

Northumberland County Council Detailed Water Cycle Study Addendum



Northumberland County Council Detailed Water Cycle Study Addendum

Prepared by: Joanna Bolding
Hydrology Consultant

Checked by: Carl Pelling
Associate

Approved by: Sarah Kelly
Associate Director, Water

Rev No	Comments	Checked by	Approved by	Date
1	Draft	CP	SK	April 2016
2	Final	CP	SK	May 2016

AECOM Infrastructure & Environment UK Limited

Scott House, Alencon Link, Basingstoke, Hampshire, RG21 7PP

Tel: +44(0) 1256 310 200

Fax: +44(0) 1256 310 201

Website: <http://www.aecom.com>

Job No: 47070326

Date Created: May 2016

Limitations

AECOM Infrastructure & Environment UK Limited ("AECOM") has prepared this Report for the sole use of **Northumberland County Council** ("Client") in accordance with the Agreement under which our services were performed in accordance with our proposal. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report is confidential and may not be disclosed by the Client nor relied upon by any other party without the prior and express written agreement of AECOM.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between **October 2015** and **May 2016** and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Copyright

© This Report is the copyright of AECOM Infrastructure & Environment UK Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

Table of Contents

1 Introduction.....	5
1.1 Background	5
1.2 Detailed WCS Addendum Scope.....	5
1.3 Overview of the potential development area options	6
1.4 Methodology and Data Collection	8
1.4.1 WwTW Capacity Assessment Method	8
2 Northumberland WCS Assessment Overview	9
2.1 Wastewater Treatment and Collection Assessment.....	9
2.1.1 WwTW Capacity Assessment Results.....	9
2.1.2 Water Quality Consents Assessment Results.....	11
2.1.3 Sewer Network Assessment Results.....	11
2.2 Water Environment.....	12
2.3 Ecology and Biodiversity	12
2.3.1 Update to the baseline ecology assessment data - Marine Conservation Zones	13
2.3.2 Ecology and Biodiversity Assessment results	14
2.4 Water Resources and Supply	17
2.5 Flood Risk Summary	17
2.6 Surface Water Management and Sustainable Drainage	17
2.6.1 Updated Surface Water Management and SuDS Summary.....	17
2.7 Climate Change	18
3 Site Assessments for Rest of North Delivery Area	19
3.1 WCS Site Assessments	19
3.2 Infrastructure Recommendations	19
4 Infrastructure Summary	25
4.1 Site Assessment Summary	25
4.1.1 Wastewater Treatment and Collection Assessment.....	25
4.1.2 Ecology and Biodiversity	26
4.1.3 Water Resources and Supply	27
4.1.4 Fluvial/Tidal Flood Risk	27
4.2 Recommended Phasing of Development.....	28
4.3 Funding Options and Developer Guidance.....	28
4.4 WCS Policy Recommendations	28
Appendix A - Figures	29

1 Introduction

1.1 Background

In October 2015, AECOM completed the Detailed Water Cycle Study (WCS) for Northumberland County Council (NCC), to support the development of NCC's Local Plan.

At the time of publication of the Final Detailed WCS, the potential development area option information for the Rest of North Delivery Area Scenario 2 was not assessed. This addendum report builds on the detailed WCS, using the same methodologies to provide an assessment of the potential development area options in scenario 2 for the Rest of North Delivery Area.

1.2 Detailed WCS Addendum Scope

The aim of this addendum is to provide a detailed WCS assessment for the potential development area options within the Rest of the North Delivery Area for Scenario 2, following the same method of assessment as that used in the main detailed WCS report.

The objective of a WCS assessment is to identify any constraints on planned housing and employment growth that may be imposed by the water cycle. The WCS assessment then identifies how these can be resolved i.e. by ensuring that appropriate Water Services Infrastructure can be provided to support the proposed development without adversely affecting the water environment. Furthermore, it should provide a strategic approach to the management and use of water which ensures that the sustainability of the water environment in the county is not compromised.

The detailed WCS and this addendum will be used to inform the NCC Infrastructure Delivery Plan (IDP), which will outline a strategic plan for development and infrastructure investment across Northumberland County over the planning period. Developed in partnership with stakeholders including Northumbrian Water (NW) and the Environment Agency, The WCS and this addendum serves to assist in coordinating and aligning the actions and investment plans of infrastructure providers and regulators to best effect, and in line with the Core Strategy. The IDP will be updated annually in order to reassess investment needs, overcome any capacity constraints and address environmental considerations.

The following sets out the key objectives of the detailed WCS and this addendum for NCC:

- Determine if solutions to wastewater treatment for each potential option for growth are required and how this might impact phasing of development within (and around) each potential growth location;
- Determine whether any Habitats Directive designated ecological sites have the potential to be impacted (either adversely or beneficially) by the wastewater treatment strategy via a screening process;
- Determine whether additional water resources are required to support growth;
- Determine upgrades required to water supply infrastructure relative to potential options for growth;
- Provide detail on SuDS constraints/opportunities, surface water and flood risk for each development location;
- Identification of opportunities for the implementation of sustainable green infrastructure;
- Provision of developer guidance for sustainable new development which protects/enhances Northumberland's water environment and assets.

1.3 Overview of the potential development area options

The potential housing development and employment growth figures assessed in the detailed WCS and this addendum have been provided by NCC and are based on the Northumberland Local Plan: Core Strategy Preferred Options for Housing, Employment and Green Belt (October 2013) and the Core Strategy Full Draft Plan (December 2014). Table 1-1 summarises the potential housing and employment figures for the Rest of the North Delivery area assessed in this addendum. The number of potential housing developments were identified by NCC using the Strategic Housing Land Availability Assessment (SHLAA), which assesses sites with potential for housing on their suitability and the likelihood of the development coming forward in the future (the availability and achievability). Whilst the potential development areas options for housing have been informed by the SHLAA, not all SHLAA sites have been examined. The potential development area options are focussed on the larger scale SHLAA sites or collections of SHLAA sites, which has been refined by the assessment of the most suitable, available and achievable sites. The sites are not an exhaustive list and there are other SHLAA sites which could contribute towards delivering the proposed housing numbers set out in the Core Strategy.

In the Rest of North Delivery Area, the total number of housing units or employment allocations across the potential development area options exceeds the total number of housing or employment development set out in the Core Strategy for the Rest of North Delivery Area. The potential development area options provide a range of development scenarios, where the sum of the individual potential development area option housing figures is greater than the Core Strategy allocation. Two potential housing scenarios have been assessed for the Rest of the North Delivery Area:

- Scenario 1 for the Rest of the North Delivery Area comprises of 180 potential dwellings across Glanton, Whittingham, Norham, Cornhill on Tweed and Scremerston, and has been assessed within the main detailed WCS report.
- Scenario 2 for the Rest of the North Delivery Area comprises of 1100 potential dwellings across 24 potential development area options (Table 1-1)

The North Northumberland Delivery Area (described in Section 2.1.3 in the main detailed WCS report) is a largely rural area and sparsely populated, therefore the potential development area options in in Scenario 2 are generally small settlements with separate WwTWs. There are no planned employment opportunities in this scenario.

As described in Section 2.2.1 of the main detailed WCS report, the following assumptions have been used for the assessment of the potential housing figures:

- Each potential development area option has been assessed against the current status of the local water infrastructure and water environment, and it has been identified if any significant constraints would limit the level of development in any one particular settlement over the plan period. NW has provided the WwTW headroom (in terms of housing units) for this study, which is based on current capacities. Further details of the WwTW capacity assessment methodology are discussed in Section 1.4.1.
- The assessment of the potential housing development in Northumberland has been phased over four time periods, 2011-2016, 2016-2021, 2021-2026 and 2026-2031 and it has been agreed with NCC that for the detailed WCS assessment, the total potential housing development for each settlement has been equally divided across these time periods at this point in time. It is recognised that the phasing of development may be dependent on infrastructure provision.

Table 1-1 Potential Development Area Option in the Rest of North Delivery Area

Dwellings Target	Potential development area options	Total Potential Housing Units	Potential Phased Housing Development			
			2011-2016	2016-2021	2021-2026	2026-2031
Scenario 2 1100	Acklington	127	32	32	31	31
	Alnmouth	36	9	9	9	9
	Amble (within Warkworth Parish)	70	18	18	17	17
	Warkworth	169	43	42	42	42
	Bowsden	13	4	3	3	3
	Branxton	13	4	3	3	3
	Christon Bank	104	26	26	26	26
	Cornhill on Tweed	133	34	33	33	33
	Eglington	24	6	6	6	6
	Ellingham	39	10	10	10	9
	Embleton	222	56	56	55	55
	Felton	182	46	46	45	45
	Glanton	48	12	12	12	12
	Hipsburn	83	21	21	21	20
	Holy Island	12	3	3	3	3
	Horncliffe	14	4	4	3	3
	Lesbury	47	12	12	12	11
	Longframlington	215	54	54	54	55
	Longhoughton	93	24	23	23	23
	Lowick	157	40	39	39	39
	Lucker	48	12	12	12	12
	Milfield	44	11	11	11	11
	Newton by the Sea	18	5	5	4	4
	Newton on the Moor	37	10	9	9	9
	Norham	51	13	13	13	12
	Powburn	17	5	4	4	4
	Rennington	41	11	10	10	10
	Rock	19	5	5	5	4
	Scremerston	264	66	66	66	66
	Shilbottle	196	49	49	49	49
South Charlton	40	10	10	10	10	
Swarland	30	8	8	7	7	
Whittingham	23	6	6	6	5	

1.4 Methodology and Data Collection

The methodology for this addendum follows that of the main detailed WCS (Section 3) with the exception of the WwTW capacity assessment as set out in the following section. Other than identified for the WwTW capacity assessment, no further data has been provided for this report in addition to that provided for the main detailed WCS report. Therefore, unless stated, any updated policy or planning documents that have been published in the interim period between the main detailed WCS and the addendum have not been included.

A description of any updates to the baseline data sources used for assessment are included in Chapter 4 of the main detailed WCS report.

1.4.1 WwTW Capacity Assessment Method

In the detailed WCS, NW provided an assessment of the headroom available at each WwTWs, identifying the current compliance and production constraints and ability for the works to accommodate the proposed growth. However, for this addendum, NW only provided the headroom available for the additional WwTWs in terms of housing units and not a direct assessment of capacity. Therefore the WwTW capacity assessment method has been revised slightly for the additional WwTWs affected in the assessed scenario.

For this addendum, the potential housing units for each potential development area option were assessed against the headroom available at each WwTW (provided as housing units available), using the Red Amber Green (RAG) assessment method in Table 1-2.

Where the headroom is available to accommodate the potential housing units, it has been concluded that there are no capacity constraints and a green RAG assessment applied. Where the headroom is not sufficient to meet the potential housing units, it was given an amber RAG assessment.

Table 1-2 Key for Wastewater Network RAG Assessment

	There are no capacity constraints to this WwTW
	There is limited capacity at the WwTW, however NW have identified potential actions to allow more headroom
	There is no capacity at the WwTW and a solution has not yet been identified

2 Northumberland WCS Assessment Overview

This section presents the results for each aspect of the water cycle for Scenario 2 of the Rest of North Delivery Area. Detailed results for each potential development area option are presented in Section 3 of this addendum (Site Assessments for Rest of North Delivery Area).

2.1 Wastewater Treatment and Collection Assessment

2.1.1 WwTW Capacity Assessment Results

NW has provided the headroom available for each WwTWs in terms of housing units. NW's housing unit capacity data assumes that no surface water will be discharged to WwTW. And hence, the headroom figures provided by NW relate to foul flows only.

Table 2-1 presents results of the WwTW capacity assessment for each WwTW in the Rest of North Delivery Area. It identifies which potential development area options (with potential development) are within the drainage catchment and the current consented dry weather flow (DWF) for the WwTW. It should be noted that Table 2-2 represents a snapshot in time (based on capacity in 2016). The capacity of WwTWs can be transient and headroom can be created and conversely taken away unexpectedly through operational issues. Similarly NW's planned investments are scheduled according to 5 year programmes and within each 5 year period of capital projects, the programmes are subject to on-going review to effectively prioritise investments according to a range of factors including demand.

Considering the points above, NW are unable to commit to delivering upgrades to WwTWs at a specific year in the future due to phasing of development, however, NW will continue to invest in headroom as a requirement when development is confirmed, and this will be monitored through the NCC IDP. The IDP will be annually updated to reassess infrastructure capacity and needs. This review process will be critical to capture changes and will also be a key mechanism by which NCC, NW, the Environment Agency and other stakeholders will work collaboratively to appraise investment needs, overcome any capacity constraints and address environmental considerations.

Table 2-1 WwTW Capacity Assessment Results Summary for the Rest of North Delivery Area

WwTW	Potential development area options	Current Permitted DWF (m ³ /d)	Headroom (Units)	Potential Development (Units)	Overall Capacity Constraints
Bowsden	Bowsden	N/A	48	13	Descriptive consent.
Branxton	Branxton	N/A	58	13	Descriptive consent.
Cornhill on Tweed	Cornhill on Tweed	N/A	20	133	Descriptive consent. Limited capacity for development at present. Potential need for upgrade
Horncliffe	Horncliffe South	15	0	14	No Capacity. No current plans to upgrade works however when development is certain NW will commence its investment procedure
Lowick	Lowick	105	152	157	Limited Capacity. If further development in excess of current headroom is certain NW will commence its investment procedure
Milfield	Milfield	56	0	44	No Capacity. No current plans to upgrade works however when development is certain NW will commence its investment procedure

WwTW	Potential development area options	Current Permitted DWF (m3/d)	Headroom (Units)	Potential Development (Units)	Overall Capacity Constraints
Norham	Norham	163	11	51	Limited Capacity. If further development in excess of current headroom is certain NW will commence its investment procedure
Berwick	Scremerston	8,100	3,190	264	
Togston	Acklington	174	140	127	
Alnmouth	Alnmouth	418	0	36	No Capacity. No current plans to upgrade works however when development is certain NW will commence its investment procedure
	Hipsburn			83	
	Lesbury			47	
Amble	Amble (within Warkworth Parish)	2,512	909	70	
	Warkworth			169	
Embleton	Christon Bank	294	0	104	No Capacity. No current plans to upgrade works however when development is certain NW will commence its investment procedure
	Embleton			222	
	Newton by the Sea			18	
Eglington	Eglington	N/A	0	24	Descriptive consent. No headroom for development at present. Potential need for upgrade
Ellingham	Ellingham	34	82	39	
Felton	Felton	971	65	182	Limited Capacity. If further development in excess of current headroom is certain NW will commence its investment procedure
	Longframlington			215	
	Swarland			30	
Glanton	Glanton	90	98	48	
Holy Island	Holy Island	N/A	90	12	Descriptive consent.
Boulmer	Longhoughton	664	249	93	
Newton on the Moor	Newton on the Moor	35	54	37	
Powburn	Powburn	106	39	17	
Rennington	Rennington	N/A	62	41	Descriptive consent.
Shilbottle	Shilbottle	376	67	196	Limited Capacity. If further development in excess of current headroom is certain NW will commence its investment procedure
Whittingham	Whittingham	77	39	23	

This assessment indicates that several WwTW (classed as amber in the RAG assessment) do not have capacity to accept further growth and that investigation to expand these works and determine a treatment solution would need to commence once further certainty of growth is forthcoming.

For the purposes of this WCS, it is important to consider whether there are any potential constraints to a further solution in relation to water quality of the watercourses receiving the treated discharge from amber assessed WwTWs. A water quality consents assessment has therefore been undertaken to determine any water quality constraints.

2.1.2 Water Quality Consents Assessment Results

Each of the consents to discharge for the WwTWs classified as 'red' or 'amber' for capacity were assessed in terms of their quality conditions, and the water quality condition for each discharge parameter compared to the value at which it is considered that further improvements cannot be achieved using conventionally applied treatment. For the purposes of this study, the limits of conventionally applied treatment processes are considered to be:

- 5mg/l for BOD;
- 1mg/l for Ammoniacal-N; and
- 1mg/l for Phosphate.

Where the conditions for a current discharge parameter can be reduced within the limits set out above, a solution is more likely to be feasible and for the purposes of this study, it has been concluded that a solution is more likely to be achieved. It should be noted that further detailed modelling would be required by NW (in conjunction with the Environment Agency) to determine the consent conditions required once the growth targets have been confirmed.

Table 2-2 shows a summary of the WwTW consents assessment. The receiving watercourses are those associated with the discharge of the WwTW.

Table 2-2 WwTW Consent Assessment Results Summary for the Rest of North Delivery Area

WwTW	Receiving Watercourse	Current WFD Status ¹	DWF (m3/d)	BOD (mg/l)	Ammonia (NH3) (mg/l)	Phosphate (mg/l)	Overall Assessment
Cornhill on Tweed	River Tweed	Good	Descriptive consent				
Horncliffe	River Tweed	Good	15	N/A	N/A	N/A	
Lowick	Tributary of the Low	Good	105	35	N/A	N/A	
Milfield	Tributary of the River Till	Good	56	25	N/A	N/A	
Norham	River Tweed	Good	163	40	N/A	N/A	
Alnmouth	River Aln (Transitional Water)	Good	418	25	N/A	N/A	
Embleton	Embleton Burn	Moderate	294	22	8	N/A	
Eglingham	Eglingham Burn	Moderate	Descriptive consent				
Felton	River Coquet	Good	971	40	30	N/A	
Shilbottle	Tyelaw Burn	Moderate	376	32	10	N/A	

Table 2-2 shows that all of the WwTW consents are greater than the conventionally applied treatment process limits. Therefore it is possible that the consents at these works can be constrained with tighter limits (and improved treatment processes) in the future and hence a solution is theoretically possible at these locations.

2.1.3 Sewer Network Assessment Results

The detailed sewer network results are included in the site specific assessments in Section 3. It has been assumed that the new developments will require local connections to the existing drainage system, for which NW will need to be consulted on during or prior to the planning application, and that no surface water will be discharged to combined sewers.

¹ Waterbody classification based on 2015 Cycle 2. Available here: <http://environment.data.gov.uk/catchment-planning/ManagementCatchment/3067> Accessed 29/03/2016.

2.2 Water Environment

The WwTW capacity assessment (Table 2-1) has been used to identify the WwTWs discharging to designated bathing waters that currently have limited capacity (Amber) or no capacity (Red). Table 2-3 shows that three of the Bathing Waters in Northumberland are at potential risk of increased discharges from proposed development in the sewer drainage catchments for Alnmouth, Felton and Embleton WwTWs. This has the potential to contribute to deterioration in the water quality of the discharges at these sites, and impact on their compliance with the Bathing Water Directive Standards, due to increased discharge volumes. However, it is likely that improvements to the WwTWs would be feasible through improved tertiary treatment, such as UV treatment, or reducing discharges from combined sewer outflows. When growth is certain at these sites, NW will commence its investment procedure.

Table 2-3 WwTW Consent Assessment Results Summary for the Rest of North Delivery Area

Designated Bathing Water Site	WwTW	WwTW capacity RAG
Warkworth	Alnmouth WwTW	Amber
Amble Links	Felton WwTW	
Low Newton	Embleton WwTW	

Under Scenario 2 for the Rest of the North Delivery Area, Holy Island has 12 potential development housing units. The Holy Island WwTW discharges to waters that are designated shellfish waters and must comply with the Shellfish Water Standards. It is assumed that due to the small scale of the potential development, the increase in discharge volumes will not impact on compliance with the designated Shellfish Waters Standards. However, when growth is certain, NW will ensure any increase in flows to the WwTW from development does not result in a breach of the existing consents.

2.3 Ecology and Biodiversity

An ecology assessment is required for WwTWs that are assessed as having limited or no available capacity for the new development. Small WwTWs with descriptive consents were excluded from the assessment due to their size and therefore negligible impact.

In line with the main detailed WCS report, a high-level ecological assessment can be undertaken for the addendum since no River Quality Planning assessment has been undertaken. NW has commented that they would intend to do their own assessment once the scale and nature of development in a particular WwTW catchment was certain. The ecology assessment has therefore been risk-based and involved an analysis of:

- which wastewater treatment works (if any) would need to increase their consented discharge volumes as a result of the new housing intended for the catchment;
- How these WwTW are situated regarding water flow and quality sensitive statutory designated wildlife sites (Special Area of Conservation, Special Protection Area, Ramsar site, Site of Special Scientific Interest, Marine Conservation Zone and Local Nature Reserve);
- What level of risk to the designated site is likely to be posed taking into account:
 - The current WFD Status of the receiving watercourse for the WwTW;
 - The vulnerabilities of the designated site;
 - The proximity and/or directness of connection between the WwTW and the designated site; and
 - The size of the WwTW in terms of DWF and thus the relative scale of its discharges relative to overall flows in the receiving watercourse.

In addition to designated sites, the WFD status of the receiving watercourse has also been taken into account in determining risk, irrespective of connections to statutory designated sites.

2.3.1 Update to the baseline ecology assessment data - Marine Conservation Zones

Since the Detailed WCS report was published, the proposed Coquet to St Mary's Marine Conservation Zone (MCZ) and Farnes East MCZ that were in consultation were designated as MCZs in January 2016.

There are three confirmed MCZs within Northumberland; the AIn Estuary MCZ, Coquet to St Mary's MCZ, and Farnes East MCZ. Impacts on these sites require consideration in line with the provisions of the Marine and Coastal Access Act 2009. Two of the three MCZs (AIn Estuary MCZ and Coquet to St Mary MCZ) are located downstream of WWTWs that will need to exceed consented discharge volumes to accommodate proposed development within Scenario 2 for the Rest of the North Delivery Area.

2.3.2 Ecology and Biodiversity Assessment results

The results of the high-level ecological analysis for Scenario 2 of the Rest of North Delivery Area are presented in Table 2-4.

Table 2-4 WwTW and Related Designated Wildlife sites for the Rest of North Delivery Area

WwTW	Receiving watercourse	Downstream designated wildlife sites (statutory and non-statutory)	Risk of impact
Horncliffe WwTW	River Tweed	WwTW discharges directly into the River Tweed SAC and Tweed Catchment Rivers - England: Lower Tweed and Whiteadder SSSI. More than 7km downstream of the WwTW the River Tweed flows into the Tweed Estuary SAC, and more than 12km downstream from the WwTW the River Tweed flows into the Berwickshire and North Northumberland Coast SAC, Northumbria Coast SPA and Ramsar site and Northumberland Shore SSSI.	<p>WwTW classified as high risk because the WwTW discharges directly into the River Tweed SAC and Tweed Catchment Rivers: Lower Tweed & Whiteadder SSSI. Both sites have significant water quality constraints due to high existing phosphate levels.</p> <p>Tweed Estuary SAC, Berwickshire and North Northumberland Coast SAC, are downstream of the WwTW at the mouth of the River Tweed, These sites are already affected by smothering macro-algal growth due to eutrophication, particularly at Budle Bay, and have poorly flushed enclosed bays. However, these are sufficiently far (over 12km in the case of River Tweed SAC and further for the other sites) that, considerable dilution of effluent will take place.</p> <p>For reasons discussed in section 4.3.1 Northumbria Coast SPA is not considered susceptible to negative effects through the pathway of increased discharge of treated sewage effluent. The Northumberland Shore SSSI consists largely of sandy bays separated by rocky headlands with wave-cut platforms, backed by dunes or soft and hard cliffs. As such, its susceptibility to high nitrogen loading is limited.</p>
Lowick WwTW	A tributary of The Low	WwTW discharges into the non-statutory tributary of The Low. The WwTW discharges more than 11.5km upstream of the Lindisfarne Ramsar/ SPA/ SSSI, Berwickshire and North Northumberland Coast SAC and North Northumberland Dunes SAC.	<p>WwTW is classified as medium risk as it is located more than 11.5km upstream of sensitive designated sites.</p> <p>Lindisfarne designated sites and Berwickshire & North Northumberland Coast SAC are known to be affected by high water column nitrate concentrations. These designated sites could be further affected by any increase in treated sewage effluent unless nitrogen removal to an improved standard was possible. Due to the distance involved, a level of dilution is likely to occur.</p> <p>North Northumberland Dunes SAC does not contain any features that would be sensitive to water quality impacts from increased discharge of treated sewage effluent.</p>

WwTW	Receiving watercourse	Downstream designated wildlife sites (statutory and non-statutory)	Risk of impact
Milfield WwTW	Unnamed tributary of the River Till	<p>The River Till, 0.2km downstream of the WwTW is covered by the River Tweed SAC and Tweed Catchment Rivers: England SSSI designations.</p> <p>Till Riverbank SSSI, Tweed Catchment Rivers: Lower Tweed and Whiteadder SSSI, Tweed Estuary SAC, Berwickshire and North Northumberland Coast SAC, Northumberland Coast SAC, Northumberland Shore SSSI, Northumbria Coast Ramsar site, and Lindisfarne SSSI/SPA/Ramsar site/NNR. Are all located downstream.</p>	<p>WwTW classified as high risk because the WwTW discharges a short distance upstream of the Till Riverbank SSSI, River Tweed SAC and Tweed Catchment Rivers: Lower Tweed & Whiteadder SSSI. All three sites have significant water quality constraints due to high existing phosphate levels. The River Till is in unfavourable declining condition. According to the Natural England condition assessment for this SSSI water quality data from the Environment Agency indicates that the P level downstream of the WwTW outfall are above the levels set out in the Favourable Condition Tables.</p> <p>Tweed Estuary SAC, Berwickshire and North Northumberland Coast SAC and Lindisfarne designated site are also downstream of the WwTW at the mouth of the River Tweed, These sites are already affected by smothering macro-algal growth due to eutrophication, particularly at Budle Bay, and have poorly flushed enclosed bays. However, these are sufficiently far (over 40km in the case of Lindisfarne) that, considerable dilution of effluent will take place.</p> <p>In addition, Lindisfarne SSSI/SPA/Ramsar site/NNR and Berwickshire & North Northumberland Coast SAC are these designated sites could be further affected by any increase in treated sewage effluent unless nitrogen removal to an improved standard was possible. However due to the distances involved, effluent will have diluted</p>
Norham WwTW	River Tweed	<p>WwTW discharges directly into the River Tweed SAC and Tweed Catchment Rivers - England: Lower Tweed and Whiteadder SSSI. More than 11km downstream of the WwTW the River Tweed flows into the Tweed Estuary SAC, and more than 16km downstream from the WwTW the River Tweed flows into the Berwickshire and North Northumberland Coast SAC, Northumbria Coast SPA and Ramsar site and Northumberland Shore SSSI.</p>	<p>WwTW classified as high risk because the WwTW discharges directly into the River Tweed SAC and Tweed Catchment Rivers: Lower Tweed & Whiteadder SSSI. Both sites have significant water quality constraints due to high existing phosphate levels.</p> <p>Tweed Estuary SAC, Berwickshire and North Northumberland Coast SAC, are downstream of the WwTW at the mouth of the River Tweed, These sites are already affected by smothering macro-algal growth due to eutrophication, particularly at Budle Bay, and have poorly flushed enclosed bays. However, these are sufficiently far (over 11km in the case of River Tweed SAC) that, considerable dilution of effluent will take place.</p> <p>For reasons discussed in section 4.3.1 Northumbria Coast SPA is not considered susceptible to negative effects through the pathway of increased discharge of treated sewage effluent. The Northumberland Shore SSSI consists largely of sandy bays separated by rocky headlands with wave-cut platforms, backed by dunes or soft and hard cliffs. As such, its susceptibility to high nitrogen loading is limited.</p>
Alnmouth WwTW	River Aln	<p>WwTW discharges directly into the Aln Estuary MCZ, Northumberland Marine pSPA, and about 0.5km upstream of the Alnmouth Saltmarsh and Dunes SSSI, Northumberland Shore SSSI, and North Northumberland Dunes SAC. Northumberland Marine pSPA is located approximately 1km downstream where the River Aln discharges into the sea at Alnmouth Bay</p>	<p>WwTW classified as high risk because the WwTW discharges directly into the Aln Estuary MCZ and Northumberland Marine pSPA, a short distance upstream of Alnmouth Saltmarsh & Dunes SSSI.</p> <p>North Northumberland Dunes SAC does not contain any features that would be sensitive to water quality impacts from increased discharge of treated sewage effluent. For reasons discussed in section 4.3.1 Northumbria Coast SPA is not considered susceptible to negative effects through the pathway of increased discharge of treated sewage effluent. The Northumberland Shore SSSI consists largely of sandy bays separated by rocky headlands with wave-cut platforms, backed by dunes or soft and hard cliffs. As such, its susceptibility to high nitrogen loading is limited. Coquet Island and the Farne Islands are unlikely to be affected due to their distance from the coast and in particular the strong southward action of longshore drift on the coast.</p> <p>Berwickshire and North Northumberland Coast SAC and the Lindisfarne designated sites are all located north of the river mouth. These sites are water quality sensitive. However, nitrogen inputs are likely to be dominated by marine sources. There is strong southward action of longshore drift on this coast so the discharge should be dispersed away from the sensitive sites.</p>

WwTW	Receiving watercourse	Downstream designated wildlife sites (statutory and non-statutory)	Risk of impact
Embleton WwTW	Embleton Burn	WwTW discharges directly into Embleton Burn, 2km downstream of Berwickshire and North Northumberland Coast SAC/SPA, Northumberland Marine pSPA and Northumberland Shore SSSI, and a short distance from the Northumbria Coast Ramsar/ pSPA.	<p>Berwickshire & North Northumberland Coast SAC is known to be affected by high water column nitrate concentrations. These designated sites could be further affected by any increase in treated sewage effluent unless nitrogen removal to an improved standard was possible.</p> <p>Northumberland Marine pSPA has potential to be affected by smothering macro-algal growth due to eutrophication, particularly at Budle Bay, and has poorly flushed enclosed bays.</p> <p>The Northumberland Shore SSSI consists largely of sandy bays separated by rocky headlands with wave-cut platforms, backed by dunes or soft and hard cliffs. As such, its susceptibility to high nitrogen loading is limited.</p> <p>For reasons discussed in section 4.3.1 Northumbria Coast SPA is not considered susceptible to negative effects through the pathway of increased discharge of treated sewage effluent.</p> <p>Due to the distances involved, the WwTW is of medium risk due to dilution of effluent.</p>
Felton WwTW	River Coquet	WwTW discharges directly into River Coquet and Coquet Valley Woodlands SSSI, which has potential to be vulnerable to changes in water quality and quantity.	<p>The WwTW is classified as high risk because the WwTW discharges directly into a water quality sensitive SSSI (River Coquet & Coquet Valley Woodlands SSSI). Some parts of the River Coquet have historic water quality issues due to diffuse pollution.</p> <p>Due to the distances of Northumberland Marine pSPA, Warkworth Dunes and Saltmarsh SSSI, Northumberland Shore SSSI, Amble Dunes LNR, and Coquet Island SPA/SSSI from the WwTW (more than 15km from the discharge point), any inputs will be sufficiently dispersed so as not to impact the sites.</p>
Shilbottle WwTW	Tyelaw Burn (River Coquet)	WwTW discharges into River Coquet with the Coquet Valley Woodlands SSSI more than 4km from the WwTW. The SSSI has potential to be vulnerable to changes in water quality and quantity.	<p>The WwTW is classified as medium risk. It is important to maintain good water and sediment levels within the River Coquet, some parts of which have historic water quality issues due to diffuse pollution. It is susceptible to increase in phosphorous from WwTW discharge where concentrations can lead to algae and the loss of characteristic plants and animals. Organic pollutants should be controlled to avoid eutrophication.</p> <p>Due to the distances of Northumberland Marine pSPA, Warkworth Dunes and Saltmarsh SSSI, Northumberland Shore SSSI, North Northumberland Dunes SAC, Warkworth Dunes and Saltmarsh SSSI, Northumberland Coast SPA/ Ramsar, Amble Dunes LNR and Coquet Island SPA/SSSI located more than 15km from the discharge point, any inputs will be sufficiently dispersed so as not to impact the sites.</p>

2.4 Water Resources and Supply

The detailed WCS report assesses the water resource and supply available to the potential development area options using Northumbrian Water Limited's Water Resources Management Plan (WRMP) 2014. The same WRMP has been used to assess water resource availability for proposed development within Scenario 2 for the Rest of the North Delivery Area.

There are two Water Resource Zones (WRZs) serving Northumberland County: the Kielder WRZ and the Berwick and Fowberry WRZ. The Kielder WRZ relies on the Kielder Reservoir to meet supply demand, augment river flows and maintain other reservoir levels in times of drought to meet demand. There is a large surplus in this WRZ, therefore there is no requirement to plan a new water resource scheme to supply new developments located in this WRZ.

The Berwick and Fowberry WRZ relies on groundwater sources from the Fell Sandstone Aquifers. At present, the Berwick and Fowberry WRZ has significant licensed surplus supply, however the Environment Agency has identified uncertainty in the sustainability of the Berwick licences, therefore an NEP investigation has been planned for completion in AMP6 (2015-20) to assess the yield of the boreholes. The Environment Agency RoC may lead to a reduction in abstraction license, causing a significant reduction in Deployable Output for this WRZ after 2020. NW are currently working on a programme to refurbish and better maintain each borehole in the Berwick and Fowberry WRZ, with the aim of completion in AMP6. This will improve the output of each source and improve resilience to the WRZ. In the meantime, in order to increase the resilience of the Fowberry area, the Environment Agency has agreed to the Fowberry abstraction licence variation, which allows the current levels of abstraction to be maintained from the boreholes in that area.

The following potential development area options are located within the Berwick and Fowberry WRZ, where water is abstracted from groundwater sources:

- Bowsden,
- Branxton,
- Horncliffe,
- Lowick,
- Milfield,
- Norham,
- Cornhill on Tweed; and
- Scremeston

2.5 Flood Risk Summary

The detailed fluvial, tidal and surface water flood risk assessments for each potential development area option for the Rest of North Northumberland Delivery Area are included in the site specific assessments in Section 3. Further detailed risk assessment for all sources of flooding, as well as policy and guidance recommendations for potential development area options are included within Section 4 of the Northumberland Level 2 SFRA.

2.6 Surface Water Management and Sustainable Drainage

2.6.1 Updated Surface Water Management and SuDS Summary

The detailed surface water flood risk and SuDS constraints assessments for each potential development area option are included in the site specific assessments in Section 3 of this addendum.

It should be noted that the limitations and constraints on the suitability or location of infiltration SuDS will be specific to each site, and for the purposes of this addendum, a higher-level assessment has been undertaken that identifies the potential key constraints for potential development areas. Developers are required to consult NCC as LLFA for SuDS applications.

2.7 Climate Change

Section 4.7 of the detailed WCS provides a summary of the potential climate change adaptation and mitigation measures that could be considered in Northumberland County Council with regards to water quality and wastewater services infrastructure, and water resources and water supply infrastructure.

3 Site Assessments for Rest of North Delivery Area

3.1 WCS Site Assessments

Table 3-1 provides a summary of the WCS site assessment for each of the potential development area options. Figures 3-1 to 3-11 in Appendix A show the risk of fluvial/tidal flooding and surface water flooding to each potential development area option as well as the location of the WwTW serving the area and any historic sewer flooding.

3.2 Infrastructure Recommendations

- NW's WRMP states that at present, the Berwick and Fowberry WRZ has significant licensed surplus supply, however there is uncertainty in the sustainable volume of water available from the groundwater sources. The Environment Agency Review of Consents process may lead to a reduction in abstraction license in the Berwick and Fowberry WRZ, causing a significant reduction in deployable output for this WRZ after 2020. Careful consideration should be given to the siting of some types of development in this area to ensure the adequate protection of existing abstraction sources. NW must be consulted on the water supply for all proposed development in Bowsden, Branxton, Horncliffe, Lowick, Milfield, Norham, Cornhill on Tweed and Scremerston, and water efficiency options should be considered.
- Cornhill WwTW, Millfield WwTW, Embleton WwTW, and Eglington WwTW currently have no headroom available, therefore these works will likely require an upgrade to accommodate foul flows from new development. If a new flow consent is required at this works then it is likely the quality consents will need to be tightened to ensure no deterioration in the water environment. The WCS assessment has determined that it is theoretically possible to tighten these consents within the limits of conventional treatment.
- The Scremerston, Acklington, Amble (within Warkworth Parish), Warkworth, Felton and Longframlington potential development area options have a 2020 sewer capacity factor of 4 and 5, which suggests that the development is likely to exacerbate the predicted hydraulic performance issue.
- Scremerston, Acklington, Amble (within Warkworth Parish), and Longframlington potential development area options have a 2020 surface water capacity factor of 3, 4 and 5. Further investigation and possible infrastructure upgrades may be required before development can commence in this area.
- SHLAA sites 42 and 128 in Felton are located near to Felton WwTW and NW would object to the development of the site. Therefore alternative potential development area options should be progressed for this settlement area.
- The SHLAA sites 1074 in Norham, 139 in Powburn and 45 in Lesbury are located within Flood Zone 3a, and SHLAA site 6667 in Milfield is located in Flood Zone 2. Development within these sites should consider a sequential approach, whereby more vulnerable development should be located in areas at lower risk of flooding in line with the requirements of the National Planning Policy Framework (NPPF). Where development is located in Flood Zones 2 or 3, mitigation of flooding both to and from the site is likely to be required with the potential need for greater investment in flood defence infrastructure.
- All development areas, except Glanton and Holy Island, are at risk of surface water flooding, therefore surface water management measures and appropriate SuDS techniques identified in the Northumberland SFRA should be used in these settlement areas.

Table 3-1 Rest of North Delivery Area Site Assessment

Potential development area option	SHLAA Sites Refs	Water Resources	Overall WwTW Assessment	Receiving Watercourse	Sewer Flooding	NW Assessment			Fluvial/Tidal Flood Risk	SW Flood Risk	Bedrock Permeability	Superficial Permeability	SPZ	SuDS Constraints	
						Foul Sewer Capacity Factor	SW Capacity Factor	Diversion/ Easement							
Bowsden	1209	Berwick and Fowberry WRZ	Bowsden WwTW	Bowsden Burn (South Low) GB103021073221		-	-		FZ1	Y	High	High			
Branxton	1037		Branxton WwTW	Pallins Burns GB102021072990		-	-		FZ1	Y	High	Very High			
Cornhill on Tweed	6950		Cornhill on Tweed WwTW	River Tweed GB650301440000		-	-		-	-	-	-	-	-	-
	1058					-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	Very High			
	1188					-	-		FZ1	Y	High	High			
	1234					-	-		FZ1		High	High			
Horncliffe	1409		Horncliffe WwTW	River Tweed GB650301440000		-	-	A Water Main crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
Lowick	1105		Lowick WwTW	Tributary of The Low		-	-		FZ1		High	High			
	1214					-	-	A Water Main crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
	1211					-	-		FZ1	Y	High	High			
Milfield	6667		Milfield WwTW	Tributary of River Till GB102021073050		-	-	-	FZ2	Y	High	High			
	1518					-	-		-	-	-	-	-	-	
Norham	1074		Norham WwTW	River Tweed GB650301440000		-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ3a	Y	High	High			
Scremerston	1168		Berwick WwTW	River Tweed GB650301440000		Direct to PS	5	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement. The site is also near to a SPS, therefore in accordance with Sewers for Adoption 6th Edition, habitable buildings should be no closer than 15 metres to the SPS.	FZ1	Y	High	High			
	1169					Direct to PS	5		FZ1	Y	High	High			
	1170					5	4	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
	1171				Direct to PS	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High				
	1174				4	4	A Water Main crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1		High	High				
	1172				4	3	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High				

Potential development area option	SHLAA Sites Refs	Water Resources	Overall WwTW Assessment	Receiving Watercourse	Sewer Flooding	NW Assessment			Fluvial/Tidal Flood Risk	SW Flood Risk	Bedrock Permeability	Superficial Permeability	SPZ	SuDS Constraints		
						Foul Sewer Capacity Factor	SW Capacity Factor	Diversion/ Easement								
Acklington	270	Kielder WRZ	Togston WwTW	The Lady Burn (Coastal Stream)		5	-		FZ1	Y	High	High				
	427					5	-		FZ1		High	Low		Infiltration SuDS may not be possible due to geology		
	6768					5	-	A Water Main crosses the site and Northumbrian Water Ltd (NWL) would require it to be diverted or placed within a suitable easement.	-	-	-	-	-	-		
Alnmouth	7065		Alnmouth WwTW	Alnmouth WwTW	River Aln (Transitional Water) GB510302203300		-	-	-	-	-	-	-	-	-	
	7105						-	-	-	-	-	-	-	-	-	-
Hipsburn	273							-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement. The site is also near to a SPS, therefore in accordance with Sewers for Adoption 6th Edition, habitable buildings should be no closer than 15 metres to the SPS.	FZ1		High	High		
	46							-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement. The site is also near to a SPS, therefore in accordance with Sewers for Adoption 6th Edition, habitable buildings should be no closer than 15 metres to the SPS.	FZ1	Y	High	High		
	274							-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High		
Lesbury	426							-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Very High	High		
	45							-	-		FZ3a	Y	High	High		
Amble (within Warkworth Parish)	13	Amble WwTW		Amble WwTW	North Sea	Sewer flooding has been reported to the east of the potential development area option, therefore there may be a risk of sewer flooding and /or potential capacity constraints at this location.	5	5		FZ1	Y	High	Low		Infiltration SuDS may not be possible due to geology	
	14					Sewer flooding has been reported to the east of the potential development area option, therefore there may be a risk of sewer flooding and /or potential capacity constraints at this location.	5	-		FZ1		High	Low		Infiltration SuDS may not be possible due to geology	
Warkworth	254							5	1	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	Low		Infiltration SuDS may not be possible due to geology
	53						5	1	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	Low		Infiltration SuDS may not be possible due to geology	

Potential development area option	SHLAA Sites Refs	Water Resources	Overall WwTW Assessment	Receiving Watercourse	Sewer Flooding	NW Assessment			Fluvial/Tidal Flood Risk	SW Flood Risk	Bedrock Permeability	Superficial Permeability	SPZ	SuDS Constraints			
						Foul Sewer Capacity Factor	SW Capacity Factor	Diversion/ Easement									
	276					5	-		FZ1		High	High					
Christon Bank	332	Kielder WRZ	Embleton WwTW	Embleton Burn GB103022076370		-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High					
	124					-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High					
	206					-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High					
	356					-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement. The site is also near to a SPS, therefore in accordance with Sewers for Adoption 6th Edition, habitable buildings should be no closer than 15 metres to the SPS.	FZ1	Y	High	High					
	164					-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1		High	High					
	126					-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1		High	High					
	119					-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High					
Embleton	6938								-	-		-	-	-	-	-	-
	298								-	-		FZ1	Y	High	High		
	122								-	-		FZ1		High	High		
	150								-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High		
	151								-	-		FZ1	Y	High	High		
	90								-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Low	High		
Newton by the Sea																	
Eglingham	296		Eglingham WwTW	Eglingham Burn (River Aln) GB103022076390		-	-		FZ1		High	High					
Ellingham	1530		Ellingham WwTW	Ellingham Burn GB103022077070		-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement. The site is also near to a SPS, therefore in accordance with Sewers for Adoption 6th Edition, habitable buildings should be no closer than 15 metres to the SPS.	FZ1	Y	Very High	High					

Potential development area option	SHLAA Sites Refs	Water Resources	Overall WwTW Assessment	Receiving Watercourse	Sewer Flooding	NW Assessment			Fluvial/Tidal Flood Risk	SW Flood Risk	Bedrock Permeability	Superficial Permeability	SPZ	SuDS Constraints			
						Foul Sewer Capacity Factor	SW Capacity Factor	Diversion/ Easement									
	1212					-	-		FZ1		Very High	High					
Felton	42	Kielder WRZ	Felton WwTW	River Coquet GB103022076693		5	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement. Part of the site is also near to a WwTW and NW may object to the development of at least part of the site being developed.	FZ1		Moderate	Very High					
	128				2	-	Part of the site is near to a WwTW and NW may object to the development of the site.	FZ1	Y	Moderate	Very High						
	193				3	-		FZ1	Y	Moderate	Very High						
	299				4	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Moderate	Very High						
Longframlington	70								5	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Very High	Low		Infiltration SuDS may not be possible due to geology
	301								4	3		FZ1	Y	Very High	Low		Infiltration SuDS may not be possible due to geology
	302								4	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Moderate	Low		Infiltration SuDS may not be possible due to geology
	6942								5	5		-	-	-	-	-	-
	303								4	3		-	-	-	-	-	-
	304								4	-		FZ1		Moderate	Low		Infiltration SuDS may not be possible due to geology
Swarland	No big sites				Sewer flooding has been reported to the east of the potential development area option, therefore there may be a risk of sewer flooding and /or potential capacity constraints at this location.	-	-	-	-	-	-	-	-	-			
Glanton	132		Glanton WwTW	Tributary of the River Aln GB103022076340		-	-		-	-	-	-					
	177						-	-		FZ1		High	High				
Holy Island	6671		Holy Island	North Sea		-	-	-	FZ1		High	High					
Longhoughton	279		Boulmer WwTW	North Sea		-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1		High	High					

Potential development area option	SHLAA Sites Refs	Water Resources	Overall WwTW Assessment	Receiving Watercourse	Sewer Flooding	NW Assessment			Fluvial/Tidal Flood Risk	SW Flood Risk	Bedrock Permeability	Superficial Permeability	SPZ	SuDS Constraints	
						Foul Sewer Capacity Factor	SW Capacity Factor	Diversion/ Easement							
	44	Kielder WRZ				-	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
Lucker	1227		No public sewerage system or NW owned treatment facility.			N/A	N/A	N/A	FZ1	Y	High	High			
	1014								FZ1		High	High			
Newton on the Moor	82		Newton on the Moor WwTW	Newton Burn (River Coquet) GB103022076710		-	-		-	-	-	-	-	-	
	168					-	-	A Water Main crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	Very High	Low		Infiltration SuDS may not be possible due to geology	
Powburn	139		Powburn WwTW	Pow Burn (River Till) GB102021073041		-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ3a	Y	High	High			
Rennington	48		Rennington WwTW	Rennington Burn GB103022076360		-	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
Rock	400		No public sewerage system or NW owned treatment facility.			N/A	N/A	N/A	FZ1		Very High	High			
Shilbottle	232		Shilbottle WwTW	Tyelow Burn (River Coquet) GB103022076720		2	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
	25					New Sewer to Works	-	Both a Water Main and Public Sewer crosses the site. NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
	100					New Sewer to Works	-	A Public Sewer crosses the site and NW would require it to be diverted or placed within a suitable easement.	FZ1	Y	High	High			
South Charlton	49		No public sewerage system or NW owned treatment facility.			N/A	N/A	N/A	FZ1	Y	Very High	High			
	275							FZ1		Very High	High				
Whittingham	No big sites	Whittingham WwTW	River Aln GB103022076310		-	-		FZ3a	Y	High	High				

4 Infrastructure Summary

4.1 Site Assessment Summary

Following the individual settlement area site assessments, the outcomes have been summarised to identify the key infrastructure issues. Funding options to address these issues have been outlined. A comprehensive developer checklist is provided to offer planning application guidance to developers as to how to account for the issues raised in the detailed WCS.

4.1.1 Wastewater Treatment and Collection Assessment

WwTW Capacity

This Addendum to the detailed Northumberland WCS has identified several WwTW across the Rest of the North Delivery Area that currently have limited or no capacity to accept or treat any further wastewater from the proposed development and these are highlighted in Table 4-1.

These works may require an upgrade to accommodate the new development. If a new hydraulic consent is required at these works then it is likely the quality consents will be tightened to ensure no deterioration in the water environment. In the majority of cases this is likely to be achievable within current conventional treatment. However, Embleton WwTW is at high risk as it is close to conventional treatment limits, therefore the discharge from this works will require modelling between the Environment Agency and NW.

Table 4-1 WwTW Capacity Summary for the Rest of North Delivery Area

Capacity Issue	WwTW
No Headroom Available – no solution currently identified but a solution is likely to be possible within limits of conventional treatment	Horncliffe
	Milfield
	Alnmouth
	Eglington
No Headroom available and likely WQ consent constraints	Embleton
Limited Headroom Available. If further development in excess of current headroom is certain NW will commence its investment procedure	Lowick
	Cornhill on Tweed
	Norham
	Felton
	Shilbottle

Water Quality Consents

The assessment undertaken for water quality implications in this WCS has been at a high level in the absence of sufficient data to undertake required modelling. The high level assessment is based on the assumption that additional treatment processes can be implemented at WwTWs in order to improve the quality of discharge up to the limits of conventional treatment. In some cases, this may not be possible due to site constraints (limiting the expansion of WwTWs) or funding constraints. In addition, going beyond conventional treatment may be required to main WFD status downstream.

Further detailed analysis will need to be considered and agreed between NW and the Environment Agency as part of any future application to increase the permitted discharge volumes at WwTWs with limited capacity.

Sewer Network

The Sewer Capacity assessment identified the potential development area options in the Rest of the North Delivery Area that have a 2020 sewer capacity of 5 and/or have historical sewer flooding recorded in the area (Table 4-2), which suggests that the development is likely to exacerbate predicted hydraulic performance issue. Further investigation and possible infrastructure upgrades may be required in these areas before development can commence in this area.

NW have also identified SHLAA sites with the Felton potential development area that they would object to due to their proximity to the WwTW. Therefore development should be steered away from the WwTWs or alternative potential development area options progressed in Felton.

Any new development must consider the impact of further urbanisation on the existing wastewater and surface water system, and discharge of surface water must be mitigated within the pumped limitations of the drained system.

Table 4-2 Sewer Capacity Summary for the Rest of North Delivery Area

Capacity Issue	Potential development area option
2020 Sewer Capacity 5 And/or Historical Sewer Flooding	Scremerston
	Acklington
	Amble (with Warkworth Parish)
	Warkworth
	Felton
	Longframlington
	Swarland
NW objections to development due to proximity to WwTW	Felton (SHLAA sites 42 and 128)

4.1.2 Ecology and Biodiversity

This Addendum summarises the assessment of the impacts of the WwTWs in the Rest of the North Delivery Area that would need to increase their capacity to accommodate the proposed new development on designated ecological sites (Table 4-3). Further investigation and possible infrastructure upgrades may be required in these areas before development can commence in this area. Further detailed analysis will need to be considered and agreed between NW and the Environment Agency as part of any future application to increase the permitted discharge volumes at WwTWs with limited capacity.

Table 4-3 Ecology Assessment Summary for the Rest of North Delivery Area

WwTW	Potentially affected wildlife sites	Risk posed by WwTW
Horncliffe	Primarily River Tweed SAC, Tweed Catchment Rivers: Lower Tweed and Whiteadder SSSI and Till Riverbanks SSSI. The WwTWs discharges either directly into these site(s) or a short distance upstream and all are known to be vulnerable to deterioration in water quality. Also, some scope for effects on Tweed Estuary SAC, Berwickshire and North Northumberland Coast SAC, Northumberland Maritime pSPA and Lindisfarne SPA /Ramsar /SSSI /NNR, which are known to be affected by eutrophication, although these are between 12km and over 50km downstream	High, due to discharging immediately into or a short distance upstream from a sensitive SAC and SSSI
Norham		
Milfield		

WwTW	Potentially affected wildlife sites	Risk posed by WwTW
Felton	Potential impact upon River Coquet and Coquet Valley Woodlands SSSI, which is known to be susceptible to phosphate and sedimentation.	High – due to discharging directly into the sensitive River Coquet and Coquet Valley Woodlands SSSI.
Alnmouth	WwTW discharges directly into the Aln Estuary MCZ and Northumberland Marine pSPA, the latter of which does contain several poorly flushed bays which are at risk of eutrophication.	High
Shilbottle	Potential impact upon River Coquet and Coquet Valley Woodlands SSSI located more than 4km from the WwTW, which is known to be susceptible to phosphate and sedimentation.	Medium
Embleton	Possible impact upon Berwickshire & North Northumberland Coast SAC, Northumberland Marine pSPA, and The Northumberland Shore SSSI	Medium - due to discharging a short way upstream of sensitive SAC, pSPA and SSSI
Lowick	Although the outfall is 11km upstream of the nearest water quality sensitive designated site and the direction of longshore drift is likely to prevent build up of smothering macro algae, this WwTW is coded medium risk as a precaution,	Medium

4.1.3 Water Resources and Supply

The following potential development area options are located within the Berwick and Fowberry WRZ and therefore careful consideration should be given to the siting of new developments in these areas to ensure the adequate protection of existing abstraction sources:

- Bowsden
- Braxton
- Cornhill on Tweed
- Horncliffe
- Lowick
- Milfield
- Norham
- Scremerston

It is recommended that NW are consulted on the water supply for all proposed development in these potential development areas.

It is recommended that consideration is given to developing planning policies to drive water efficiency in new developments and to ensure satisfactory provision of an adequate water supply. Consideration should also be given to developing a monitoring framework to monitor the effectiveness of such policies, especially in the Berwick and Fowberry WRZ where a resource deficit may occur if a sustainability reduction is implemented by the Environment Agency.

4.1.4 Fluvial/Tidal Flood Risk

The following potential development area options from the Rest of the North Delivery Area are located within Flood Zones 2, 3a or 3b and are therefore at risk of fluvial/tidal flooding:

- Milfield
- Norham
- Lesbury
- Powburn
- Whittingham

In accordance with the Northumberland SFRA, site-specific FRAs are required for all development in Flood Zone 2 and Flood Zone 3 and for sites greater than 1 ha in Flood Zone 1, in accordance with the NPPF. These will be reviewed either by NCC and the Environment Agency depending upon the scale and nature of the proposed development. Before allocation, the NPPF Sequential Test will need to be applied, and depending on the level of risk and vulnerability, may also need to apply the Exception Test. The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if a non-allocation) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

New development within Flood Zones 2 and 3 should be sited in areas at lower risk of flooding in line with the sequential approach under the NPPF. Where development is located in Flood Zones 2 or 3, greater investment in flood defence and mitigation of flooding both to and from the site is likely to be required.

4.2 Recommended Phasing of Development

As with the detailed WCS report, it has not been feasible to identify a timeline of when infrastructure constraints will impact on the phasing of development due to the following key issues:

- Water and Sewerage companies are financed for five year periods and within the current period (2015 – 2020), NW have only committed to capital projects for the first two years. All works scheduled post 2017 are subject to a June 2016 review and should growth in the catchment be at a slower rate than anticipated, NW may review the start dates and invest in higher priority WwTW's.
- Headroom availability at each WwTWs is continuously impacted by operational issues, both positively and negatively, therefore an assessment based on headroom would only be accurate at the time of publication.

Considering the points above NW are unable to commit to delivering upgrades to WwTWs at a specific year in the future due to phasing of development; however, NW will continue to invest in headroom as a requirement when development is confirmed, and this will be monitored through the NCC IDP. The IDP will be updated annually to reassess infrastructure capacity and needs. This review process will be critical to capture changes and will also be a key mechanism by which the Council, NW, the Environment Agency and other stakeholders will work collaboratively to appraise investment needs, overcome any capacity constraints and address environmental considerations.

Planning applications which propose that phasing of certain development is taken forward should be consulted with NW to identify what infrastructure investment may be required, and when this may be feasible. Strategic approaches to development phasing should be considered for areas where developers and key stakeholders may need to work together for a larger strategic solution).

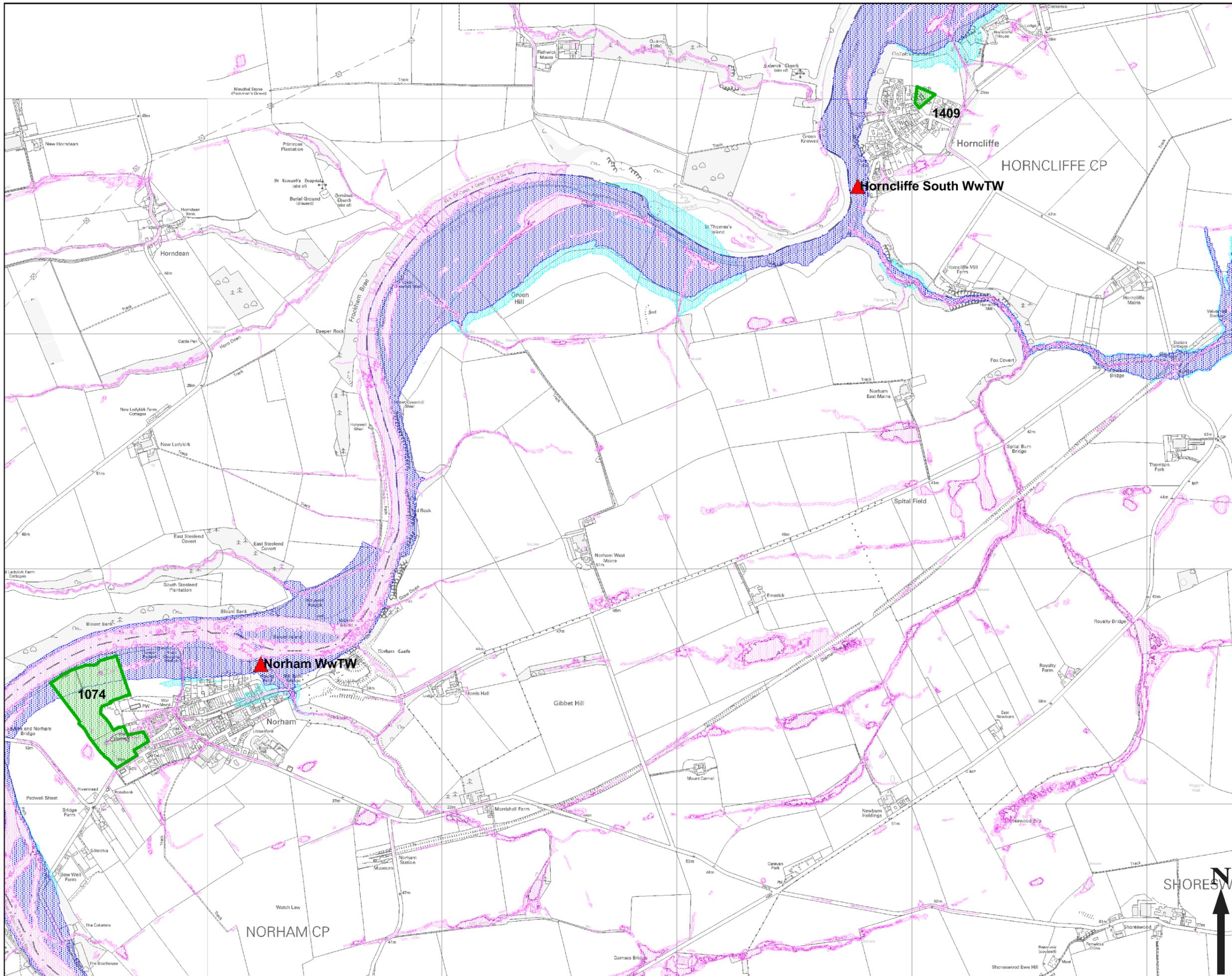
4.3 Funding Options and Developer Guidance

Details on the funding options and developer guidance are provided in the detailed WCS report in **Section 6.3** and **Section 6.4**, respectively. Note that these details were correct at the time the report was published in October 2015.

4.4 WCS Policy Recommendations

The WCS policy recommendations have been identified in Section 7 of the detailed WCS. These recommendations should be considered by Northumberland County Council, working in partnership with the EA and NW, to ensure that the Northumberland Local Plan considers potential limitations (and opportunities) presented by the water environment and water infrastructure on growth.

Appendix A - Figures



LEGEND

- SHLAA Sites
- DG5
- WwTW
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright © Crown copyright, Ordnance Survey, Northumberland County Council. Licence No.100049048 2016.



Drawing Status **FINAL**

Job Title **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title **Horncliffe and Norham-SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

Scale at A3 **1: 15,000**

Drawn EP	Approved SK		
Stage 1 Check	Stage 2 Check	Originated	Date 05/16

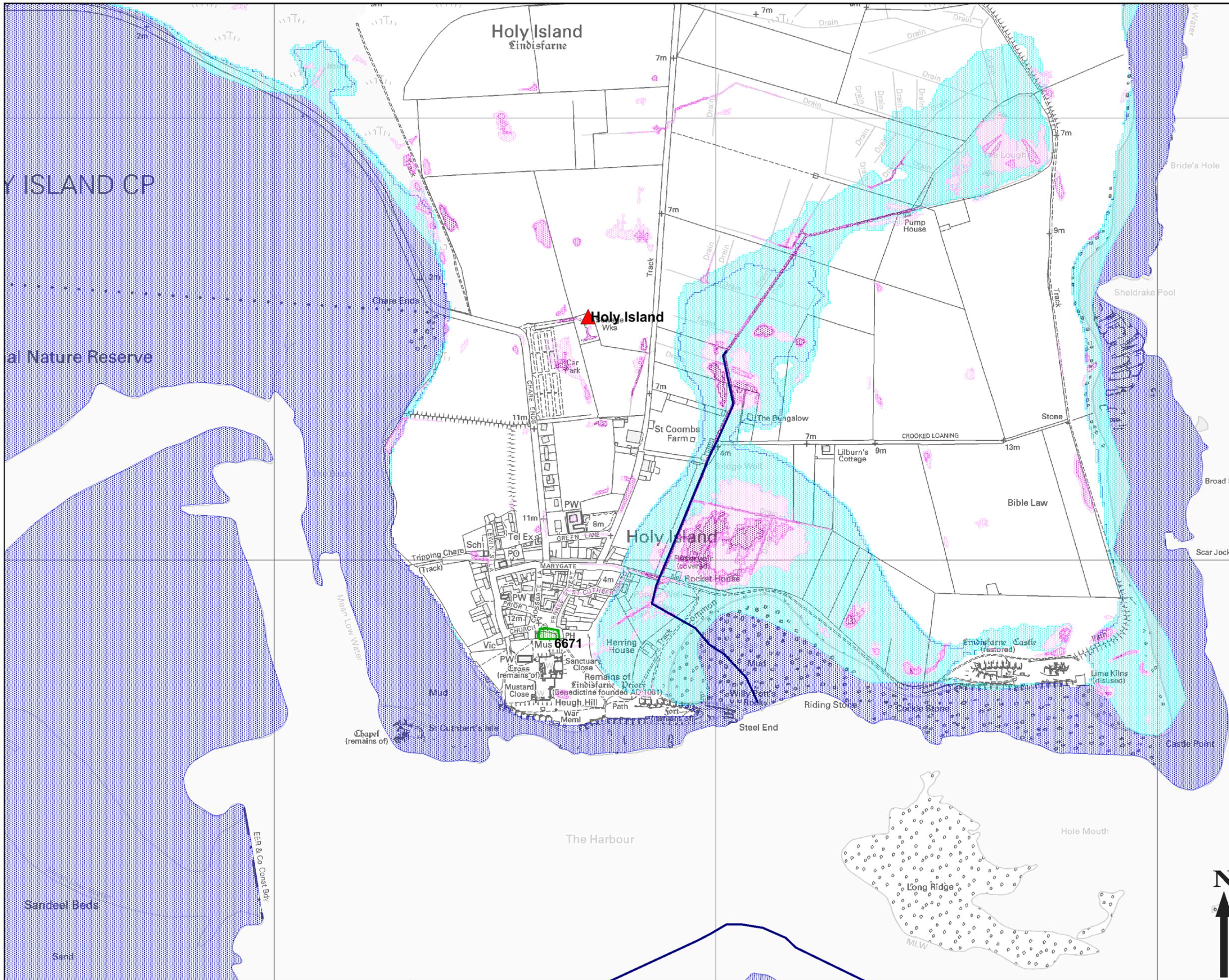
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED. © AECOM 2016

AECOM Ltd
Bridgewater House
Whitworth Street
Manchester, M1 6LT
Telephone +44 (0)161 907 350
Fax +44 (0)161 907 3501
www.aecom.com



Drawing Number **FIGURE 3-1** Rev





LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.

Northumberland
 Northumberland County Council

Drawing Status
FINAL

Job Title
 Northumberland County Council -Water Study
 Cycle Addendum
 Rest of North Delivery Area

Drawing Title
 Holy Island-
 SHLAA Sites with Updated
 Flood Map for Surface Water
 (uFMfSW), Flood Risk and
 DG5 Records

Scale at A3
 1: 8,000

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

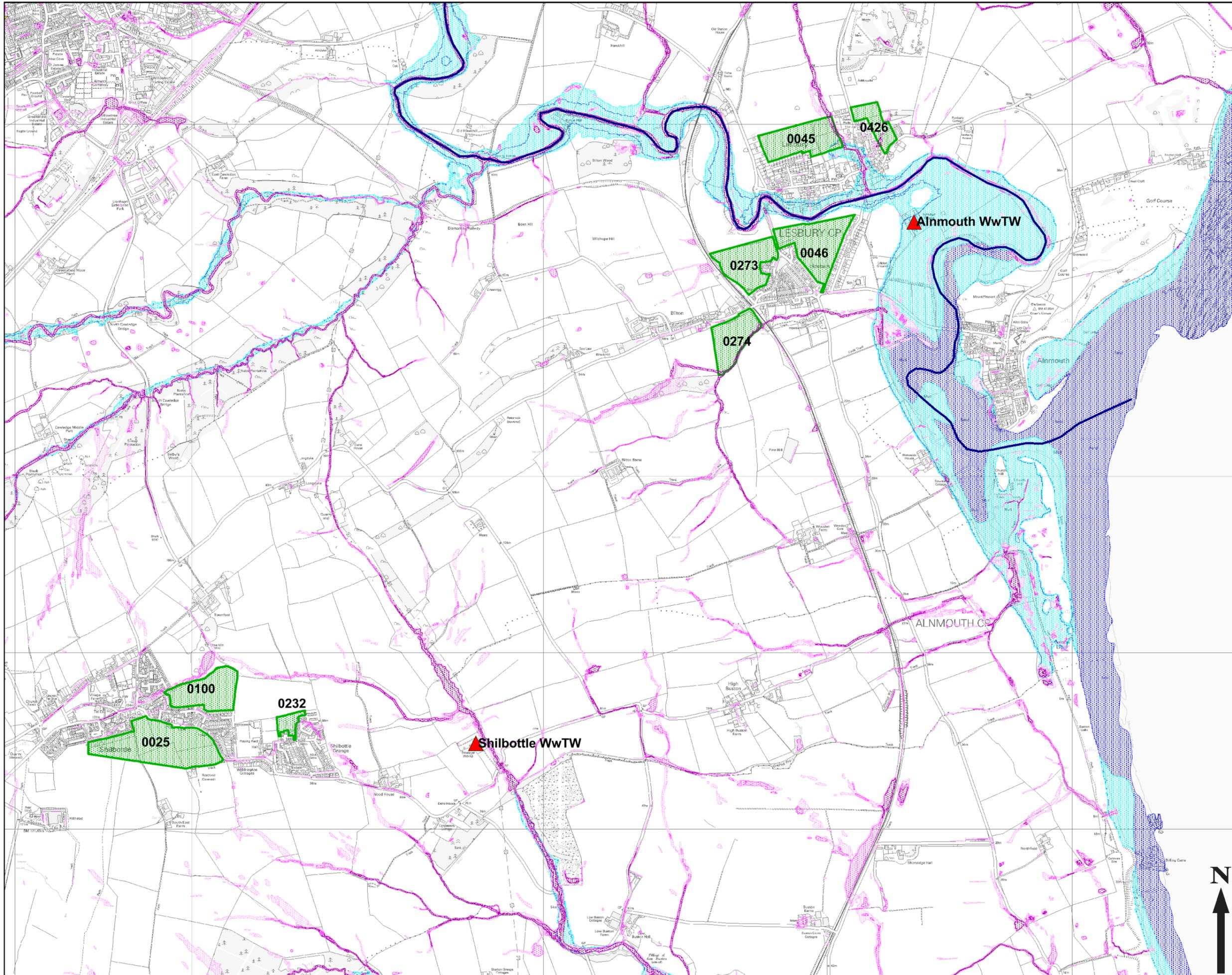
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com

AECOM

Drawing Number
FIGURE 3-2





LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.



Drawing Status: **FINAL**

Job Title: **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title: **Shilbottle and Alnmouth- SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

Scale at A3: **1: 20,000**

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

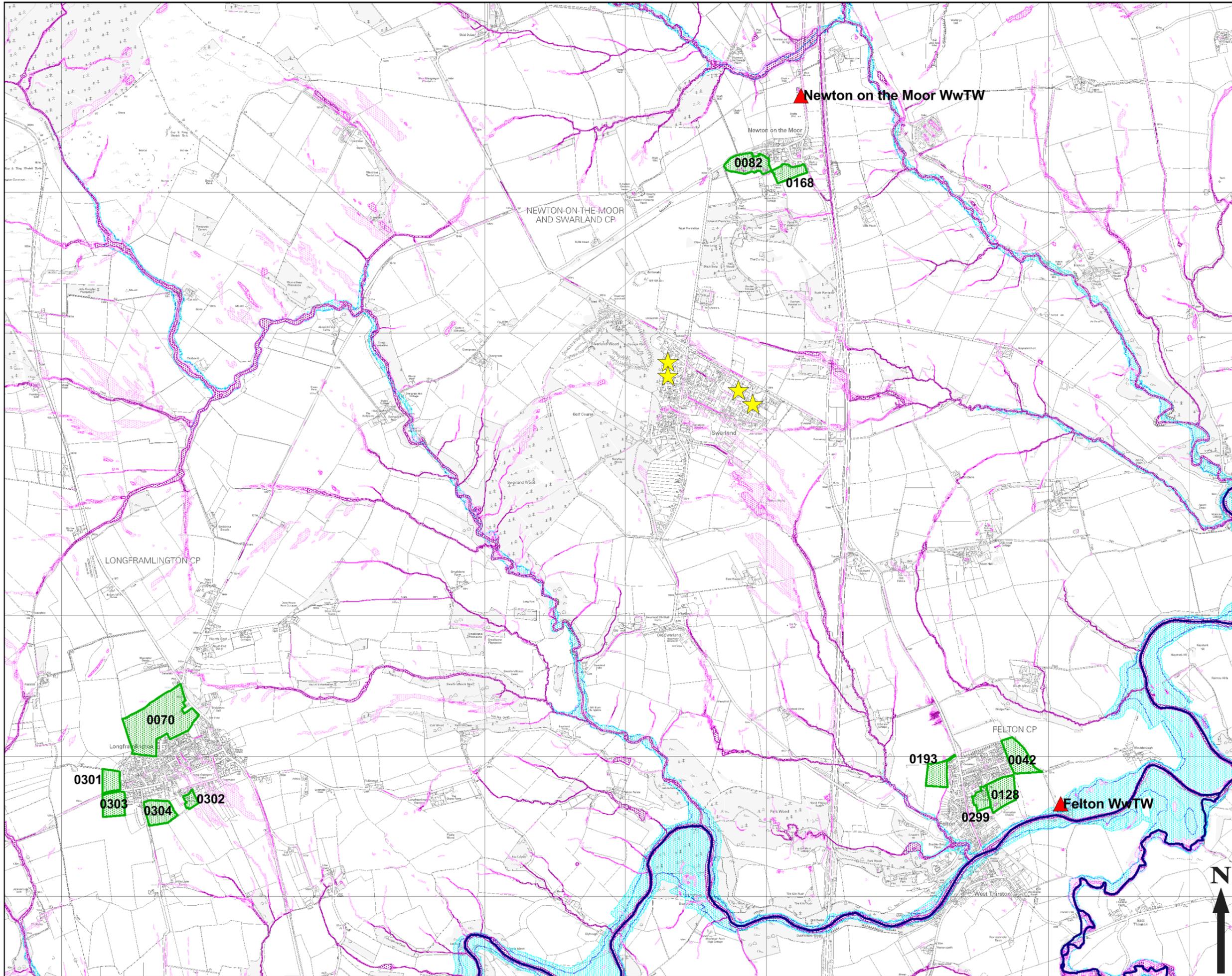
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com



Drawing Number: **FIGURE 3-3** Rev





LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk (>= 3.33% AEP)
- uFMfSW- Medium Risk (>= 1% AEP)
- uFMfSW- Low Risk (>= 0.1% AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No. 100049048 2016.



Drawing Status: **FINAL**

Job Title: **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title: **Felton and Newton on the Moor - SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

Scale at A3: 1: 25,000

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

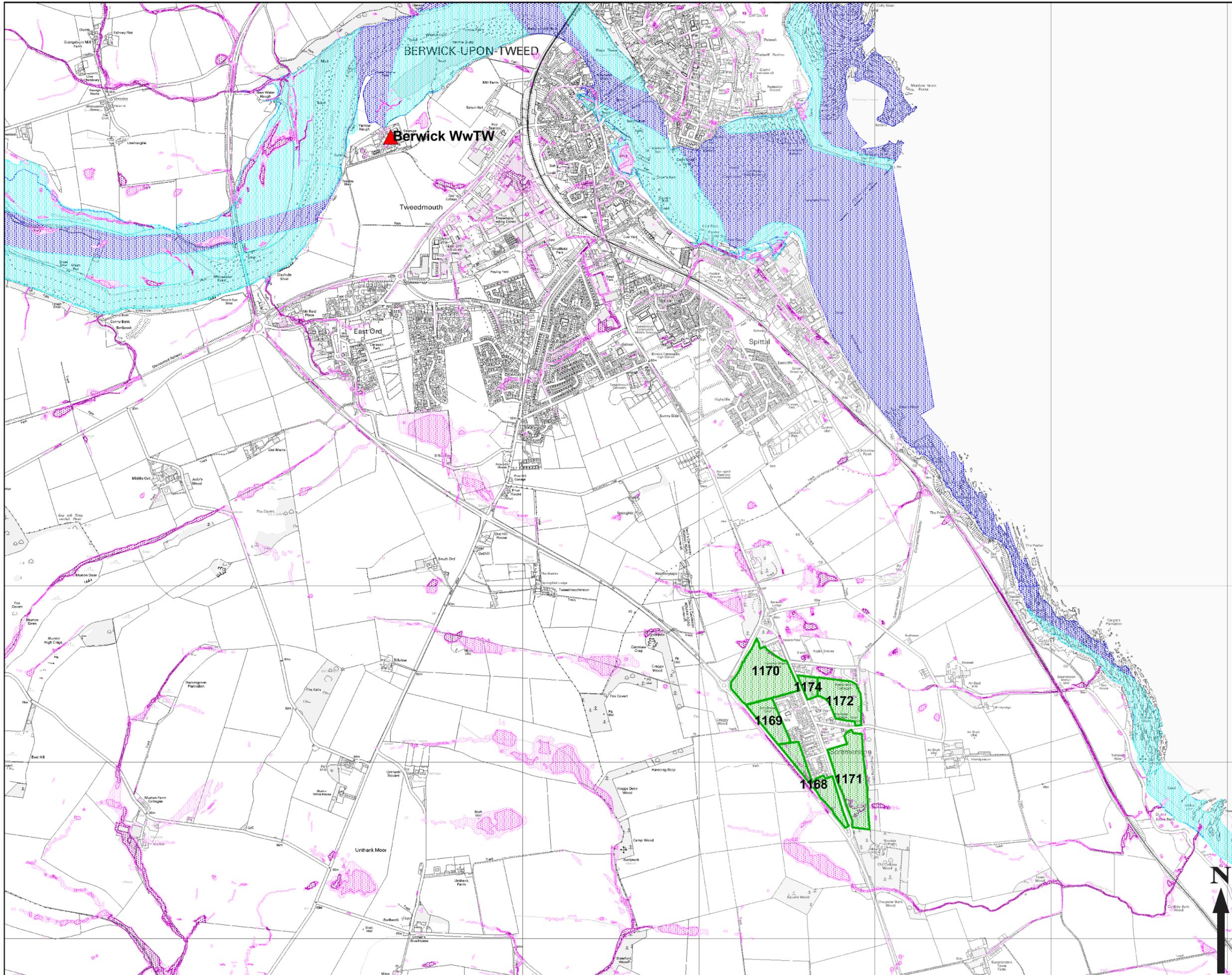
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com



Drawing Number: **FIGURE 3-4**





LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2014.



Drawing Status: **FINAL**

Job Title: **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title: **Berwick- SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

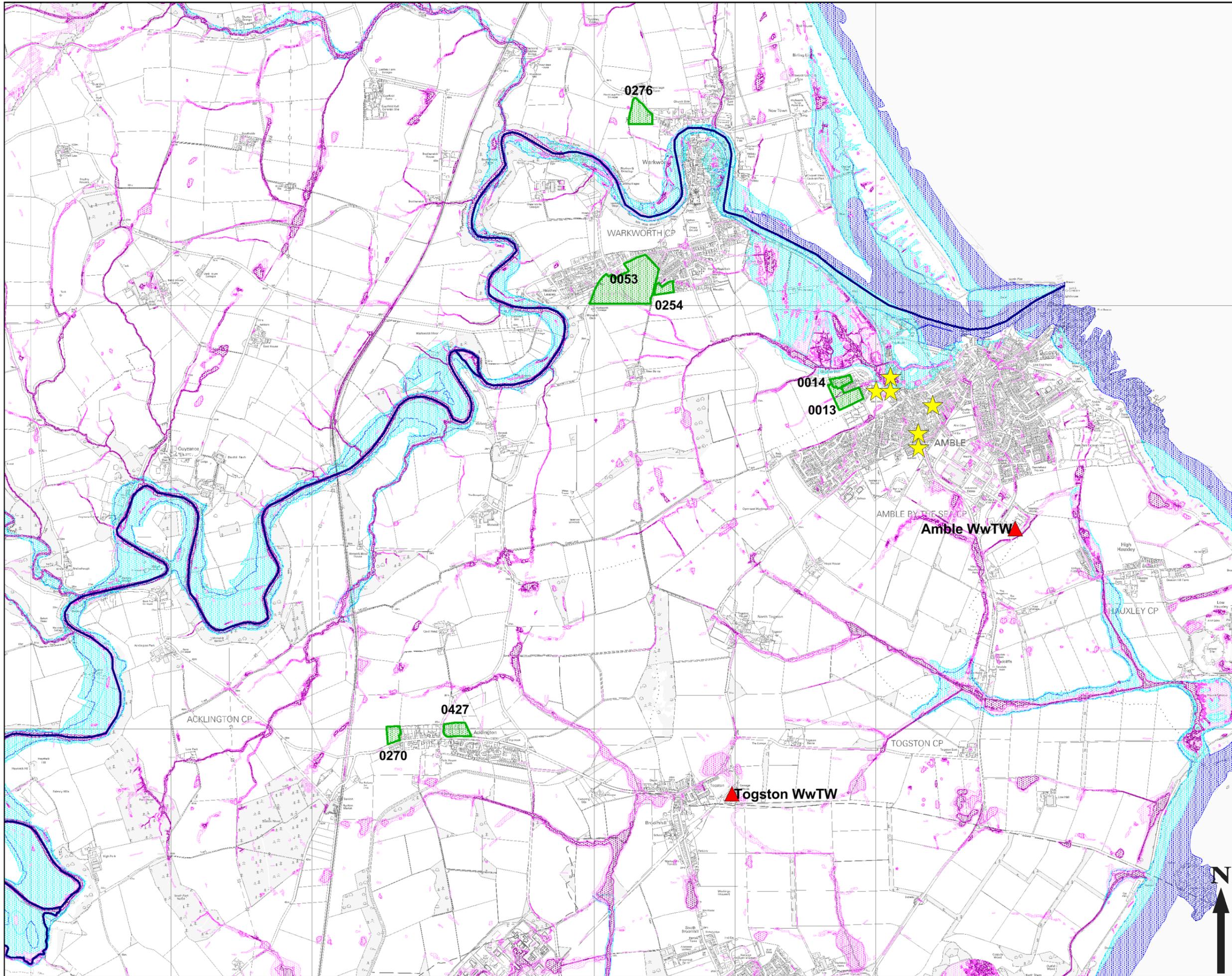
Scale at A3: **1: 20,000**

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF URS'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. URS ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © URS INFRASTRUCTURE & ENVIRONMENT UK LTD 2015

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.ursglobal.com

Drawing Number: **FIGURE 3-5**



LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.

Northumberland
 Northumberland County Council

Drawing Status
FINAL

Job Title
 Northumberland County Council -Water Study
 Cycle Addendum
 Rest of North Delivery Area

Drawing Title
 Amble and Togston -
 SHLAA Sites with Updated
 Flood Map for Surface Water
 (uFMfSW), Flood Risk and
 DG5 Records

Scale at A3
 1: 25,000

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

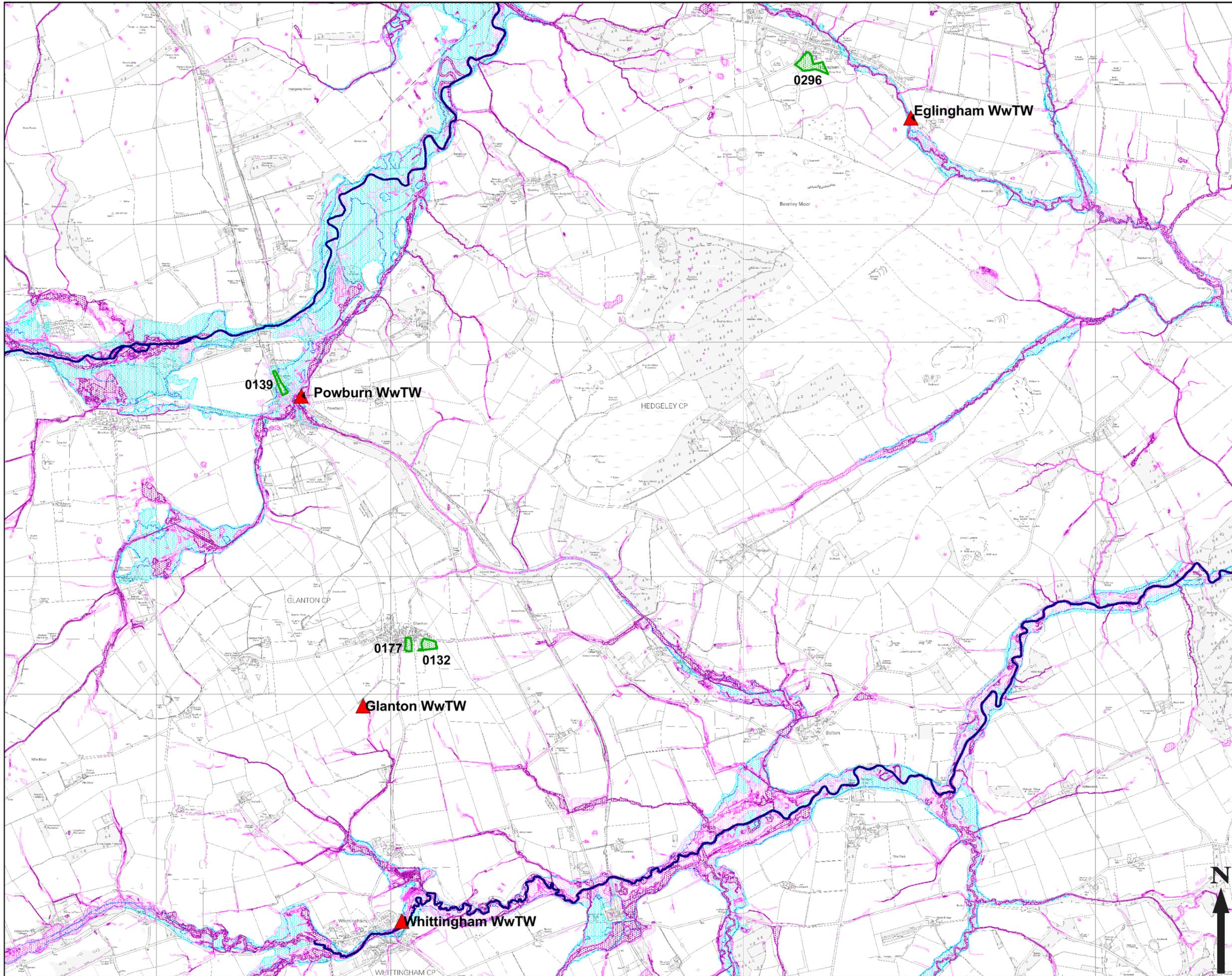
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com

AECOM

Drawing Number
FIGURE 3-6





LEGEND

- SHLAA Sites
- DG5
- WwTW
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.

Northumberland
 Northumberland County Council

Drawing Status: **FINAL**

Job Title:
**Northumberland County Council -Water Study
 Cycle Addendum
 Rest of North Delivery Area**

Drawing Title:
**Glanton, Whittingham, Powburn
 and Eglington - SHLAA Sites with
 Updated Flood Map for Surface
 Water (uFMfSW), Flood Risk
 and DG5 Records**

Scale at A3:
1: 30,000

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

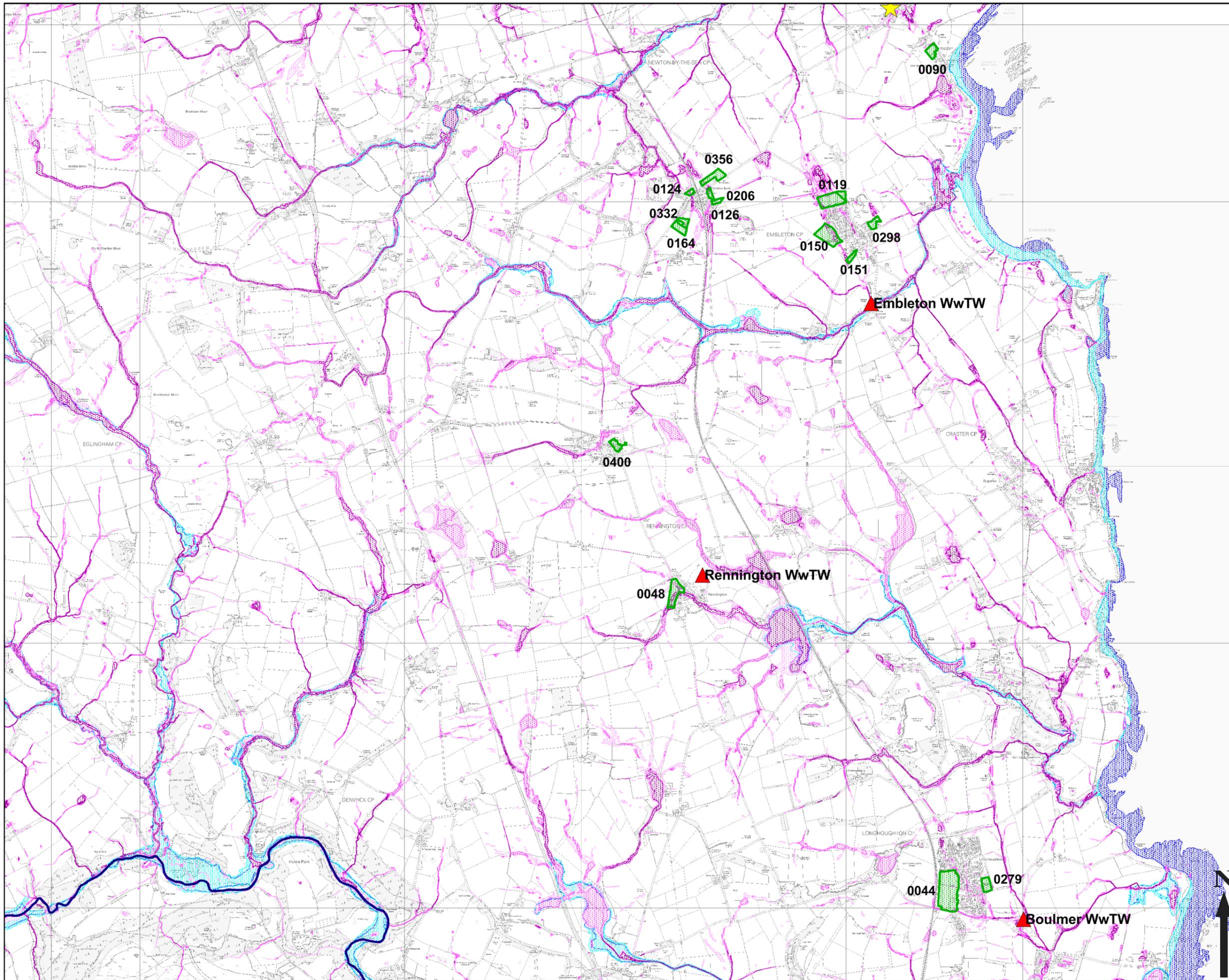
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com

AECOM

Drawing Number: **FIGURE 3-7**





LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
© Crown copyright, Ordnance Survey, Northumberland County Council. Licence No.100049048 2016.

Northumberland
Northumberland County Council

Drawing Status: **FINAL**

Job Title: **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title: **Embleton, Rennington and Boulmer - SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

Scale at A3: **1: 40,000**

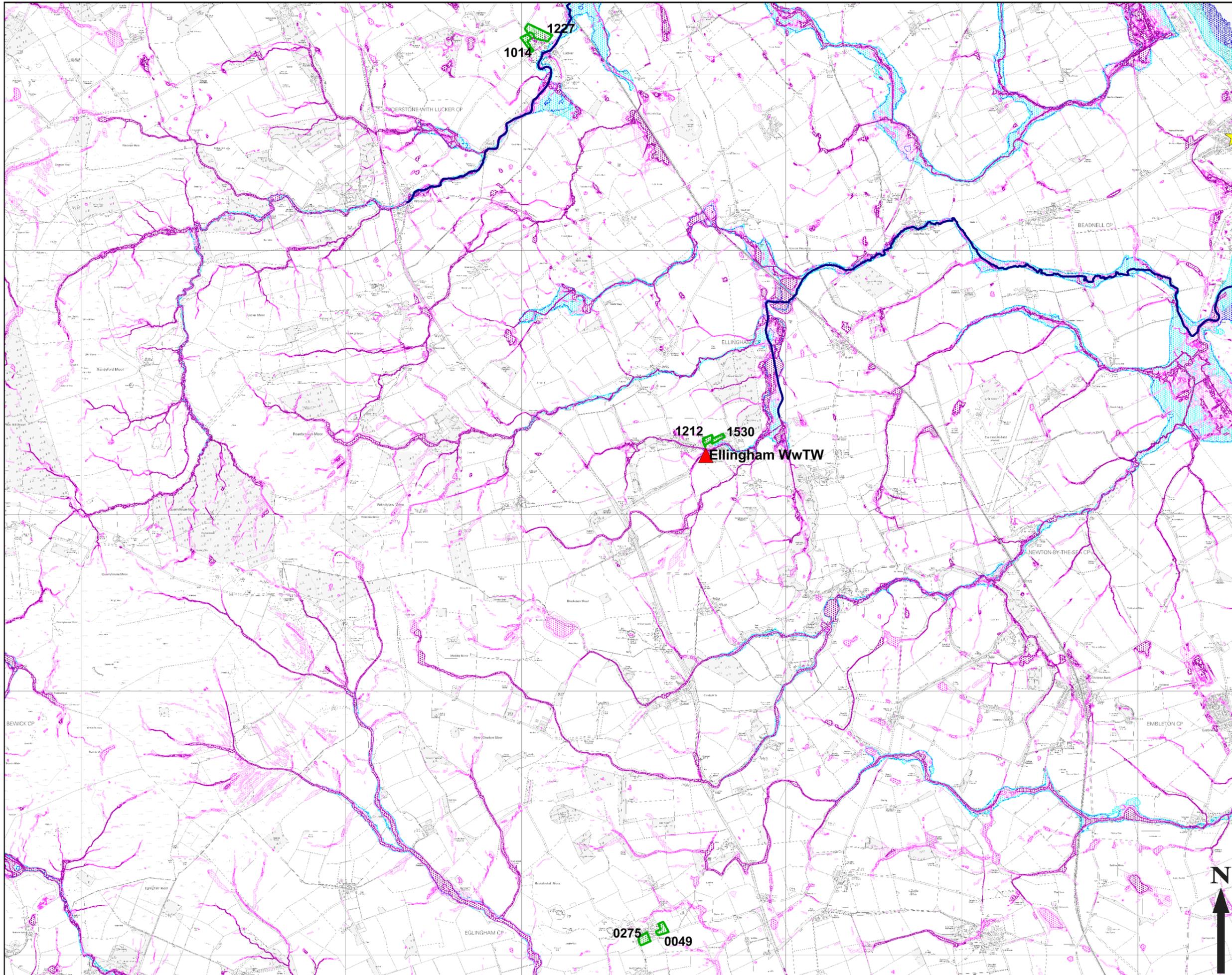
Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
© AECOM 2016

AECOM Ltd
Bridgewater House
Whitworth Street
Manchester, M1 6LT
Telephone +44 (0)161 907 3500
Fax +44 (0)161 907 3501
www.aecom.com

AECOM

Drawing Number: **FIGURE 3-8**



LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk (>= 3.33% AEP)
- uFMfSW- Medium Risk (>= 1% AEP)
- uFMfSW- Low Risk (>= 0.1% AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.

Northumberland
 Northumberland County Council

Drawing Status: **FINAL**

Job Title:
 Northumberland County Council -Water Study
 Cycle Addendum
 Rest of North Delivery Area

Drawing Title:
 Ellingham, Lucker and South Charlton - SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records

Scale at A3: 1: 40,000

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date 05/16

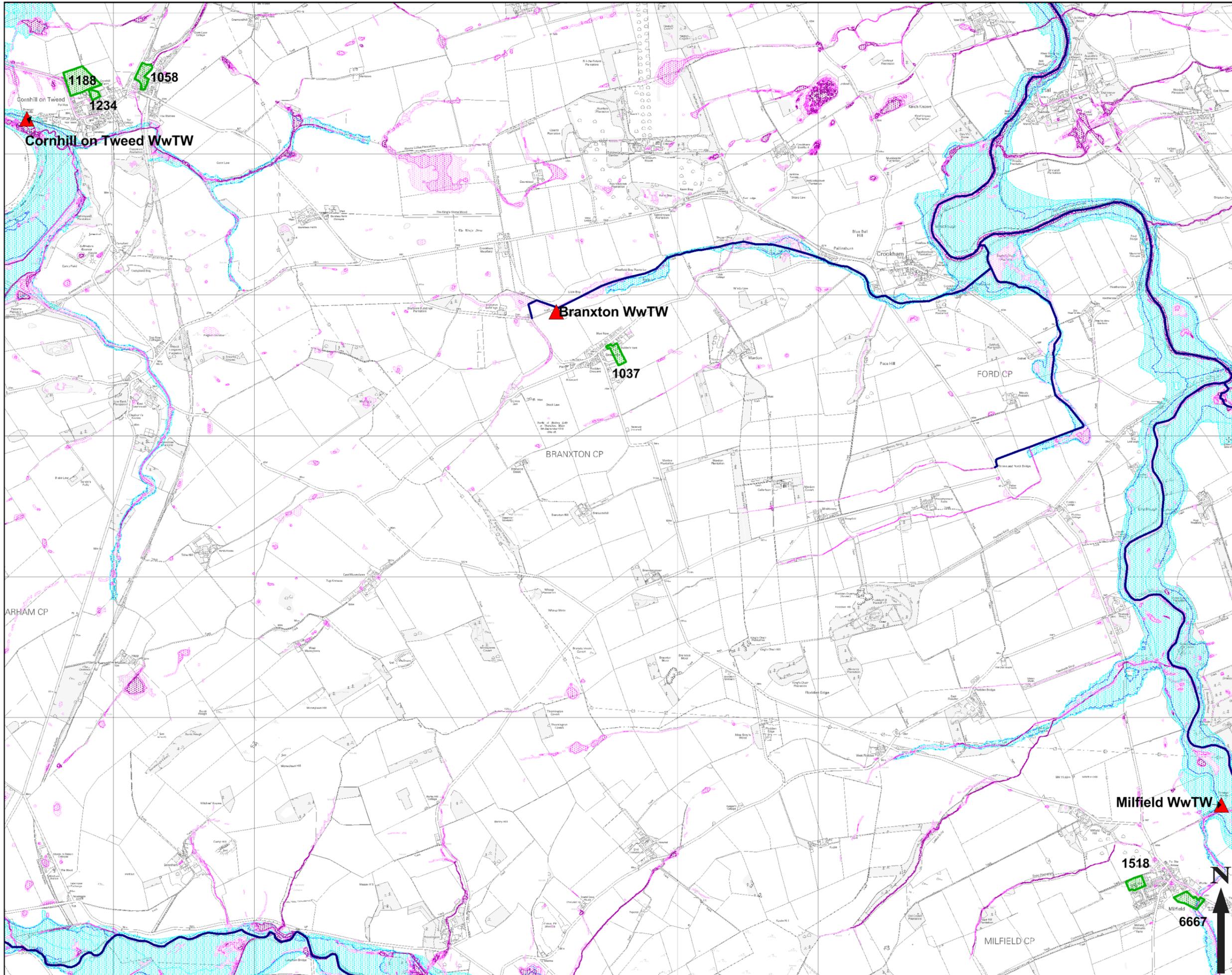
THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com

AECOM

Drawing Number: **FIGURE 3-9** Rev





LEGEND

- SHLAA Sites
- DG5
- WWTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.

NORTHUMBERLAND
 Northumberland County Council

Drawing Status
FINAL

Job Title
Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area

Drawing Title
Cornhill on Tweed, Branxton and Millfield- SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records

Scale at A3
1: 25,000

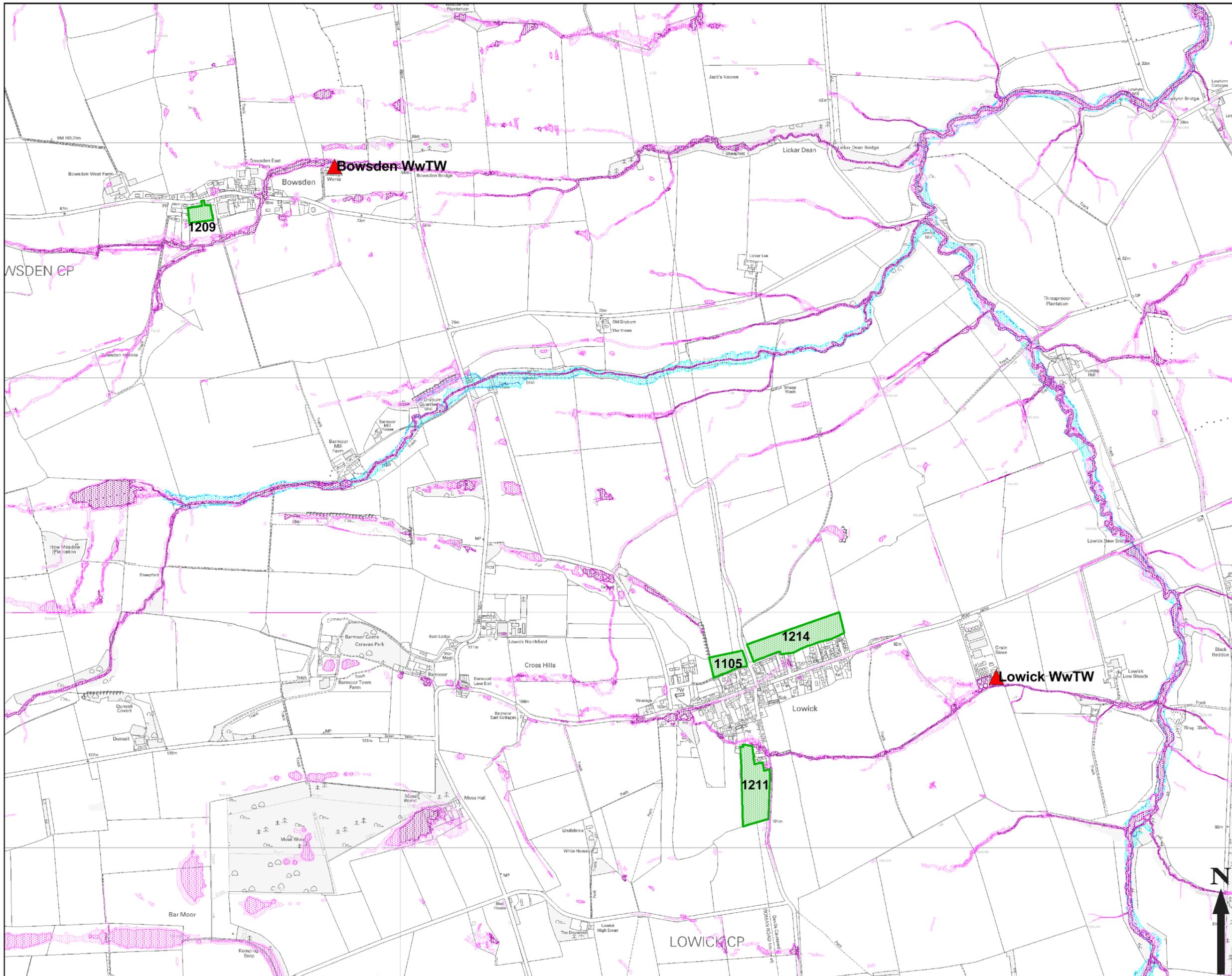
Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com

AECOM

Drawing Number
FIGURE 3-10



LEGEND

- SHLAA Sites
- DG5
- WwTWs
- Main Rivers
- uFMfSW- High Risk ($\geq 3.33\%$ AEP)
- uFMfSW- Medium Risk ($\geq 1\%$ AEP)
- uFMfSW- Low Risk ($\geq 0.1\%$ AEP)
- Flood Zone 3
- Flood Zone 2

Copyright
 © Crown copyright, Ordnance Survey.
 Northumberland County Council
 Licence No.100049048 2016.



Drawing Status: **FINAL**

Job Title: **Northumberland County Council -Water Study Cycle Addendum Rest of North Delivery Area**

Drawing Title: **Bowsden and Lowick- SHLAA Sites with Updated Flood Map for Surface Water (uFMfSW), Flood Risk and DG5 Records**

Scale at A3: **1: 15,000**

Drawn	EP	Approved	SK
Stage 1 Check	Stage 2 Check	Originated	Date
			05/16

THIS DOCUMENT HAS BEEN PREPARED IN ACCORDANCE WITH THE SCOPE OF AECOM'S APPOINTMENT WITH ITS CLIENT AND IS SUBJECT TO THE TERMS OF THAT APPOINTMENT. AECOM ACCEPTS NO LIABILITY FOR ANY USE OF THIS DOCUMENT OTHER THAN BY ITS CLIENT AND ONLY FOR THE PURPOSES FOR WHICH IT WAS PREPARED AND PROVIDED.
 © AECOM 2016

AECOM Ltd
 Bridgewater House
 Whitworth Street
 Manchester, M1 6LT
 Telephone +44 (0)161 907 3500
 Fax +44 (0)161 907 3501
 www.aecom.com



Drawing Number: **FIGURE 3-11** Rev

About AECOM

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 100,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A Fortune 500 company, AECOM serves clients in more than 100 countries and has annual revenue in excess of \$6 billion.

More information on AECOM and its services can be found at www.aecom.com.

AECOM
Scott House
Alencon Link
Basingstoke
Hampshire
RG21 7PP
United Kingdom Telephone: +44 (0)1256 310 200