

PLACE BASED THINKING: ANGLIAN WATER AMP STRATEGIC PLAN REPORT

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Introduction

Interviews
and data
collection

Methodology

Observation
and major
outcomes

Summary
of key
findings

Next steps

Conclusions

INTRODUCTION

We have worked on the following items

1. Connected places catapult has supported Anglian Water's Place-based thinking approach to understand the issues, system interconnections and relationships dominantly focussed on Norfolk region.
2. We modelled different portfolios from PR24 AMP of Anglian Water.
3. We identified opportunities from Norfolk river trust, Norfolk County Councils, WWF, Coca-Cola and real estate properties around the investment locations of Anglian Water portfolios.
4. Identified overlapping interests and proximity of the investments within and outside of Anglian water.
5. We made maps on different catchments, such as Wensum, Yare, Waveney and Bure.
6. Identified opportunities of integrated investment plans with categorical classification based on different portfolio levels.



Connected Places Catapult had initial and followed by a regular interaction with the following people:

- **Matt Humphreys** - Head of Strategic investments, Anglian Water
- **Alex Rosenbaum** - PR24 Strategy Manager
- **Sophie Joy** - PR24 Project Manager
- **Elizabeth Cornelius** - Portfolio Manager

Data structure and terminologies from Anglian Water were understood for the data management of place-based thinking.

The initial interaction was done to understand the scope of AW's PR24 projects, existing datafiles, catchment maps, and coordinates information for investments and identification of AW operational sites.

Main outcomes

- Connected Places Catapult to pull together cross-cutting investments (sewerage, drainage, etc.) to:
 - provide a helicopter view of Anglia Water investments
 - bring awareness of on-going investments in parts of the region
 - view of works in the region over five years
 - focus on Norfolk County
 - potential sectors to investigate (National River Trust, Environmental Agency, Housing Development Plans, local authorities etc.)



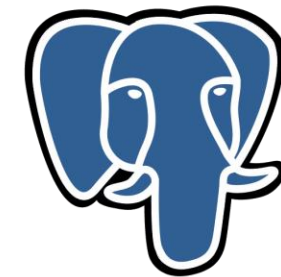
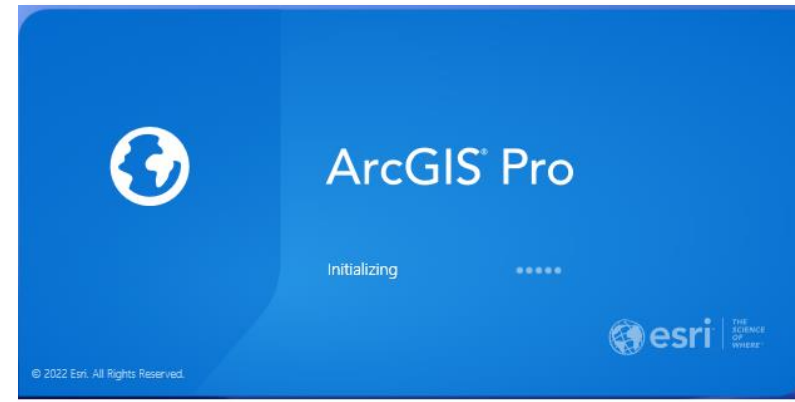
Interviews and outcome with the Portfolio leads

Date	Who we met	Portfolio	Outcome with place based thinking
13 th Feb 2023	George Onyango	Programme Manager, WINEP	Investments were plotted to identify clusters and overlapping interests. Made a hexagonal bin model to zone CAPEX cost aggregate. Completed for all WINEP investments.
13 th Feb 2023	Martin Bowes	Strategic Lead, WINEP	
15 th Feb 2023	Naomi Nanor	Portfolio lead (WINEP)	Identified cluster of opportunities and overlapping interests. Investments (WRS 03.05) are mapped with the intersecting and closest sewerage catchments.
16 th Feb 2023	Claire Piper	Portfolio lead (WINEP); First time sewerage schemes	'Flow related' investments mapped together based on sewerage catchment.
20 th Feb 2023	Tom Swain	Treated Water Distribution	<ul style="list-style-type: none"> • Only few investments have locations • Smart meter locations are variable (no data received)
20 th Feb 2023	Nicola Smith	Water Treatment & Distribution	<ul style="list-style-type: none"> • Maintenance based portfolios – repetitive jobs not allocated. Locations mapped.
22 nd Feb 2023	Steve Riches	WRS (WINEP)	Included in the WINEP analyses.
2 nd Mar 2023	Victoria Lemmon	WRS,CWS,WSS	'Flow related' investments mapped together based on sewerage catchment. WRS 03.06 points were also mapped with sewerage catchments.
2 nd Mar 2023	Nicky Keegan	WSS	Received desalination plant locations and bi/unidirectional pipe connection map (pdf by Mott Mcdonald)

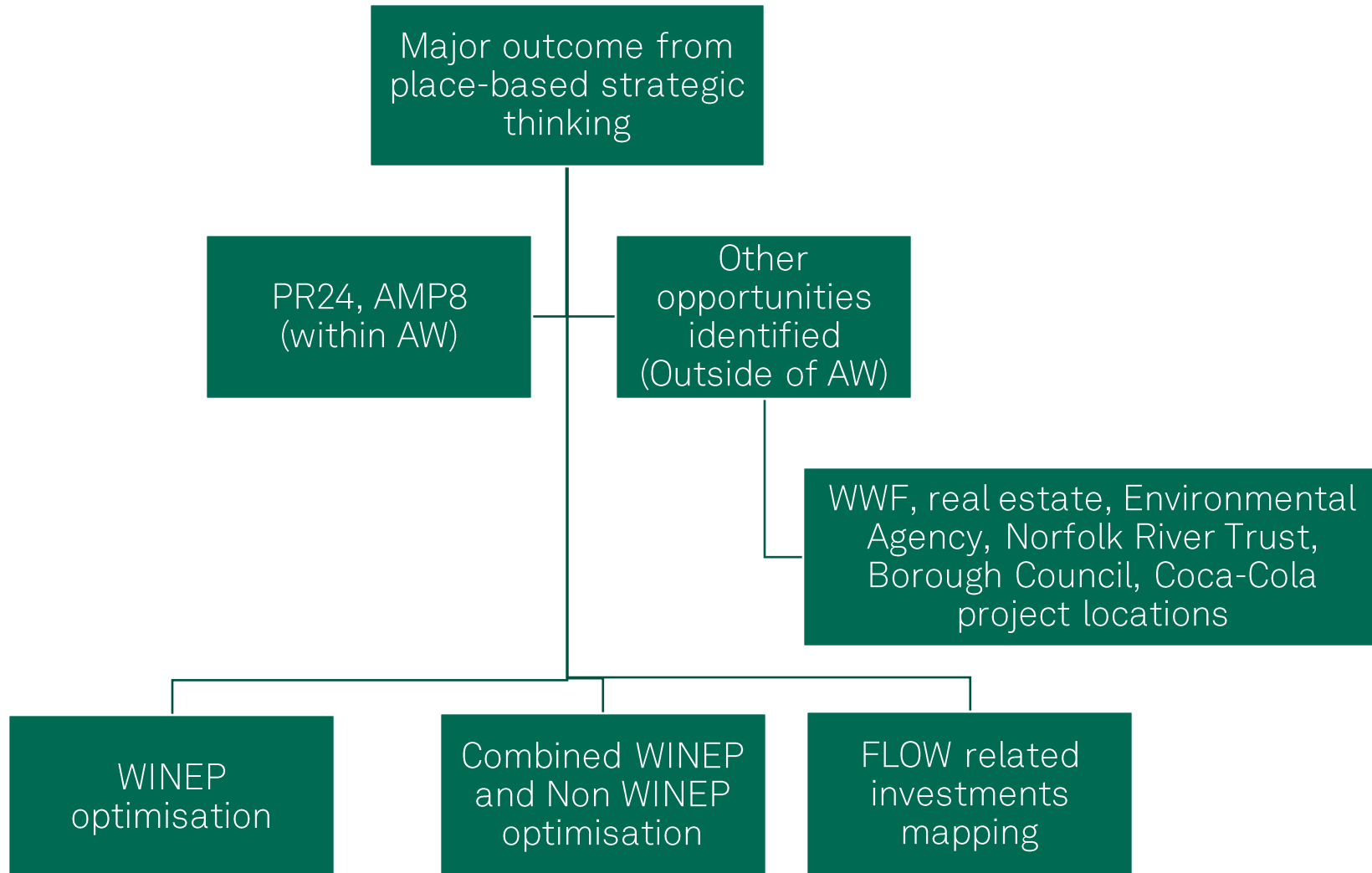
METHODOLOGY

ArcGIS, QGIS and Postgres were mostly used to do GIS based analyses.

List of appendices were mentioned in the technical note.

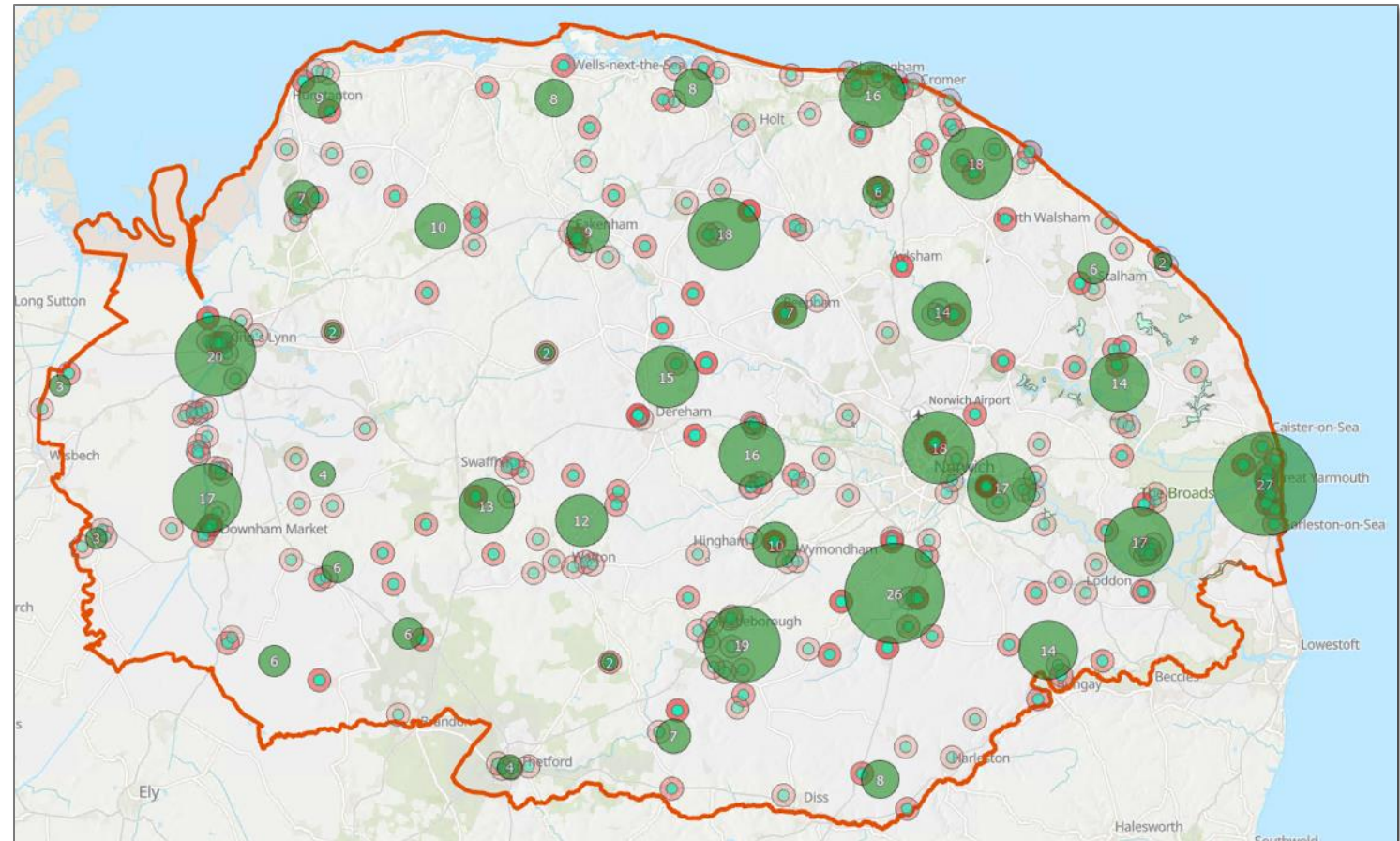
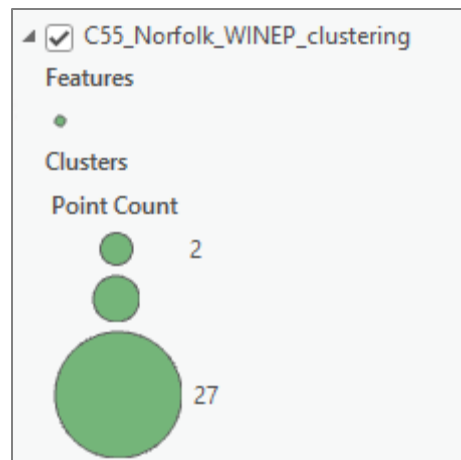


PostgreSQL



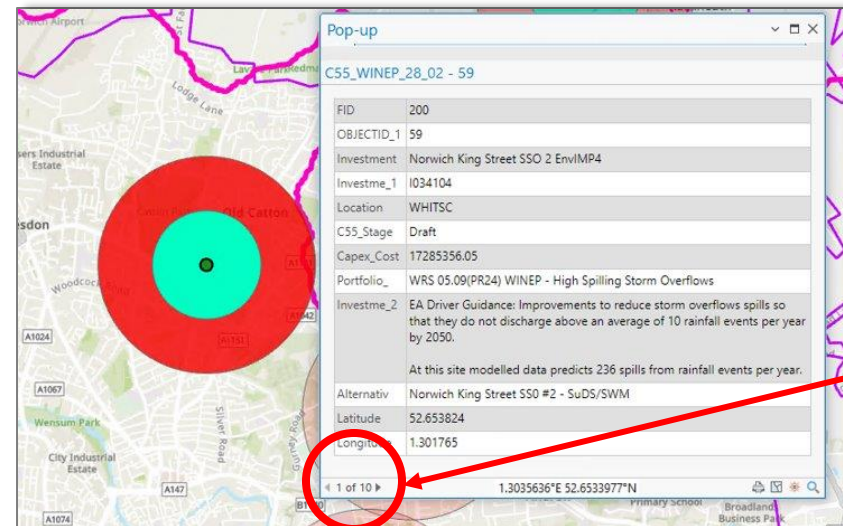
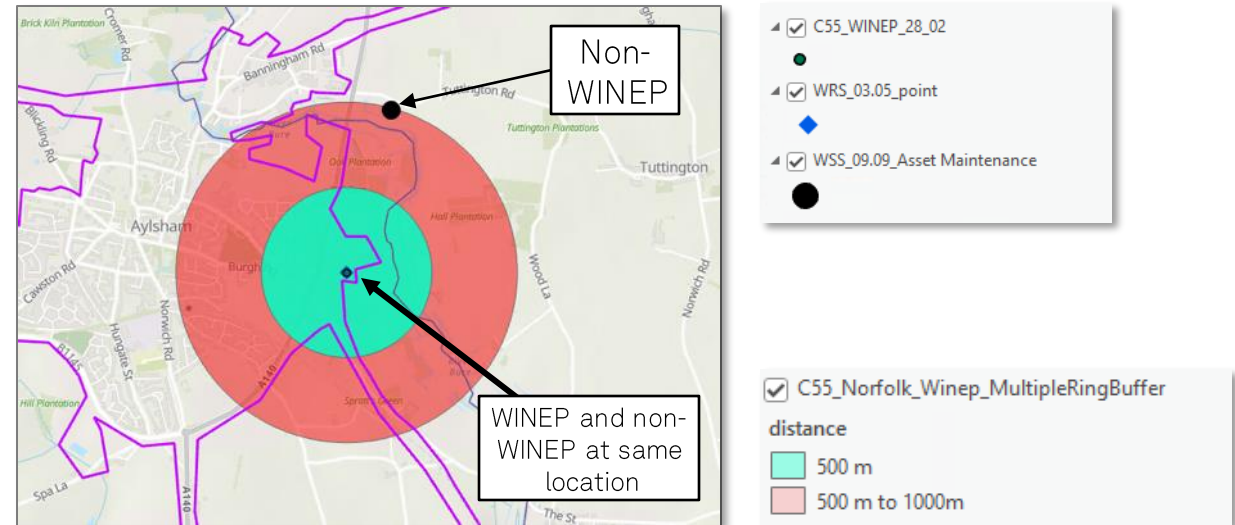
WINEP OPTIMISATION

We initially identified the highest and lowest clusters for visualisation and then delved deeper into the analysis to gain a better understanding of the data patterns and trends within each cluster.



WINEP OPTIMISATION

- **Multiple locations at a single location:** We identified overlapping WINEP investments. These are plotted for Norfolk region. The map shows 10 investments at the same location.
- We identified **cross-AW WINEP and non-WINEP** investments at a single locations and within very close proximity.
- Clusters of investments were identified **within 500 m /1000m Isochrones/buffer zones** created for each location to identify the overlaps and clusters of investments from the datasets.

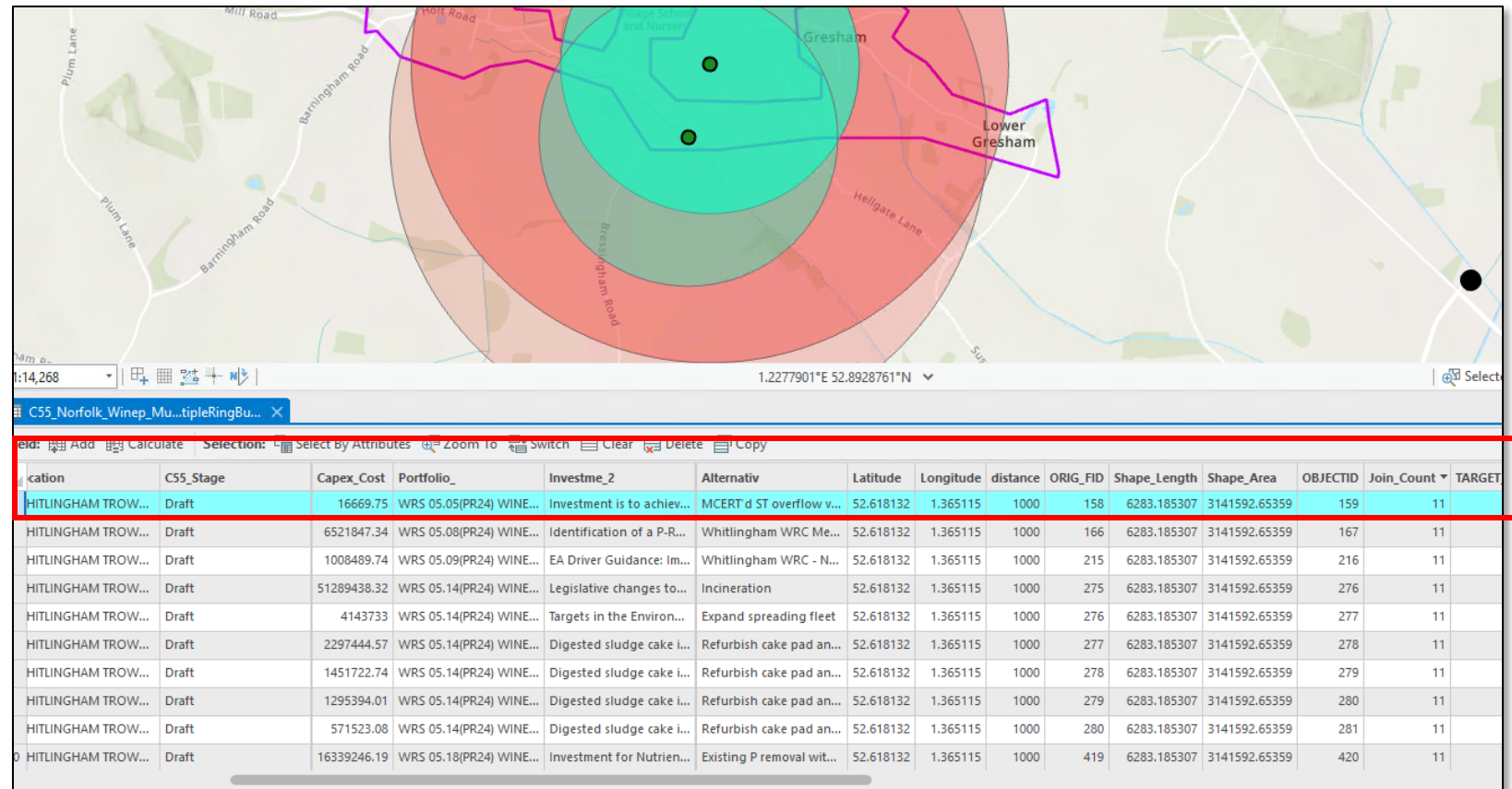


One of 10 investments

WINEP OPTIMISATION

The image shows the number of counts of WINEP investment around each location and at a particular buffer radius.

The highlighted row shows that WRS 05.05 portfolio at a particular location and at 1000 m distance, there are 11 joint counts, i.e. 11 WINEP investments.



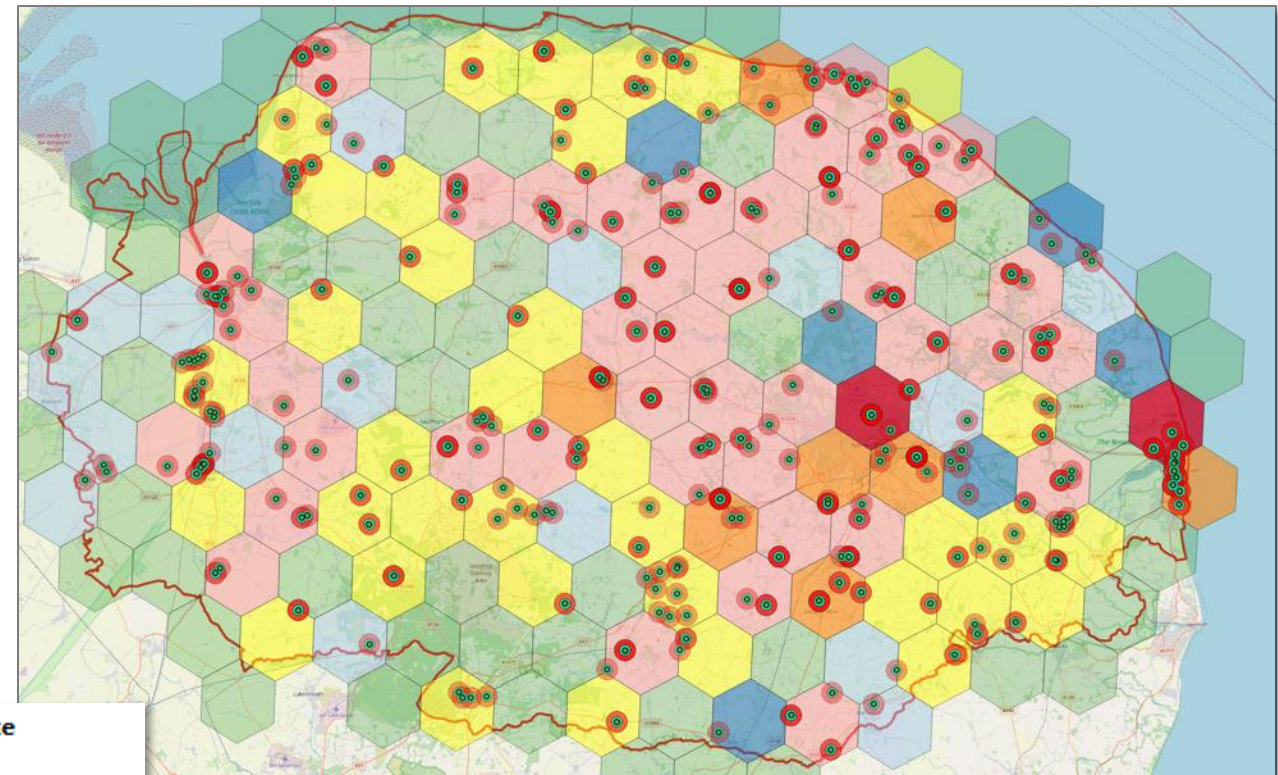
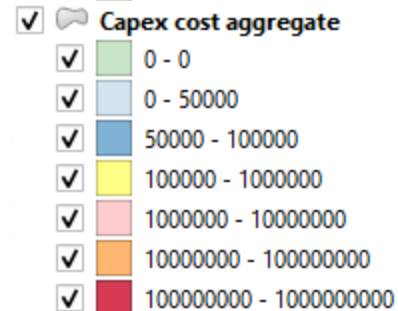
WINEP OPTIMISATION

Hexagonal binning map

Created a hexagonal binning map (resembles heat map) on the aggregate of the CAPEX cost on a specific zone based system (particular size of hexagon cell) and identified the regions with maximum and least capex cost amount. The screenshot shows zero investment (green) and highest investment costs (red).

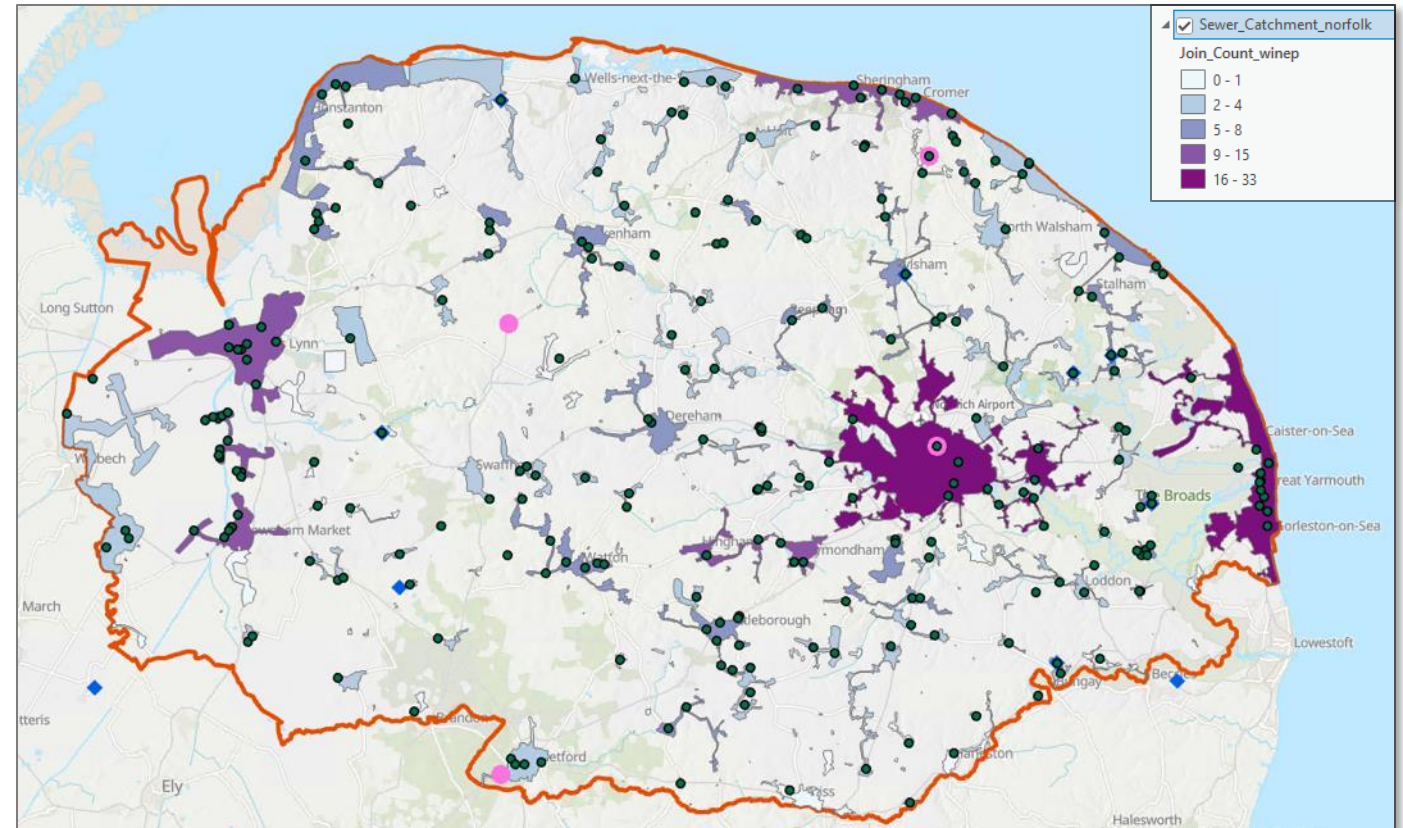
Capex cost aggregate — Features Total: 165, Filtered: 165, Selected: 0

uid	path	count	coalesce
1	6	0	0
2	7	0	0
3	8	0	0
4	21	1	16669.75
5	22	6	2374550.55
6	23	1	95810.78
7	24	0	0
8	25	2	160636.53
9	26	0	0
10	27	4	155919.33
11	28	0	0
12	30	0	0
13	35	0	0



COMBINED WINEP AND NON-WINEP

1. Joined portfolios for WRS_04.01, WRS 03.05 and WINEP points from Norfolk on a single table of sewage catchment. Also calculated the number of WINEP, non-WINEP portfolios present in each sub-catchment. If there is no point location in a sub-catchment it shows null. The screenshot of the table reflects one long particular row of the joined table and tells us that there are 33 WINEP, 1 WRS 04.01 and 0 WRS 03.05 locations are there.
2. The purple symbology denotes the classification of the sewage catchment on the basis of number of WINEP investments present in each catchment.

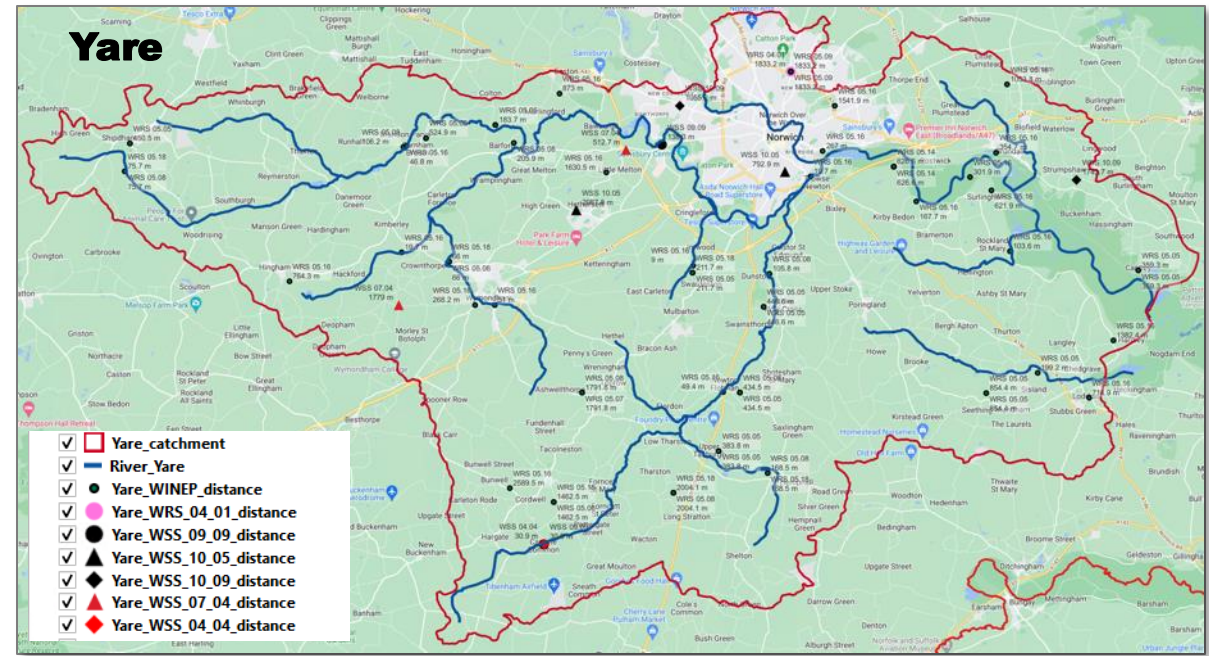
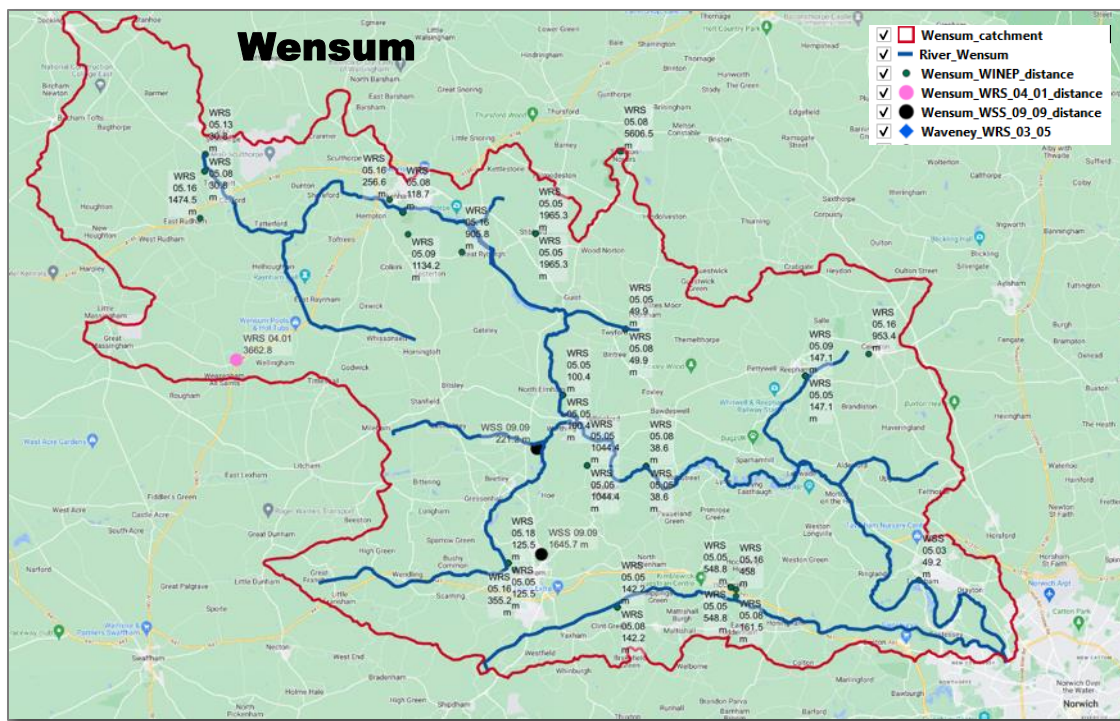


AREANAME	AREASHORTC	STWS_TOTNU	SEWOUTFALL	ID	OBJECTID *	Shape_Star	Shape_STLe	Obj1	OBJECTID_12	Join_Count_wrs_04_01	TARGET_FID	Investment Name
Whitlingham Trowse	WHITSC	0	0	6429	329835	120354350.341	321804.865025	939	141	1	141	Hellesdon Road, Norw...
Investment Description	Alternative Description	Latitude	Longitude	OBJECTID_12	Join_Count_winep *	TARGET_FID	OBJECTID_1	Investment	Investme_1	Location	Portfolio	Investme_2
This investment is desi...	Hellesdon Road, Norw...	52.653824	1.301765	141	33	141	939	WHITLINGHAM TROW...	1032787	WHITSC	WRS 05.05(PR24) WINE...	Investment is to achiev...
OBJECTID_12	Join_Count_wrs_03_05	TARGET_FID	Investment Name	Investment Code	Location	Capex Cost	Portfolio Hierarchy	Investment				
38	0	38	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>				



COMBINED WINEP AND NON-WINEP

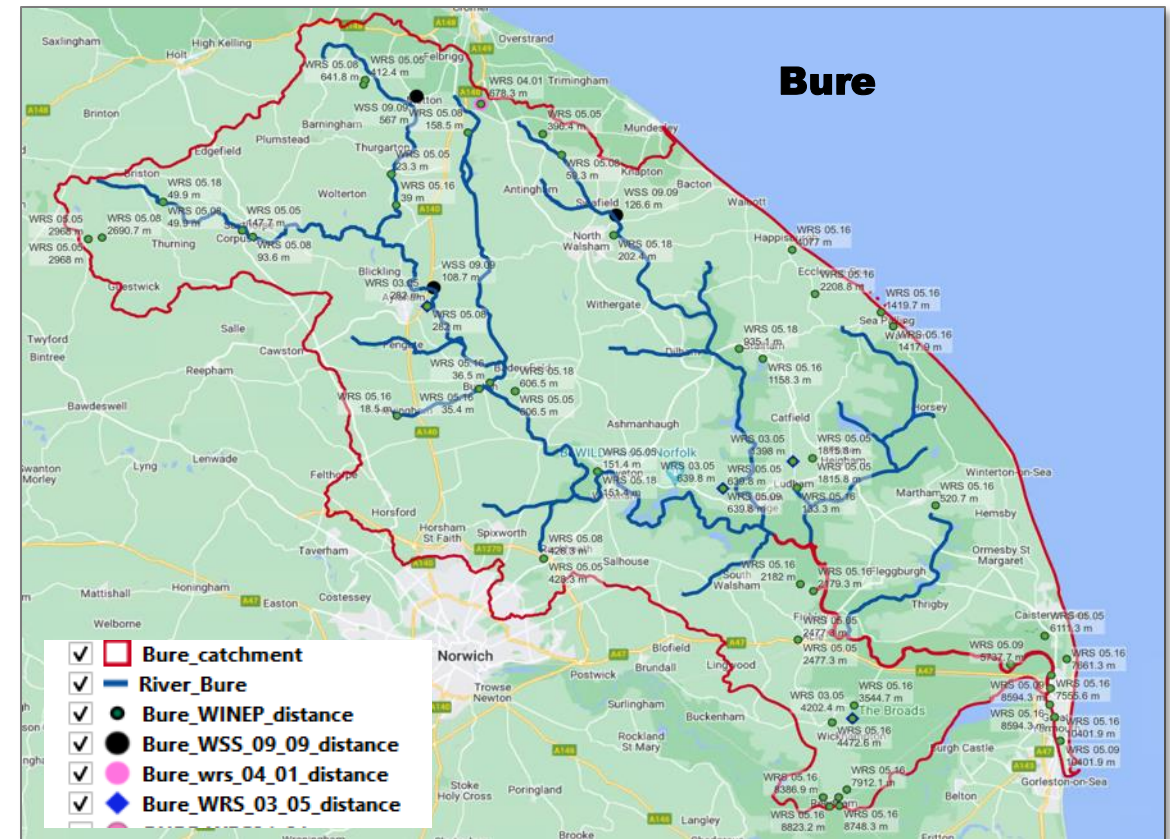
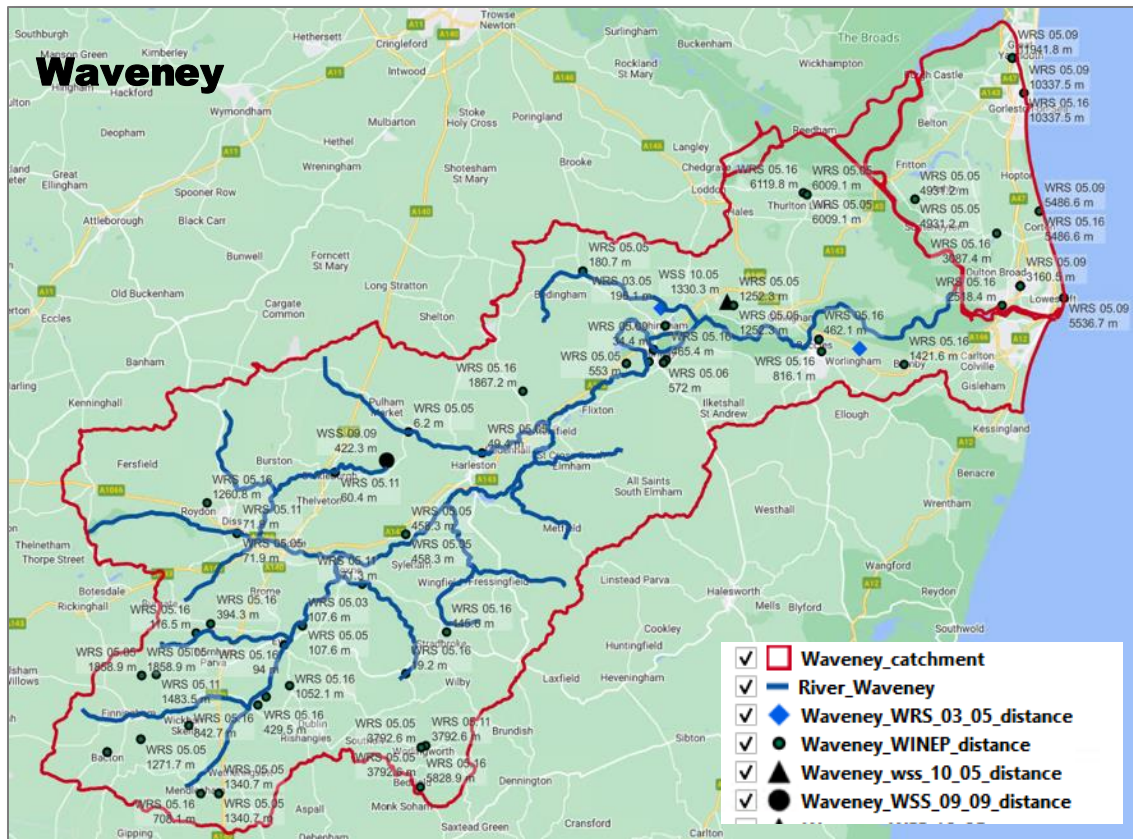
Calculations were done on the nearest distance from each investment to the WFD river waterbodies



How the table of each portfolio looks like:

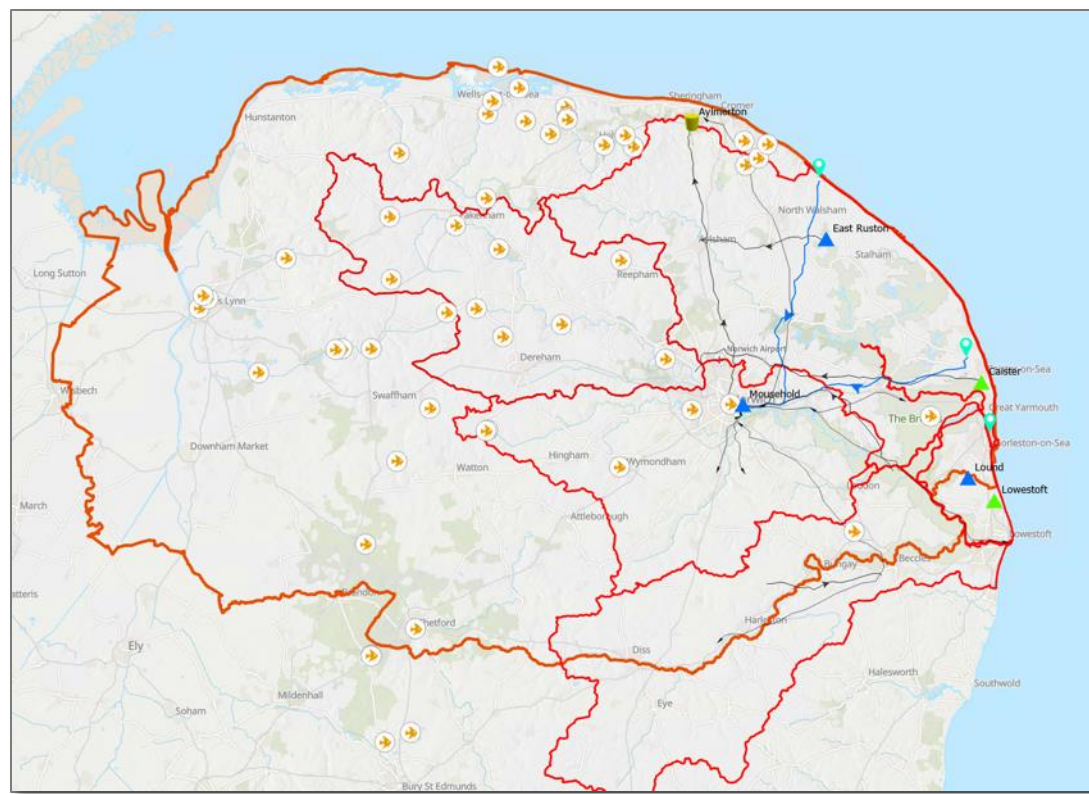
Capex_Cost	Portfolio_	Investme_2	Alternativ	Latitude	Longitude	WB_CAT	RBD_ID	MNCAT_NAME	RBD_NAME	OPCAT_ID	hydromorph	MANCAT_ID	url	OPCAT_NAME	WB_ID	version	WB_NAME	n	distance	feature_x	fea
1176541.080000	WSS 10.09(PR24...	A replacement ...	Provide Booster...	52.64105877000	1.23307520000	River	5	Broadland Rivers	Anglian	3553	heavily modified	3008	/catchment-pla...	Yare	GB105034051281	1	Yare (Tiffey to ...	1	1055.170590076...	618839.7104000...	309717
218316.1700000	WSS 10.09(PR24...	Strumpshaw W...	Strumpshaw W...	52.61327987000	1.47783230000	River	5	Broadland Rivers	Anglian	3553	heavily modified	3008	/catchment-pla...	Yare	GB105034051310	2	Witton Run	1	1743.690868092...	635543.3537999...	307399

COMBINED WINEP AND NON-WINEP



[*Details provided in the appendix note]

Other opportunities identified (outside of AW) and location of desalination plants along with interconnected pipes



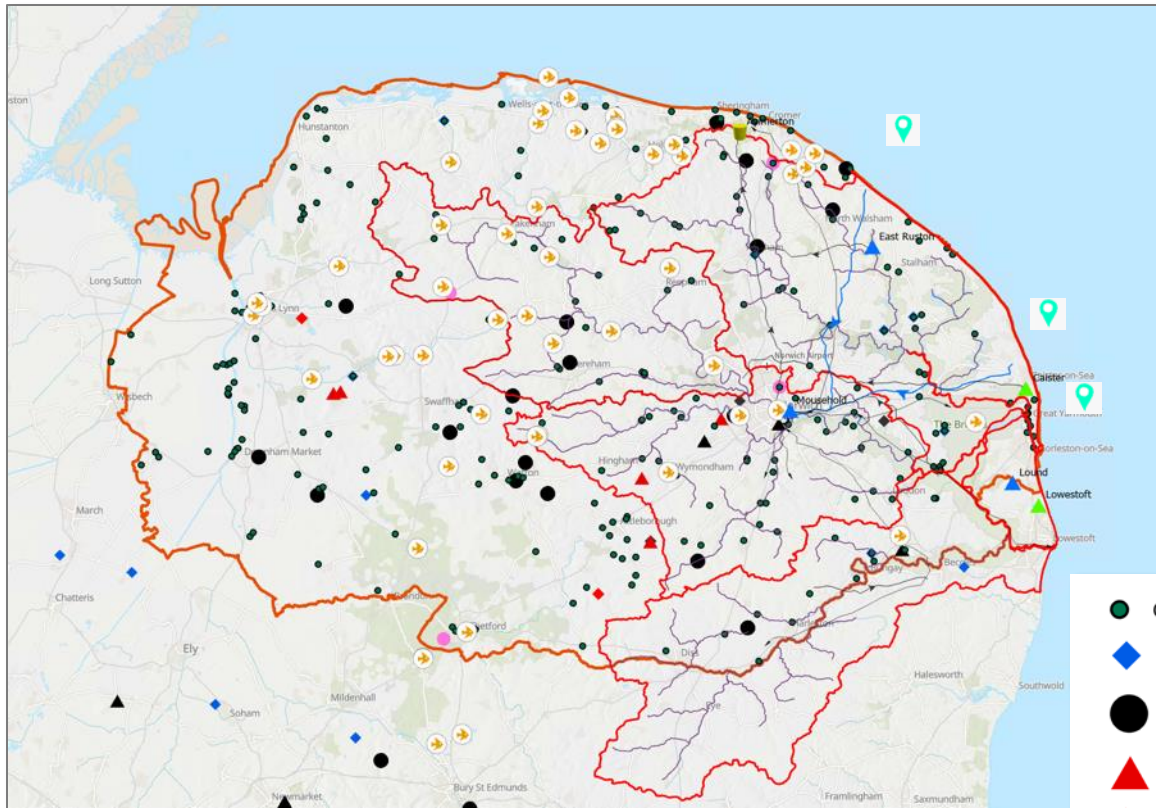
- Norfolk_river_trust_data
- other_features_WTW_WRC_WT_SR
 - Type
 - WR
 - WRC
 - WTW
- Desal_point
- Desal_pipeline
 - Name
 - BCTTW_84_WRMP24_owenay
 - BCTTW-80_other_one_way
 - BCTTW_80_WRMP24_owenay
 - bidirectional

FID	Shape * Id	Proj_name
0	Point	0 Norfolk_wildflower_restoration_project
1	Point	0 River_habitat_improvements_on_Yare
2	Point	0 Himalayan_Balsam_on_Wensum
3	Point	0 Fish_migration_routes_restored_on_Tiffey
4	Point	0 Water_Protect_kirby_lane
5	Point	0 Boradland_catchment_partnership
6	Point	0 Your_Fisheries_Wensum
7	Point	0 Silt_trapsonRiver_Wensum
8	Point	0 Run_off_mitigation_at_a_site_Wensum
9	Point	0 Wending Beck Exemplar Project
10	Point	0 Upper soil trapping_WWF_Coca_Cola_Water Quality_related
11	Point	0 Mileham restoration:Creating a varied channel
12	Point	0 Creating a diverse and complex habitat to slow the flow
13	Point	0 Re-awakening the river at Snoring (Stiffkey)
14	Point	0 CaSTCo
15	Point	0 Green cover crop trials on outdoor pig units
16	Point	0 Diversifying the Babingley at Hillington
17	Point	0 North Creake: Mixing up the flow
18	Point	0 Water Sensitive Farming for World Water Day
19	Point	0 Track changes, buffers, gateway removal and cover crops
20	Point	0 Trimmingham: capturing soil and water
21	Point	0 Frogshall: Creating an Integrated Constructed Wetland (ICW)
22	Point	0 Reducing sedimentation at Baconsthorpe Castle
23	Point	0 Sediment management in the upper Glaven
24	Point	0 Ecological restoration of Selbrigg pond
25	Point	0 A nature-based solution for road and farm run-off
26	Point	0 Stiffkey Integrated Constructed Wetland
27	Point	0 Financing nature-based solutions using Environmental Impact Bonds
28	Point	0 Stiffkey Fen restoration
29	Point	0 Blakeney harbour netting
30	Point	0 Riffles for Wiveton
31	Point	0 Glaven Eel Project
32	Point	0 New meandering river channel for the Glaven at Bayfield Estate
33	Point	0 Beaver reintroduction
34	Point	0 Norfolk Non-Native Species Initiative
35	Point	0 Re-connecting the lost river at Emmanuel's Common
36	Point	0 The cycle of a farm visit
37	Point	0 Stopping the silt: River Wissey restoration & enhancement
38	Point	0 Riffles at Castle Acre
39	Point	0 Working with an outdoor pig unit
40	Point	0 A more dynamic river at West Acre
41	Point	0 River restoration at Pentney
42	Point	0 River restoration at Pentney (Norfolk Rivers Trust, King's Lynn Internal Drainag...
43	Point	0 Bringing life back to a stretch of the River Gaywood

Data collected from: [Norfolk Rivers Trust | Restoring, protecting and enhancing the water environments of Norfolk for people and wildlife](#)

COMBINED WINEP, NON-WINEP AND OTHER OPPORTUNITIES

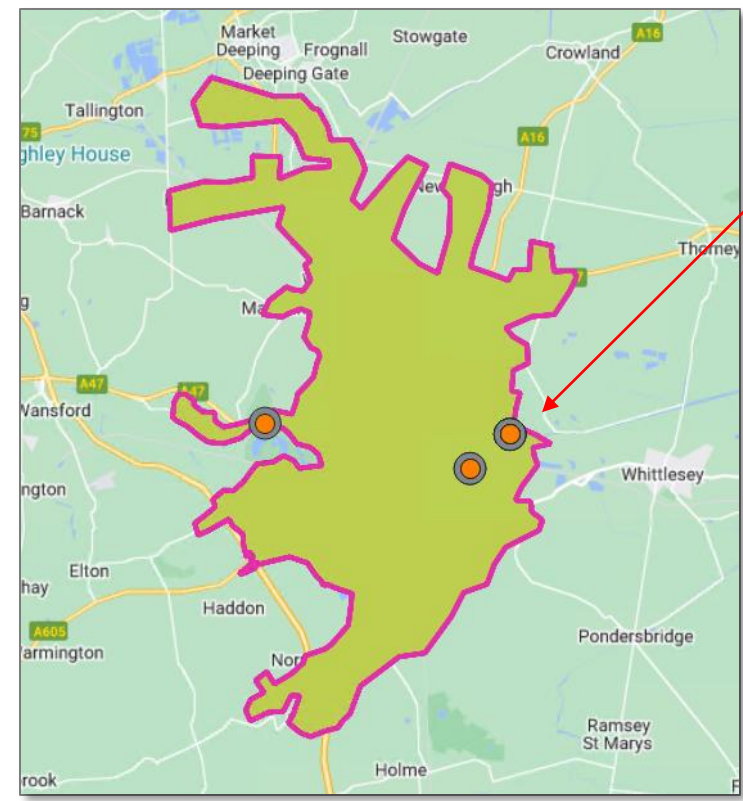
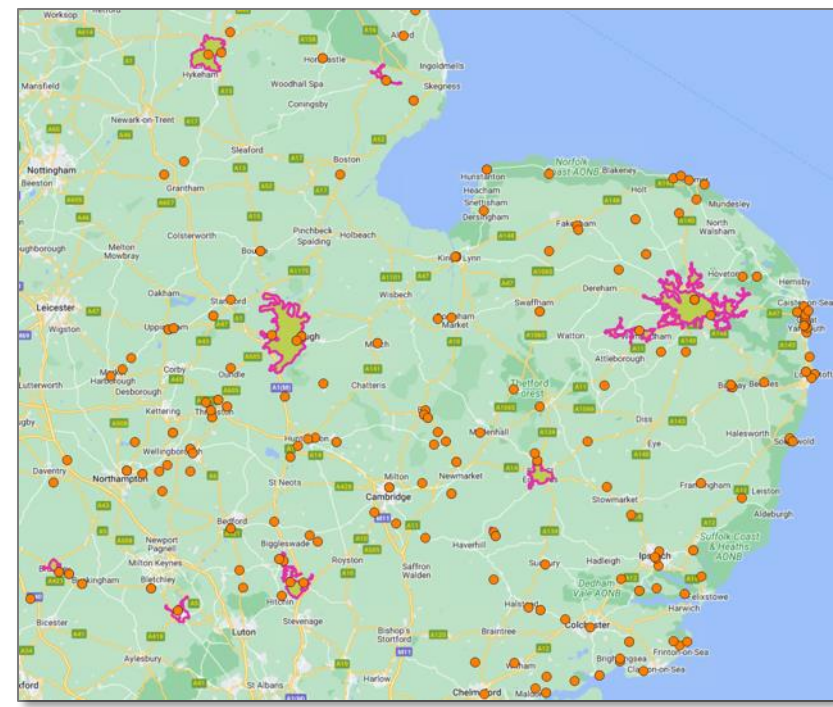
Opportunities were plotted on the hexagon bin map of capex cost for WINEP



- C55_WINEP
- ◆ WRS_03.05
- WSS_09.09_Asset Maintenance
- ▲ WSS_07.04
- ◆ WSS_04.04
- ◆ WSS_10.09
- ▲ WSS_10.05



FLOW RELATED



500m buffer around the flow-related investment location because there are few points outside of the sewage catchment

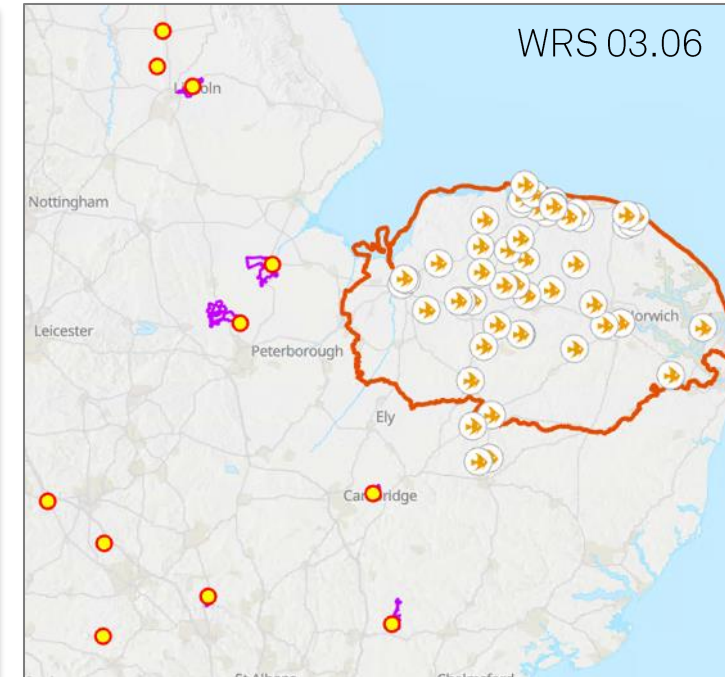
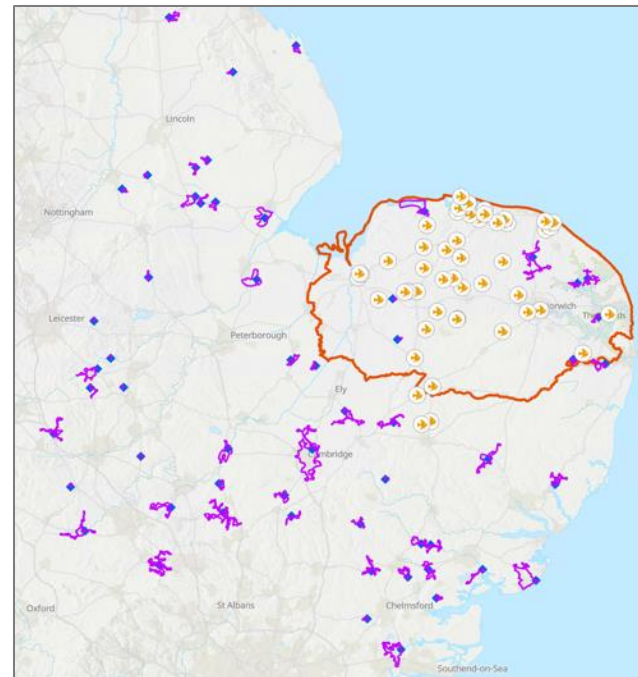
AREANAME	AREASHORTC	STWS_TOTNU	SEWOUTFALL	ID	OBJECTID	Shape_STAR	Shape_STLe	Obj1	Shape_Leng	Shape_Area	Investment	Investme_1	Location	C55_Stage	Capex_Cost	Portfolio_	Investme_2	Alternativ
Brackley (New)	BRAKSC	0	0	6445.000000000000	329926	5879038.401479...	19426.31104220...	1030	31556.87614670...	15518614.97399...	Brackley New ...	1034781	BRACKLEY STW...	Draft	1284834.979999...	WRS 05.07(PR2...	Increasing stor...	Glass coated St...
Brackley (New)	BRAKSC	0	0	6445.000000000000	329926	5879038.401479...	19426.31104220...	1030	31556.87614670...	15518614.97399...	Brackley WRC E...	1034076	BRACKLEY STW...	Draft	134890.1600000...	WRS 05.09(PR2...	EA Driver Guida...	Brackley WRC ...
Bungay	BUNGSC	0	0	6507.000000000000	329979	1837817.169169...	10425.48856070...	1083	17086.92835480...	4936818.190960...	Bungay WRC U...	1034006	BUNGAY STW	Draft	1484045.870000...	WRS 05.06(PR2...	Investment to c...	3 x DWF Inreas...
Bungay	BUNGSC	0	0	6507.000000000000	329979	1837817.169169...	10425.48856070...	1083	17086.92835480...	4936818.190960...	Bungay U_IMP6	1034793	BUNGAY STW	Draft	755638.3199999...	WRS 05.07(PR2...	Increasing stor...	Glass coated St...
Bungay	BUNGSC	0	0	6507.000000000000	329979	1837817.169169...	10425.48856070...	1083	17086.92835480...	4936818.190960...	Bngy-Ditchngh...	1033468	BUNGAY-DITC...	Draft	299988.1500000...	WRS 05.09(PR2...	CSO does not h...	BUDISP CSO Ne...
Bungay	BUNGSC	0	0	6507.000000000000	329979	1837817.169169...	10425.48856070...	1083	17086.92835480...	4936818.190960...	Bungay-Ditchin...	1034118	BUNGAY-DITC...	Draft	245145.9599999...	WRS 05.09(PR2...	EA driver guide...	Bungay Ditchin...
Canwick	CANWSC	0	0	6063.000000000000	329305	44139689.20059...	47094.39384810...	409	78588.16236479...	122955345.6309...	Canwick WRC ...	1034795	CANWICK STW	Draft	3734028.370000...	WRS 05.07(PR2...	Increasing stor...	Glass coated St...

[*Details provided in the appendix note]



Similar work for other non-WINEP and non-flow related portfolios

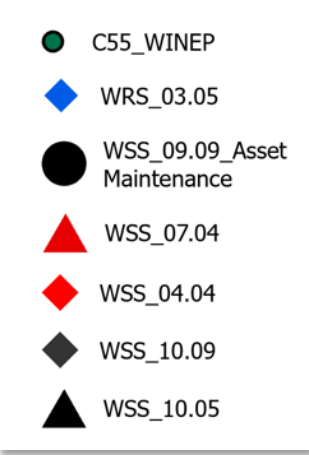
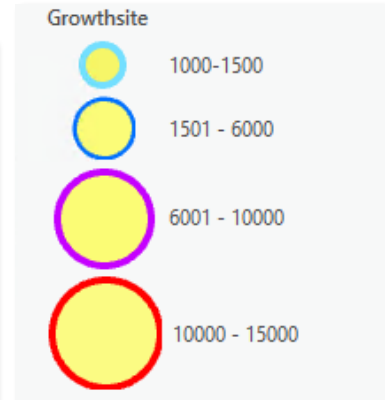
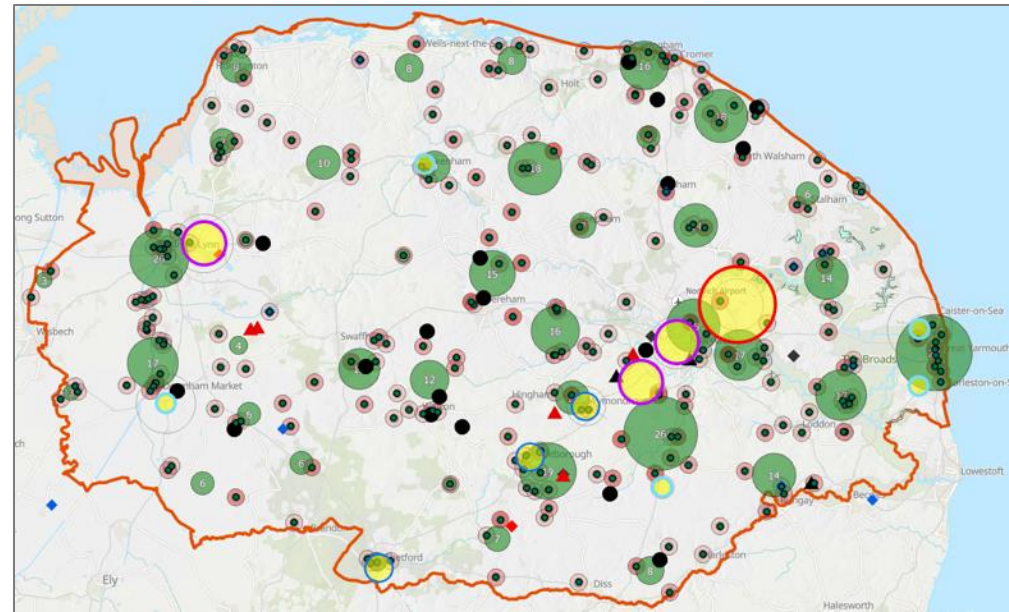
Similar work was done on WRS 03.05 and WRS 03.06. The sewage catchments outside of Norfolk were also considered



AREASHORTC	SWS_TOTNU	SEWOUTFALL	ID	OBJECTID	Shape_Star	Shape_STLe	Obj1	Shape_Leng	Shape_Area	OBJECTID *	Join_Count	TARGET_FID	JOIN_FID	Investment Name	Investment Code	Location	CSS Stage	Capex Cost	Portfolio	Highr
HECKSC	0	0	4264	329712	2564725.32288	10448.350196	816	17342.765688	7065004.30893	1	1	0	716	Heckington WRC Gro...	I039205	HECKINGTON STW	Draft	1528676.69	WRS 03.05/PR2	
BECCSC	0	0	4350	329715	4878433.65256	24072.878937	819	39452.749111	13104708.3418	2	1	1	1252	Beccles WRC Growth...	I034440	BECCLES-MARSH LANE...	Draft	232802.5	WRS 03.05/PR2	
AILSSC	0	0	5778	329297	9839853.75172	89170.097969	401	147229.764656	26828433.948	3	1	2	333	Aylsham WRC Growth...	I034516	ALLSHAM STW	Draft	3162545.39	WRS 03.05/PR2	
HIGHSC	0	0	4275	329756	745562.884354	6178.342333	860	9961.25509	1939214.89967	4	1	3	3747	Highwood WRC Growth...	I034433	HIGHWOOD STW	Draft	6884.1	WRS 03.05/PR2	
ECOLSC	0	0	4556	329790	4257019.66294	36449.080461	894	59057.537066	11174906.5925	5	1	4	3741	Earls Colne WRC Growth...	I034371	EARLS COLNE STW	Draft	8566.57	WRS 03.05/PR2	
COGGSC	0	0	4484	329808	6516003.18139	37950.525185	912	61392.231073	17049781.5151	6	1	5	837	Coggeshall WRC Gro...	I039329	COGGESHALL STW	Draft	939777.4	WRS 03.05/PR2	
GNORSC	0	0	4204	329814	641093.263939	4682.099908	918	7626.947373	1700375.07678	7	1	6	820	Greens Norton WRC G...	I034428	GREENS NORTON STW	Draft	979044.23	WRS 03.05/PR2	
GOXESC	0	0	4210	329844	1494414.77702	16196.942801	948	26544.671266	4014866.59374	8	1	7	701	Great Oxendon WRC...	I034334	GREAT OXENDON STW	Draft	1597182.46	WRS 03.05/PR2	
BOZESC	0	0	4388	329853	837608.671478	4954.818877	957	8082.931717	2229543.22402	9	1	8	1340	Bozeat WRC Growth D...	I034425	BOZEAT STW	Draft	176806.59	WRS 03.05/PR2	
COWBSC	0	0	4503	329879	1686650.9945	23843.021052	983	39370.733503	45977523.6509	10	1	9	370	Cowbit WRC Growth...	I034447	COWBIT STW	Draft	2903369.48	WRS 03.05/PR2	
GSAMSC	0	0	4224	329902	2290159.92734	21722.376343	1006	35258.502488	6034835.1414	11	1	10	3744	Gt Samford WRC Gro...	I034432	GREAT SAMPFORD STW	Draft	6884.1	WRS 03.05/PR2	
STOWSC	0	0	6125	329298	11606550.0448	47551.156426	402	77484.887922	30816063.6268	12	1	11	445	Stowmarket WRC Gro...	I034519	STOWMARKET STW	Draft	2482249.54	WRS 03.05/PR2	
KIRKSC	0	0	3691	328899	1885704.94386	10681.718129	3	17737.303527	5199979.73128	13	1	12	618	Kirby la Thorpe WRC...	I034509	KIRBY LA THORPE STW	Draft	1886358.28	WRS 03.05/PR2	
STABSC	0	0	6061	329304	11308274.4432	95879.721104	408	155264.563642	29661377.1225	14	1	13	292	Stanbridgeford WRC...	I034430	STANBRIDGEFORD STW	Draft	3616824.82	WRS 03.05/PR2	
STHPSC	0	0	3940	329343	682605.685471	4180.353074	447	6804.485969	1809132.47464	15	1	14	117	Stradishall WRC Gro...	I040015	STRADISHALL-HIGHPOI...	Draft	9906771.07	WRS 03.05/PR2	
SWITSC	0	0	3982	329380	900739.781952	9414.665861	484	15558.318016	2457807.33878	16	1	15	791	South Witham WRC G...	I034512	SOUTH WITHAM STW	Draft	1082169.76	WRS 03.05/PR2	
MARMSC	0	0	5503	329389	8964562.52556	37936.231224	493	61671.93527	23697219.842	17	1	16	224	Marston Moretaine Gr...	I034424	MARSTON MORETAINE...	Draft	5061292.42	WRS 03.05/PR2	

OTHER OPPORTUNITIES IDENTIFIED OUTSIDE OF AW

- We have found out the investment plans of Norfolk housing growth sites and observed the association with the plots.
- The map outlines the key strategic housing sites that will deliver the majority of this growth correlated with key urban areas that have existing infrastructure and services that have the capacity to support high levels of growth.
- Norfolk authorities will need to collectively plan for an additional 84,000 (approx. 4,100 per annum) homes by 2036 (~ as per documentation) (<https://www.norfolk.gov.uk>)
- The population is forecast to grow from 900,000 to over 1m by 2036 (<https://www.norfolk.gov.uk>) in Norfolk

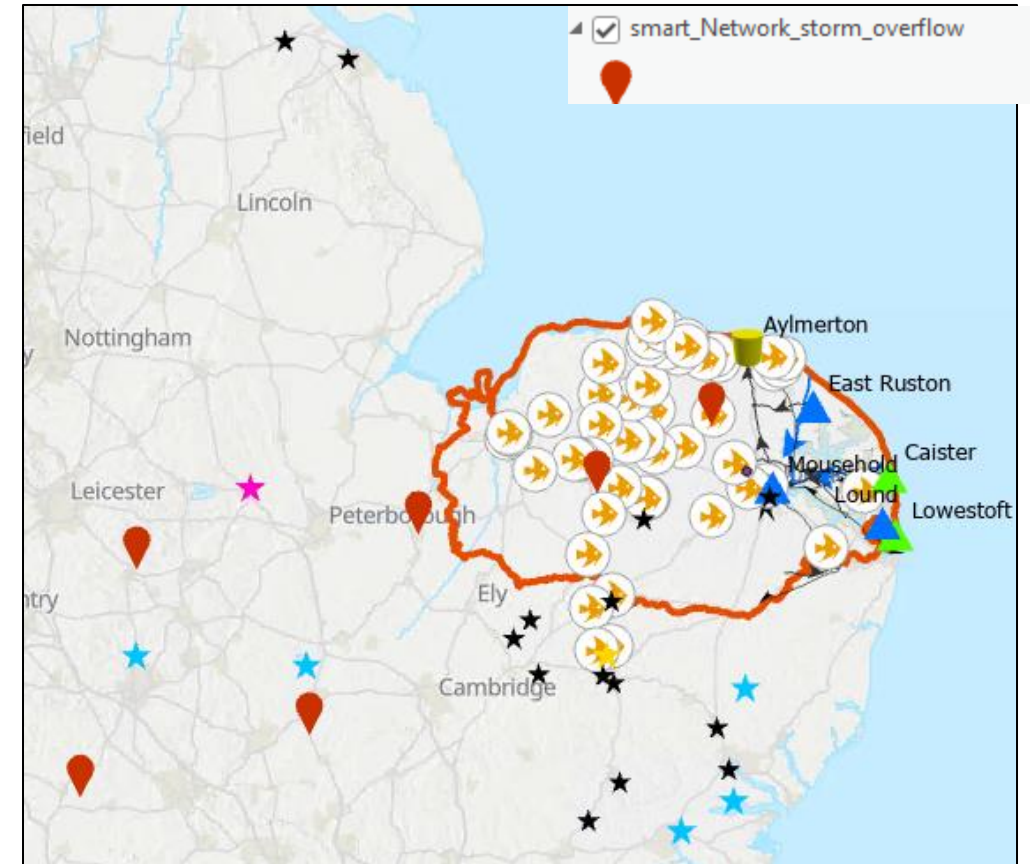


Location	Planned Investments
King's Lynn and West Suffolk	A149 King's Lynn Bypass; West Winch Housing Access Road; A47 Wisbech Bypass Junction Upgrades; A47 Tilney to East Winch Dualling; Future Fens Flooding Infrastructure; New Creative Hub; Kings Lynn Multi-User Hub
Breckland	Snetterton Energy Supply; Thetford Water Supply; Thetford Sewerage Scheme; Thetford Sustainable Urban Extension; Attleborough Link Road; Thetford Energy Supply Upgrades; Attleborough Energy Supply Upgrades; Snetterton Heath Energy Supply Upgrades; A11 Thetford Bypass Junction Upgrades; Thetford Community Shop (Employment Support)
South Norfolk	Easton, Hethersett and Cringleford Sewerage Upgrade; A140 Long Stratton Bypass; John Innes Centre HP3; Norwich Research Park Expansion; Smart Emerging Technology Institute (SETI)
Broadland	Broadland Growth Triangle Link Road; Broadland Business Park Rail Station; Broadland Growth Triangle Secondary School; Burlingham County Park Investments; A47 Acle Straight Dualling; Honingham Food Hub; Food Enterprise Park Solar Farm

<https://www.norfolk.gov.uk/-/media/norfolk/downloads/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/business/appendix-a-nif-evidence-base.pdf>

CUSTOMER BENEFIT BASED APPROACH

- We have identified a number of portfolios which are directly related to customer benefit. The portfolios are symbolized using multi-coloured stars. They are CWS 03.03, WSS 05.08, WSS 09.09 and WSS 10.09.
- In addition to this, we have added the investments related to Smart Networks and disconnection from **WRS 05.09** to reduce storm overflow spills and controls on that. The portfolio is symbolized as red marker on the map
- This is to be noted that **WSS 05.08 (PFAS)** is associated with Contamination of the water supplies by PFAS which is now regulated by the DWI guidance letters under the requirement to supply wholesome water to customers.
- **WSS 09.09** is associated with WW and suffers from high algal counts in the raw water affecting its ability to treat. Risk of loss of supply to customers. It also describes 25 year old steel infrastructure maintenance and possible threat to local customer's water supply.
- **CWS 03.03** has a preferred connection grid from customer's perspective.
- **WSS 10.09** at Stamford-Northfields WB describes customer complaints on the noisy pump and reliability. Loss of one pump will lead to low pressures and both is a loss of supply.



Portfolio Hierarchy - Portfolio Level5

- ★ CWS 03.03(PR24) Developer Driven Growth-NWK Reinforcement
- ★ WSS 05.08(PR24) PFAS
- ★ WSS 09.09(PR24) WTW - Asset Maintenance
- ★ WSS 10.09(PR24) TWD - Treated Water Dist PStations



- Identified all WINEP, non WINEP overlapping investments and their proximity and cluster from Norfolk county.
- Identified the ongoing projects and future project collaborations of external organisations like, WWF, Coca-Cola, real estate companies, Norfolk River Trust, Borough Councils, County Council and Environmental Agency.
- Made a heatmap like model that shows the zone wise divisions for highest and lowest capex cost on the investment locations from WINEP related portfolios.
- Identified the related sewage catchments with Flow-related and other portfolios, even outside of Norfolk county.
- Calculated the nearest distances of the WINEP and Non-WINEP investments to the river water bodies for main four catchments, Wensum, Yare, Waveney and Bure.
- Extracted the dataset from C55 on customer benefit and possible threat on water supply that will directly impact customers.



NEXT STEPS

1. We can look for more clean and good quality external location data and opportunities from different organisations including local authorities.
2. Hexagon bin mapping could be done for other portfolios.
3. The work could be repeated for the rest of the Anglian Water supply area and enable the scale up of place-based thinking.
4. Data could be collected from National Highways and Network Rail, for example, to do in-depth investigations on future place-based opportunities.
5. More quantitative data could be achieved to investigate flood control and water management in a particular area.



CONCLUSIONS

1. Looking at the vast varieties of data from different portfolios, we conclude that there is significant scope to improve the scalability of place based thinking.
2. More external data and analyses could be done to identify more place-based opportunities.
3. A quantitative model could be developed with numerical datasets from different portfolios.
4. This work shows a brief review of the place-based thinking and delivered within a short period of time.
5. We could improve the current model for place-based thinking for future analyses if commissioned to undertake further work.