,683	6	2,302	4,647	16
Suffolk	202	668,350	790,580	18,527	34,300	5	50,162	76,933	12
Yorkshire	*1*	*1,148*	*1,158*	*27*	*49*	*4*	*59*	*74*	*6*
Total	**1,130**	**5,941,550**	**7,001,102**	**207,101**	**428,928**	**7**	**595,630**	**107,7417**	**18**

Notes: household population is domestic population served by public sewerage, population equivalent includes domestic population, non-household population and an equivalent population for trade effluent.

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.

Number of catchments refers to the number of catchments where investment is planned.



Regional investment in AMP7 also includes;

£5.9M

to install 559 flow monitors at strategic trigger points in our catchments and at large development sites, to provide growth intelligence to be monitored as a key indicator for growth.

£1.4M

in the use of live scenario modelling software that integrates with our hydraulic models. These will take inputs from the flow meters and external growth data (key indicators for growth) to ensure least regret solutions are delivered that align with our long-term strategies.

£2.56M

to increase the capacity of our vacuum stations, largely driven by infill developments.

£0.9M

for the IT and processes needed for a flow monitoring dashboard, annual assessment of growth risk, and to produce the new Water UK Drainage and Wastewater Management Plan (framework due September 2018).

£0.8M

for the installation of flow meters where DWF may be >50m³.

4.6 Business as usual

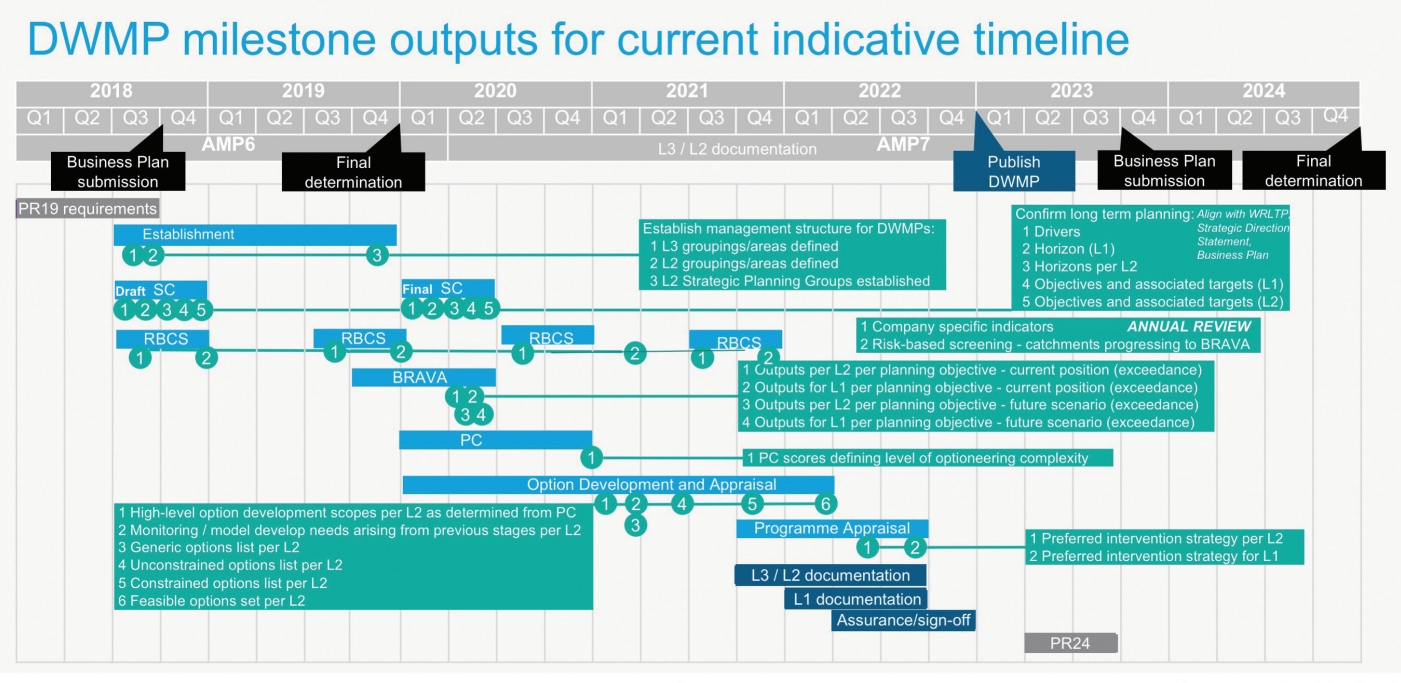
Our transformed business as usual process has been adapted from the lessons we have learnt through the approach we have taken to developing the growth strategies for this WRLTP. Business as usual in AMP7 will see the first adaptive programme delivery that reflects change in growth uncertainty and risk.

- **Growth forecast and risk to our service is reviewed annually and population/housing trends mapped, including very close monitoring of emerging sites.** Historically the growth forecast and assessment of risk to our assets has been completed every five years, as part of our planning cycle. Due to the volume of growth planned for our region, and the levels of uncertainty, we have established an annual review process that will build confidence in the growth forecast and the need to invest in the short, medium and long term. The aim is to deliver schemes before the confirmed and committed growth happens.

- **'Live' monitoring of key indicators for growth through a dashboard will drive optimal timing of investment – this may bring forward catchment, or push back investment – adapting the long-term plan.** We will have hydraulic models for foul sewers for our entire region by 2020. We are running a continuous rolling programme of refreshing and improving confidence in these hydraulic models, as well as extending the coverage of surface water sewers within them. The use of advanced optimisation software, such as Mode Frontier by Enginsoft, will provide us with improved continuous and current proactive hydraulic modelling of these key indicators and long-term strategies. This software offers multiple scenario modelling to test least regret solutions using the latest growth data and intelligence. Coupled with investment management, these decision-making tools ensure our long-term strategies remain effective. Dynamic asset plans will be used to monitor the changes at each WRC, along with predictive analytics to understand timings and location of interventions. A rolling programme of design capacity assessments for WRCs will feed into these dynamic asset plans to continually improve our baseline understanding of risk.

- **Integrate the DWMP frameworks and 21st Century Drainage tools into business as usual and business planning.** The WRLTP process is aligned to the proposed DWMP process and we are ahead of the proposed timeline (below). We have included investment in WRLTP review and implementation of DWMP in AMP7. As tools and framework become available, we will embed into our processes.

Our DWMP implementation timeline



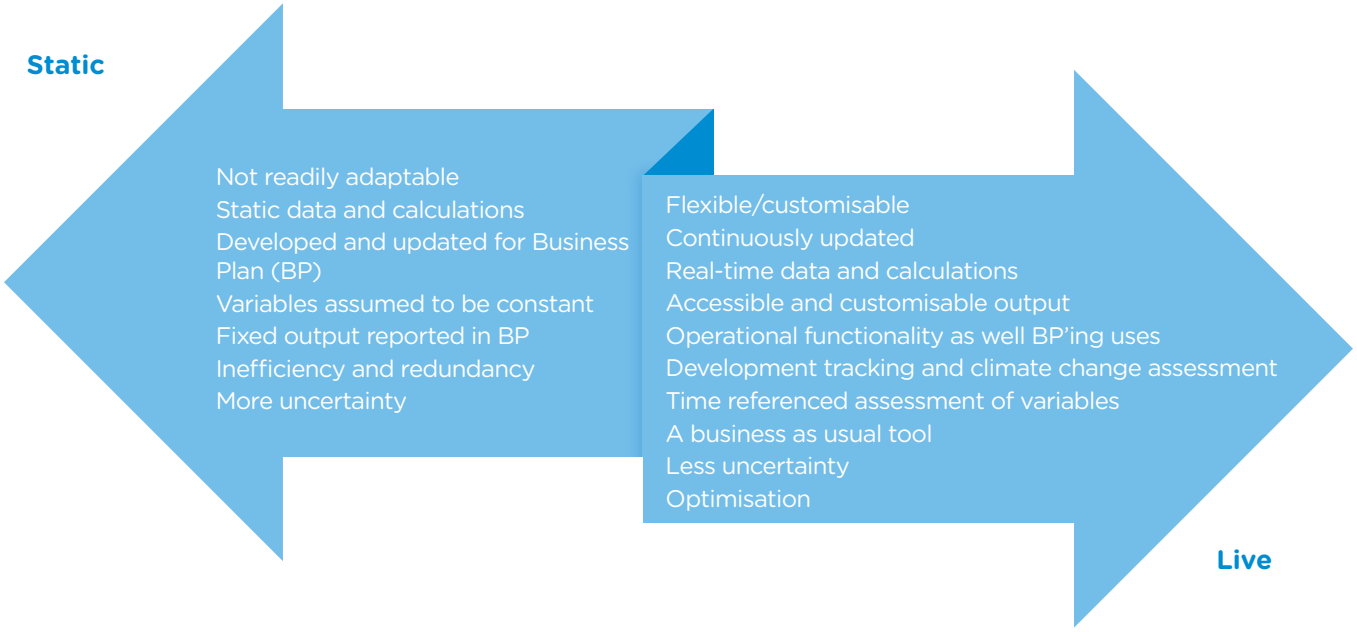
SNC·LAVALIN | ATKINS Member of the SNC-Lavalin Group

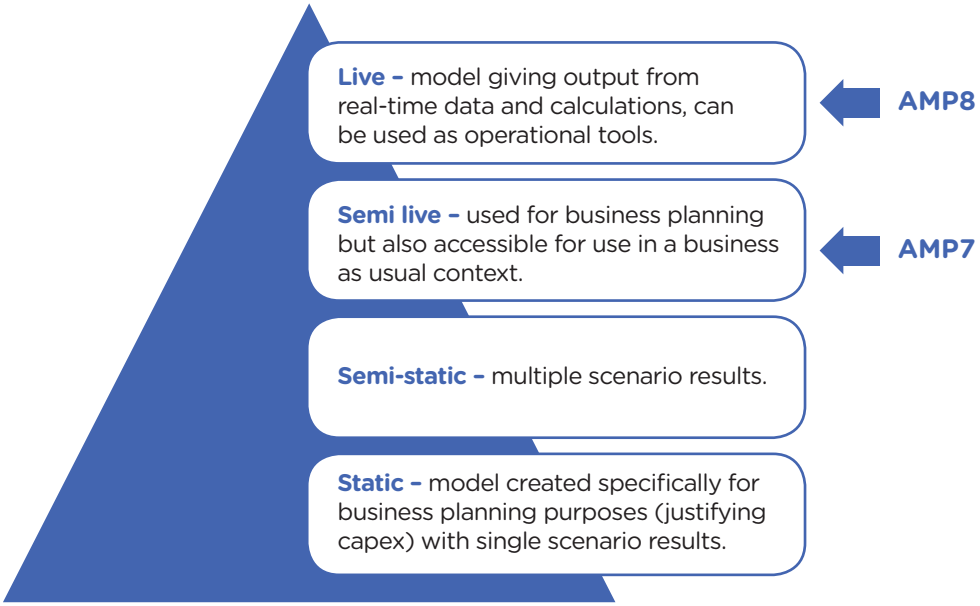
Key
Potential implementation range
SC Strategic context
RBCS Risk-based catchment screening
BRAVA Baseline risk and vulnerability assessment
PC Problem categorisation
L1. L2. L3 Level 1, level 2, level 3 planning areas

Note
For implementation, programme complexity will increase due to prioritisation of L3/L2 activities, and differing timescales for process step completion across L3/L2 areas, which will result in a staggering of deliverables. Dates indicated represent those at which it is anticipated that all deliverables will be available for the stated activity, for this planning cycle.

This 'live' process that we have described is aligned with one of the key 6 guiding principles of Drainage Strategy Framework and ensures we are agile enough to adapt our investment programme and continue to achieve the customer outcomes and ODIs. As a result we may change the WRCs and catchments that we invest in, the scope or the design horizon, if the key indicators demonstrate it is the right thing to do.

UKWIR WWSDF and DSF Framework Guiding Principle – 'Live';





PART 5 - EXTERNAL ENGAGEMENT

5.1 Customer engagement

In preparing our AMP7 Business Plan, we are consulting in the widest sense of the word, to give us a rich understanding of our customers' expectations of us, and their experiences of our service. We have an online community of 500 customers with whom we can get into details, for example, around the key investments in the plan, proposed performance commitments, financing levers and associated bill profiles. Our Customer Board and our Customer Engagement Forum have challenged us throughout our businesses planning period. We also held focus groups and public events, social media activities and formal acceptability research, as well as engaging with developers and water retailers to better understand their needs and improve our service to them. We believe this has given us the deepest and richest understanding of our customers we have ever had and will transform our business: how we think, how we operate and how we deliver. Here are some of our customer views.

SUPPLY MEETS DEMAND

- Of all the challenges faced by Anglian Water, population change and new development emerged as the issues that customers were most concerned about: they were highly emotive and generally negative in tone, and very concerned about the perceived unfairness of having to pay more to support new residents. The processes within the WRLTP seek to ensure investment in supply–demand is delivered at the right time and at best value.
- Supply Meets Demand is regarded as one of the most important of the company's ten outcomes. Population growth and new development is seen as the second most important of the company's four long-term goals, after resilience (although customers link the two issues). Customers want the want the company to plan ahead, influence the planning system, and work in partnership. The WRLTP fully supports and helps us to deliver this company outcome and goals, meeting customers' needs for long-term plans and working in partnership.

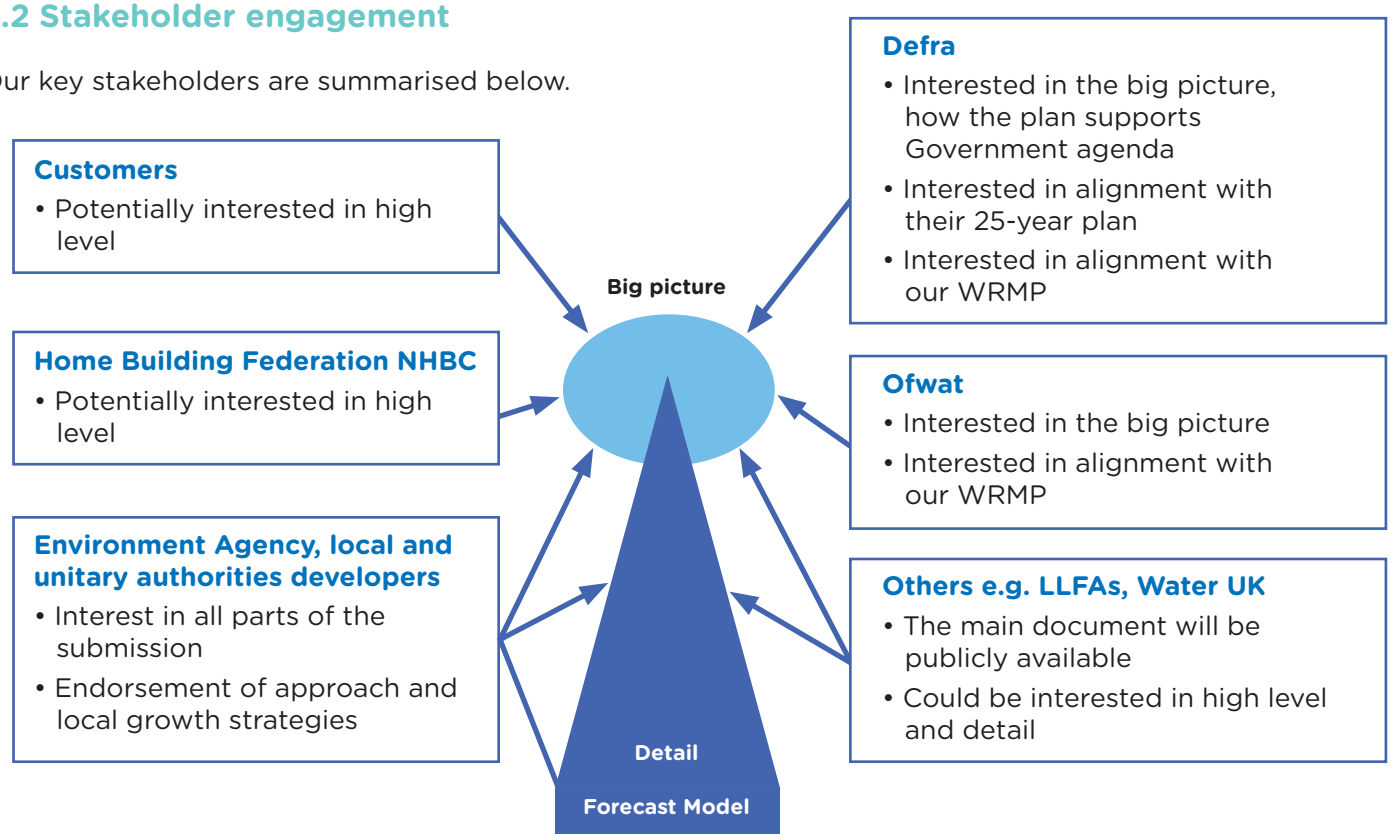
RESILIENCE

- There is support for increasing storage capacity and knowing that Anglian Water has a long-term plan for tackling resilience boosts perceptions of it as a proactive and forward-thinking company.

  This WRLTP is a very innovative and leading approach in the water industry, demonstrating us to be proactive and forward-thinking in water recycling resilience to growth.

5.2 Stakeholder engagement

Our key stakeholders are summarised below.



To date we have:

- consulted on a first draft WRLTP with the Environment Agency (EA) and representatives from several local authorities, and have amended the structure of the document to provide more detail of local strategies, based on the feedback received
- presented our approach to the WRLTP at WWT Wastewater Conference January 2018, where it was well received
- engaged with Defra and Ofwat on our WRLTP to demonstrate Anglian Water as an innovative and leading water company, during PR19 Business Planning, and
- started to consult local authorities and the EA on our plans, to explore partnership opportunities.

5.3 Acting on feedback

In summary, during consultation you said...	We did...
you would like to understand when and how to engage with us to influence planning decisions and aid working in partnership	please refer to section 5.5
we need to provide detail on scheme location, costs and timing	included in our County summaries
further clarity required concerning SuDS adoption and future maintenance	please refer to section 4.3.2

5.4 Endorsement

During the preparation and consultation of our WRLTP, we have gained endorsement of our approach with a number of key stakeholders, as shown from the statements they have been happy for us to publish below.

"The Environment Agency is very supportive of a WRLTP as an innovative means of providing more certainty and effectiveness in securing environmental protection while accommodating growth. We find the growth data particularly forward-thinking and helpful."

Chris Swain, Planning Specialist, Environment Agency
August 2018

"We welcome the adaptive programme for delivery and we support AWS intention to increase the communication with local authorities and developers. CBC will be happy to have regular communication with the relevant officers at AWS to support the delivery of key infrastructure necessary as part of the delivery of our growth agenda. As part of being adaptive, we support the use of key indicators and the use of live modelling tools."

Connie Frost-Bryant, Head of Strategic Growth, Central Bedfordshire Council
May 2018

"The approach set out in the consultation document looks to be soundly based on evidence, taking into account existing knowledge about growth and contextual matters relating to the environment and climate change. The WRLTP may need to be revised early on if additional capacity is required as a consequence of any accelerated growth that might take place as a result of Growth Deals relating to the Oxford–Cambridge Corridor."

Paul Everard, Planning, Policy and Heritage Manager, Northampton Borough Council
May 2018

5.5 Engaging with us

We positively encourage stakeholders to engage with us at the early stages of spatial planning of development sites, investment in infrastructure for growth, surface water removal schemes, as well as flooding alleviation schemes. Our website provides lots of helpful information at **anglianwater.co.uk**. Here are further ways to get in touch;

Pre-planning and pre-development services, strategic planning, Water Cycle Studies.

planningliaison@anglianwater.co.uk

Surface water removal schemes.

makerainhappy@anglianwater.co.uk

Flooding alleviation schemes, Partnership funding.

FloodRiskManagement@anglianwater.co.uk

Water reuse enquiries

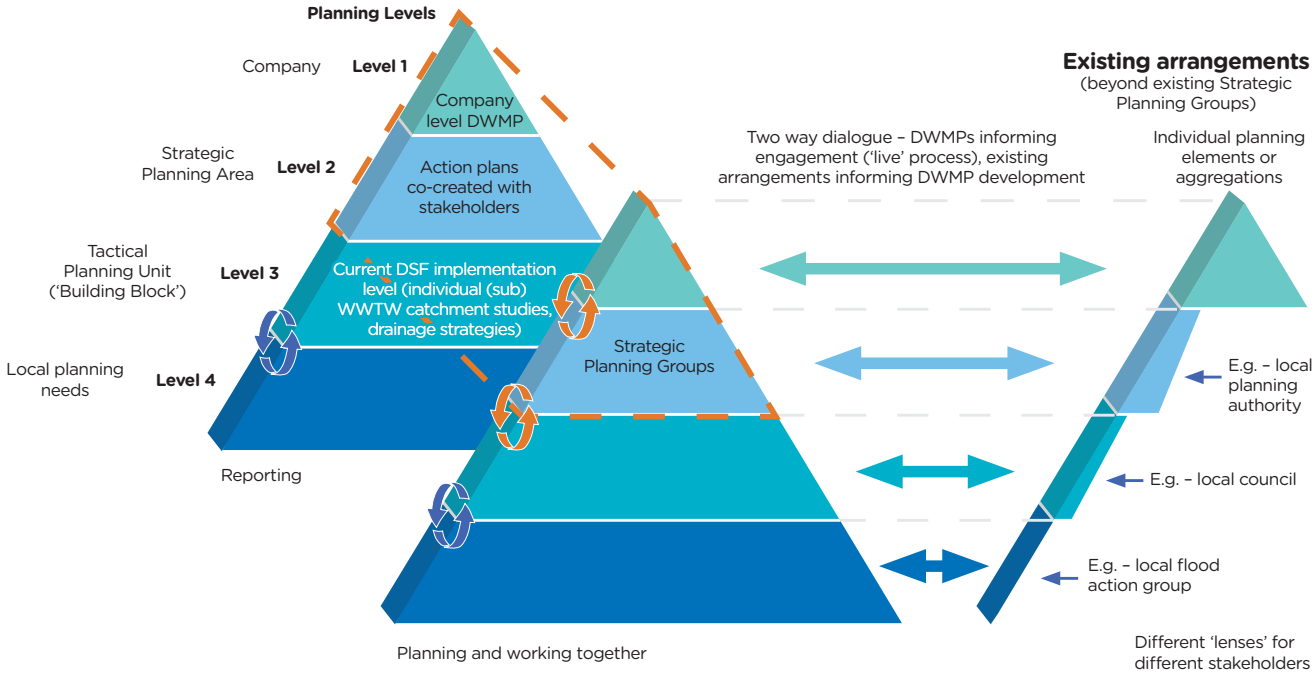
GreenWater@anglianwater.co.uk

Enquiries regarding the content of this WRLTP

WRLTP@anglianwater.co.uk

In 2019 we will start to implement the new Drainage and Wastewater Management Plan (DWMP) framework, which will be published by Water UK. Within this framework, a key principle in developing options is the need to work in collaboration with customers and stakeholders in the identification, co-creation and assessment of options. This will help promote and encourage optioneering on the broadest scale possible without losing the desired level of granularity to address priority risks. To achieve this we will need to proactively share information and form collaborative groups as outlined by the image below (Developing a framework for Drainage and Wastewater Management Plans, Draft, July 2018). The Department for Environment, Food & Rural Affairs (Defra) have recently published Surface Water Management: An Action Plan (July 2018) that helps to clarify surface water risks and responsibilities and better enable those responsible to manage them more effectively. It is not surprising that sharing data, improved communications and joined-up planning feature heavily in strengthening the delivery of surface water management.

DWMP Framework Management Structure



DWMP – Drainage and Wastewater management Plan

DSF – Drainage Strategy Framework

If you would like to get involved, please contact us via **WRLTP@anglianwater.co.uk**.

PART 6 – COUNTY SUMMARIES

BEDFORDSHIRE

9,018
homes planned to 2025

23,985
homes planned to 2045

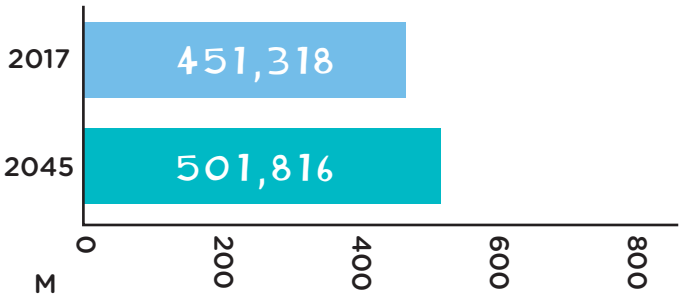
17,857
new people to 2025

34,112
new people to 2045

£15.34m
investment to 2025

£37.24m
investment to 2045

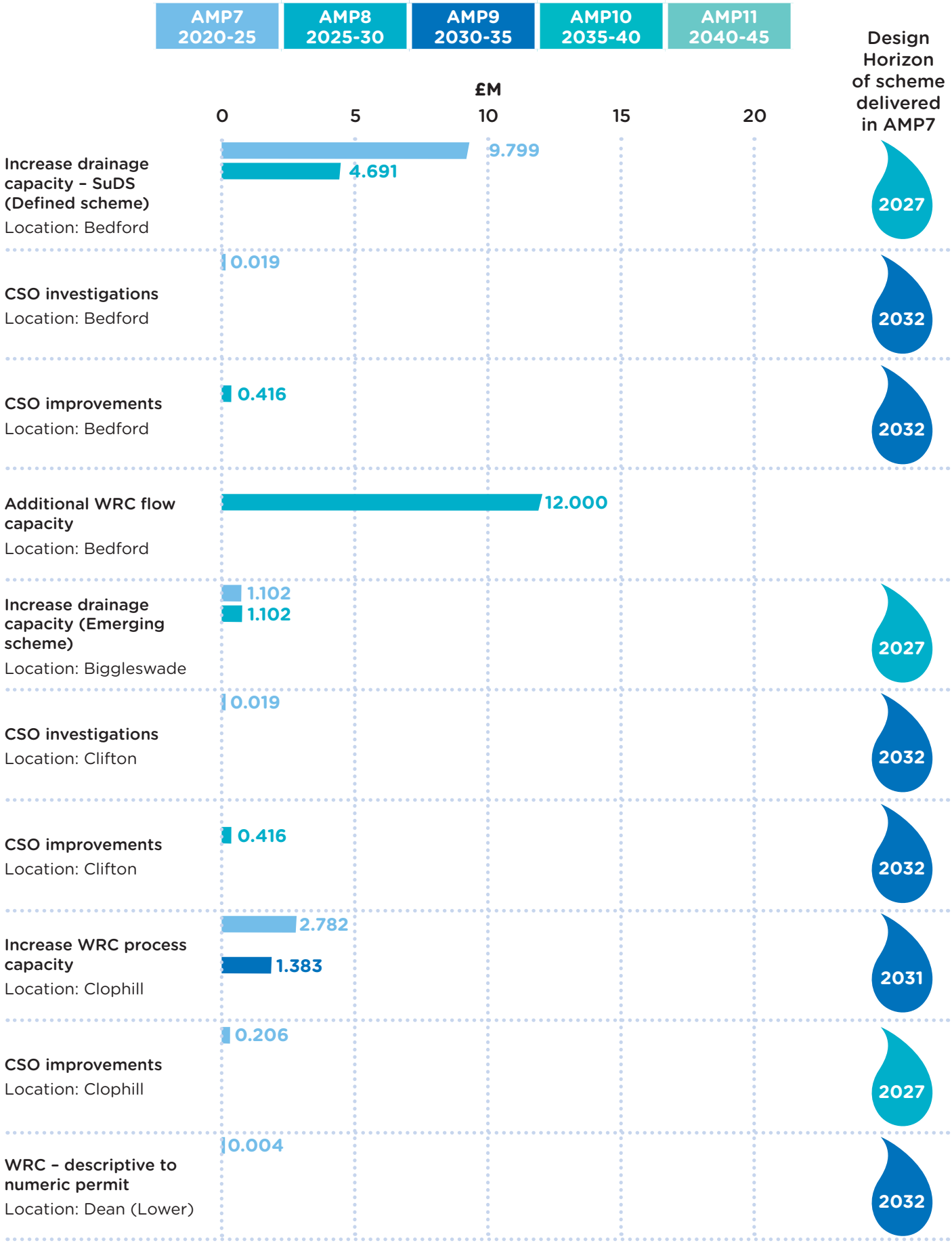
Increase in PE from 2017 to 2045

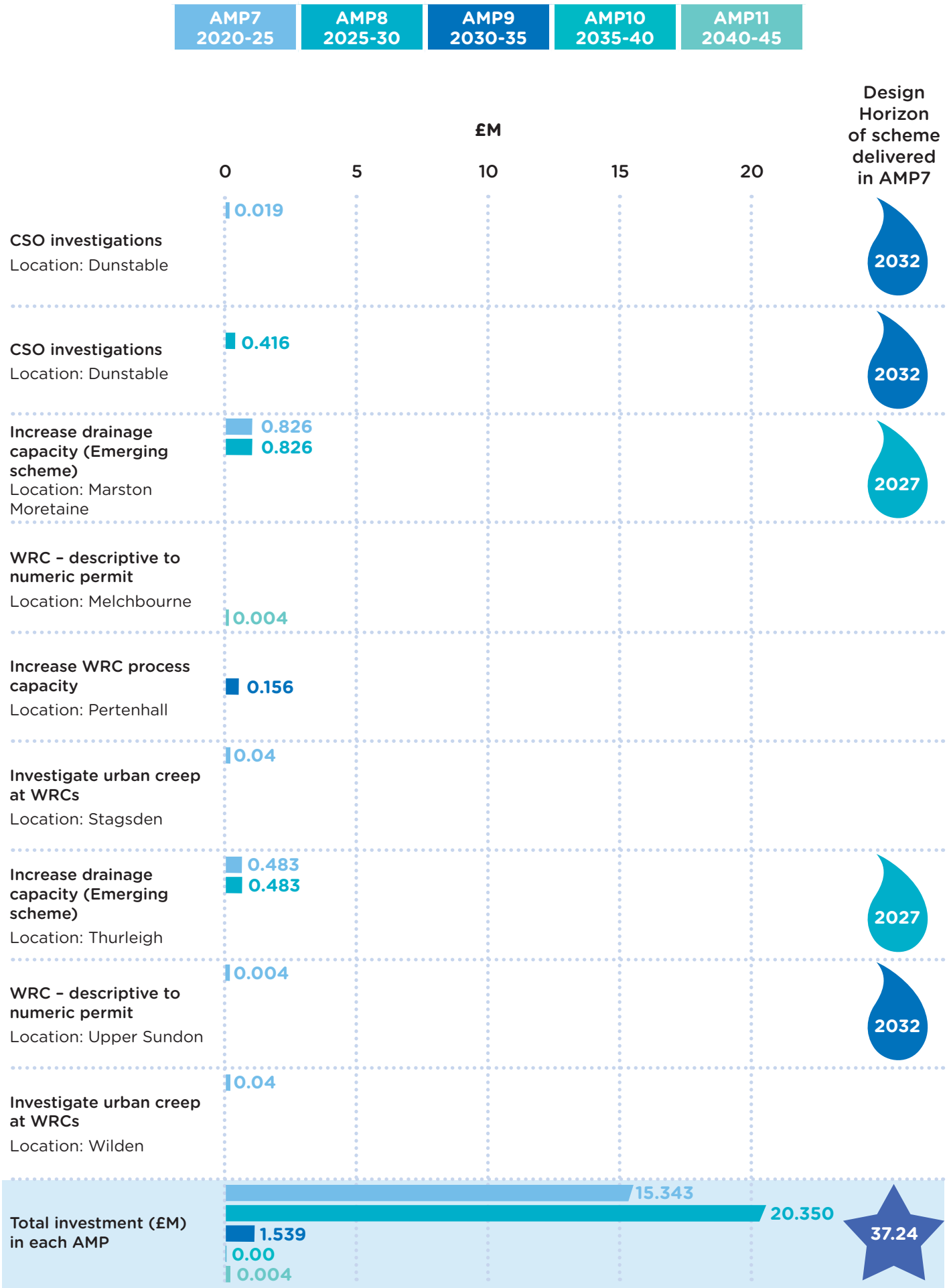


Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Barton le Clay	4,866	4,916	61,816	1	1	16
Bedford	136,049	178,440	966,247	6	15	15
Biggleswade	20,950	21,455	101,454	7	2	5
Bletsoe	938	1,108	6,745	-	3	19
Clifton	16,879	17,226	69,966	6	1	9
Clophill	7,210	7,340	29,064	3	0	10
Dean (Lower)	252	269	4,683	-	12	31
Dunstable	45,910	51,698	271,445	2	0	2
Flitwick & Ampthill	27,591	28,915	128,630	3	4	7
Leighton Linslade & Leighton Buzzard	41,599	42,616	179,880	3	-	-
Marston Moretaine	10,751	11,181	50,914	3	1	11
Poppyhill	19,620	19,949	121,955	1	1	17
Sandy	11,692	11,922	54,285	2	1	5
Stagsden	298	312	2,614	-	3	19
Thurleigh	496	513	2,861	2	3	21
Upper Sundon	493	498	1,053	-	-	13
Wilden	319	322	5,344	-	3	22

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.



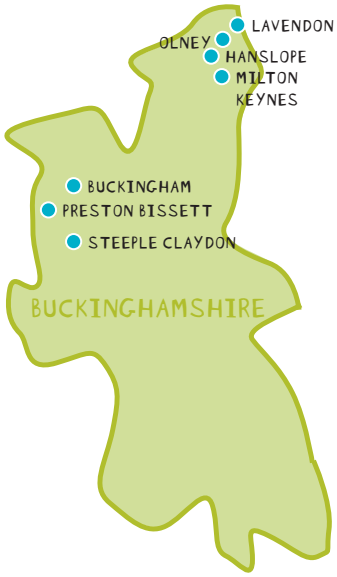

AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
CSO investigations
Location: Dunstable
0.019
2032
CSO investigations
Location: Dunstable
0.416
2032
Increase drainage capacity (Emerging scheme)
Location: Marston Moretaine
0.826
0.826
2027
WRC – descriptive to numeric permit
Location: Melchbourne
0.004
Increase WRC process capacity
Location: Pertenhall
0.156
Investigate urban creep at WRCs
Location: Stagsden
0.04
Increase drainage capacity (Emerging scheme)
Location: Thurleigh
0.483
0.483
2027
WRC – descriptive to numeric permit
Location: Upper Sundon
0.004
2032
Investigate urban creep at WRCs
Location: Wilden
0.04
Total investment (£M) in each AMP
15.343
20.350
1.539
0.00
0.004
37.24

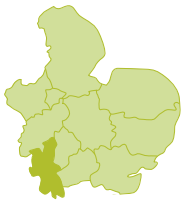
Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Barton le Clay, Bedford, Biggleswade, Bletsoe, Clophill, Dunstable, Flitwick, Leighton Linslade, Marston Moretaine, Poppyhill, Sandy.

For 'WRC – descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

BUCKINGHAMSHIRE





17,312
homes planned to 2025

46,000
homes planned to 2045

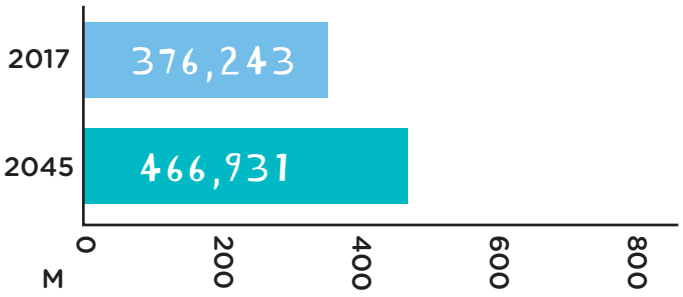
39,569
new people to 2025

91,321
new people to 2045

£7.66m
investment to 2025

£91.90m
investment to 2045

Increase in PE from 2017 to 2045

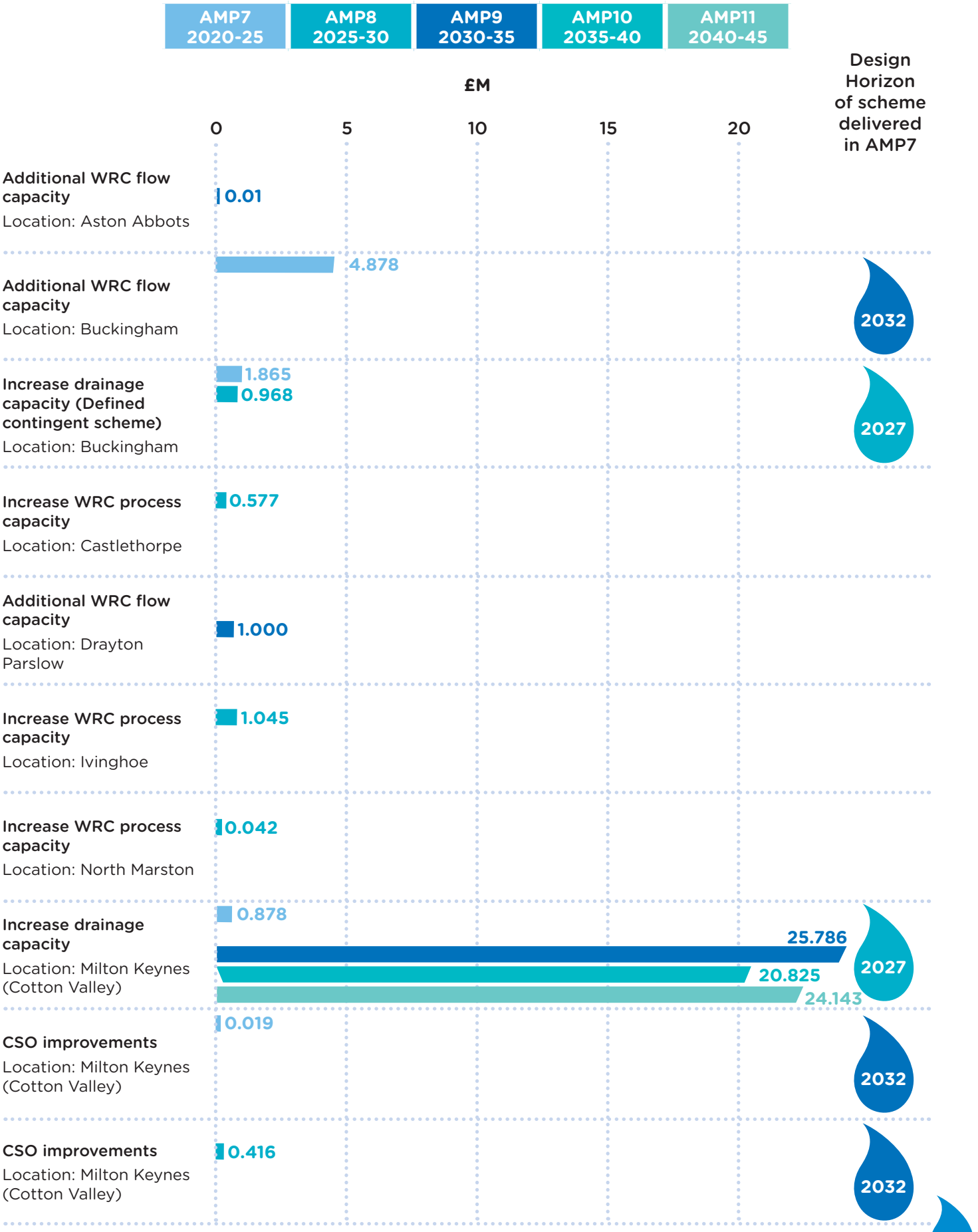


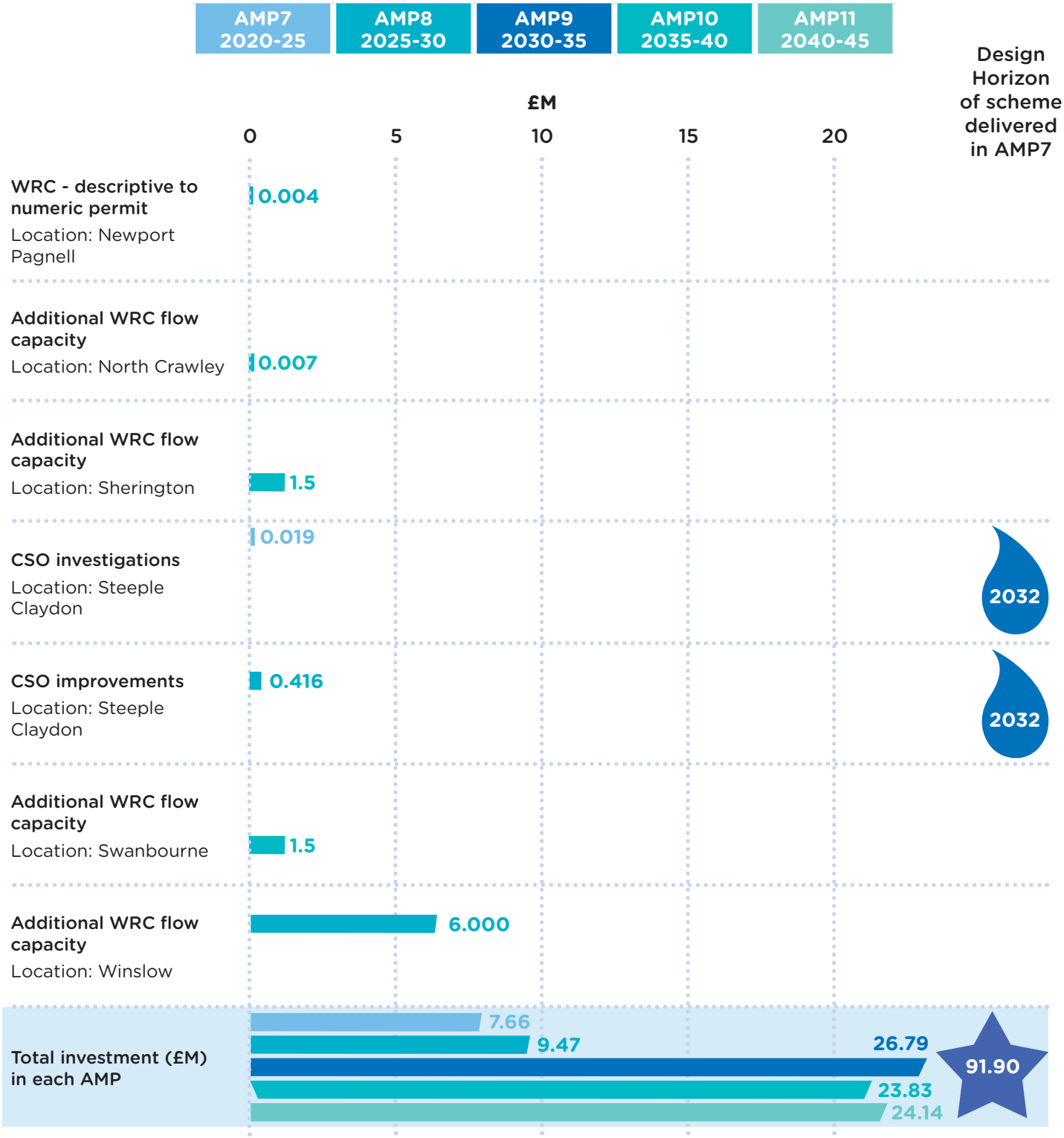
Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Buckingham	18,020	18,452	102,011	17	11	19
Hanslope	2,272	2,329	13,695	2	75	117
Lavendon	1,300	1,316	5,246	–	2	3
Milton Keynes (Cotton Valley)	263,409	315,916	1,685,526	14	10	23
Olney	7,217	7,595	45,646	1	3	5
Preston Bissett	239	241	1,597	–	5	24
Steeple Claydon	2,578	2,619	16,745	–	8	24

We serve a limited part of Buckinghamshire, part of Aylesbury Vale District only together with MK.

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.





Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Hanslope, Lavendon, Milton Keynes, Olney, Winslow.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

CAMBRIDGESHIRE

29,399
homes planned to 2025

87,044
homes planned to 2045

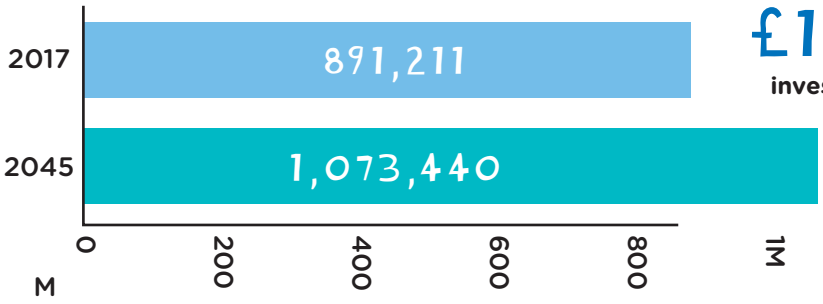
62,384
new people to 2025

161,894
new people to 2045

£118.26m
investment to 2025

£332.27m
investment to 2045

Increase in PE from 2017 to 2045

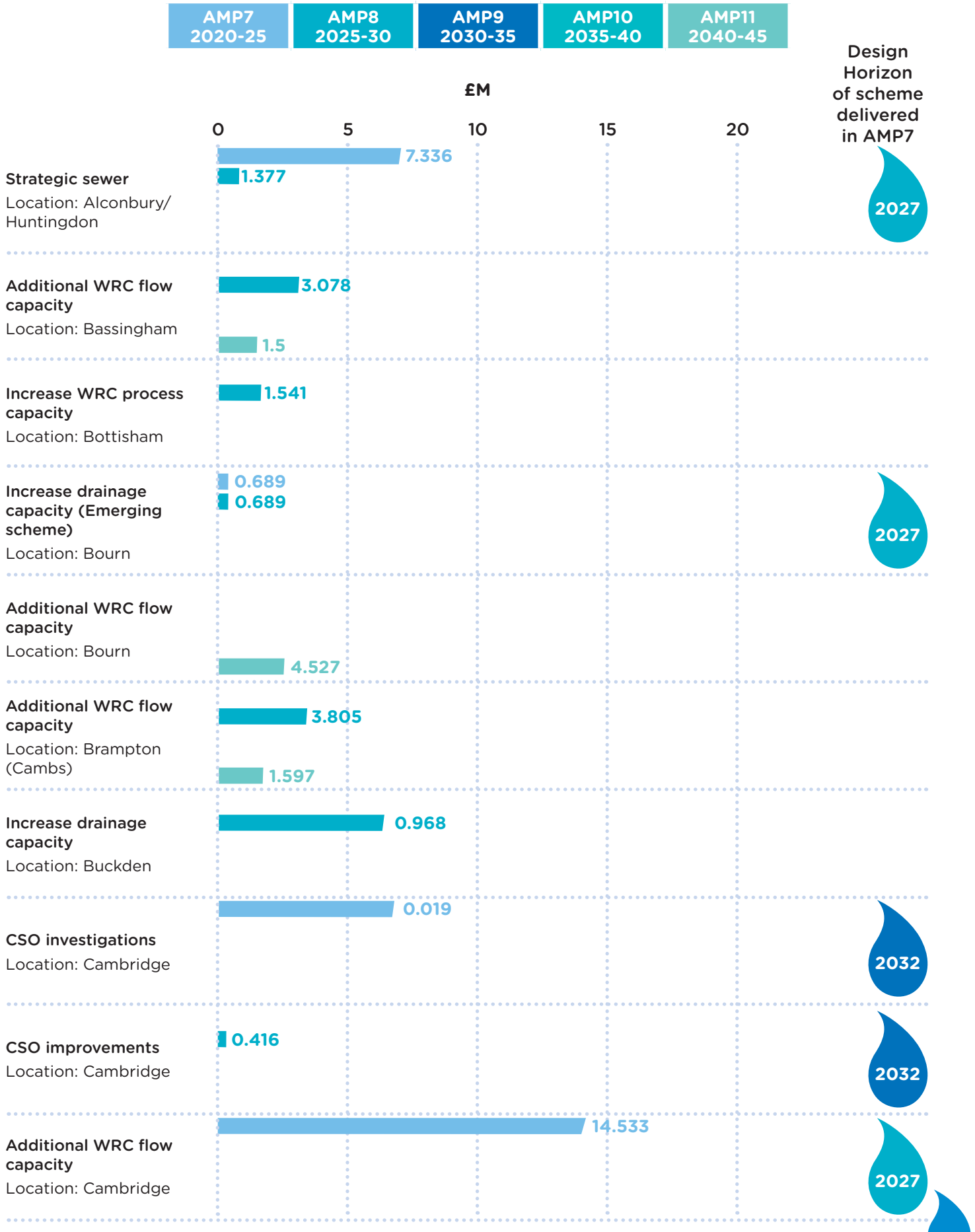


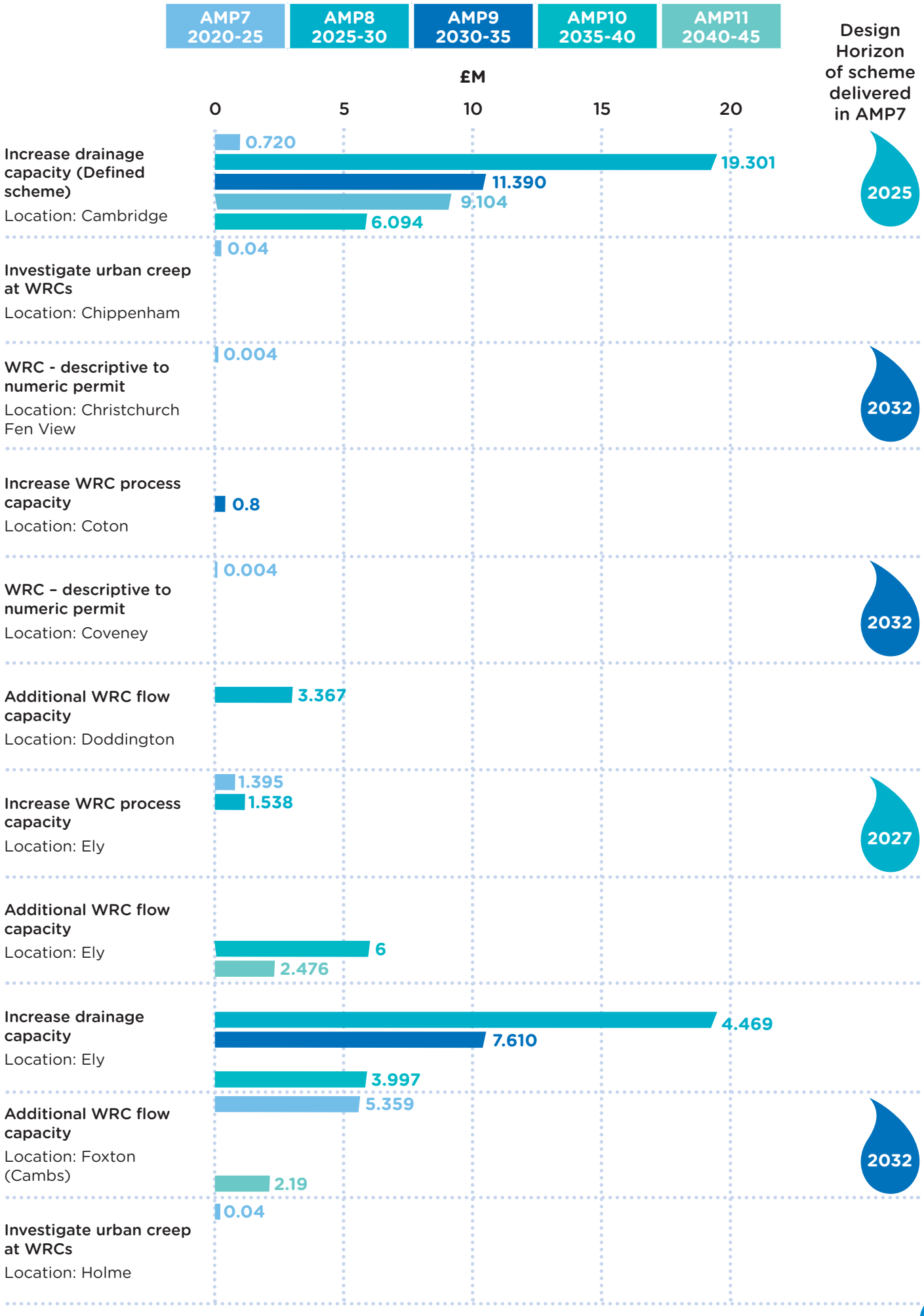
Subject to external growth rates.

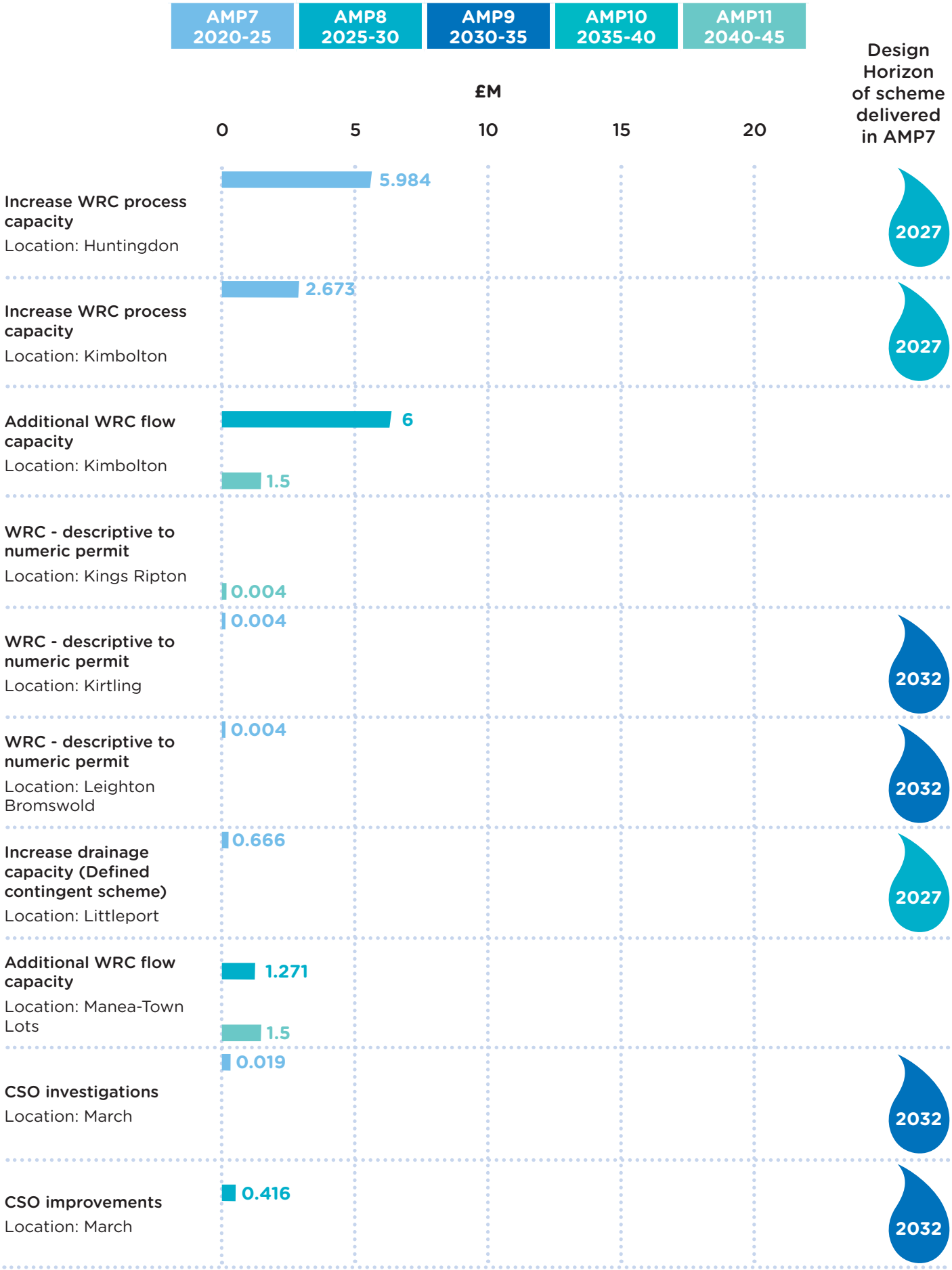
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Alconbury	3,432	3,752	24,164	1	12	27
Bourn	2,932	3,062	60,719	4	3	52
Brampton	5,455	5,519	25,904	2	26	52
Cambridge	148,789	166,206	777,104	7	9	17
Chatteris-Nightlayer Fen	10,506	10,959	55,927	4	13	22
Chippenham	424	433	2,063	1	12	26
Christchurch-Fen View	319	324	4,729	–	9	24
Coveney	251	262	2,519	1	16	30
Ely	19,275	20,571	147,363	8	28	79
Foxton (Cambs)	6,002	6,144	46,259	4	2	21
Haslingfield	9,174	9,566	76,989	6	3	7
Huntingdon (Godmanchester)	36,281	39,370	235,554	10	24	60
Kennett	124	125	878	–	12	27
Kimbolton	3,829	3,887	34,391	4	13	33
Kirtling	199	201	5,252	1	–	–
Linton	5,964	6,515	30,614	2	3	6
Littleport	7,268	7,801	37,252	6	11	12

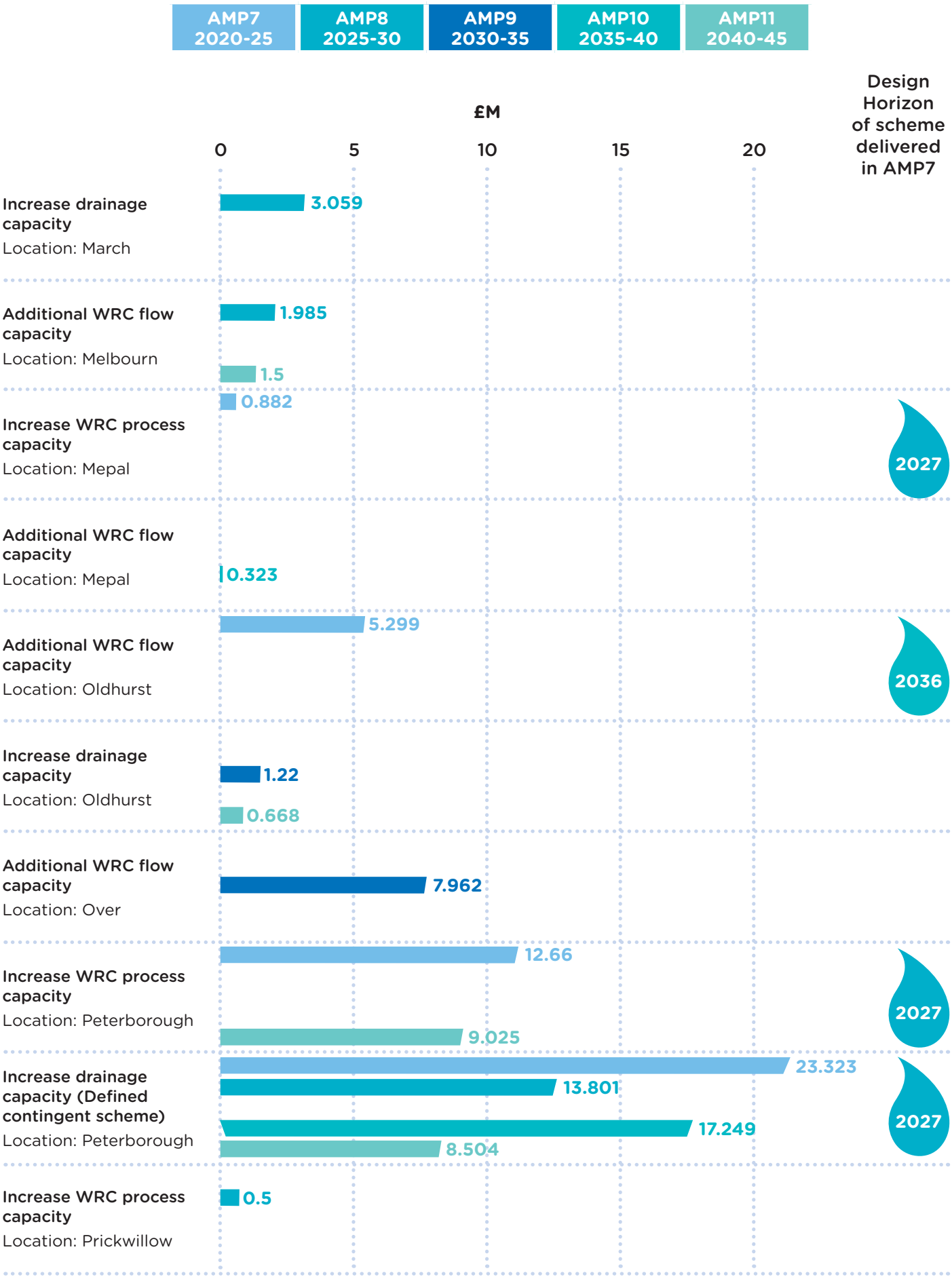
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
March	20,821	21,533	115,915	9	11	12
Melbourn	6,721	7,444	28,848	2	3	10
Mepal	1,023	1,039	9,897	2	11	25
Oldhurst	4,841	5,073	44,771	4	17	35
Over	12,607	13,093	65,630	4	3	12
Papworth Everard	4,708	4,805	46,182	6	3	7
Peterborough (Flag Fen)	196,139	213,263	1,190,564	55	7	18
Ramsey	9,927	10,068	60,026	13	15	19
Sawtry	6,167	6,257	39,537	5	6	19
Soham	13,938	14,508	71,216	6	7	24
Somersham	7,458	7,546	41,326	2	9	29
St Ives	16,492	16,900	90,877	9	6	24
St Neots	39,126	40,194	160,638	12	7	24
Stibbington	1,145	1,987	15,905	4	4	16
Stretham	1,749	1,782	6,600	3	13	27
Teversham	6,023	6,260	41,229	2	3	13
Tilbrook	165	167	2,283	–	1	19
Uttons Drove	18,745	19,385	129,539	7	3	8
Waterbeach	6,244	6,496	18,379	1	8	25
West Walton	41,401	104,677	330,959	9	9	21
Whittlesey	14,973	15,170	67,738	6	13	19
Wittering	4,588	4,631	5,779	1	9	19
Wyton	1,613	1,777	emerging – unknown	emerging – unknown	9	27

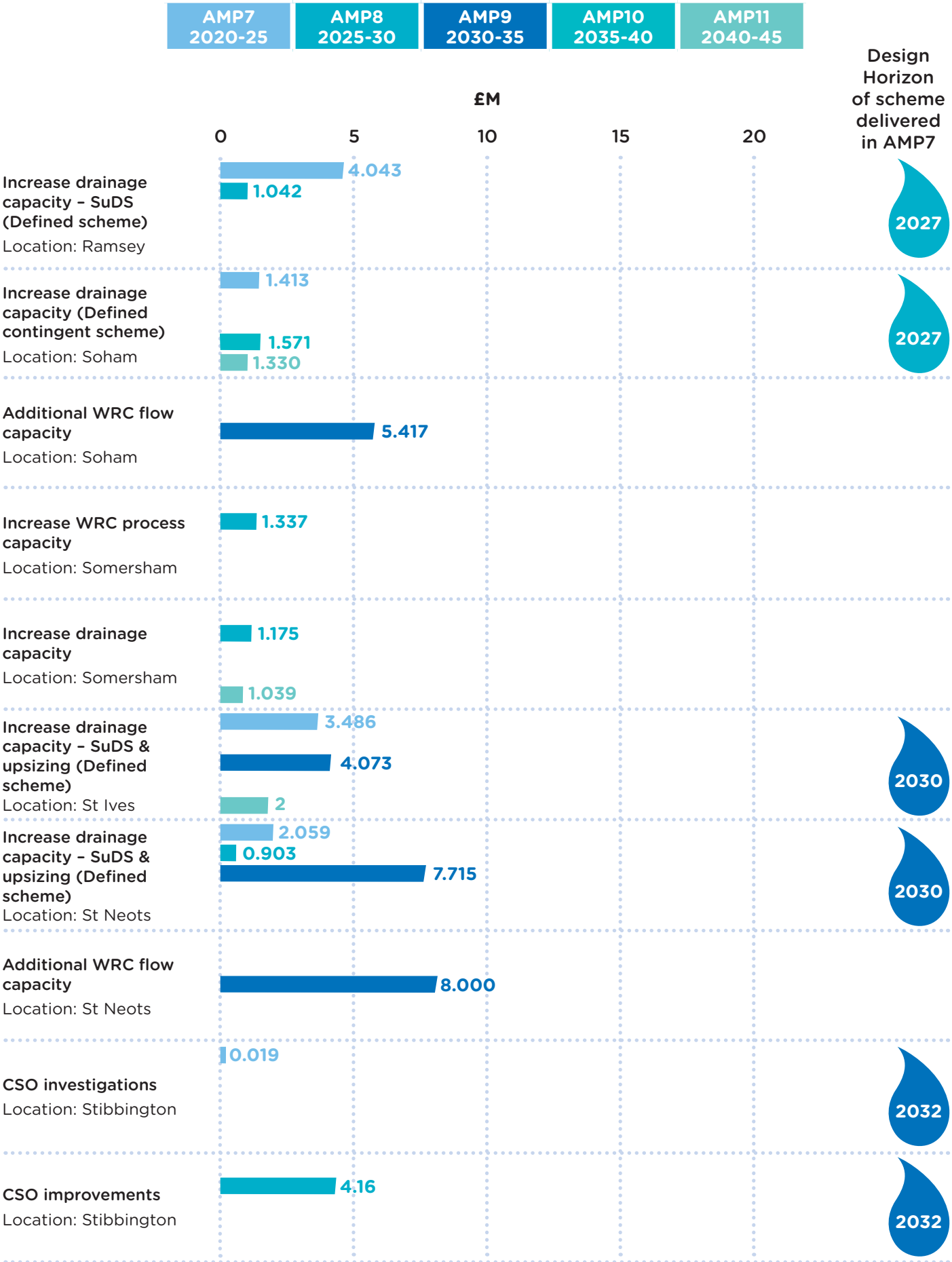
The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.

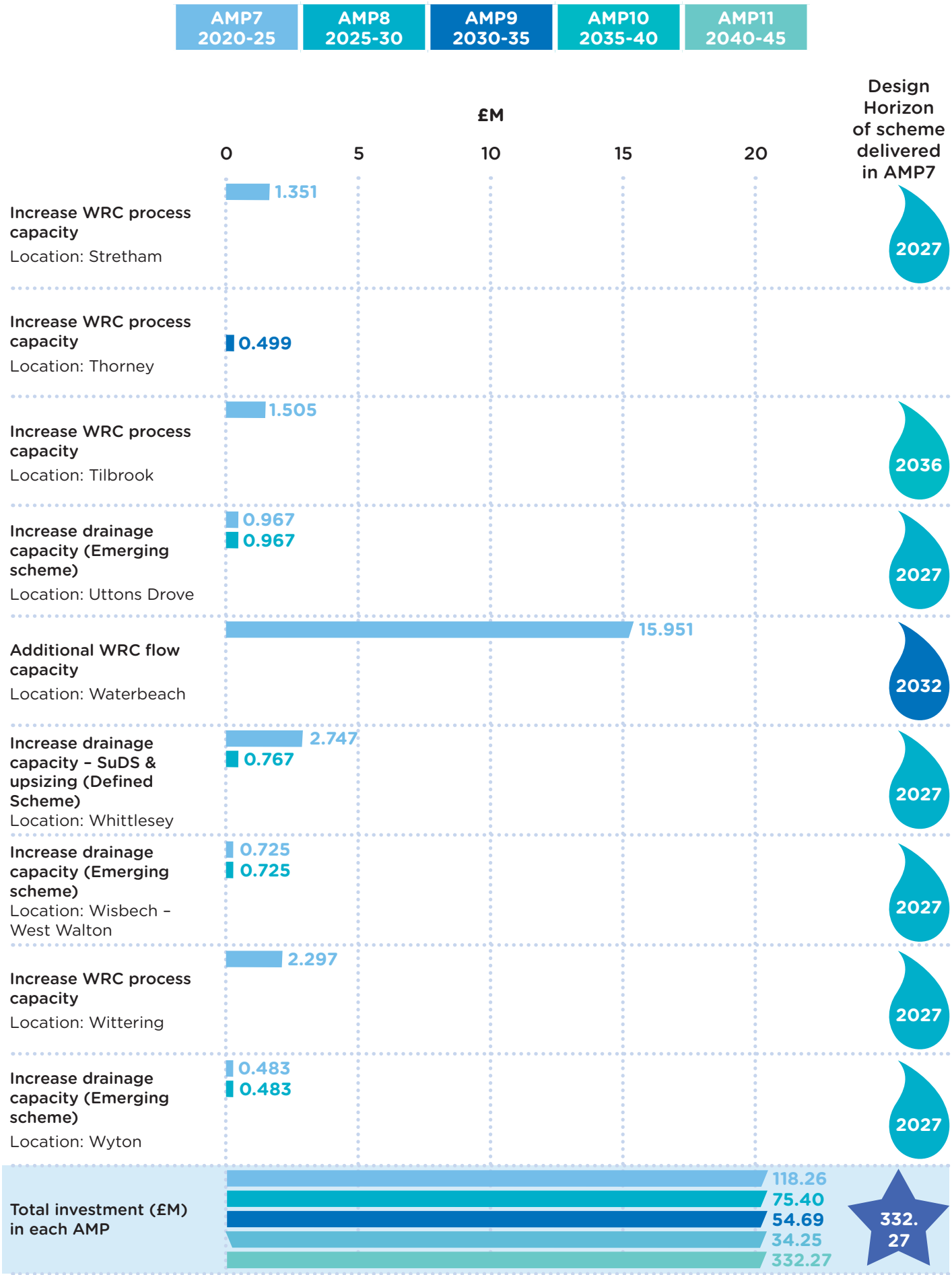



AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase drainage capacity (Defined scheme)
Location: Cambridge
0.720
19.301
11.390
9.104
6.094
2025
Investigate urban creep at WRCs
Location: Chippenham
0.04
WRC - descriptive to numeric permit
Location: Christchurch Fen View
0.004
2032
Increase WRC process capacity
Location: Coton
0.8
WRC – descriptive to numeric permit
Location: Coveney
0.004
2032
Additional WRC flow capacity
Location: Doddington
3.367
Increase WRC process capacity
Location: Ely
1.395
1.538
2027
Additional WRC flow capacity
Location: Ely
6
2.476
Increase drainage capacity
Location: Ely
4.469
7.610
3.997
Additional WRC flow capacity
Location: Foxton (Cambs)
5.359
2.19
2032
Investigate urban creep at WRCs
Location: Holme
0.04


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase WRC process capacity
Location: Huntingdon
5.984
2027
Increase WRC process capacity
Location: Kimbolton
2.673
2027
Additional WRC flow capacity
Location: Kimbolton
6
1.5
WRC - descriptive to numeric permit
Location: Kings Ripton
0.004
WRC - descriptive to numeric permit
Location: Kirtling
0.004
2032
WRC - descriptive to numeric permit
Location: Leighton Bromswold
0.004
2032
Increase drainage capacity (Defined contingent scheme)
Location: Littleport
0.666
2027
Additional WRC flow capacity
Location: Manea-Town Lots
1.271
1.5
CSO investigations
Location: March
0.019
2032
CSO improvements
Location: March
0.416
2032


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase drainage capacity
Location: March
3.059
Additional WRC flow capacity
Location: Melbourn
1.985
1.5
Increase WRC process capacity
Location: Mepal
0.882
2027
Additional WRC flow capacity
Location: Mepal
0.323
Additional WRC flow capacity
Location: Oldhurst
5.299
2036
Increase drainage capacity
Location: Oldhurst
1.22
0.668
Additional WRC flow capacity
Location: Over
7.962
Increase WRC process capacity
Location: Peterborough
12.66
9.025
2027
Increase drainage capacity (Defined contingent scheme)
Location: Peterborough
23.323
13.801
17.249
8.504
2027
Increase WRC process capacity
Location: Prickwillow
0.5


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase drainage capacity – SuDS (Defined scheme)
Location: Ramsey
4.043
1.042
2027
Increase drainage capacity (Defined contingent scheme)
Location: Soham
1.413
1.571
1.330
2027
Additional WRC flow capacity
Location: Soham
5.417
Increase WRC process capacity
Location: Somersham
1.337
Increase drainage capacity
Location: Somersham
1.175
1.039
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: St Ives
3.486
4.073
2
2030
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: St Neots
2.059
0.903
7.715
2030
Additional WRC flow capacity
Location: St Neots
8.000
0.019
CSO investigations
Location: Stibbington
2032
CSO improvements
Location: Stibbington
4.16
2032


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase WRC process capacity
Location: Stretham
1.351
2027
Increase WRC process capacity
Location: Thorney
0.499
Increase WRC process capacity
Location: Tilbrook
1.505
2036
Increase drainage capacity (Emerging scheme)
Location: Uttons Drove
0.967
0.967
2027
Additional WRC flow capacity
Location: Waterbeach
15.951
2032
Increase drainage capacity – SuDS & upsizing (Defined Scheme)
Location: Whittlesey
2.747
0.767
2027
Increase drainage capacity (Emerging scheme)
Location: Wisbech – West Walton
0.725
0.725
2027
Increase WRC process capacity
Location: Wittering
2.297
2027
Increase drainage capacity (Emerging scheme)
Location: Wyton
0.483
0.483
2027
Total investment (£M) in each AMP
118.26
75.40
54.69
34.25
332.27
332.27

Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Brampton, Bourn, Cambridge, Chatteris, Ely, Foxton, Haslingfield, Huntingdon, Kennett, Linton, Melbourn, March, Over, Papworth Everard, Peterborough, Ramsey, Sawtry, St Ives, St Neots, Soham, Somersham, Teversham, Uttons Drove, Waterbeach and Whittlesey.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

ESSEX

46,871
homes planned to 2025

144,549
homes planned to 2045

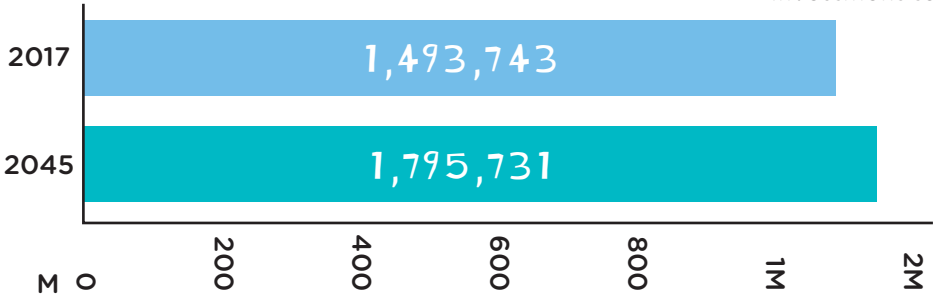
97,936
new people to 2025

274,684
new people to 2045

£73.90m
investment to 2025

£416.61m
investment to 2045

Increase in PE from 2017 to 2045

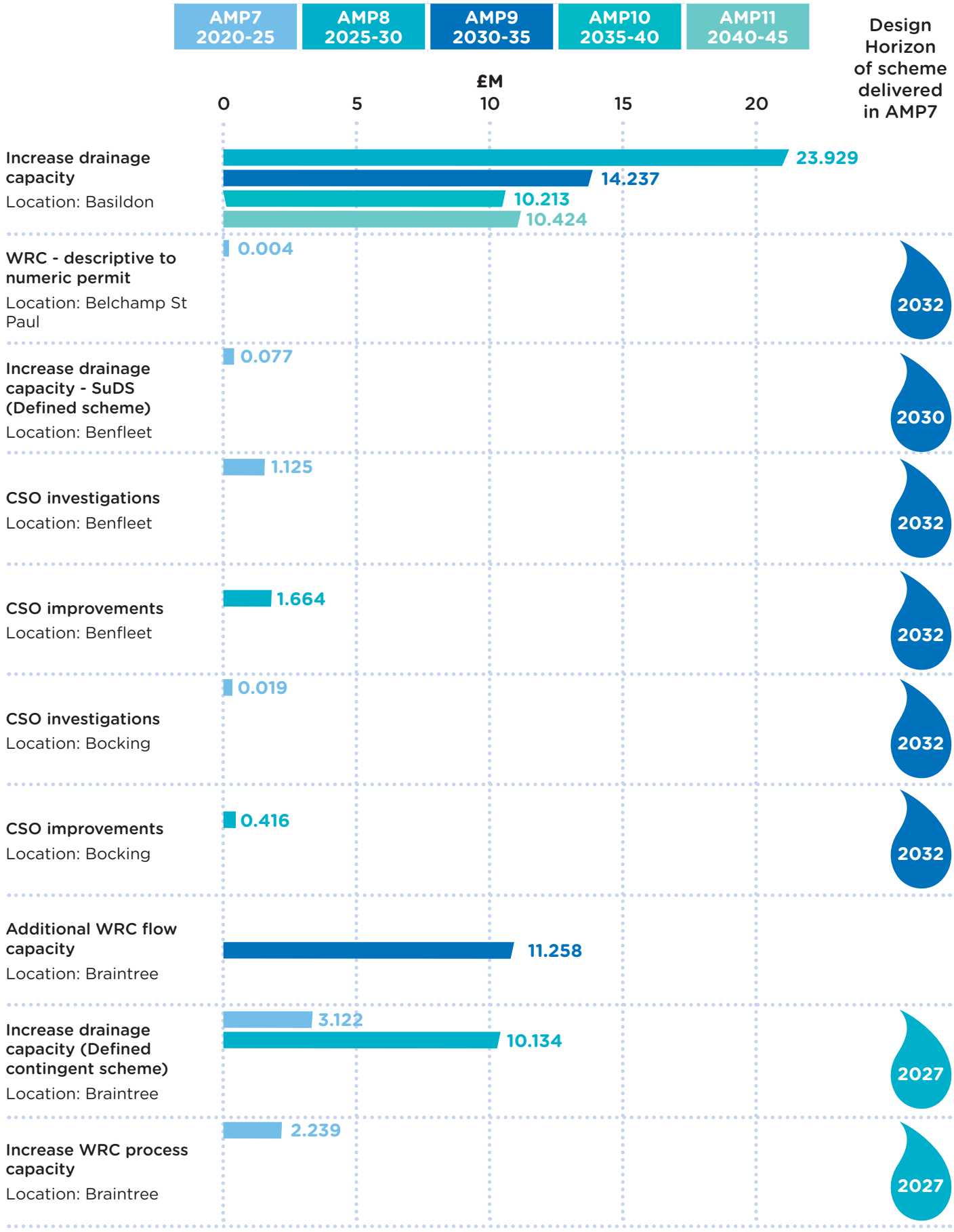


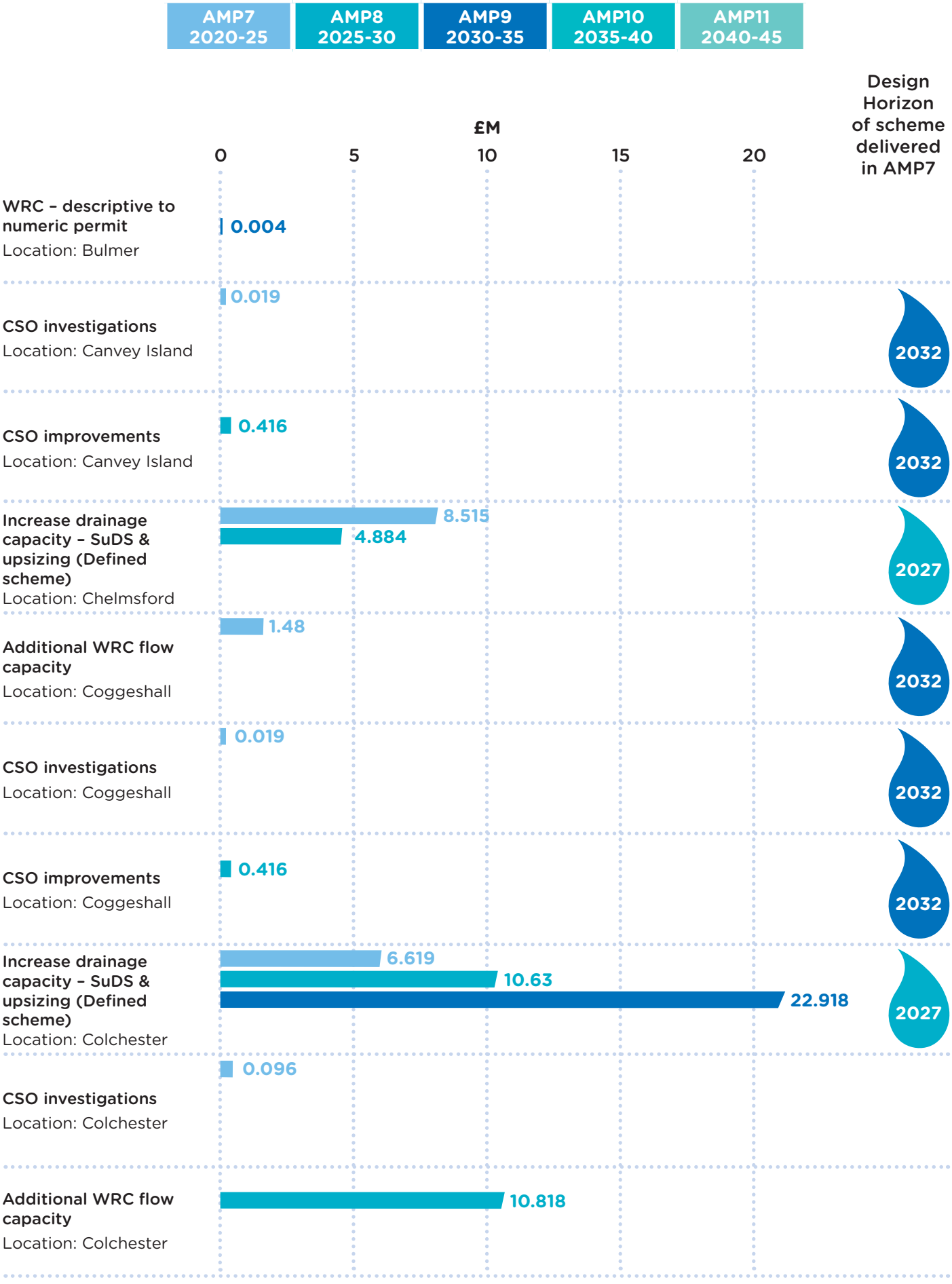
Subject to external growth rates.

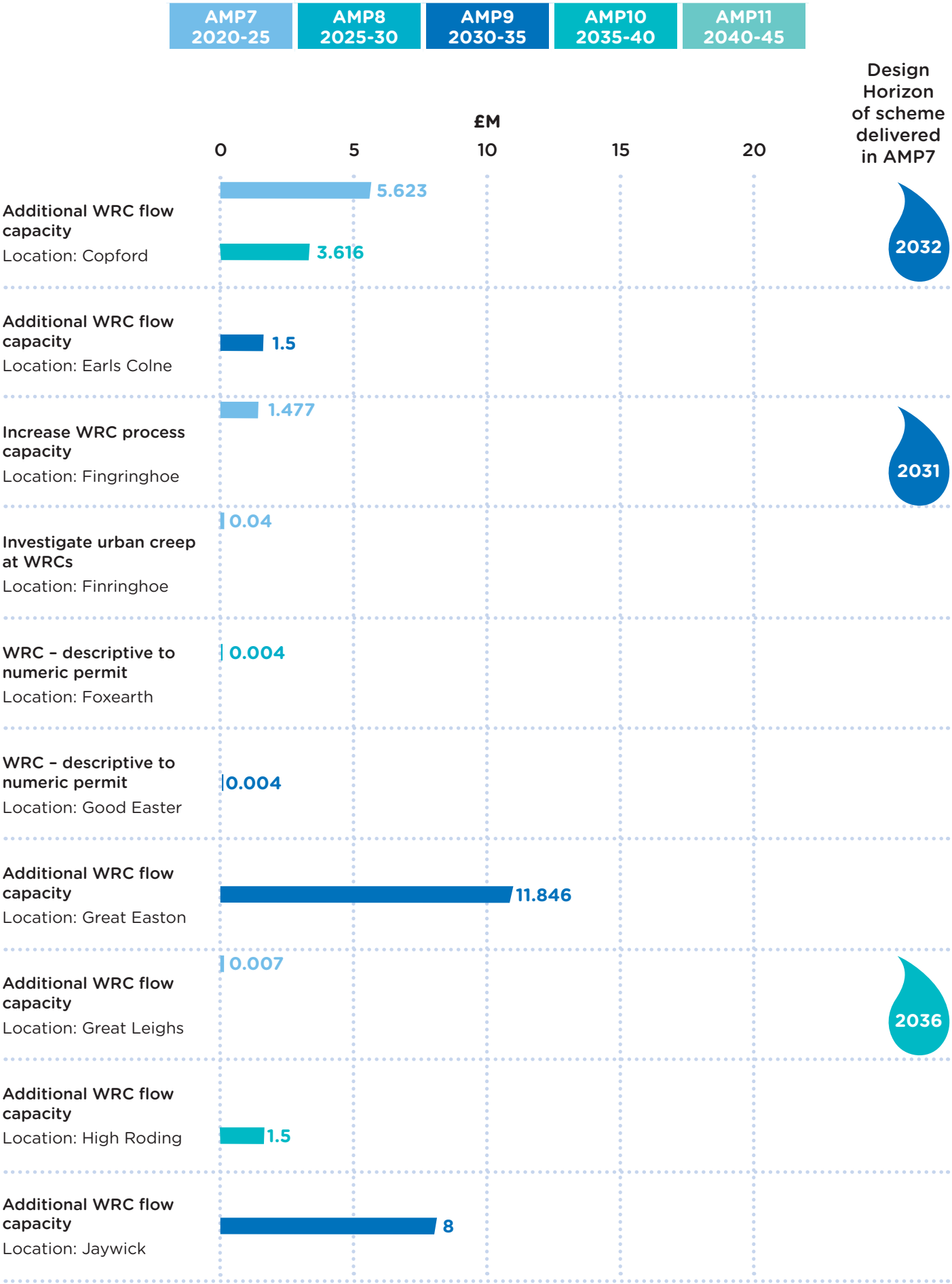
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Basildon	115,183	123,661	584,814	2	4	20
Belchamp St. Paul	270	274	4,837	–	14	31
Benfleet	27,017	27,514	155,543	13	6	14
Billericay	7,023	7,238	154,338	5	4	8
Bocking	19,287	19,761	91,648	4	19	29
Braintree	27,123	28,088	152,681	5	10	28
Burnham-on-Crouch	7,834	8,444	39,947	1	20	24
Canvey Island	36,613	38,858	200,848	10	3	3
Chelmsford	137,096	143,981	750,336	31	13	16
Clacton-Holland Haven	42,114	47,128	258,181	7	6	24
Coggeshall	9,273	9,469	47,512	3	21	42
Colchester	129,562	133,449	653,746	25	11	29
Copford	4,267	4,425	31,733	5	8	92
Felsted	5,667	5,843	39,390	–	10	32
Fingringhoe	1,900	1,927	18,577	3	7	16
Great Chesterford	2,886	3,370	25,331	3	9	32
Great Dunmow	8,674	8,964	52,705	1	10	32

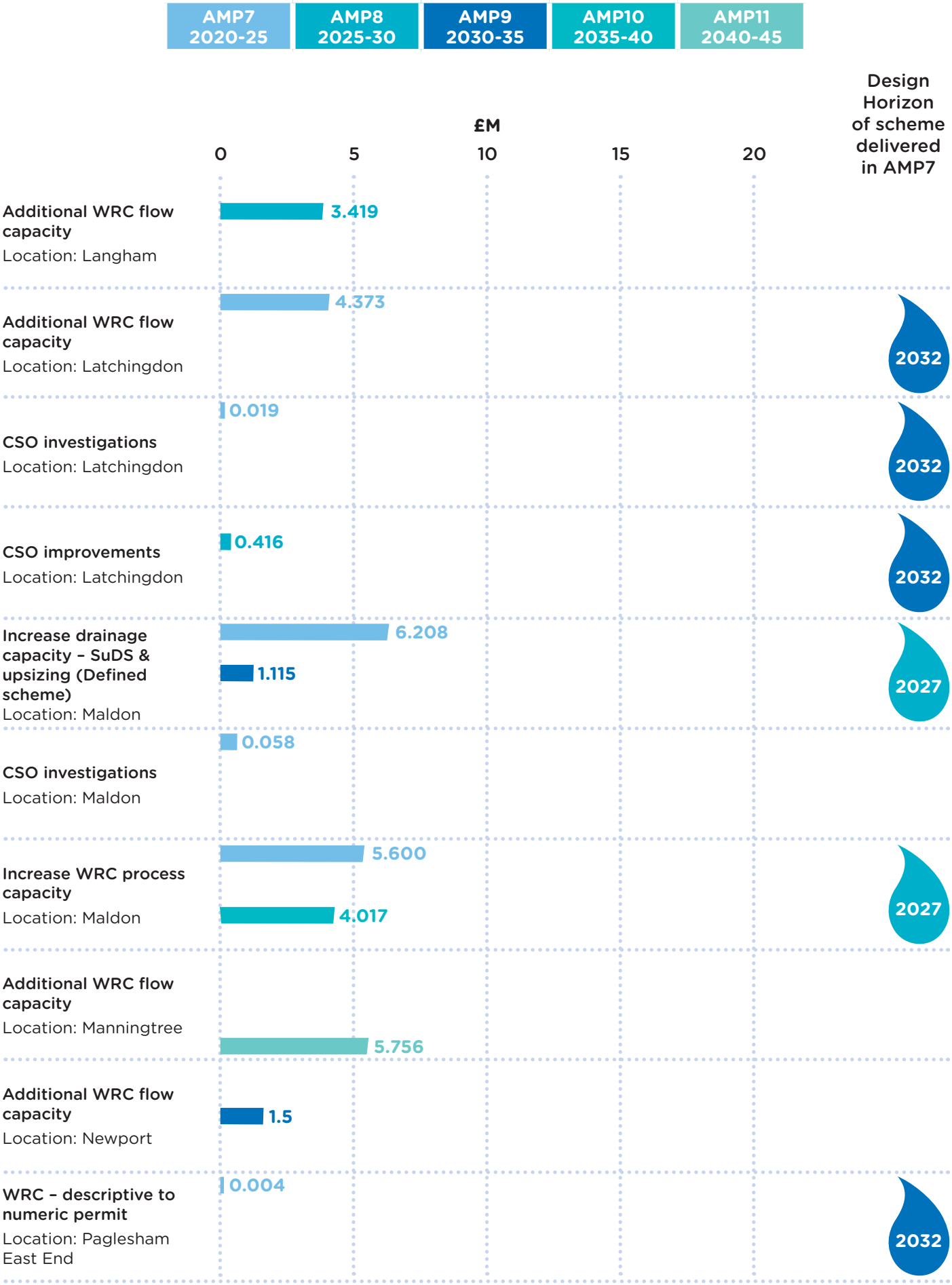
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Great Easton	3,190	3,302	25,933	2	2	30
Great Leighs	2,669	2,709	24,249	4	–	15
Greenstead Green	289	296	1,798	–	9	25
Halstead	13,206	13,604	67,781	–	10	15
Harwich and Dovercourt	20,955	23,605	149,877	8	6	24
Jaywick	21,772	27,185	115,423	6	5	21
Latchingdon	2,618	2,681	12,491	3	11	41
Maldon	21,705	23,052	143,109	6	27	39
Manningtree	9,459	9,687	64,019	9	4	11
Maylandsea	4,442	5,240	35,358	6	1	21
Newport	2,735	2,770	23,383	2	10	33
Paglesham-East End	134	502	2,912	2	4	7
Pebmarsh	388	392	3,266	–	12	19
Pitsea	21,982	22,434	117,375	2	4	8
Rayleigh-East	16,844	17,288	94,322	5	8	10
Rayleigh-West	21,876	22,234	128,316	11	7	18
Rayne	2,640	2,742	13,078	2	2	227
Rochford	32,976	33,662	232,744	18	5	16
Saffron Walden	15,453	16,348	61,630	4	3	22
Salcott	228	410	2,365	1	8	13
Shalford	633	652	7,117	–	6	11
Shenfield and Hutton	42,736	43,835	157,776	1	6	20
Southend	186,851	193,550	1,172,111	47	4	5
Southminster	3,857	3,925	21,322	4	7	19
Thurrock and Tilbury	132,209	153,922	674,170	4	4	19
Tiptree	9,513	10,051	67,034	4	7	11
Upminster	16,642	17,070	114,466	6	7	47
Walton on the Naze and Frinton	20,879	22,526	131,162	10	6	24
White Notley	3,973	4,109	21,621	2	3	26
Wickford	41,062	41,689	224,566	16	4	21
Witham	30,677	39,260	197,732	4	9	25

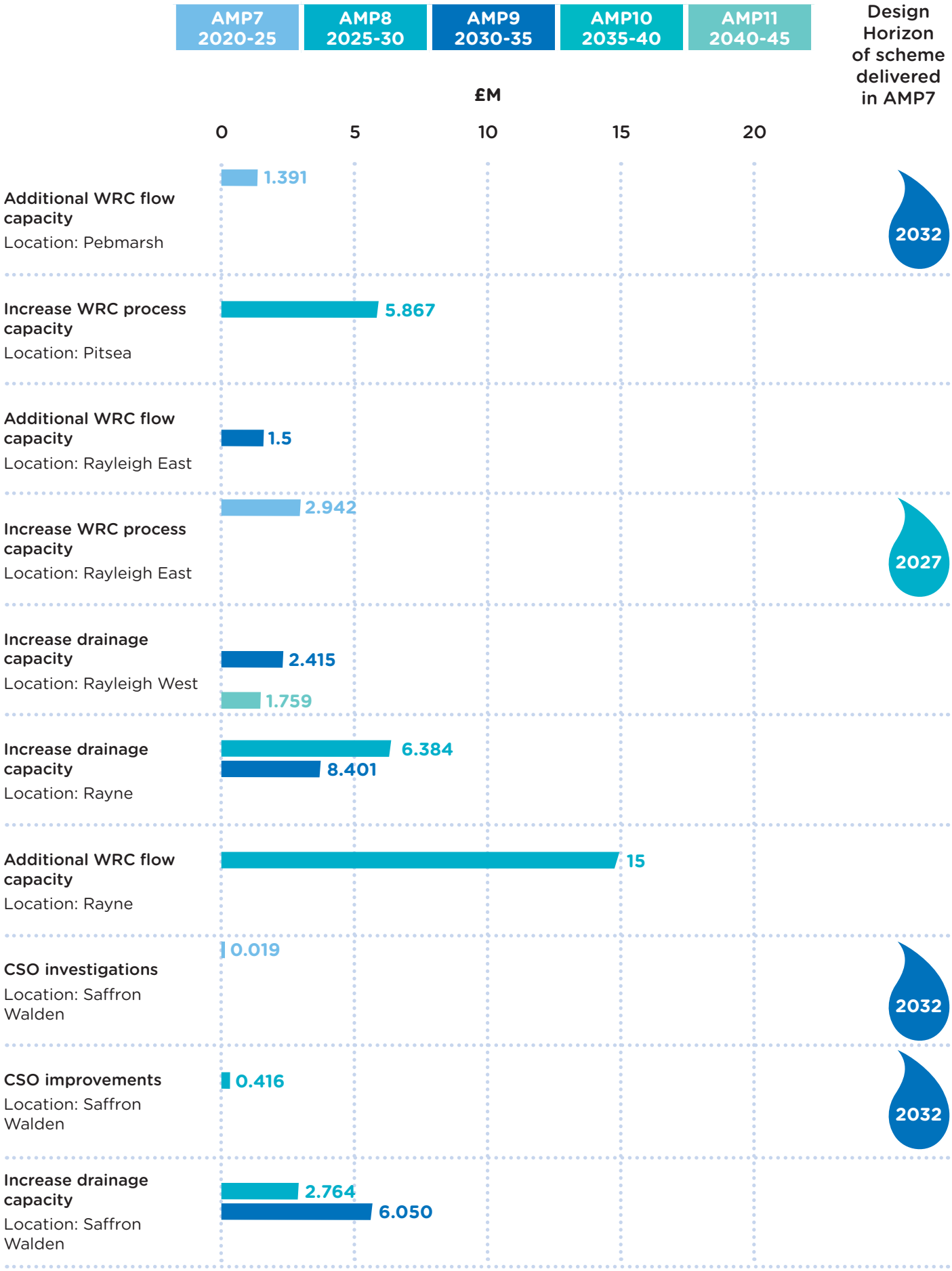
The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.

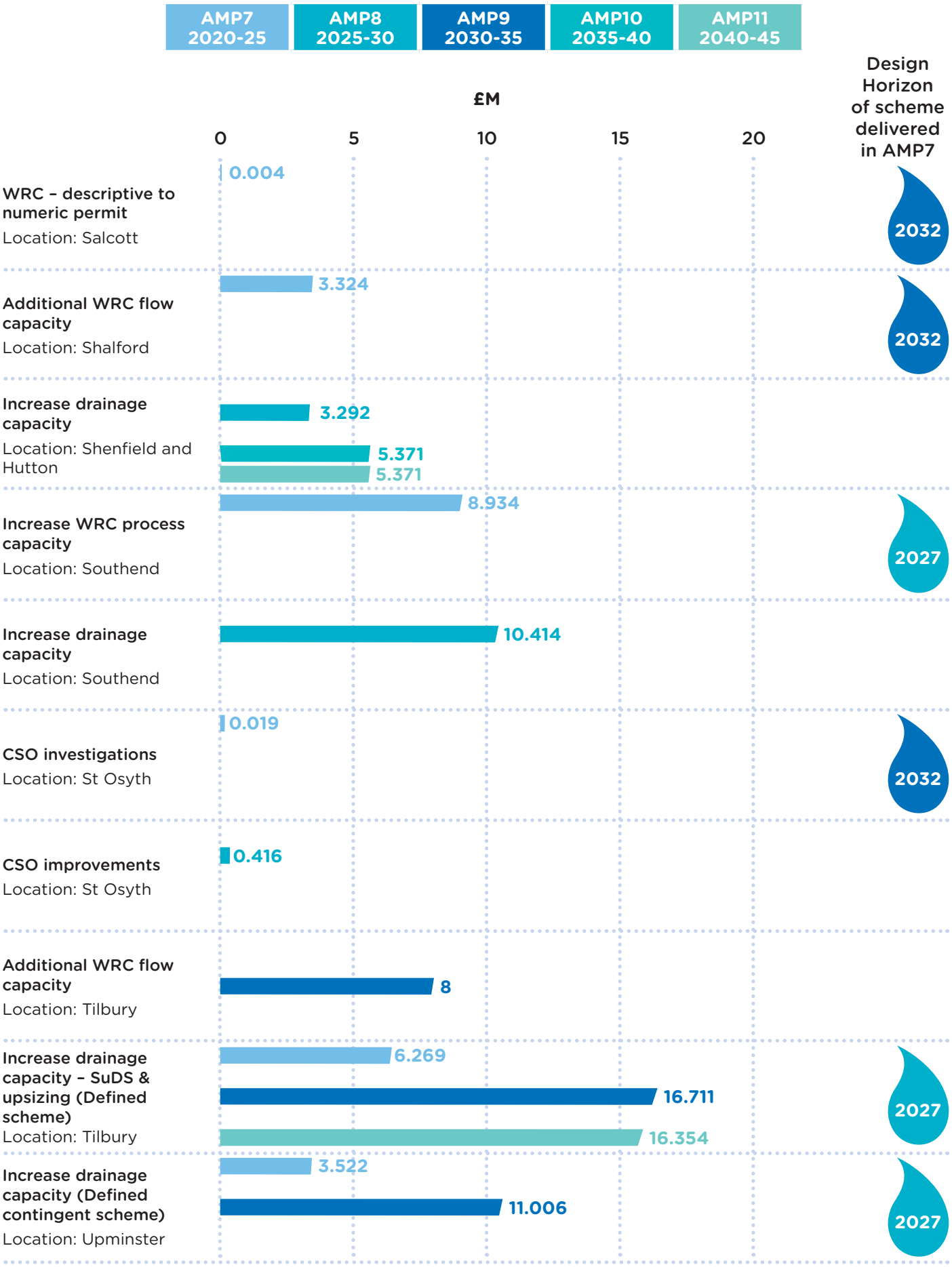


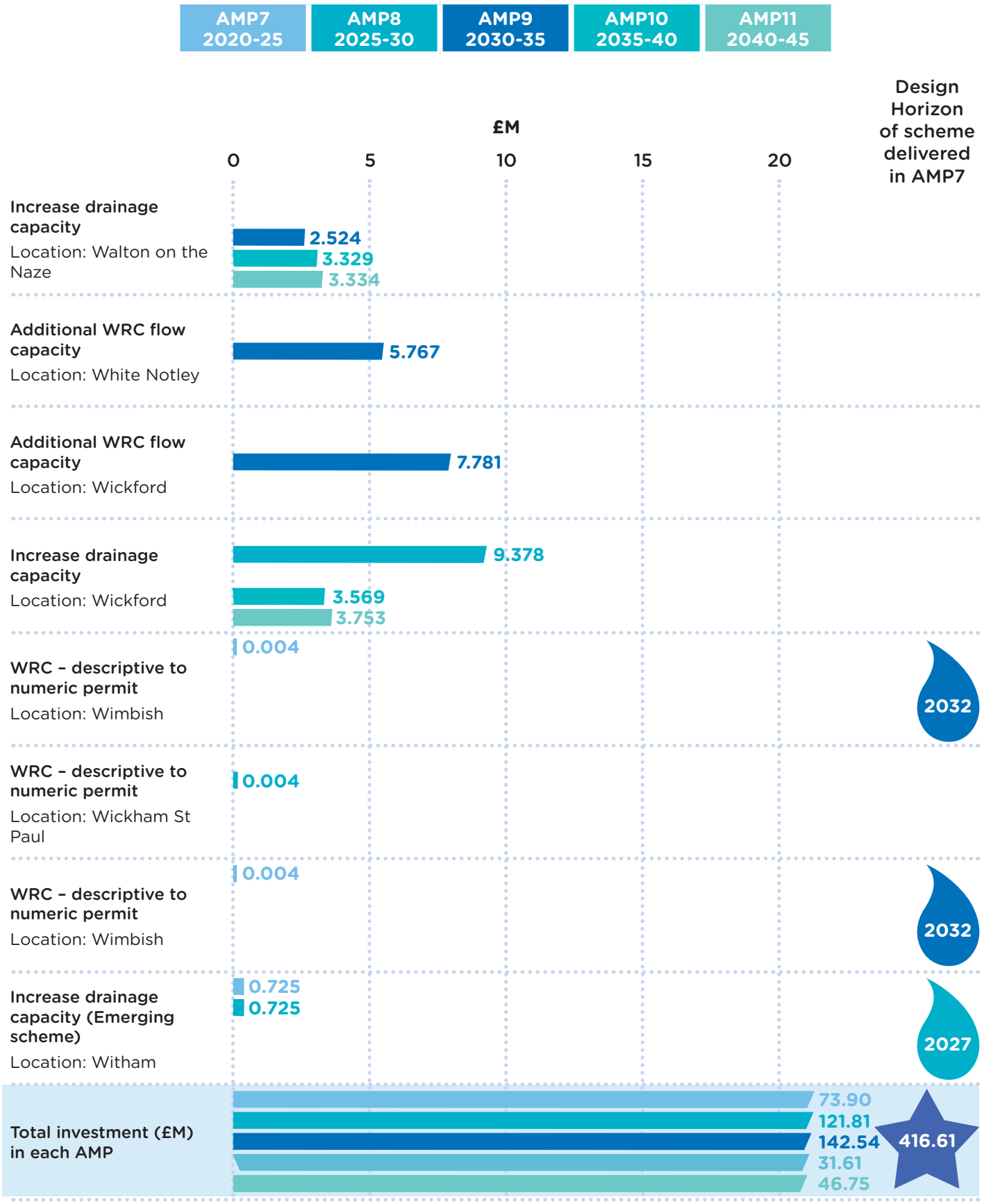

AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
WRC – descriptive to numeric permit
Location: Bulmer
0.004
CSO investigations
Location: Canvey Island
0.019
2032
CSO improvements
Location: Canvey Island
0.416
2032
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: Chelmsford
8.515
4.884
2027
Additional WRC flow capacity
Location: Coggeshall
1.48
2032
CSO investigations
Location: Coggeshall
0.019
2032
CSO improvements
Location: Coggeshall
0.416
2032
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: Colchester
6.619
10.63
22.918
2027
CSO investigations
Location: Colchester
0.096
Additional WRC flow capacity
Location: Colchester
10.818


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Additional WRC flow capacity
Location: Copford
5.623
3.616
2032
Additional WRC flow capacity
Location: Earls Colne
1.5
Increase WRC process capacity
Location: Fingringhoe
1.477
2031
Investigate urban creep at WRCs
Location: Finringhoe
0.04
WRC – descriptive to numeric permit
Location: Foxearth
0.004
WRC – descriptive to numeric permit
Location: Good Easter
0.004
Additional WRC flow capacity
Location: Great Easton
11.846
Additional WRC flow capacity
Location: Great Leighs
0.007
2036
Additional WRC flow capacity
Location: High Roding
1.5
Additional WRC flow capacity
Location: Jaywick
8


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Additional WRC flow capacity
Location: Langham
3.419
Additional WRC flow capacity
Location: Latchingdon
4.373
2032
CSO investigations
Location: Latchingdon
0.019
2032
CSO improvements
Location: Latchingdon
0.416
2032
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: Maldon
6.208
1.115
2027
CSO investigations
Location: Maldon
0.058
Increase WRC process capacity
Location: Maldon
5.600
4.017
2027
Additional WRC flow capacity
Location: Manningtree
5.756
Additional WRC flow capacity
Location: Newport
1.5
WRC – descriptive to numeric permit
Location: Paglesham East End
0.004
2032


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
Additional WRC flow capacity
Location: Pebmarsh
1.391
2032
Increase WRC process capacity
Location: Pitsea
5.867
Additional WRC flow capacity
Location: Rayleigh East
1.5
Increase WRC process capacity
Location: Rayleigh East
2.942
2027
Increase drainage capacity
Location: Rayleigh West
2.415
1.759
Increase drainage capacity
Location: Rayne
6.384
8.401
Additional WRC flow capacity
Location: Rayne
15
CSO investigations
Location: Saffron Walden
0.019
2032
CSO improvements
Location: Saffron Walden
0.416
2032
Increase drainage capacity
Location: Saffron Walden
2.764
6.050


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
WRC – descriptive to numeric permit
Location: Salcott
0.004
2032
Additional WRC flow capacity
Location: Shalford
3.324
2032
Increase drainage capacity
Location: Shenfield and Hutton
3.292
5.371
5.371
Increase WRC process capacity
Location: Southend
8.934
2027
Increase drainage capacity
Location: Southend
10.414
CSO investigations
Location: St Osyth
0.019
2032
CSO improvements
Location: St Osyth
0.416
Additional WRC flow capacity
Location: Tilbury
8
Increase drainage capacity – SuDS & upsizing (Defined scheme)
Location: Tilbury
6.269
16.711
16.354
2027
Increase drainage capacity (Defined contingent scheme)
Location: Upminster
3.522
11.006
2027

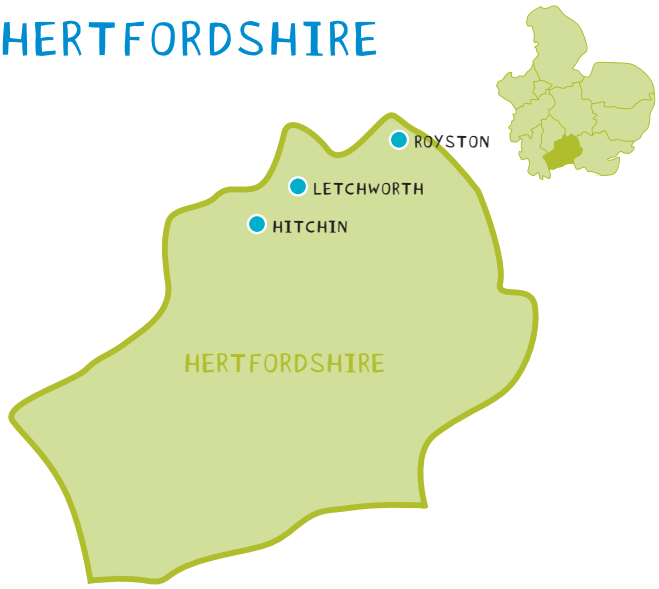

AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase drainage capacity
Location: Walton on the Naze
2.524
3.329
3.334
Additional WRC flow capacity
Location: White Notley
5.767
Additional WRC flow capacity
Location: Wickford
7.781
Increase drainage capacity
Location: Wickford
9.378
3.569
3.753
WRC – descriptive to numeric permit
Location: Wimbish
0.004
2032
WRC – descriptive to numeric permit
Location: Wickham St Paul
0.004
WRC – descriptive to numeric permit
Location: Wimbish
0.004
2032
Increase drainage capacity (Emerging scheme)
Location: Witham
0.725
0.725
2027
Total investment (£M) in each AMP
73.90
121.81
142.54
31.61
46.75
416.61

Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Basildon, Benfleet, Billericay, Braintree, Burnham-on-Crouch, Caister, Canvey Island, Chelmsford, Clacton, Coggeshall, Colchester, Copford, Felstead, Ipswich, Great Chesteron, Great Dunmow, Great Easton, Great Leighs, Greenstead Green, Halstead, Harwich and Dovercourt, Jaywick, Maldon, Manningtree, Maylandsea, Newport, Pitsea, Rayne, Rayleigh West, Rochford, Saffron Walden, Southend, Shenfield and Hutton, Southminster, Tilbury, Tiptree, Upminster, Walton on the Naze, Wickford, Witham, White Notley.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

HERTFORDSHIRE



5,142
homes planned to 2025

16,942
homes planned to 2045

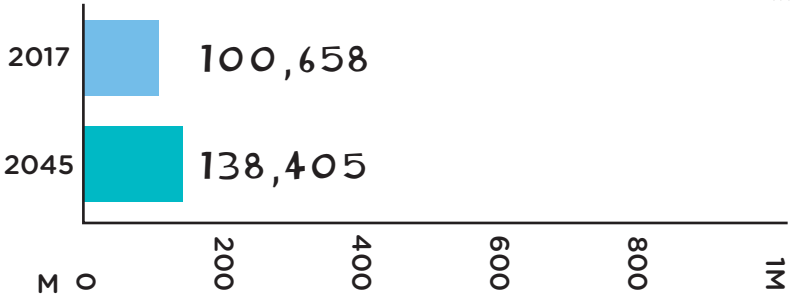
11,176
new people to 2025

31,433
new people to 2045

£–m
investment to 2025

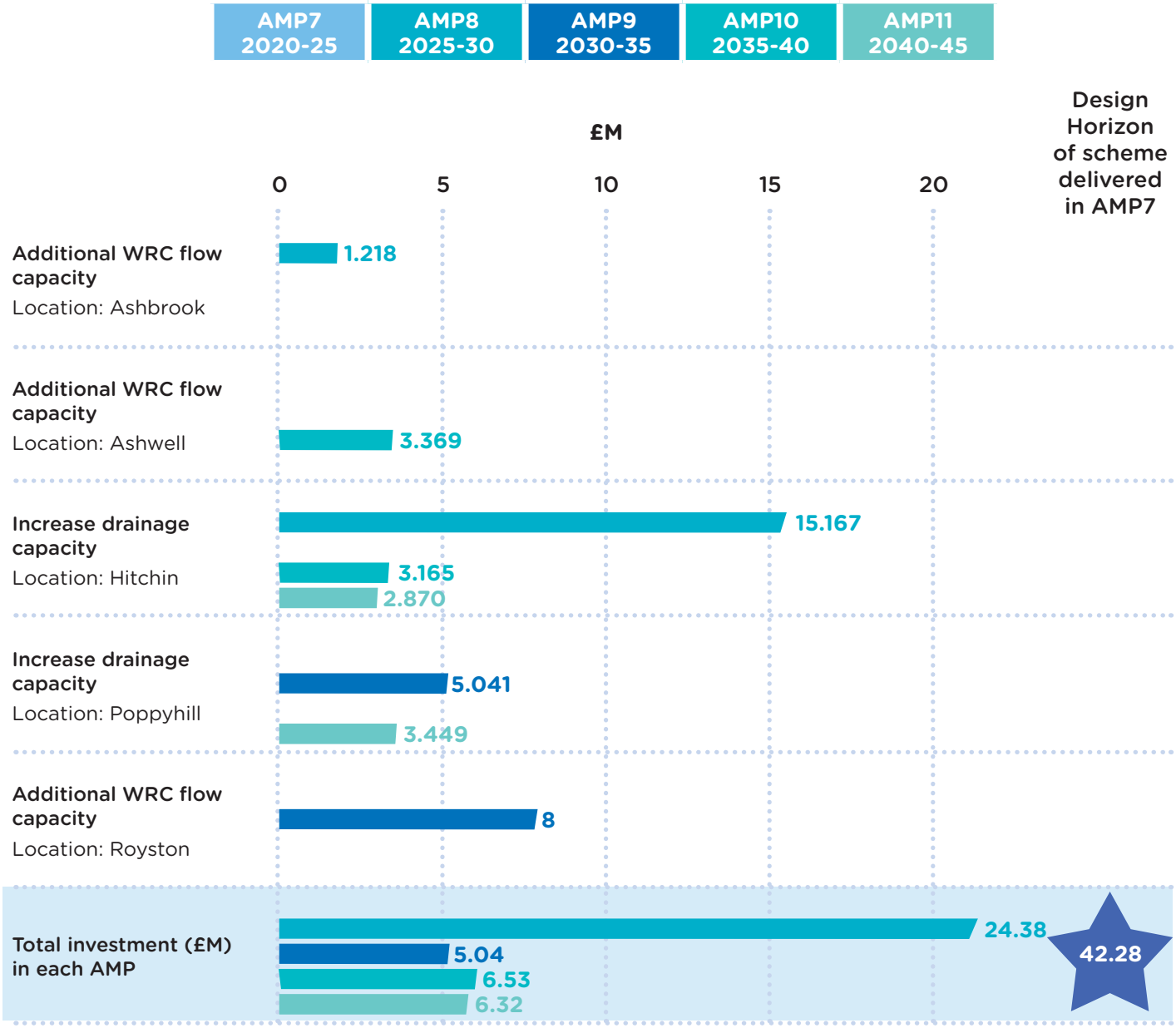
£42m
investment to 2045

Increase in PE from 2017 to 2045



Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Hitchin	33,475	34,800	186,672	4	10	10
Letchworth	41,612	44,028	290,285	3	8	27
Royston	14,688	15,743	51,344	3	10	32



Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at;Ashbrook, Hitchin, Letchworth, and Royston.

LEICESTERSHIRE

1,179
homes planned to 2025

2,460
homes planned to 2045

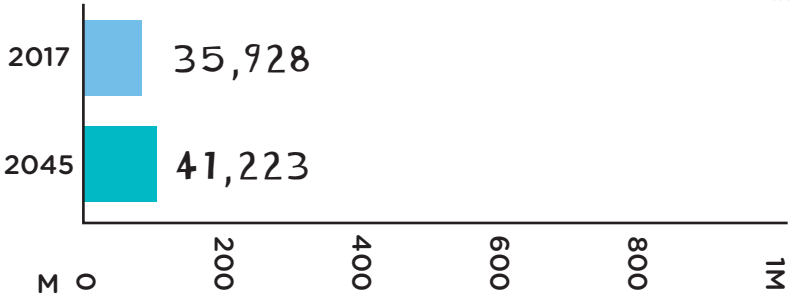
2,395
new people to 2025

4,293
new people to 2045

£0.09m
investment to 2025

£1.75m
investment to 2045

Increase in PE from 2017 to 2045

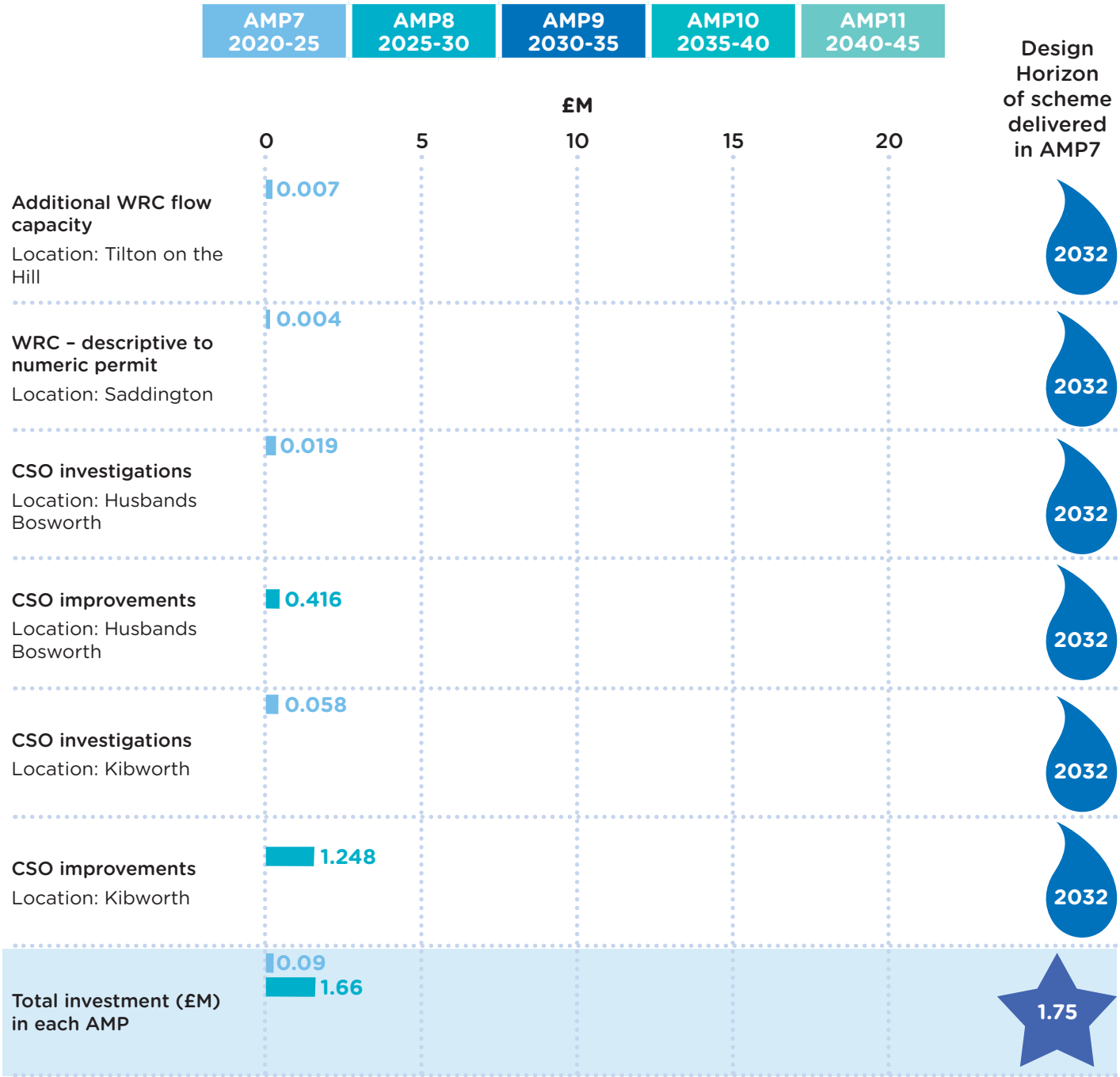


Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Husbands Bosworth	886	897	6,537	1	9	20
Kibworth	5,246	5,297	39,068	7	5	28
Market Harborough	24,117	24,552	133,556	4	7	7
Saddington	219	221	1,266	0	19	32
Tilton on the Hill	332	335	3,223	0	18	30

We serve a limited part of Leicestershire, part of Melton Borough and Harborough District only.

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.



Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Kibworth, Market Harborough, Saddington.

For 'WRC – descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

LINCOLNSHIRE

21,083
homes planned to 2025

79,493
homes planned to 2045

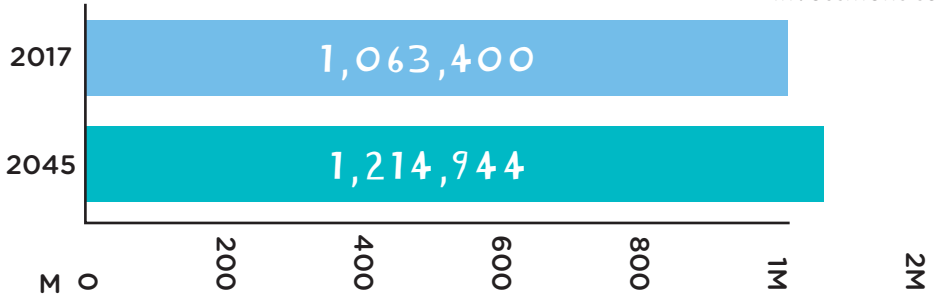
42,207
new people to 2025

144,506
new people to 2045

£36.30m
investment to 2025

£179.45m
investment to 2045

Increase in PE from 2017 to 2045

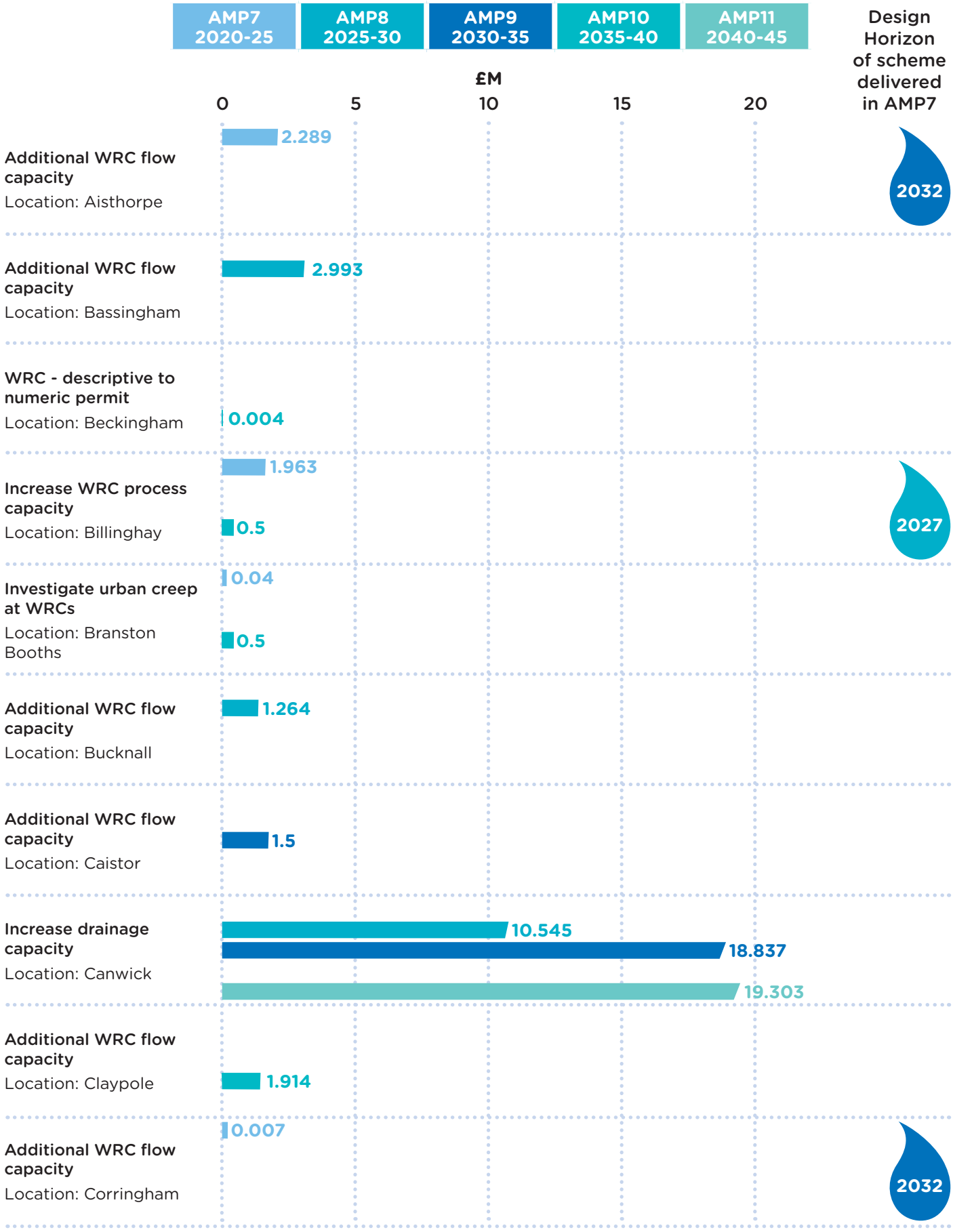


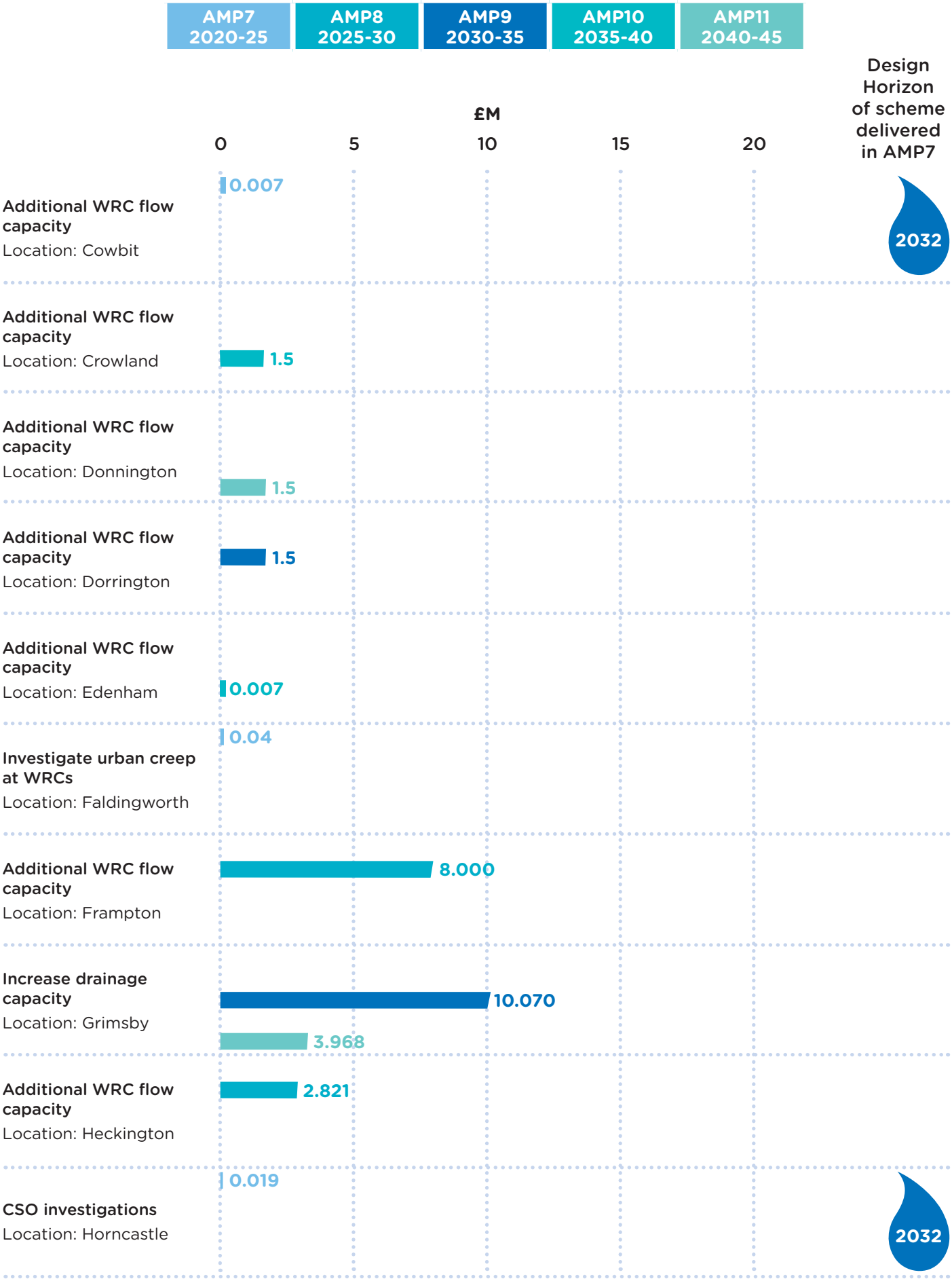
Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Aisthorpe	374	383	5,363	2	9	29
Billinghay	2,509	2,538	16,318	4	5	25
Boston	29,986	45,218	186,821	11	3	10
Bourne	21,563	29,785	135,253	6	3	18
Branston Booths	231	240	1,192	-	5	31
Canwick	110,163	117,893	619,598	5	3	24
Claypole	1,196	1,219	9,125	1	3	31
Corby Glen	904	921	6,679	-	7	18
Corringham	378	392	3,844	-	14	32
Cowbit	2,231	2,265	27,228	9	7	18
Cranwell	3,465	3,510	13,188	1	13	38
Deeping	17,094	17,867	91,753	6	5	6
Dunholme	5,652	5,752	37,740	2	10	30
Faldingworth	338	341	2,897	-	-	16
Fiskerton	1,002	1,356	5,067	3	8	23
Frampton	8,643	11,935	64,444	-	7	23
Grimsby-Pyewipe	88,347	138,215	516,469	13	7	18
Heckington	3,947	4,053	25,141	1	9	22

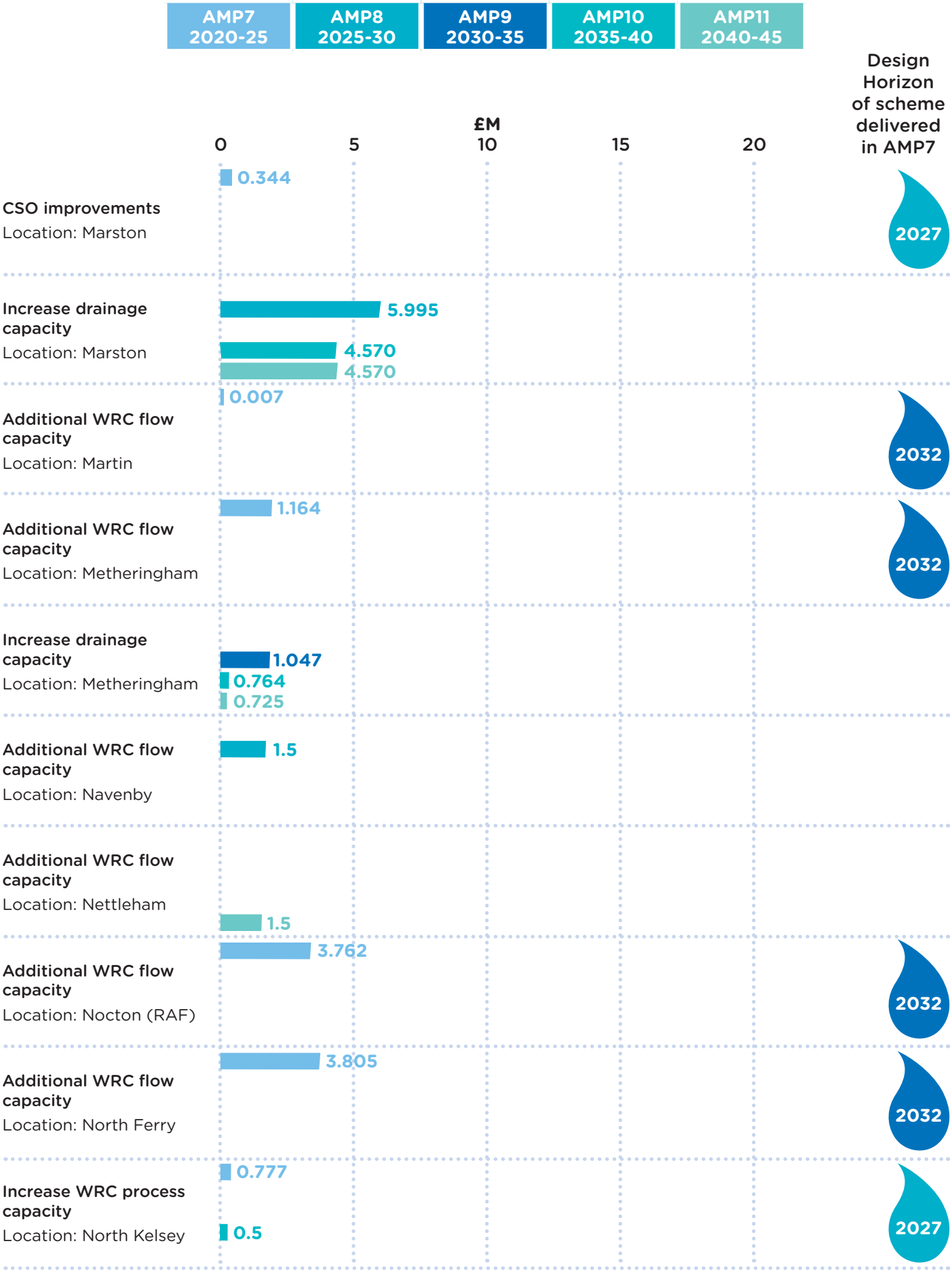
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Holbeach	8,721	9,167	46,623	–	4	55
Holton Le Clay	3,415	3,458	26,112	1	3	5
Horncastle	7,513	8,954	54,989	4	7	13
Ingoldsby	252	265	3,526	–	8	20
Little Ponton	47	48	1,974	–	2	14
Louth	20,053	21,063	36,130	9	3	5
Market Rasen	6,468	6,721	43,172	5	10	29
Marston	46,959	66,420	341,874	8	5	18
Martin	1,158	1,197	11,012	2	7	16
Metheringham	4,043	4,187	31,327	2	4	30
Nocton (RAF)	689	695	5,503	1	12	37
North Ferry	5,238	5,385	41,649	1	9	12
North Hykeham	19,189	19,904	79,992	3	3	7
North Kelsy	1,355	1,429	19,173	7	5	22
Owmby	616	622	2,476	–	5	24
Reepham	7,327	7,746	48,992	3	9	27
Sibsey	1,529	1,713	14,102	1	3	28
Skellingthorpe	4,405	4,676	43,823	9	8	14
Sleaford	17,350	17,946	119,871	4	3	14
South Hykeham	3,329	3,553	68,653	7	5	75
South Killingholme	1,795	2,005	26,917	3	626	648
Spalding	30,843	74,832	208,371	6	4	8
Spilsby	4,140	4,391	32,614	3	3	6
Stamford	21,702	22,207	118,065	6	3	7
Surfleet	925	942	10,708	6	15	25
Swinderby	2,467	2,488	976	–	–	5
Tetney-Newton Marsh	51,679	56,623	14	14	6	9
Toynton	276	279	4,286	0	7	16
Washingborough	3,335	3,405	72,947	6	5	59
Winteringham	8,270	9,051	94,653	13	8	14
Woodhall Spa	4,404	5,074	35,588	3	3	12

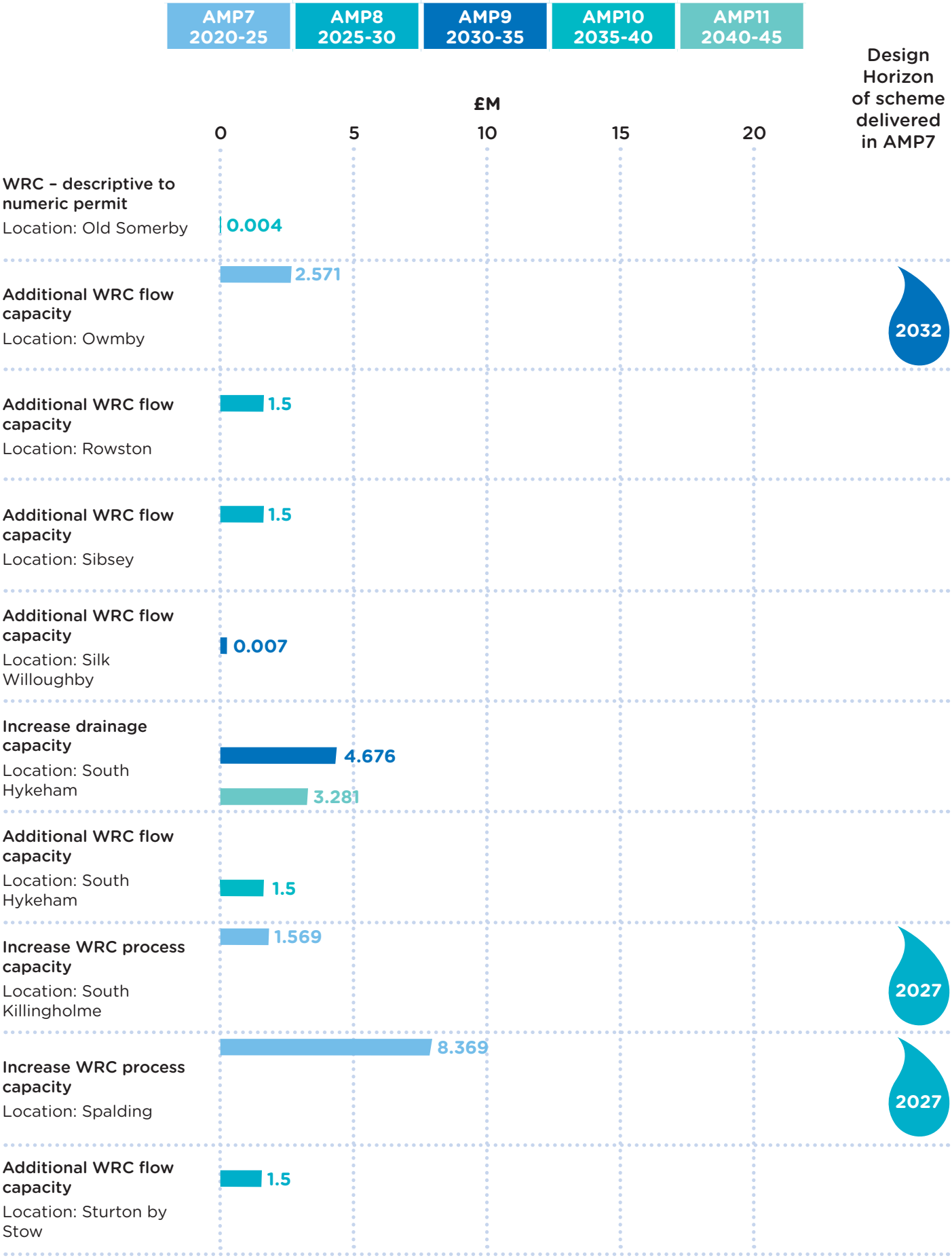
The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.

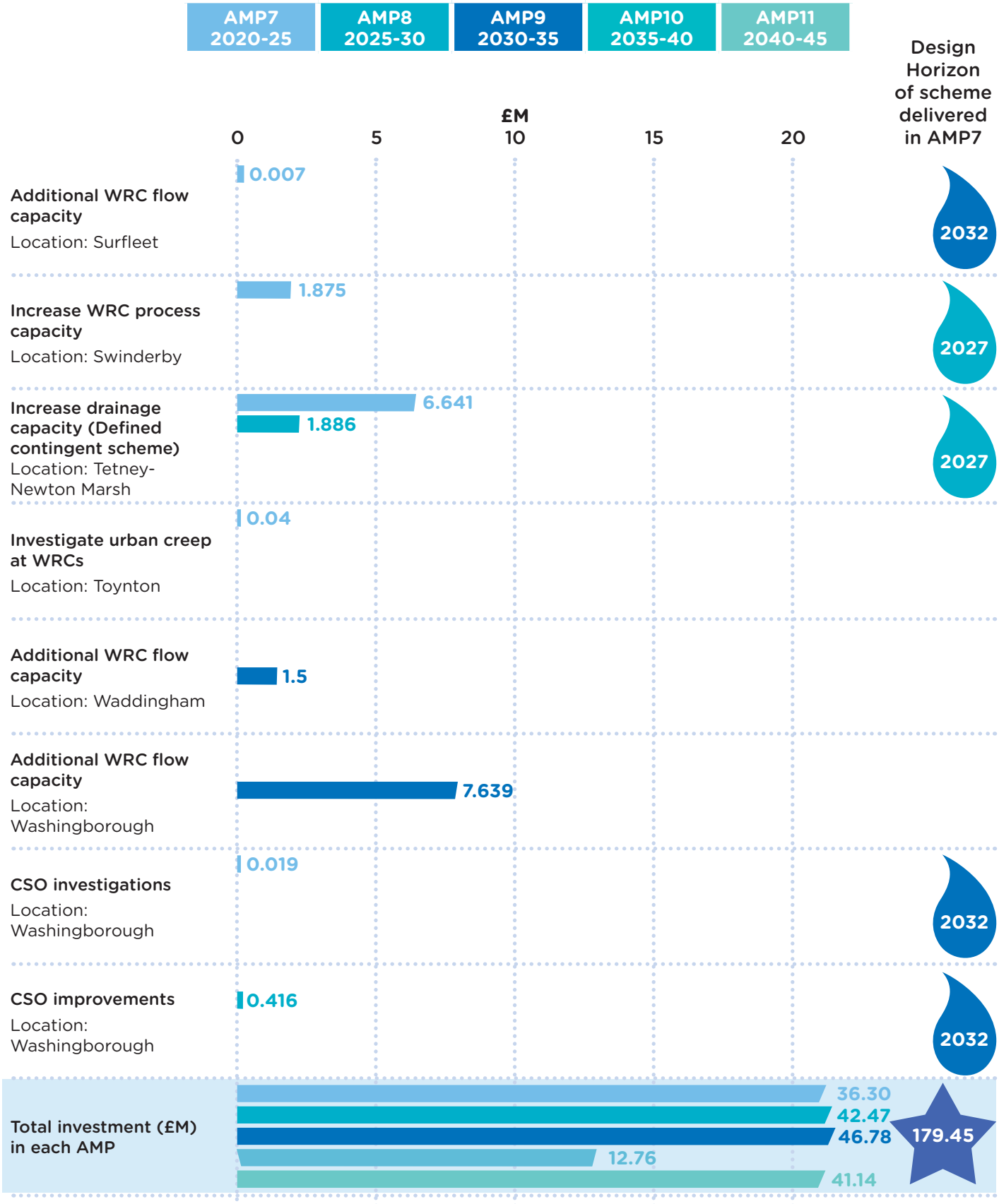



AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Additional WRC flow capacity
Location: Cowbit
0.007
2032
Additional WRC flow capacity
Location: Crowland
1.5
Additional WRC flow capacity
Location: Donnington
1.5
Additional WRC flow capacity
Location: Dorrington
1.5
Additional WRC flow capacity
Location: Edenham
0.007
Investigate urban creep at WRCs
Location: Faldingworth
0.04
Additional WRC flow capacity
Location: Frampton
8.000
Increase drainage capacity
Location: Grimsby
10.070
3.968
Additional WRC flow capacity
Location: Heckington
2.821
CSO investigations
Location: Horncastle
0.019
2032


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
CSO improvements
Location: Horncastle
0.416
2032
Additional WRC flow capacity
Location: Ingham
0.007
Investigate urban creep at WRCs
Location: Ingoldsby
0.04
Additional WRC flow capacity
Location: Kirkby la Thorpe
1.5
Increase drainage capacity (Emerging scheme)
Location: Little Ponton
0.886
0.866
CSO investigations
Location: Louth
0.038
2032
CSO improvements
Location: Louth
0.832
2032
CSO investigations
Location: Market Rasen
0.019
2032
CSO improvements
Location: Market Rasen
0.416
2032
Additional WRC flow capacity
Location: Market Rasen
6.289


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
CSO improvements
Location: Marston
0.344
2027
Increase drainage capacity
Location: Marston
5.995
4.570
4.570
Additional WRC flow capacity
Location: Martin
0.007
2032
Additional WRC flow capacity
Location: Metheringham
1.164
2032
Increase drainage capacity
Location: Metheringham
1.047
0.764
0.725
Additional WRC flow capacity
Location: Navenby
1.5
Additional WRC flow capacity
Location: Nettleham
1.5
Additional WRC flow capacity
Location: Nocton (RAF)
3.762
2032
Additional WRC flow capacity
Location: North Ferry
3.805
2032
Increase WRC process capacity
Location: North Kelsey
0.777
0.5
2027


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
WRC – descriptive to numeric permit
Location: Old Somerby
0.004
Additional WRC flow capacity
Location: Owmby
2.571
2032
Additional WRC flow capacity
Location: Rowston
1.5
Additional WRC flow capacity
Location: Sibsey
1.5
Additional WRC flow capacity
Location: Silk Willoughby
0.007
Increase drainage capacity
Location: South Hykeham
4.676
3.281
Additional WRC flow capacity
Location: South Hykeham
1.5
Increase WRC process capacity
Location: South Killingholme
1.569
2027
Increase WRC process capacity
Location: Spalding
8.369
2027
Additional WRC flow capacity
Location: Sturton by Stow
1.5

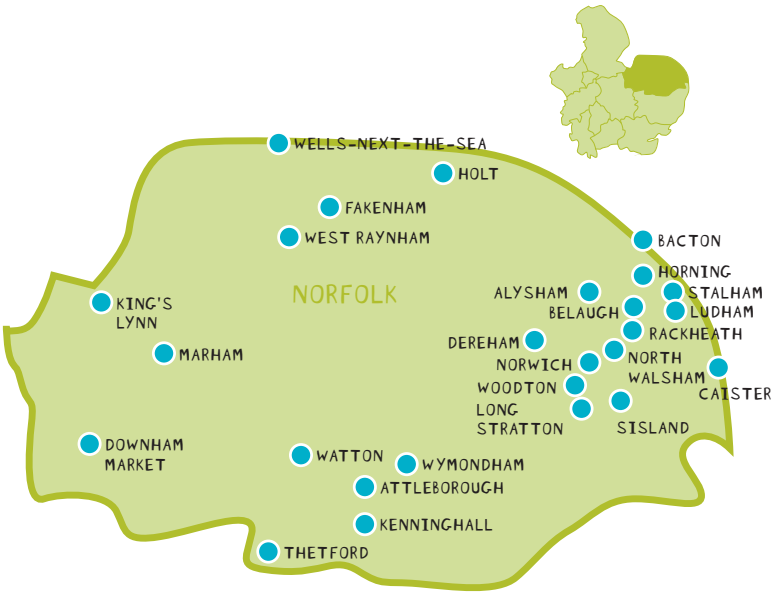

AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
Additional WRC flow capacity
Location: Surfleet
0.007
2032
Increase WRC process capacity
Location: Swinderby
1.875
2027
Increase drainage capacity (Defined contingent scheme)
Location: Tetney-Newton Marsh
6.641
1.886
2027
Investigate urban creep at WRCs
Location: Toynton
0.04
Additional WRC flow capacity
Location: Waddingham
1.5
Additional WRC flow capacity
Location: Washingborough
7.639
CSO investigations
Location: Washingborough
0.019
2032
CSO improvements
Location: Washingborough
0.416
2032
Total investment (£M) in each AMP
36.30
42.47
46.78
12.76
41.14
179.45

Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Boston, Bourne, Canwick, Claypole, Corby Glen, Cranwell, Deeping, Dunholme, Fiskerton, Frampton, Grimsby, Heckington, Holbeach, Holton Le Clay, Louth, Little Ponton, Marston, Market Rasen, North Hykeham, Tetney-Newton Marsh, Reepham, South Hykeham, Sibsey, Skellingthorpe, Sleaford, Splading, Spilsby, Stamford, Washingborough, Winteringham and Woodhall Spa.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

NORFOLK



31,595
homes planned to 2025

73,256
homes planned to 2045

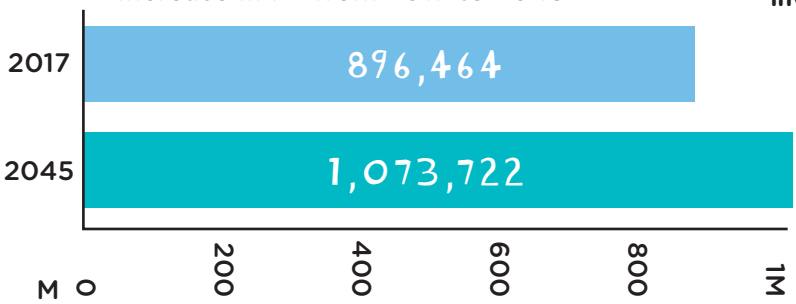
65,015
new people to 2025

134,650
new people to 2045

£111m
investment to 2025

£212.27m
investment to 2045

Increase in PE from 2017 to 2045

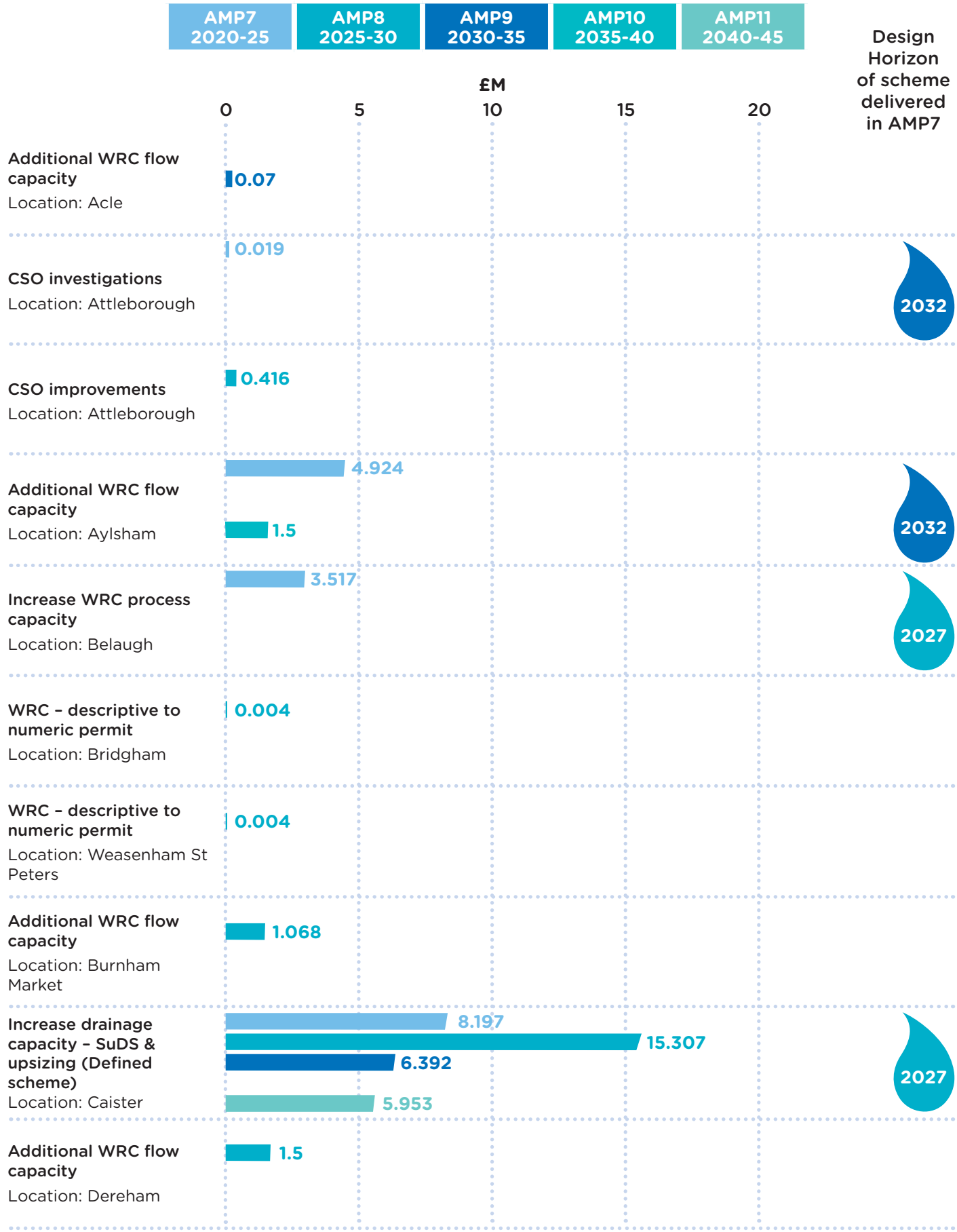


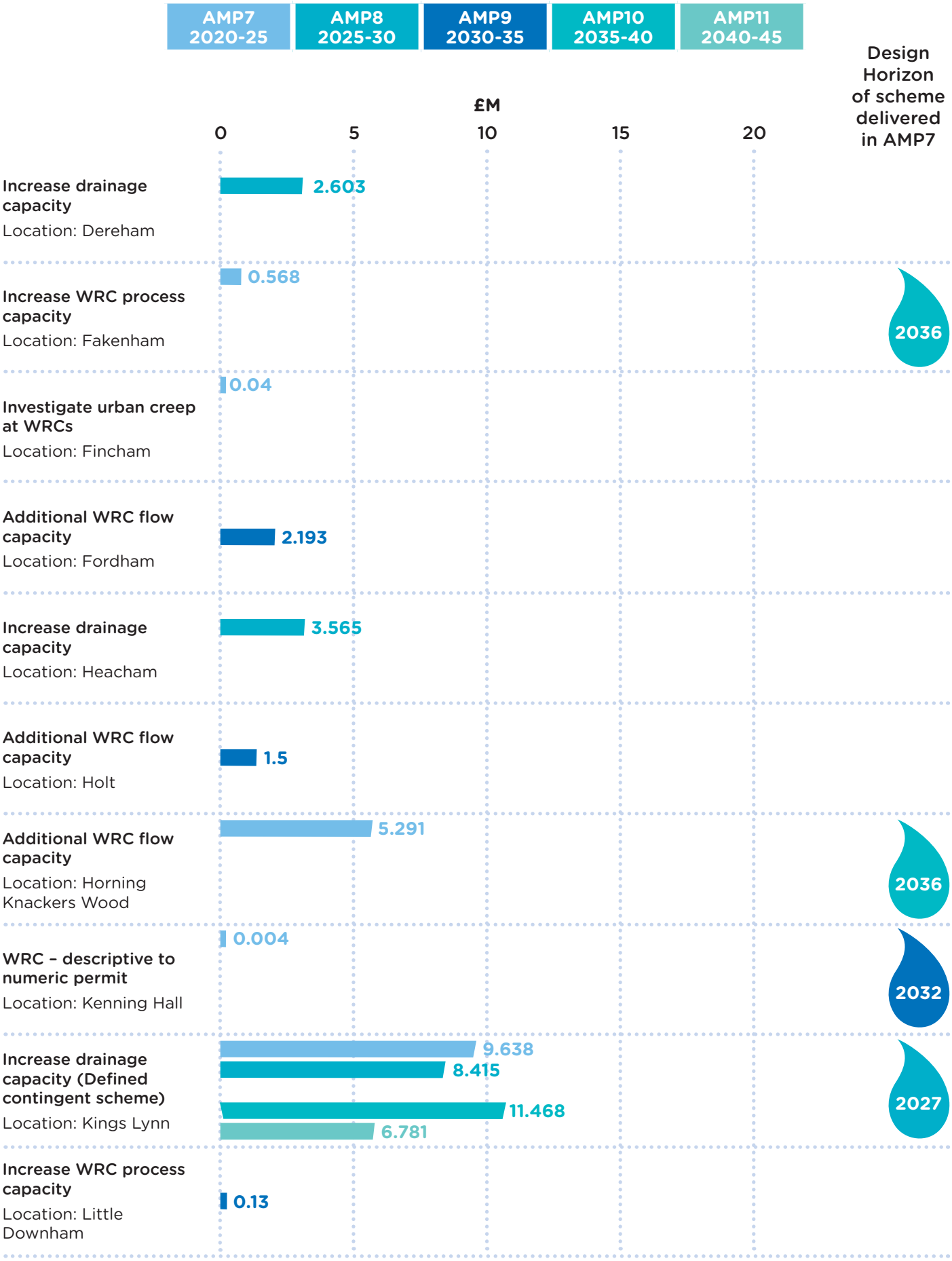
Subject to external growth rates.

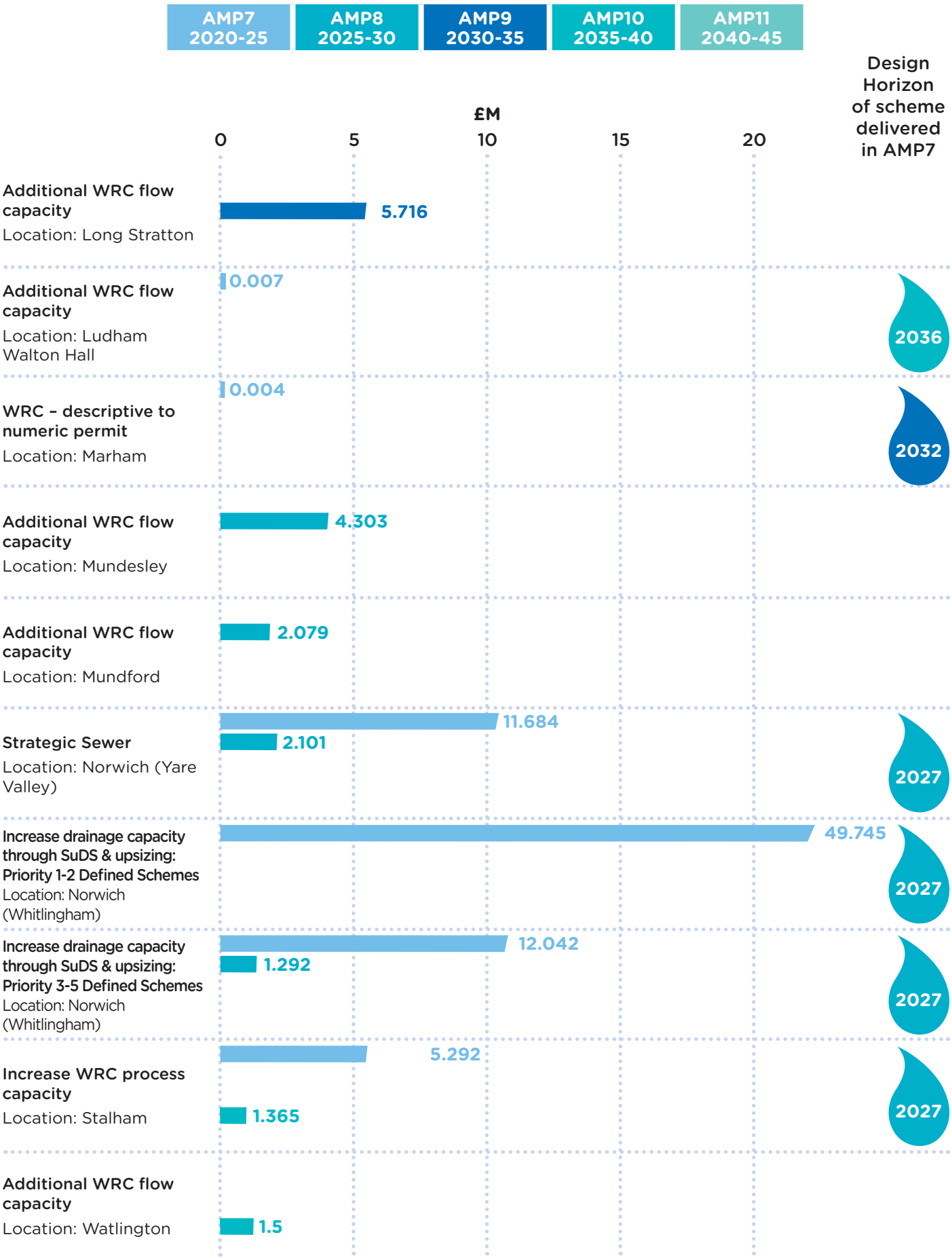
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Attleborough	11,035	12,601	90,595	7	10	28
Alysham	9,748	10,057	79,926	4	9	12
Belaugh	8,482	9,506	66,592	–	8	12
Caister	92,712	110,960	425,878	15	6	16
Dereham-Rushmeadow	23,042	23,599	180,377	3	2	9
Downham Market	12,100	12,418	77,776	10	10	21
Fakenham	14,738	21,233	89,820	4	–	1
Holt	5,591	6,659	37,973	1	16	26
Horning-Knackers Wood	1,179	1,265	11,715	1	7	7
Kenninghall	272	284	117	–	8	17
King's Lynn	24,218	64,194	373,389	28	4	26
Long Stratton	5,600	5,679	43,097	–	29	65
Ludham-Walton Hall	3,083	3,482	44,177	3	7	19
Marham and School Hillside	93	366	489	–	7	10
North Walsham	12,245	12,885	67,038	4	5	8
Rackheath Springs – Wroxham	250	280	21,767	–	1	10
Sisland	7,069	7,699	66,592	3	9	22

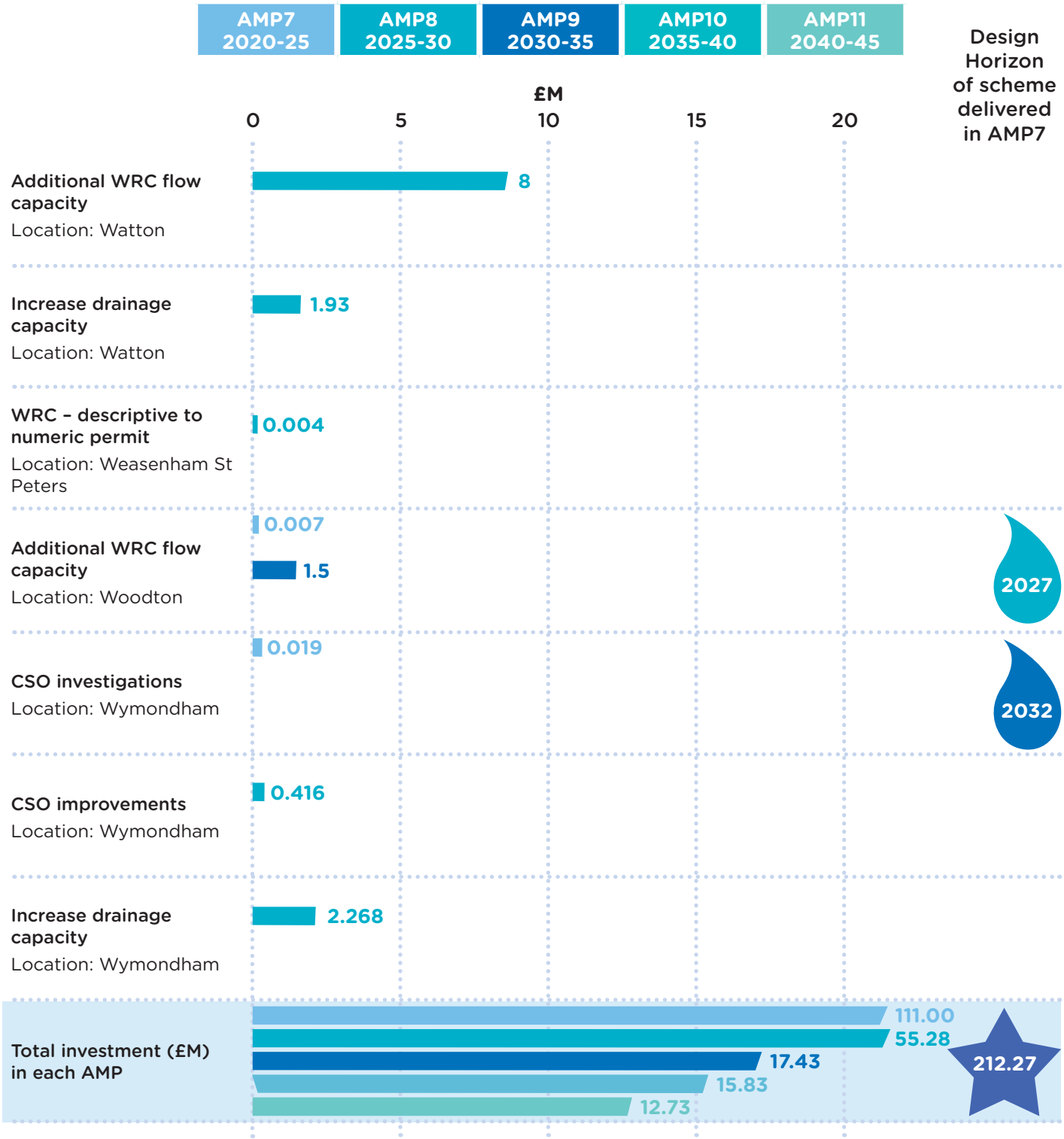
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Stalham	7,534	9,230	70,720	6	8	20
Thetford	22,958	32,604	181,417	4	10	13
Watton	14,218	15,057	110,123	5	5	15
Wells-next-the-Sea	3,451	5,173	25,182	1	3	12
West Raynham	33	63	emerging – unknown	emerging – unknown	2	12
Woodton	439	452	5,639	–	15	30
Norwich (Whitlingham)	241,983	293,988	1,481,372	38	10	14
Wymondham	17,720	19,236	91,820	2	9	19

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.




AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
Increase drainage capacity
Location: Dereham
2.603
Increase WRC process capacity
Location: Fakenham
0.568
2036
Investigate urban creep at WRCs
Location: Fincham
0.04
Additional WRC flow capacity
Location: Fordham
2.193
Increase drainage capacity
Location: Heacham
3.565
Additional WRC flow capacity
Location: Holt
1.5
Additional WRC flow capacity
Location: Horning Knackers Wood
5.291
2036
WRC – descriptive to numeric permit
Location: Kenning Hall
0.004
2032
Increase drainage capacity (Defined contingent scheme)
Location: Kings Lynn
9.638
8.415
11.468
6.781
2027
Increase WRC process capacity
Location: Little Downham
0.13


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
Additional WRC flow capacity
Location: Long Stratton
5.716
Additional WRC flow capacity
Location: Ludham Walton Hall
0.007
2036
WRC – descriptive to numeric permit
Location: Marham
0.004
2032
Additional WRC flow capacity
Location: Mundesley
4.303
Additional WRC flow capacity
Location: Mundford
2.079
Strategic Sewer
Location: Norwich (Yare Valley)
11.684
2.101
2027
Increase drainage capacity through SuDS & upsizing: Priority 1-2 Defined Schemes
Location: Norwich (Whitlingham)
49.745
2027
Increase drainage capacity through SuDS & upsizing: Priority 3-5 Defined Schemes
Location: Norwich (Whitlingham)
12.042
1.292
2027
Increase WRC process capacity
Location: Stalham
5.292
1.365
2027
Additional WRC flow capacity
Location: Watlington
1.5

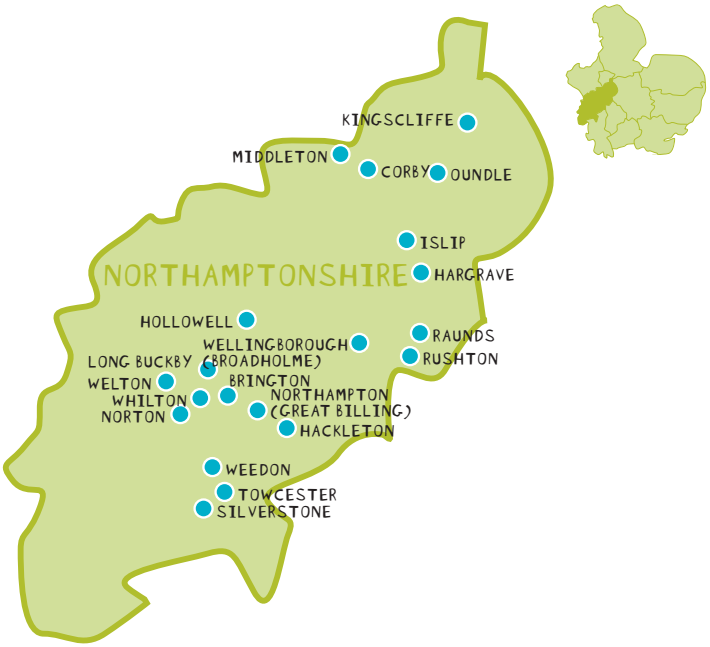


Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Attleborough, Alysham, Belaugh, Dereham, Downham Market, Fakenham, Holt, Kings Lynn, Long Stratton, North Walsham, Sisland, Swafham, Rackheath Springs – Wroxham, Thetford, Watton, Wells-next-the-Sea, Norwich, West Raynham, and Wymondham.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

NORTHAMPTONSHIRE



25,105
homes planned to 2025

67,042
homes planned to 2045

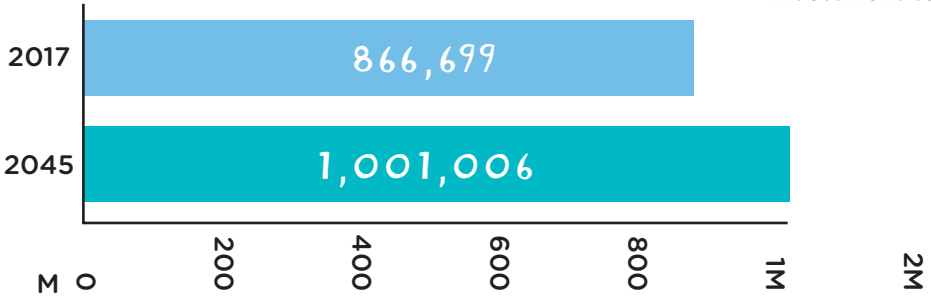
51,821
new people to 2025

115,205
new people to 2045

£20.76m
investment to 2025

£129.43m
investment to 2045

Increase in PE from 2017 to 2045

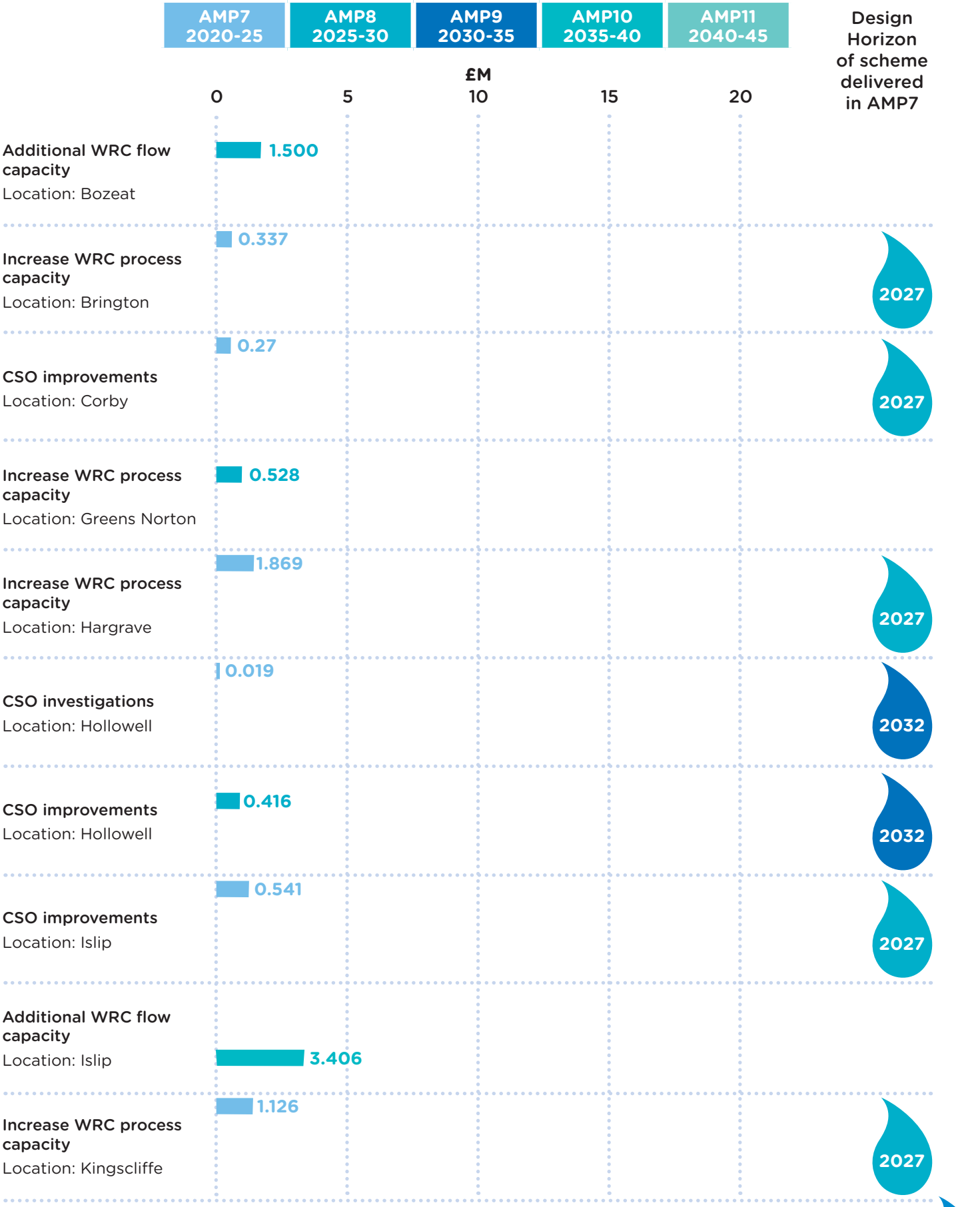


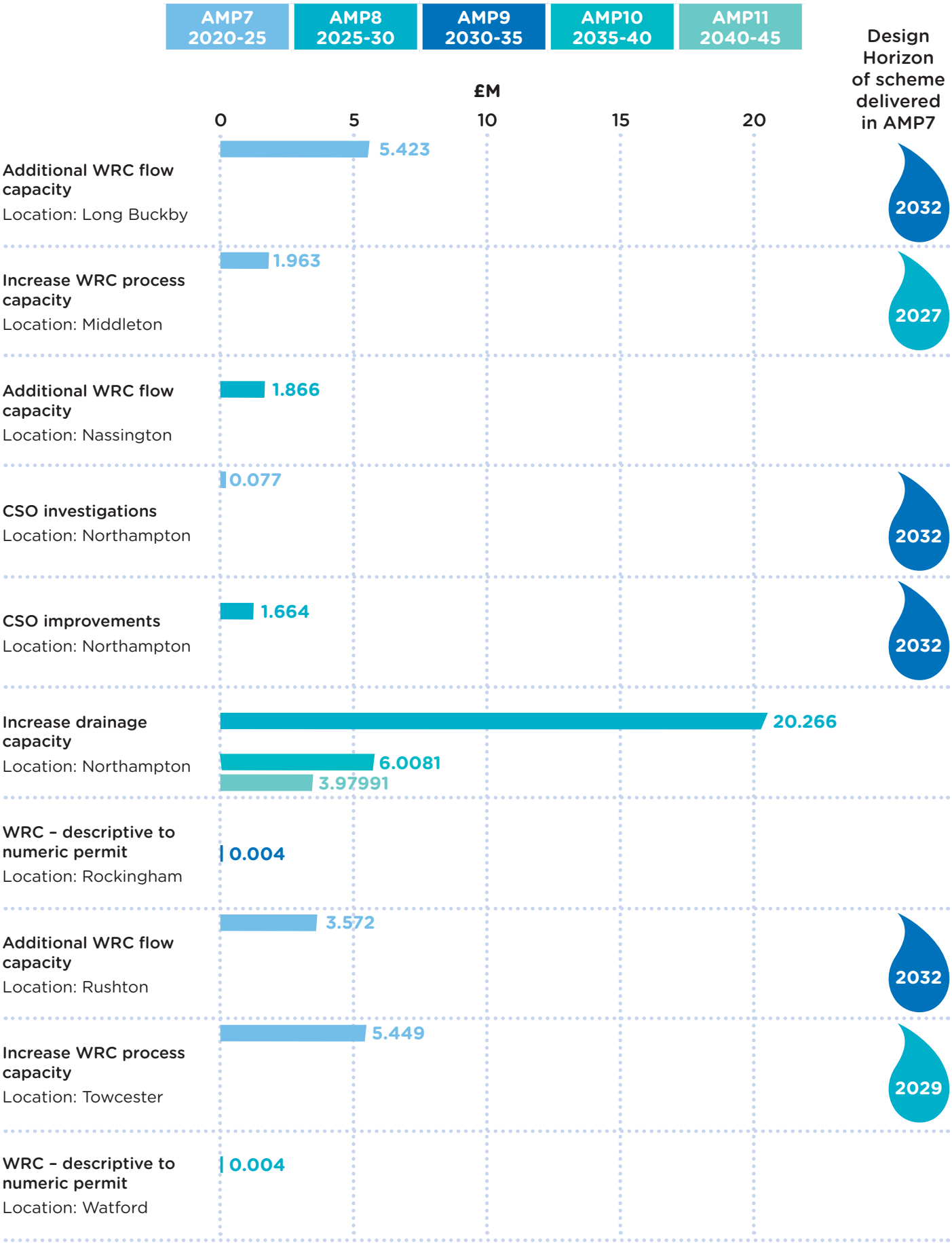
Subject to external growth rates.

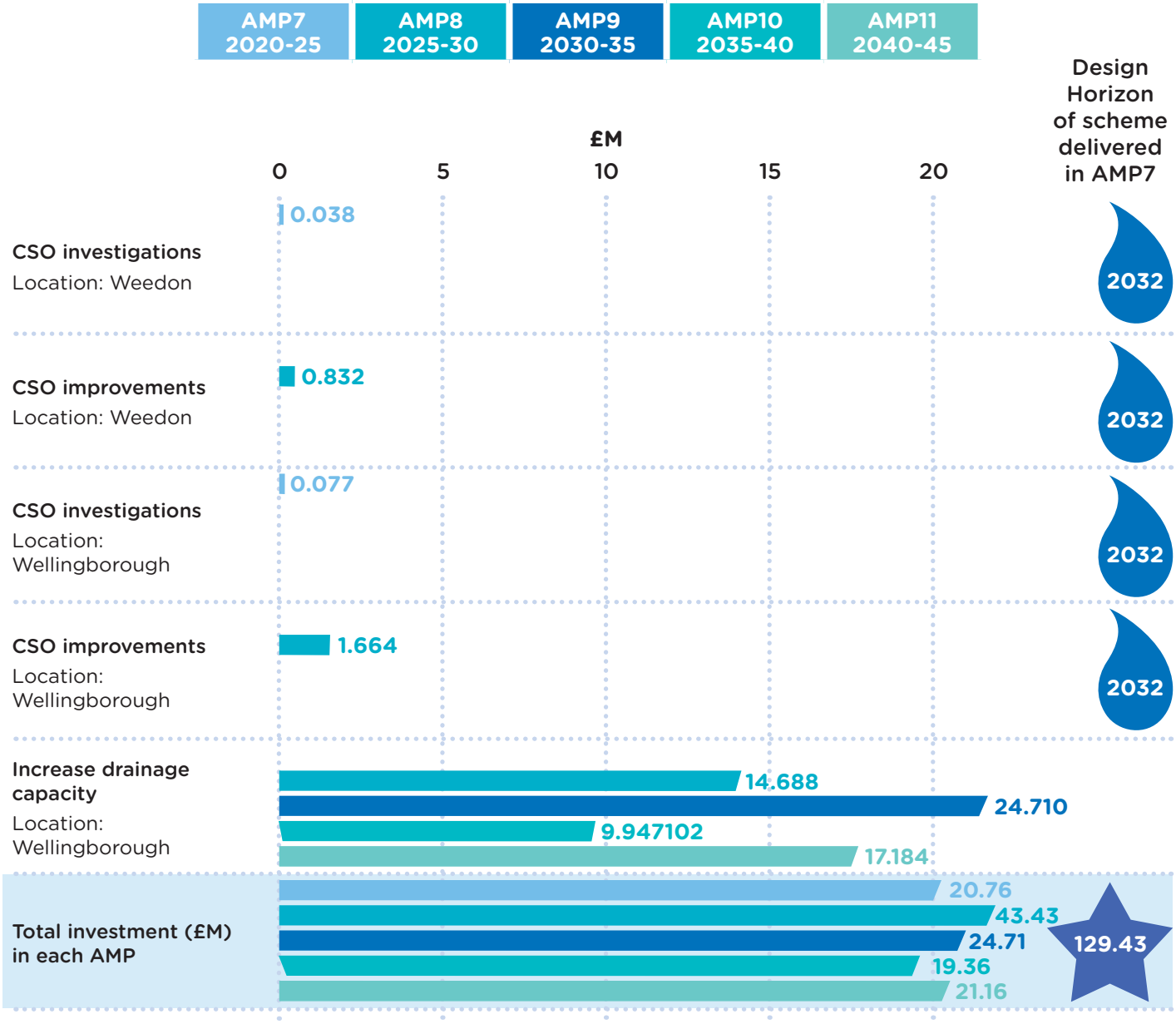
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Ashton	4,966	5,026	27,380	5	14	11
Brington	481	489	6,794	3	–	9
Corby	65,120	116,942	373,753	9	10	32
Hackleton	2,091	2,127	12,369	3	5	4
Hargrave	186	190	2,150	–	–	9
Hollowell	1,397	1,425	19,636	7	11	19
Islip	12,081	13,633	94,582	15	4	10
Kingscliffe	1,409	1,424	7,203	2	–	–
Long Buckby	6,536	6,633	34,445	5	16	19
Middleton	1,571	1,645	9,838	–	8	18
Northampton (Great Billing)	229,173	320,778	1,440,729	54	6	11
Norton	328	353	2,062	–	3	12
Raunds	11,148	11,319	56,091	5	2	10
Rushton	335	452	11,777	1	4	14
Silverstone	2,756	2,985	15,868	–	4	21
Towcester	10,728	11,119	73,771	4	13	22

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Weedon	3,166	3,274	15,819	3	3	12
Wellingborough (Broadholme)	203,363	235,641	1,153,870	62	9	21
Welton	633	639	4,002	–	3	13
Whilton	28,255	29,842	173,293	4	13	22

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.




AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
Design Horizon of scheme delivered in AMP7
£M
0
5
10
15
20
Additional WRC flow capacity
Location: Long Buckby
5.423
2032
Increase WRC process capacity
Location: Middleton
1.963
2027
Additional WRC flow capacity
Location: Nassington
1.866
CSO investigations
Location: Northampton
0.077
2032
CSO improvements
Location: Northampton
1.664
2032
Increase drainage capacity
Location: Northampton
20.266
6.0081
3.97991
WRC – descriptive to numeric permit
Location: Rockingham
0.004
Additional WRC flow capacity
Location: Rushton
3.572
2032
Increase WRC process capacity
Location: Towcester
5.449
2029
WRC – descriptive to numeric permit
Location: Watford
0.004

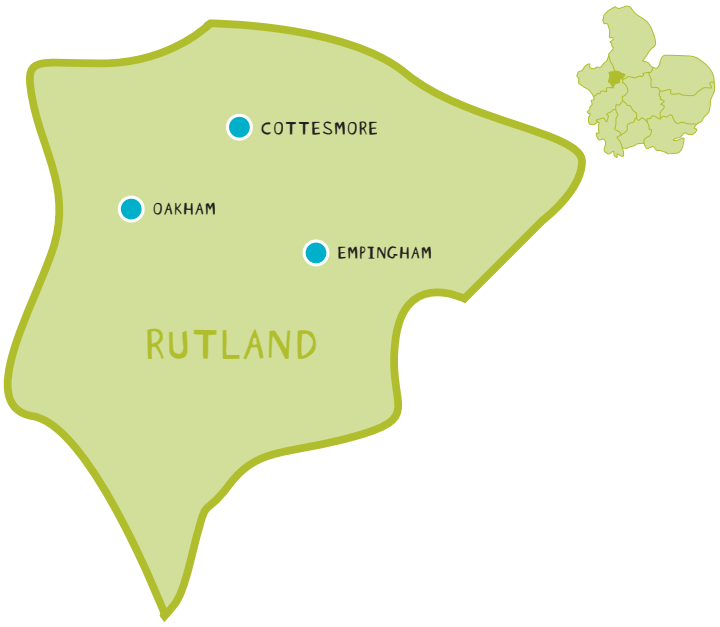


Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Ashton, Corby, Hackleton, Islip, Long Buckby, Northampton, Norton, Raunds, Silverstone, Towcester, Wellingborough, Welton and Whilton.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

RUTLAND



772
homes planned to 2025

2,302
homes planned to 2045

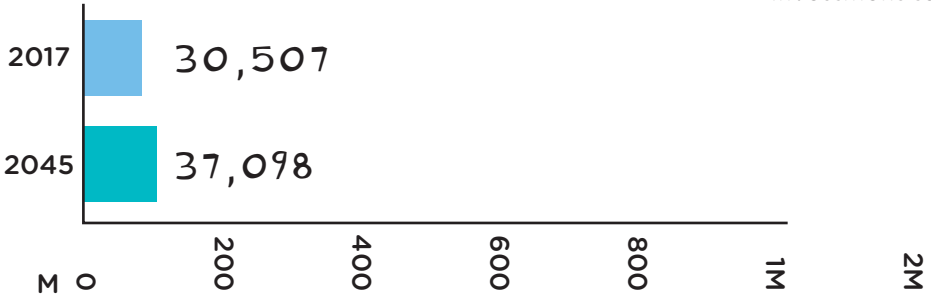
1,683
new people to 2025

4,647
new people to 2045

£7.38m
investment to 2025

£9.58m
investment to 2045

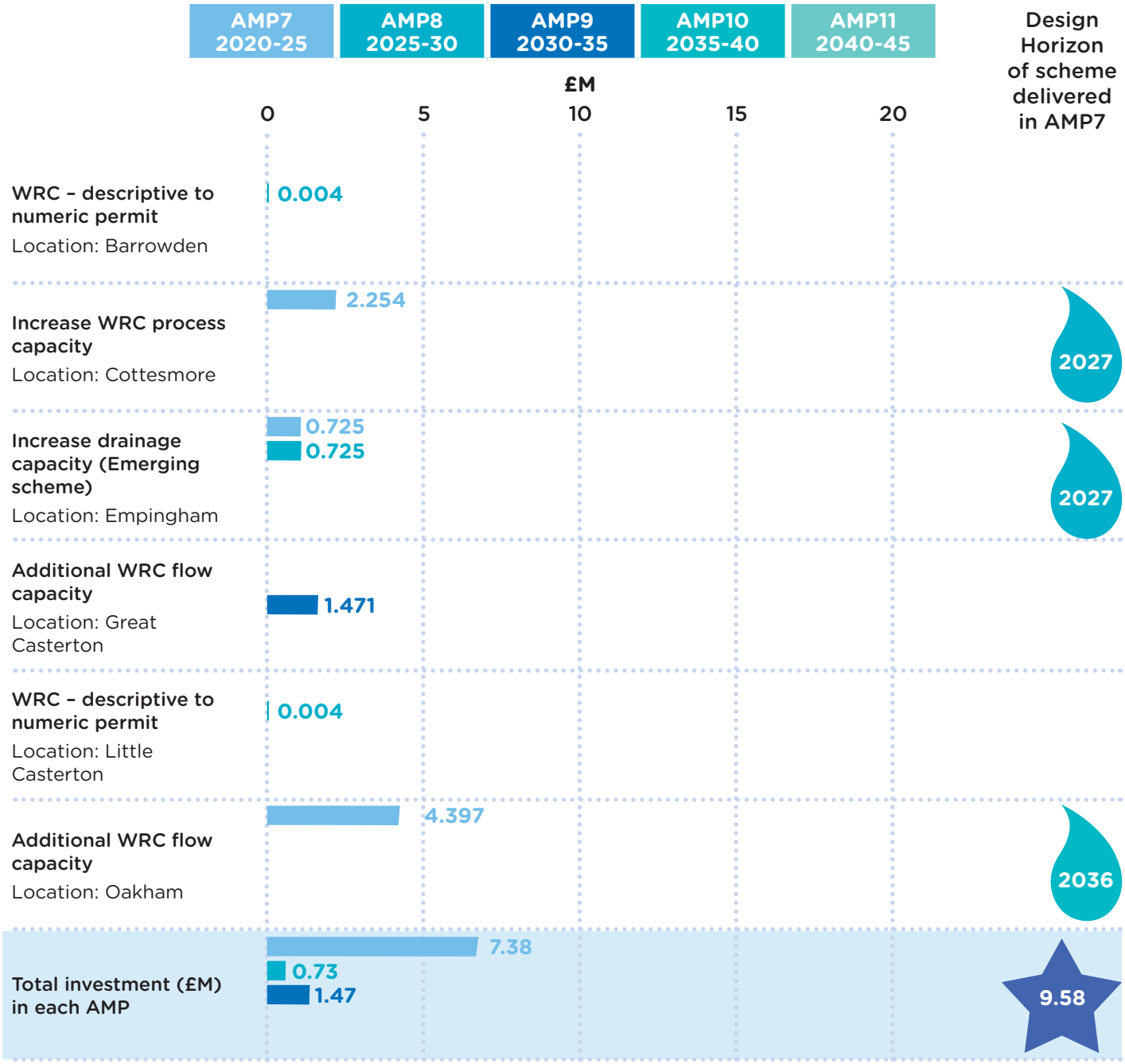
Increase in PE from 2017 to 2045



Subject to external growth rates.

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Cottesmore	4,005	4,105	23,906	3	6	7
Empingham	1,756	2,167	50,945	4	2	6
Oakham	11,325	11,641	84,399	5	8	22

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.

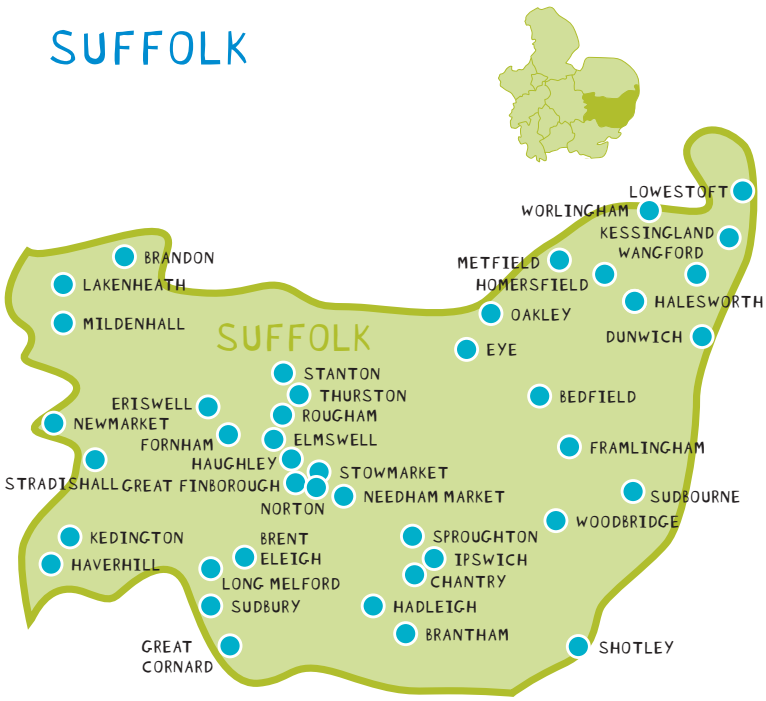


Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Oakham.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

SUFFOLK



19,550
homes planned to 2025

52,270
homes planned to 2045

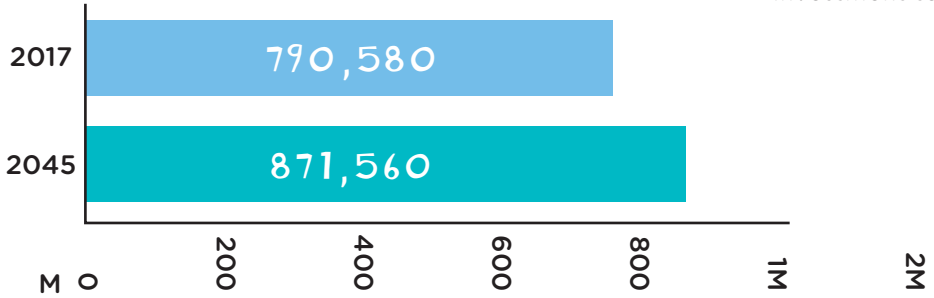
36,759
new people to 2025

81,146
new people to 2045

£49.64m
investment to 2025

£97.86m
investment to 2045

Increase in PE from 2017 to 2045

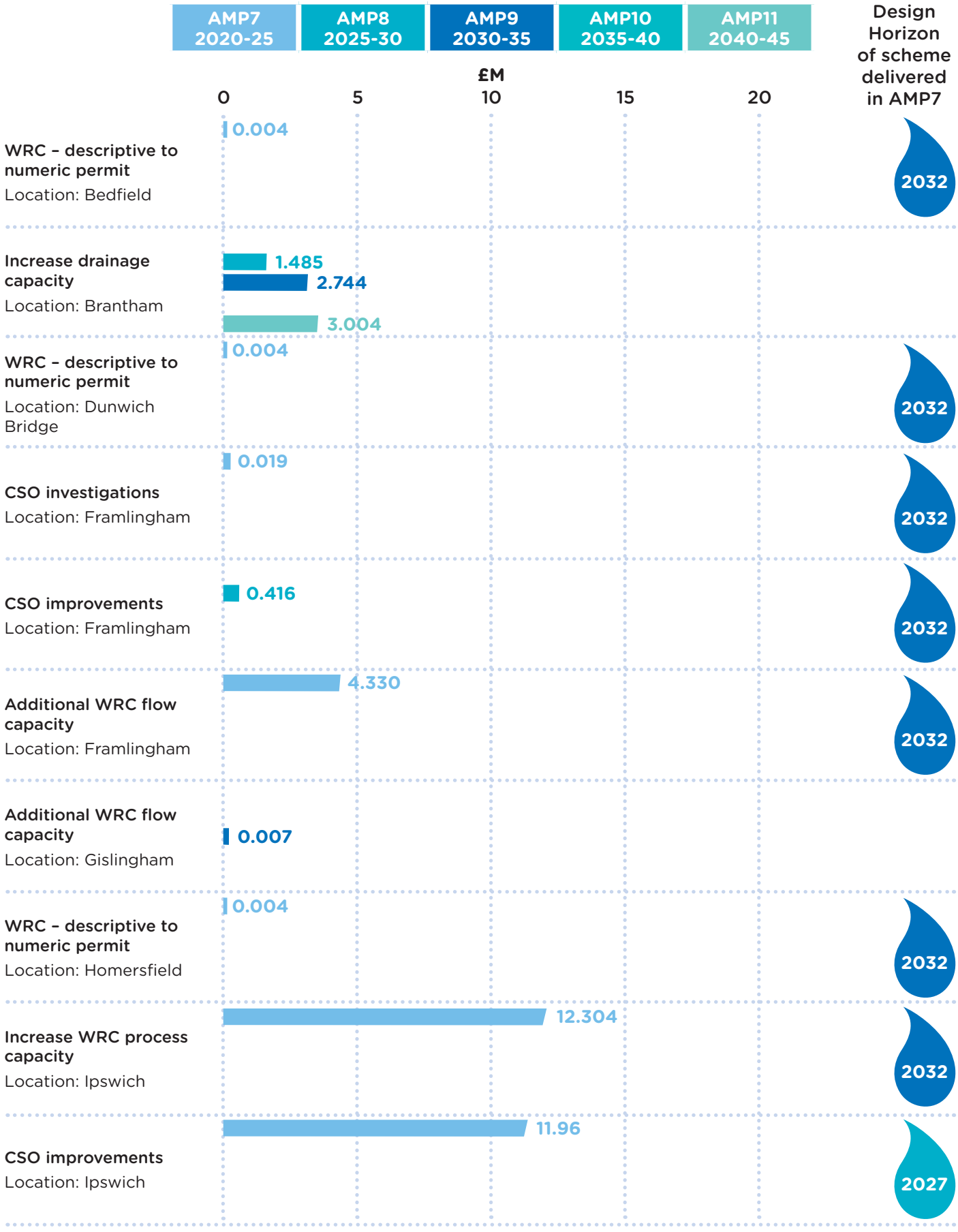


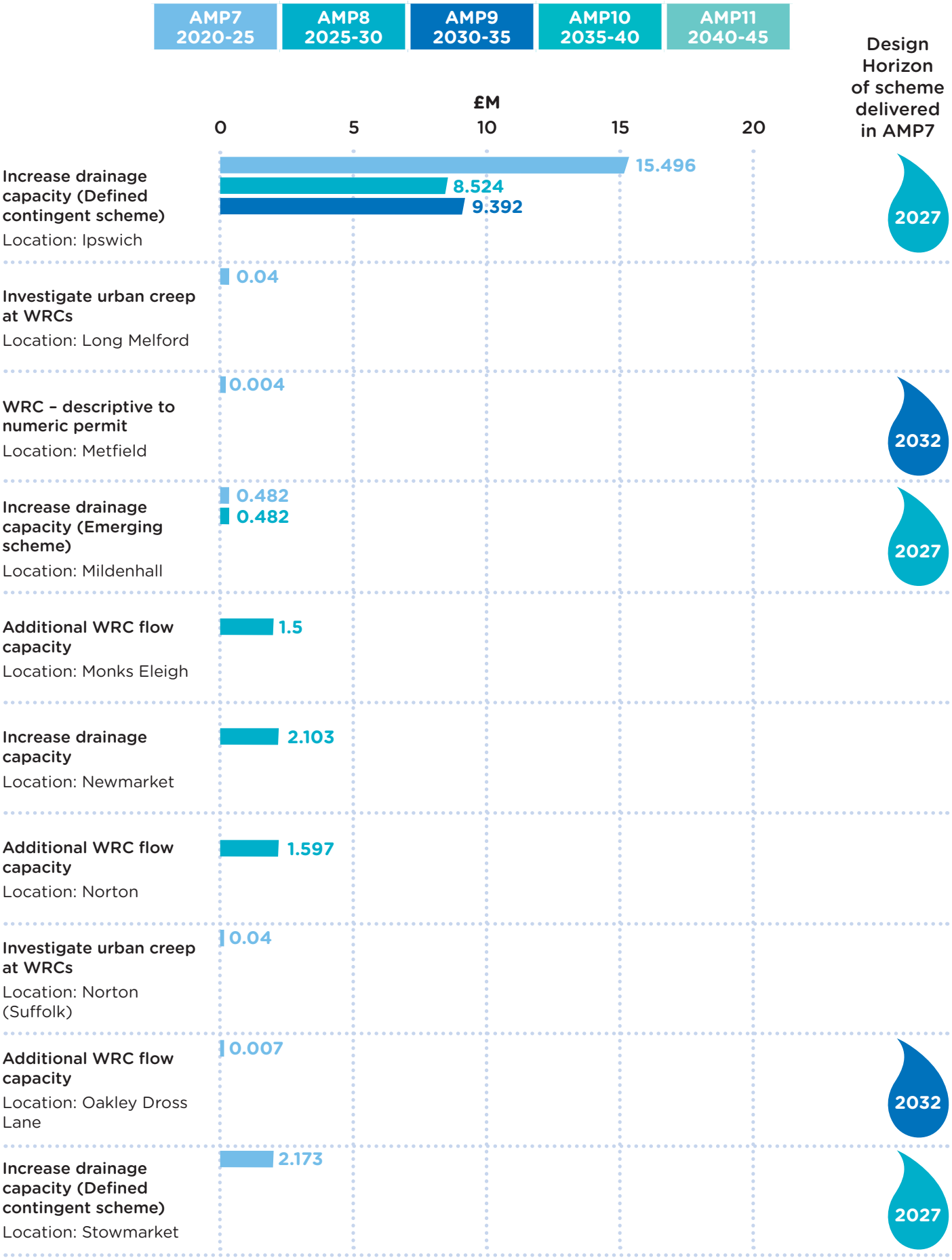
Subject to external growth rates.

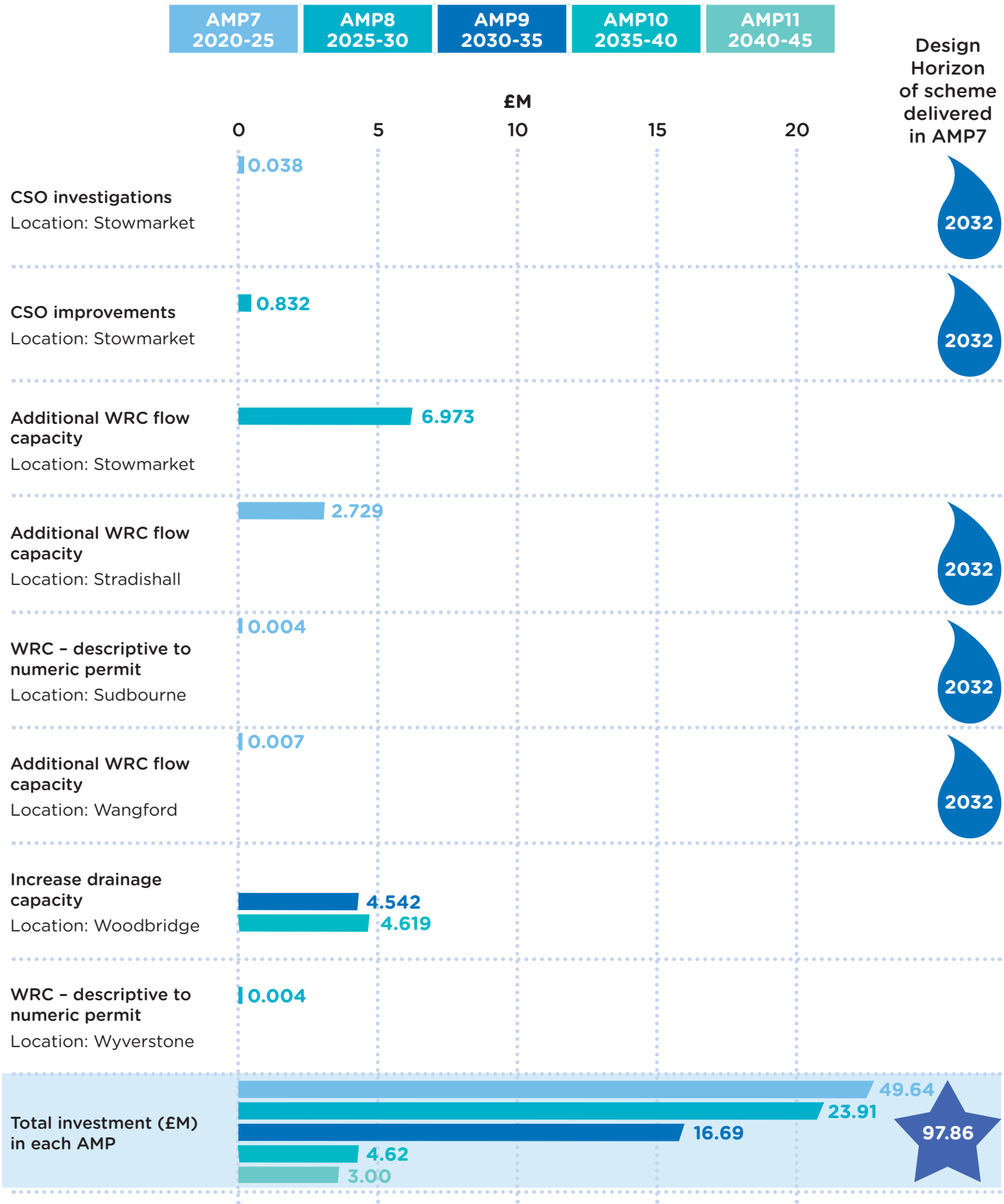
Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Bedfield	294	306	4,655	1	5	13
Brandon	9,880	10,135	40,264	–	9	8
Brantham	3,203	3,249	31,768	3	14	82
Brent Eleigh	51	51	18	–	2	11
Chantry	19,154	19,669	110,939	1	4	6
Dunwich-Bridge	122	499	2,949	1	–	–
Elmswell	6,265	6,412	48,120	4	5	25
Eriswell	1,308	1,334	4,326	1	9	18
Eye	3,642	9,330	37,118	4	9	48
Fornham All Saints	44,631	90,815	250,190	3	10	15
Framlingham	4,207	4,369	40,058	9	8	12
Great Cornard	8,116	10,060	50,404	1	3	6
Great Finborough	1,841	1,869	17,880	3	1	9
Hadleigh	7,874	8,111	44,761	3	6	16
Halesworth	7,460	7,851	126,758	7	–	4
Haughley	2,028	2,915	15,424	–	2	5
Haverhill	24,835	29,839	147,147	2	2	15

Settlement	Household Population	Population Equivalent	Length of sewer catchment (m)	No of CSOs	% growth 2020 to 2025	% growth 2020 to 2045
Homersfield	94	270	798	–	–	2
Ipswich – Cliff Quay Raeburn	137,157	146,756	651,529	19	6	12
Kedington	2,130	2,164	17,055	4	10	14
Kessingland	5,106	7,760	36,246	1	–	12
Lakenheath	4,986	4,927	18,494	–	9	9
Long Melford	4,819	4,965	31,406	3	2	12
Lowestoft	76,863	97,249	502,585	19	1	2
Metfield	299	314	3,422	–	–	7
Mildenhall	16,234	17,090	89,688	1	7	12
Needham Market	6,584	6,774	57,255	9	9	21
Newmarket	24,436	26,569	121,503	6	9	16
Norton	830	842	7,560	–	5	13
Oakley-Dross Ln	284	298	4,530	–	–	6
Rougham (St Edmundsbury)	1,077	1,169	14,415	2	10	20
Shotley-Overhall	1,828	1,899	11,512	2	25	40
Sproughton	1,142	1,304	10,349	2	5	7
Stanton	5,126	5,800	34,103	3	10	11
Stowmarket	21,830	22,751	138,010	8	7	18
Stradishall-Highpoint	1,153	1,189	1,892	–	15	26
Sudbourne-Snape Rd	236	259	2,840	2	–	4
Sudbury	13,561	15,415	92,620	6	5	15
Thurston	6,371	6,594	56,697	5	7	16
Wangford	591	628	3,142	–	–	–
Woodbridge	17,133	17,905	90,106	4	1	27
Worlingham	3,089	3,233	35,936	1	1	–

The table and illustrations below provide the long-term growth strategy and expected investment. Our delivery programme is adaptive: the optimal timing of solution delivery will be driven by regularly reviewing risk, through the collection of growth intelligence, monitoring of key indicators and modelling the impact of growth.




AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
Increase drainage capacity (Defined contingent scheme)
Location: Ipswich
15.496
8.524
9.392
2027
Investigate urban creep at WRCs
Location: Long Melford
0.04
WRC – descriptive to numeric permit
Location: Metfield
0.004
2032
Increase drainage capacity (Emerging scheme)
Location: Mildenhall
0.482
0.482
2027
Additional WRC flow capacity
Location: Monks Eleigh
1.5
Increase drainage capacity
Location: Newmarket
2.103
Additional WRC flow capacity
Location: Norton
1.597
Investigate urban creep at WRCs
Location: Norton (Suffolk)
0.04
Additional WRC flow capacity
Location: Oakley Dross Lane
0.007
2032
Increase drainage capacity (Defined contingent scheme)
Location: Stowmarket
2.173
2027


AMP7 2020-25
AMP8 2025-30
AMP9 2030-35
AMP10 2035-40
AMP11 2040-45
£M
0
5
10
15
20
Design Horizon of scheme delivered in AMP7
CSO investigations
Location: Stowmarket
0.038
2032
CSO improvements
Location: Stowmarket
0.832
2032
Additional WRC flow capacity
Location: Stowmarket
6.973
Additional WRC flow capacity
Location: Stradishall
2.729
2032
WRC – descriptive to numeric permit
Location: Sudbourne
0.004
2032
Additional WRC flow capacity
Location: Wangford
0.007
2032
Increase drainage capacity
Location: Woodbridge
4.542
4.619
WRC – descriptive to numeric permit
Location: Wyverstone
0.004
Total investment (£M) in each AMP
49.64
23.91
16.69
4.62
3.00
97.86

Regional investment in AMP7 also includes;

In AMP7 we are investing in catchment flow monitors to monitor growth at; Brandon, Branthan, Brent Eleigh, Chantry, Elmswell, Eriswell, Eye, Fornham All Saints, Framlingham, Great Cornard, Great Finborough, Hadleigh, Halesworth, Haughley, Haverhill, Kedington, Kessingland, Lakenheath, Long Melford, Lowestoft, Needham Market, Rougham, Shotley-Overhall, Sproughton, Stanton, Stowmarket, Sudbury, Thurston, Woodbridge, and Worlingham.

For 'WRC - descriptive to numeric permit' the county tables detail investment planned for investigations. In addition we have ringfenced investment at the descriptive WRCs at highest risk of meeting a numeric permit following the investigations: £15.8M in AMP7, £7.9M in AMP8, £2.6M in AMP9, £1.8M in AMP10 and £1.8M in AMP11.

Appendix 1 Glossary of terms

AMP6	Asset Management Plan No 6 (since privatisation) 2015-2020
AMP7	Asset Management Plan No 7 (since privatisation) 2020-2025
AWS	Anglian Water Services
BOD	Biological Oxygen Demand – a measure of the strength of sewage based on the amount of oxygen utilized in biological stabilization of the sewage.
COD	Chemical Oxygen Demand – a measure of the strength of sewage based on the amount of oxygen used in chemical oxidation of the sewage. Typically around twice the BOD.
CSO	Combined Sewer Overflow – point of discharge of excess storm flows from sewer to watercourse. Regulated by environmental permit issued by EA.
Defra	Department of environment, farming and rural affairs. Department with overall responsible for water industry, Ofwat and EA.
DSF	Drainage Strategy Framework
DWF	Dry weather flow. For WRC compliance the 90 percentile of daily flows for a calendar year. Theoretically taken as PG + I + E where: P = population G= per capita flow I = Infiltration E = Trade effluent flow
DWMP	Drainage and Wastewater Management Plan
3DWF	3PG + I + 3E. Usual requirement for Flow to Full Treatment.
EA	Environment Agency – the main environmental regulator and leading public body for protecting and improving the environment
EO	Emergency Overflow – point of discharge of excess flows from a sewer to a watercourse in times of emergency. Regulated by environmental permit issued by EA.
FOG	Fats, oils and greases – unwanted products in the sewerage system
FFT	Flow to full treatment. The minimum flow which must be passed to full treatment before overflow to storm treatment is permitted. Usually 3PG + I + 3E
GIS	Geographical information system
Green infrastructure	Use of the natural environment to manage surface water flows, and or to clean flows through the use of plants, stone and soil. Can also be referred to as SuDS
Infrastructure	(Ofwat) – underground assets such as pipes which were not allocated finite asset lives.
LPA	The public authority whose duty it is to carry out specific planning functions for a particular area. All references to local planning authority in this document apply to the district council, borough council, and county council, to the extent appropriate to their responsibilities.
LLFA	Lead Local Flood Authority (unitary authorities or county councils) are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.
Modelling Specification	Current processes and requirements for model build, verification and model use

ODI	Outcome Delivery Incentive – targets for company performance which are linked to financial incentives and penalties.
Ofwat	Water Services Regulation Authority
OSM	Operator Self Monitoring. On 1st April 2009 the Environment Agency (EA) changed the way it monitors discharges to water. Operator Self Monitoring (OSM) was introduced for the 10 largest Water and Sewerage Companies making us responsible for collecting, analysing and reporting compliance on our own discharges. The Environment Agency has an auditing role to ensure that OSM is being carried out correctly and that there is no detrimental effect on the environment.
Pcf	Per Capita Returned Flow – The amount of water released per person
PCC	Per Capita Consumption – The amount of water consumed per person
PE	Population Equivalent – defined in UWWTD as average measured BOD load for peak two weeks of the year divided by 60g. This definition is generally accepted as impracticable to measure. For this report and reporting PE is defined as estimated residential population plus average (over year) non-residential population plus average (over year) measured trade settled COD (kg/d) multiplied by 11
Permit	Refers to a permit to discharge treated sewage (final effluent) to a watercourse. Set by the Environment Agency, this provides flow and quality standards to be met.
PR14	Periodic Review 2014 – for planning AMP6 2015-2020
PR19	Periodic Review 2019 – for planning AMP7 2020-2025
PR24	Periodic Review 2024 – for planning AMP7 2025-2030
Q80/20%ile	Q80 DWF – The accurate annual measure of DWF. The value in which 20% of all daily measured flows fall under.
Q90/10%ile	Q90 DWF – The compliance assessment of DWF against the permit. The value in which 10% of all daily measured flows fall under.
RBDM	Risk Based Decision Making – a process to make the correct choice based on an assessment of the risks.
Sanitary	Organic parameters assessed for compliance such as Ammonia, BOD, COD and suspended solids. Generally set as 95%ile standards with Upper tiers
SDS	Strategic Direction Statement
Sewerage	(Ofwat) The water recycling function carried out by WASCs
	(General) The collection and transfer of sewage and surface water to watercourses. Hence sewerage system.
Sludge	Residual matter from sewage treatment processes that can be processed into biosolids, a fertiliser product.
Strategic Sewers	Large sewer designed to serve a number of developments connecting in different timeframes
SuDS	Sustainable Drainage Systems, e.g. green infrastructure such as swales, detention basins, ponds and wetlands.
SW	Surface water
SWM	Surface water management
SWMP	Surface Water Management Plan
Totex	Total operation expenditure

UKWIR	UK Water Industry Research – key strategy; • to advise, procure and deliver the highest quality independent scientific and strategic research on single voice issues, which contributes to the continued success of UK water companies, • to provide leadership in shaping the water industry's future research agenda, • to undertake research that adds value to the membership's businesses.
Urban creep	The loss of permeable surfaces within urban areas creating increased runoff
UT	Upper Tier standard – absolute standard which all samples must pass.
UWWTD	Urban waster Treatment Directive
UWWTR	Urban Waster Treatment (England and Wales) Regulations 1994
WaSC	Water and Sewerage Company. The statutory sewerage undertaker for an area. Originally 10 in number they have now been supplemented by new entrants to the industry.
WCS	Water Cycle Study – prepared by Local planning authorities to demonstrate how local plans can be delivered without adverse impact on the water cycle.
WFD	Water Framework Directive
WIA	Water Industry Act 1991
WRC	Water Recycling Centre also known as Sewage Treatment Works, Wastewater Treatment Works.
WRc	Environmental company (ex Water Research Centre).
WRMP	Water Resources Management Plan
YB	Year Book – annual report published by AWS setting out key financial and non-financial statistics.

LED675/08/18