

Introduction

Water Cycle Studies (WCS) have been completed by AECOM for the Borough of Colchester and the District of Braintree to support the authorities' Local Plans covering growth to 2033. These studies included the proportion of growth likely to come forward for the three proposed north Essex Garden Communities (GC) within the Local Plan period (up to 2033); however, a significant proportion of the GC growth is planned to occur beyond 2033. Therefore, the full potential quantum of growth that the GC's could deliver does not have identified solutions for the treatment of wastewater, provision of water supply and assessment of impact and compliance with water based environmental legislation. It is therefore essential that a further study fully addressing the long-term impact of growth within the GCs is completed, supporting the development of the authority partnerships' developing Shared Strategic Plan (SSP) for the GCs.

Approach overview

An Integrated Water Management Strategy (IWMS) approach is being undertaken to meet the needs of the authority partnership and to support the SSP, building on the Local Plan WCS for Colchester and Braintree Districts, as well as the Strategic Flood Risk Assessments (SFRA) for the Borough of Colchester and District of Braintree and the GC Concept Feasibility Studies.

The IWMS is to be undertaken in three stages.

- Stage 1 – evidence base for the SSP;
- Stage 2 – Outline IWMS;
- Stage 3 – where needed, a detailed IWMS delivery plan for preferred strategy.

This Technical Note provides interim outputs from the ongoing Stage 1 study in relation to wastewater capacity. To inform the outputs, a meeting was held with Anglian Water Services (AWS) to discuss wastewater treatment options across the three GCs.

Stage 1 IWMS - Aims

The aim of the Stage 1 IWMS is to provide evidence that workable solutions exist with regards to wastewater treatment and water supply for the three standalone north Essex GC at West of Braintree (WoB), Colchester Braintree Borders (CBB) and Colchester Tendring Borders (CTB), sufficient to support the SSP.

In liaison with AWS and the Environment Agency, it will present a range of strategic-level wastewater and water supply options which are feasible and deliverable without impacting on regulatory environmental standards, thereby providing evidence that solutions to serve the development with strategic infrastructure are available. The solutions identified in Stage 1 will be taken into the Stage 2 Outline IWMS which will develop a preferred strategy for wastewater and water supply option delivery, which will be fully integrated with more local site specific issues such as flood risk and network connectivity.

The aim of this Stage 1 Technical Note is to present succinct, high level findings related to wastewater treatment options to feed into the ongoing Sustainability Appraisal of the SSP. The full Stage 1 report will provide full detailed study findings for wastewater and water supply options as well as baseline flood risk making up the full scope of Stage 1.

It should be noted that this note presents an interim position and the interim summary provided should not be relied upon as an external or public facing document other than the intended purpose of supporting the ongoing Sustainability Appraisal of the SPP. The findings within this Technical Note may be superseded through ongoing work on the Stage 1 study finalisation.

Existing Evidence Base

The following studies, reports and discussions have been used to inform the baseline conditions and option review for Stage 1 to date:

- Braintree District Council WCS, March 2017;
- Colchester Borough Council WCS, December 2016;
- North Essex Garden Communities Concept Feasibility study, Volume 3 Options and Evaluation (AECOM, 2016);
- Liaison with Masterplanning team for the West of Braintree (WoB) GC;
- Braintree Level 1 and Level 2 SFRA update;
- Colchester Level 1 and Level 2 SFRA update;
- Environment Agency Water Quality data (provided previously for the Braintree and Colchester WCSs);
- Meeting with AWS to discuss potential wastewater options (2nd May 2017);
- AWS WRMP 2014; and
- Affinity Water WRMP 2014.

Garden Communities Planning Figures

The following planning figures for the north Essex GCs have been provided by the WoB GC Masterplanning team and Colchester Council for this assessment, and are up to date as of April 2017. These figures show the maximum potential planning figures for each of the GCs.

Table 1: North Essex Garden Communities maximum planning figures (as of April 2017)

Garden Community	Total Proposed Development		Estimated Total Additional wastewater Flow (m ³ /d)
	Homes	Employment (ha)	
West of Braintree (WoB)	12,350	13	4,958
Colchester Braintree Borders (CBB)	24,000	40	9,641
Colchester Tendring Borders (CTB)	8,500	30	3,421

Wastewater Treatment Management Options

Based on the outcomes of the Braintree and Colchester WCS's, the Conceptual Feasibility Study and discussions with AWS, there are four potential wastewater treatment options to be assessed for each GC. These are presented below. To make the terminology in this note clear, it should be noted that AWS refer to wastewater treatment facilities as 'Water Recycling Centres' (WRC).

Option 1 - All GC growth to be served by an existing WRC:

WoB

All of the growth from WoB would be directed to Bocking WRC, which is located approximately 6km to the east of the proposed development (See Figure 1, Appendix A). The Conceptual Feasibility study states that the existing works would require an upgrade to treat the additional capacity and a new 6km pipeline would be required.

CBB and CTB

- The growth from both CBB and CTB would be directed to Colchester WRC.
- CBB is located approximately 11km to the west of Colchester WRC. Significant new infrastructure would be required including five new 2,000 m³/d pumping stations and 10km pipe network to connect it to Colchester WRC (Conceptual Feasibility Study).
- The most southerly point of CBT is approximately 1km north of Colchester WRC, however a new pipeline to connect to the WRC would need to cross the River Colne and a major road (A133). The Conceptual Feasibility Study identifies that a new 2000 m³/d pumping station would be required and a 2.5km pipeline.

Option 2 - All GC growth to be served by upgrading existing local WRCs

WoB options

Rayne WRC, Braintree WRC and Felsted WRC (see Appendix 1, Figure 1) were identified as potential options to treat the additional wastewater from the WoB GC, due to their proximity. Following discussions with AWS (2nd May 2017) it was concluded that:

- Rayne WRC has limited land for expansion, however if it were possible to purchase adjacent farmland then there would be potential for the construction of new medium sized WRC to serve the GC.
- Braintree WRC has no potential for expansion as site has been surrounded by development and odour complaints would restrict further expansion.
- Felsted WRC – *further information required from AWS.*

AECOM POSITION STATEMENT – 5TH MAY 2017

Felsted WRC is located with the District of Uttlesford and AWS were unable to provide full details on capacity of the WRC at the meeting held on the 2nd May 2017. AWS are providing further information for all WRC's discussed at the meeting and this detail will be included in the Stage 1 report.

CBB options

Coggeshall WRC, Great Tey WRC, Copford WRC and Birch WRC were identified as potential options to treat the additional wastewater from the CBB GC, due to their proximity. Following discussions with AWS it was concluded that:

- Coggeshall WRC has land around it therefore there is potential for expansion.
- Great Tey WRC would require complete rebuilding of the works and there would be significant opposition due to nearby roman archaeological sites.
- Copford WRC has no land available to expand as it is surrounded by designated sites.
- Birch WRC – *further information required from AWS.*

AECOM POSITION STATEMENT – 5TH MAY 2017

AWS were unable to provide full details on capacity of the Birch WRC at the meeting held on the 2nd May 2017. AWS are providing further information for all WRC's discussed at the meeting and this detail will be included in the Stage 1 report.

CTB options

The only existing local WRC suitable for the CTB GC is Colchester WRC, which potentially has space available for expansion; however the works are already close to existing consented flow.

Option 2 summary

The following WRCs have been considered for Option 2 for each GC as realistic options for treating some wastewater from each GC at local WRCs¹:

- WoB – Rayne WRC
- CBB – Coggeshall WRC
- CBT – Colchester WRC

¹ When further information on other WRCs is provided by AWS, the Stage 1 report may include detail on splitting flows for WoB and CBB to other WRCs

Option 3 - All GC growth to be served by the construction of a new WRC for each GC

WOB option

For WoB GC, the Conceptual Feasibility Study recommends that a new WRC is constructed to treat foul water closer to the proposed development and the IWMS has identified that pumping the treated effluent to Bocking WRC to be discharged into the River Blackwater would be the preferential option. The Braintree WCS states that this due to the limited environment capacity of nearby watercourses which would be unable to accept the volume of treated effluent without compromising WFD objectives and/or requiring significant treatment upgrades.

CBB option

The construction of a new package WRC within CBB GC is an alternative option to directing the wastewater to Colchester WRC. The IWMS has identified that treated effluent would be pumped to Coggeshall WRC and discharged into the River Blackwater.

CBT option

The construction of a new package WRC within CBT GC is an alternative option to directing the wastewater to Colchester WRC. The treated effluent would be discharged into the tidal River Colne, downstream of the existing Colchester WRC effluent discharge.

Option 4 - All GC growth to be served by one new strategic WRC (AWS Strategic Option)

AECOM POSITION STATEMENT – 5TH MAY 2017

The information provided on this option is confidential at the time of providing this Technical Note and should not be shared publically outside of the intended use of the note. AWS has shared their current thoughts on a strategic solution for the GC growth (as well as wider Local Plan growth) in light of the restricted capacity at existing facilities and the details of this option are at an early stage and need to be agreed with the Environment Agency. AWS will provide further detail for the Stage 1 report, and full assessment of this option will be undertaken at that time.

During discussions with AWS (May 2017), an alternative wastewater option was proposed to build a new strategic WRC that would serve all the growth from all three GCs, as well as to replace other local WRCs which are already near capacity and which would not be cost-effective to expand by bolting on new treatment processes.

It is suggested that the new WRC would discharge somewhere into the River Blackwater with an estimated treatment capacity of 40,000 m³; sufficient to serve the proposed GC growth, replace several existing (ageing) WRCs and provide further capacity into the future. The feasibility of this option requires a review of the potential impact of removing treated flow discharged to waterbodies which may be sensitive to this loss at low flow conditions, and a high level review of this impact will be considered in the Stage 1 report.

This new strategic WRC would also have the potential to treat the effluent to (or close to) potable standards, which could be used to meet the water supply demands in the local area either through an indirect re-use scheme (discharge of treated effluent to a river for later abstraction) or directly, depending on certain risk factors.

Wastewater treatment options summary

These four wastewater treatment options are summarised for each GC in Table 2.

Table 2: A summary of the wastewater demand options for each Garden Community

Option	GC	Serving WRC	Receiving watercourse	Benefits	Drawbacks
Option 1	WoB	Bocking WRC	River Blackwater	<ul style="list-style-type: none"> Lower cost due to economy of scales upgrading existing assets and treating large volume of wastewater. Colchester WRCs coastal discharge likely to require a less stringent discharge permit. 	<ul style="list-style-type: none"> Infrastructure cost undermining the viability of local WRCs whose discharge is essential component to flow in local watercourses. Loss of treated wastewater as a water resource to coastal discharge.
	CBB	Colchester WRC	River Colne		
	CTB	Colchester WRC	River Colne		
Option 2	WoB	Upgrade/replace: Rayne WRC	River Brain	<ul style="list-style-type: none"> Long term sustainability, balance between cost and environmental requirements. Maintain/improve flow conditions in local watercourses. 	<ul style="list-style-type: none"> High cost due to significant upgrades required to treatment processes and flow capacity at a number of local WRCs. Fluvial discharges (Rayne and Blackwater) likely to require tight discharge permit conditions due to nature of small watercourses.
	CBB	Upgrade Coggeshall WRC	River Blackwater		
	CTB	Upgrade Colchester	River Colne		
Option 3	WoB	New WRC within WoB	River Blackwater (Bocking WRC)	<ul style="list-style-type: none"> Additional headroom made available at Colchester WRC and Bocking WRC. Potential use of treated wastewater to contribute to local watercourse flow and replenish water resources Reduced pumping costs 	<ul style="list-style-type: none"> High cost associated with construction of new WRC. Suitable location of a new WRC requires detailed investigation.
	CBB	New WRC within CBB	River Blackwater (Coggeshall WRC)		
	CTB	New WRC within CTB	River Colne d/s of Colchester WRC		
Option 4	All GC growth	New Strategic WRC	River Blackwater	<ul style="list-style-type: none"> Greater economies of scale in building a new dedicated WRC New WRC location could be selected away from urban centres solving odour concerns at replaced WRCs Treatment processes built from new – tighter quality standards required for environmental compliance easier to achieve with new design as opposed to bolting treatment processes Potential for combined re-use scheme 	<ul style="list-style-type: none"> Financial feasibility would be dependent on a degree of certainty that growth will come forward Delays in implementation may make a scheme unviable if early phases of GC connect and utilise existing capacity Replacing smaller WRCs will remove potentially important baseflow of treated effluent to some watercourses

Wastewater Treatment Options Assessment

Headroom assessment

In order to determine the deliverability of each of the options, it is necessary to determine how much flow capacity is available at each WRC within its current permit to discharge. This determines how much additional wastewater can be accepted before a new permit will be required and potential upgrades to treatment processes being necessary.

The headroom capacity assessment has been completed in 2 stages. The first stage was to calculate the future headroom capacity for each WRC by the end of the current local plan period (2033), but excluding the early phasing of growth from the GCs which was initially included in the WCS. This identifies the potential headroom capacity and equivalent additional housing capacity that would be available by 2033 to accommodate the GC growth based on different assumptions included within the WCS.

The second stage was then to include the additional wastewater flow that would need to be treated on top of the previous local plan growth based on the various wastewater treatment options.

The volume of wastewater, measured as Dry Weather Flow (DWF), which would be generated from the proposed housing and employment growth over the a) Local Plan period and b) Local Plan growth plus the GC growth, within each WRC catchment has been calculated and compared to the treatment capacity at each WRC. DWF is an estimate of flow of foul water to a WRC.

The results for the headroom assessment for each WRC are presented in Table 3. The headroom capacities coloured green shows WRCs that can accept the proposed growth within the current permitted flow and the yellow shows the WRCs that would require a new discharge permit and a water quality assessment to further detail how much growth can be accommodated.

Table 3: Headroom capacity assessment for each WRC

WRCs	Headroom Assessment post local plan growth excluding GCs (to 2033)			Headroom Assessment post local plan growth including GCs (beyond 2033)				WRC Remaining Capacity (% of permitted flow after GC growth)
	Post Local Plan growth DWF (excl. GCs) (m3/d)	Headroom capacity after growth (m ³ /d)	Housing capacity after growth (dwellings)	Maximum no. of additional houses from GCs	Maximum Employment (Ha)	Post GC growth DWF (m3/d)	Headroom capacity after growth (m ³ /d)	
Bocking	3597	303	754	12,350	5	8,550	-4,650	-119%
Rayne	532	118	293	12,350	5	5,485	-4,835	-744%
Colchester	27865	1,419	3,539	24,000 + 8,500	16+12	40,926	-11,642	-40%
Coggeshall	2741	-506	-1,262	24,000	16	12,382	-10,147	-454
Great Tey	120 ²	22	55	24,000	16	9760	-9,618	-6773

Green - WRCs where growth can be accepted within the current permitted flow

Yellow - WRCs that require a new discharge permit and need a water quality assessment

Table 3 shows that for all the WRCs except Coggeshall, the existing permitted headroom is sufficient to accommodate the growth proposed in the Local Plans up to 2033 (excluding the GCs)³. The Braintree WCS demonstrated that based on the Braintree District Council housing trajectory for the local plan, the existing discharge permit at Coggeshall WRC will be exceeded in 2019.

However, once the maximum additional growth for each GC has been applied to each WRC, none of the WRCs would have sufficient headroom to receive all of the GC growth and would exceed their maximum permitted DWF under their existing discharge permits.

In order to accommodate the GC growth the WRCs would require a new discharge permit. To ensure that the increase in permitted DWF required to serve the proposed GC growth would not impact on downstream environmental requirements, further water quality modelling is required for each WRC to determine whether theoretically achievable

² Note, this is a different value compared to the Colchester WCS due to different assumptions on consumption for Braintree WCS, which is a more recent assessment

³ A WCS has not yet been completed for Tendring District, however a review of Local Plan site allocations suggests that Colchester WRC would receive limited growth from Local Plan sites.

quality conditions can be applied to a revised discharge permit. The key driver used in this assessment is attaining compliance with the Water Framework Directive (WFD) standards for water bodies.

Water Quality Assessment

Bocking, Rayne, Coggeshall and Great Tey WRCs all discharge to freshwater, inland waterbodies. Therefore, statistical based water quality modelling⁴ has been performed to check for compliance with the WFD objectives in terms of permit conditions for ammonia and phosphate. Load standstill calculations have been used to determine the future permit conditions for BOD. This approach follows Environment Agency guidelines and best practice.

Colchester WRC discharges into the tidal River Colne, therefore the RQP modelling software is not suitable for this site. Instead, load standstill calculations were used to determine the future permit conditions for BOD and Ammonia.

A summary of the results for each option within each GC are included in Tables 4, 5 and 6. The results show whether the increase in discharge from the GC growth would have the potential to impact WFD objectives as follows:

- A green cell indicates that the current permit quality conditions would be sufficient to ensure no WFD objective failures in the receiving waterbody – minimal upgrades would be required at the WRC;
- An amber cell identifies where the permit conditions for BOD, ammonia and phosphate would need to be revised in the future, however, the treatment processes required are achievable (and hence deliverable) within the limits of conventionally applied treatment and hence a solution is possible to ensure WFD compliance; and,
- A red cell identifies where a treatment solution beyond what is considered 'technically feasible' or within the limits of conventional treatment would be required, and hence compliance with the WFD is considered to be unachievable for this option.

The results are summarised in the following tables for each option for each GC in turn.

Table 4 shows the water quality results for the wastewater treatment options for the WoB GC. Options 1 and 3, where all the additional treated effluent would be discharged into the River Blackwater at Bocking WRC⁵ show that no deterioration of WFD status is achievable within the current limits of conventional treatment by tightening the permit conditions for BOD and ammonia, and a new condition for phosphate.

The load standstill results for Option 2 (Rayne WRC) show that only 10% of the proposed development at WoB GC growth (1250 houses) could be accommodated before a treatment solution beyond conventional treatment levels would be required to achieve no deterioration of WFD status in the River Brain. BOD is the restricting parameter and would drive how many houses could be connected to the works. Therefore, wastewater flow would need to be split between Rayne and Bocking WRCs depending on phasing and pumping requirements.

Table 4: Summary of RQP and Load Standstill Calculations – West of Braintree GC

Option	WRC	Growth Option	Consent DWF (m ³ /d)	BOD (mg/l)	Ammonia (mg/l)	Phosphate (mg/l)
1 and 3	Bocking	Current Consent conditions	3,900	15	10	-
		2033 Baseline (Local Plan Development excluding GC growth)	Within consented DWF	Within LCT	Within LCT	
		2033 Baseline + WoB growth	Exceeds consented DWF	Within LCT	Within LCT (No Deterioration)	Within LCT (No Deterioration)
2	Rayne	Current Quality Consent	650	10	3	-
		2033 Baseline (Local Plan Development excluding GC growth)	Within consented DWF	Within LCT		
		2033 Baseline + WoB growth	Exceeds consented DWF	Not within LCT		
		2033 Baseline + 10% of proposed growth for WoB	Exceeds consented DWF	Within LCT		

⁴ using Environment Agency River Quality Planning (RQP) software

⁵ Option 1 with wastewater treated at the WRC, and option 3 with treatment onsite and transfer to the River Blackwater for discharge

Table 5 shows the water quality results for the wastewater treatment options for the CBB GC. Option 1, where all the additional treated effluent (from both CBB and CTB GCs) would be discharged into the River Colne at Colchester WRC, shows that no deterioration of WFD status is achievable within the current limits of conventional treatment by tightening the permit conditions for BOD and ammonia. Therefore this is a workable solution for both CBB and CTB combined, and as individual GCs.

The water quality assessment for discharging into the River Blackwater at Coggeshall WRC (Options 2 and 3) shows that only 50% of the proposed development at CBB GC growth (12,000 houses) could be accommodated within the limits of conventional treatment to ensure no deterioration of WFD status of the receiving waterbody.

The water quality assessment for discharging into the Roman River at Great Tey WRC (Option 2) shows that it is not possible to achieve no deterioration of WFD status within the current limits of conventional treatment. The remaining 50% of the proposed housing and employment land wastewater would therefore need to be transferred to Colchester WRC for treatment, depending on phasing and pumping requirements. Colchester WRC is not considered to be a 'local' WRC within the context of the aim of Option 2, and therefore, Option 2 is not considered to be a viable option for the CBB GC. Additionally, local treatment for discharge at Coggeshall (Option 3) is also likely to be challenging unless new treatment process beyond conventional treatment are used.

Table 5: Summary of RQP and Load Standstill Calculations – CBB

Option	WRC	Growth Option	Consent DWF (m ³ /d)	BOD (mg/l)	Ammonia (mg/l)	Phosphate (mg/l)
1	Colchester	Current Quality Consent	29,284	35	15	-
		2033 Baseline (Local Plan Development excluding GC growth)	Within consented DWF	Within LCT	Within LCT	-
		2033 Baseline + CTB growth + CBB growth*	Exceeds consented DWF	Within LCT	Within LCT	-
2 and 3	Coggeshall	Current Quality Consent	2235	19	13	-
		2033 Baseline (Local Plan Development excluding GC growth)	Exceeds consented DWF	Within LCT		
		2033 Baseline + CBB growth	Exceeds consented DWF	Not within LCT	Within LCT (No Deterioration)	Within LCT (No Deterioration)
		2033 Baseline + 50% houses for CBB growth	Exceeds consented DWF	Within LCT	Within LCT (No Deterioration)	Within LCT (No Deterioration)
2	Great Tey	Current Quality Consent	142	30	-	-
		2033 Baseline (Local Plan Development excluding GC growth)	Within consented DWF	Within LCT		
		2033 Baseline + CBB growth	Exceeds consented DWF	Not within LCT	Not within LCT	Not within LCT
		2033 Baseline + 50% houses for CBB growth	Exceeds consented DWF	Not within LCT	Not within LCT	Not within LCT

* CBB Option 1 includes the growth from both CBB and CTB GCs being directed to Colchester WRC for treatment.

Table 6 shows the water quality results for the wastewater options for the CTB GC. All three options for CTB require discharging the full additional treated effluent into the River Colne at Colchester WRC. The results show that no deterioration of WFD status is achievable within the current limits of conventional treatment by tightening the permit conditions for BOD and ammonia.

Table 6: Summary of Load Standstill Calculations – Colchester and Tendring Border GC

Option	WRC	Growth Scenario	Consent DWF (m3/d)	BOD (mg/l)	Ammonia (mg/l)	Phosphate (mg/l)
1,2,3	Colchester	Current Quality Consent	29,284	35	15	-
		2033 Baseline (Local Plan Development excluding GC growth)	Within consented DWF	Within LCT	Within LCT	-
		2033 Baseline + CTB growth *	Exceeds consented DWF	Within LCT	Within LCT	-

* CTB Options 1,2,3 only includes growth for CTB GC to be treated at Colchester WRC.

Summary of Options

The headroom capacity assessments and water quality assessments have shown that there are workable wastewater options within the limits of conventional treatment for each of the three GCs in North Essex which would not impact on the WFD status of receiving waterbodies. The preferred options have been highlighted in bold below:

WoB – Option 1, directing all growth to Bocking WRC

– Option 2: 10% of growth to Rayne WRC, 90% to Bocking WRC

– **Option 3, constructing a new WRC on site and directing all treated effluent to discharge into the River Blackwater at Bocking WRC**

CBB – **Option 1, directing all growth to Colchester WRC**

– Option 2 – there is insufficient environmental capacity (within WFD limitations) in local watercourses to accept flow at local WRCs

– Option 3, constructing a new WRC on site and directing all treated effluent to discharge into the River Blackwater at Coggeshall WRC, however this location would only be able to accommodate 50% of CBB growth within limits of conventional treatment; the remainder would need to discharge to Colchester WRC

CTB – **Option 1 & 2, directing all growth to Colchester WRC**

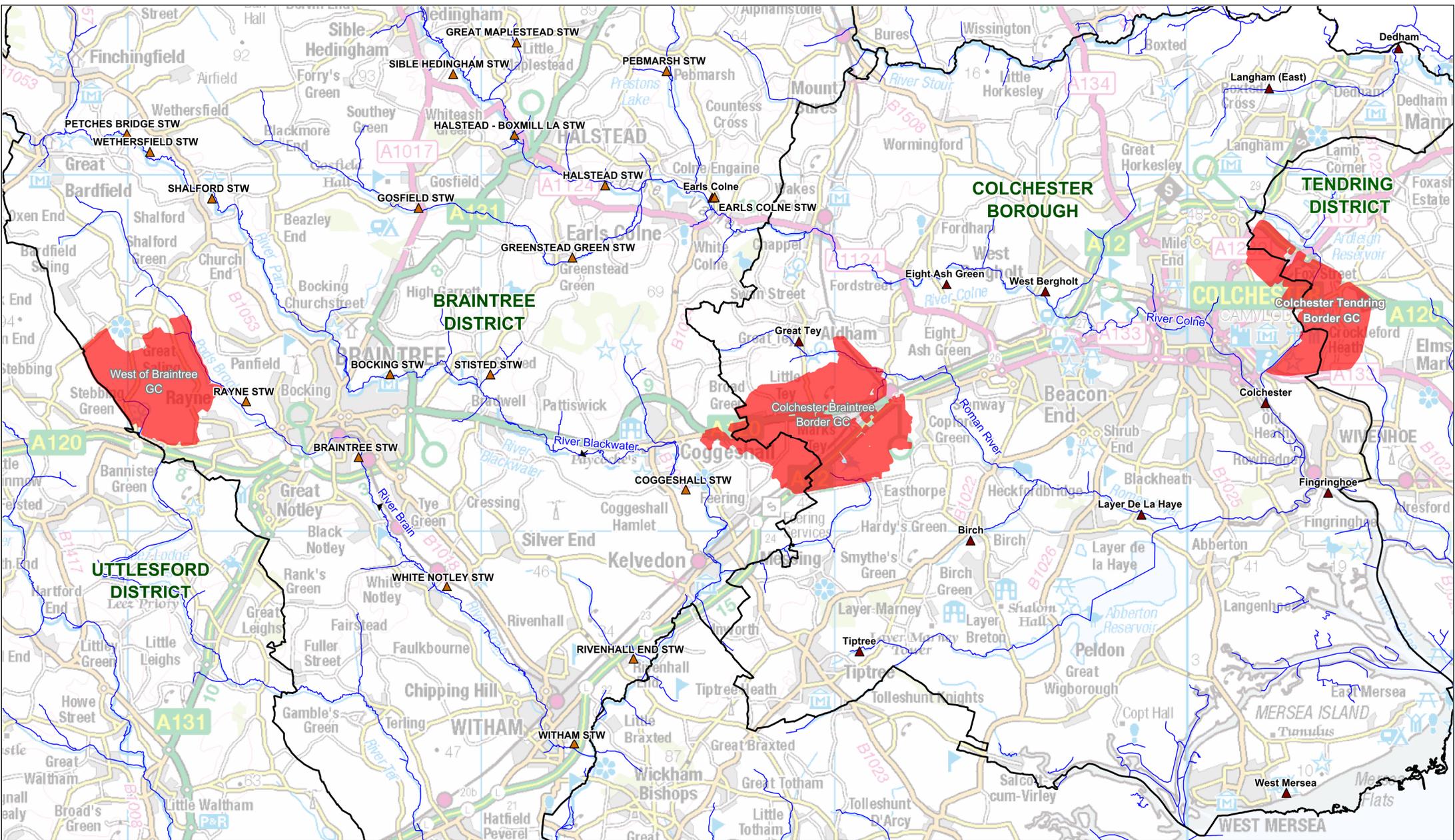
– Option 3, constructing a new WRC on site and directing all treated effluent to discharge into the River Colne downstream of Colchester WRC

Next Steps

Further detail regarding the interim solutions will be provided in the full Stage 1 report, including a high level assessment of connecting network infrastructure issues for each option and full technical details of the assessments undertaken. Water supply issues will also be addressed, alongside presentation of the baseline water environment and flood risk conditions. Further information from AWS and discussion with the Environment Agency will also be included.

Appendix A – Figure 1: Garden Communities Location Map

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- Legend**
- Council Boundary
 - Main Rivers
 - Proposed Garden Community Site
 - ▲ AWS WRC Locations

**North Essex Garden Communities
IWMS**

FIGURE 1 - LOCATION MAP

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Scale 1: 100,000

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