Session 2 – Paper 5

Drainage & Wastewater Management Plans (DWMP): Initial feedback on application of Risk Based Catchment Screening

UDG Autumn Conference, Blackpool (6-9 November 2018)

Author: Paul Hurcombe: Severn Trent Water (paul.hurcombe@severntrent.co.uk) or Hafren Dyfrdwy (paul.hurcombe@hdcymru.co.uk)

Background

The Drainage and Wastewater Management Plan (DWMP) framework[1] was published by Water UK in September 2018. This framework was developed in collaboration with Defra, Welsh Government, Ofwat, Natural Resources Wales, Environment Agency, Consumer Council for Water, ADEPT (Association of Directors of Environment, Economy, Planning and Transport representing county, unitary and metropolitan authorities), Blueprint for Water and all UK sewerage companies. The overall objective being to develop a 25 year (minimum) company wide long-term strategic plan that will set out how companies intend to extend and maintain a robust and resilient drainage and wastewater system. The outcomes being to facilitate achievement of individual and common goals and objectives for the many stakeholders that have drainage responsibilities to drive efficiencies.

The framework structure sets out a series of process steps as set out below:

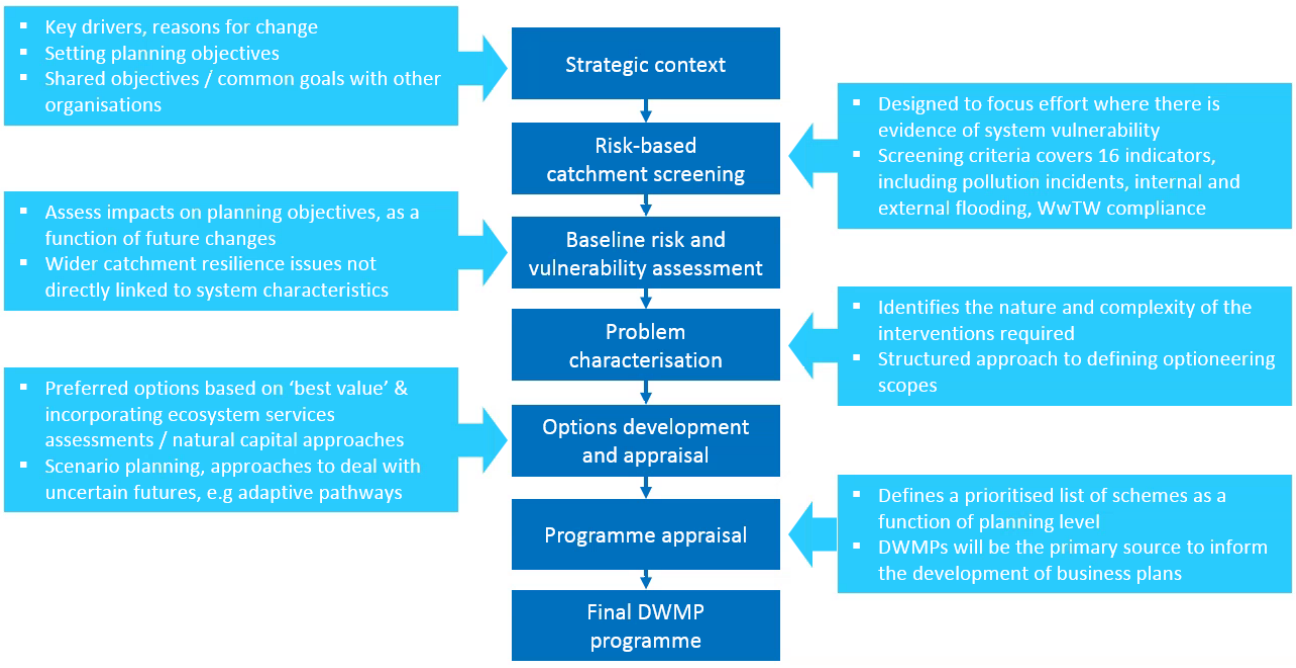

Figure 1: Schematic of the DWMP process steps

[1] https://www.water.org.uk/policy/improving-resilience/21st-century-drainage/long-term-planning

Within the risk based catchment screening (RBCS) activity there is a requirement to assess each wastewater treatment works (WwTW) catchment, against 16 indicators summarised below:

1) Wastewater 1 in 50 year resilience:
   Aligned to the new PR19 Common Performance metric: "% of population at risk of internal sewer flooding from a 1 in 50 year storm" to assess how resilient the sewerage system to surface water connectivity. *(Note this is a Tier 2 indicator)*
2) Intermittent discharge impacts upon bathing or shellfish waters:
   Not applicable to Severn Trent or Hafren Dyfrdwy as we have no coastal discharges
3) Continuous or intermittent discharge impacts upon other sensitive receiving waters:
   Detrimental discharge to sites identified on Natural England's Designated Sites system or Natural Resources Wales Actions Database.
4) Storm Overflow Assessment Framework (SOAF):
   Aligned to new 21st Century Drainage framework to identify high frequency/high impact CSO spills.
5) Capacity Assessment Framework (CAF):
   Aligned to new 21st Century Drainage sewer surcharge performance mapping framework.
6) Internal sewer flooding:
   Aligns to PR19 common performance commitment.
7) External sewer flooding:
   Aligns to PR19 asset health performance commitment.
8) Pollution incidents (category 1, 2 and 3):
   Aligns to the Environmental Performance Assessment (EPA).
9) WwTW quality compliance:
   As per Environmental Performance Assessment (EPA).
10) WwTW flow compliance:
    Based on measured flows compared to dry weather flow permit conditions.
11) Storm overflow spills:
    To identify any overflow that is not operating in accordance with permit conditions.
12) Other Risk Management Authority drainage systems:
    To determine any significant risks arising from interaction with other RMA drainage systems / receiving waterbodies.
13) Planned residential new development:
    Residential PE forecast above percentage exceedance threshold (10 year/25 year).
14) The Water Industry National Environmental Programme (WIINEP):
    Linked to AMP7 drivers needed to meet environmental obligations set out in WIINEP3.
15) Sewer collapses:
    Aligned to PR19 common asset health performance commitment (*Tier 2 indicator*).
16) Sewer blockages:
    Aligned to PR19 asset health performance commitment (*Tier 2 indicator*).

More details of the criteria to determine if a catchment 'fails' or 'passes' any of the indicators is included in Appendix B of the DWMP Framework but the BRAVA trigger is if either:

a) **two or more** indicators are breached (excluding sewer collapses and blockages)
b) **one** indicator is breached (again excluding sewer collapses and blockages) where the indicator is included in the first tier.

If **only** sewer collapses and/or blockages indicators fail then these alone do not trigger a breach.

There is however acceptance within the framework that water companies have the opportunity to include bespoke indicators if deemed necessary to enhance RBCS assessments.

As part of our PR19 Business Plan submitted to Ofwat on 3rd September 2018 Severn Trent published a DWMP 'Lite' document. Whilst in the limited time available it was clearly not possible to produce a full blown DWMP, it did provide us with an opportunity to apply the risk based catchment screening to all our catchments whilst also supporting the strategic investments we are proposing in AMP7 (2020 – 2025). In keeping with our position as a sector leader and innovator, production of a PR19 DWMP 'Lite'[2] demonstrated our commitment to the DWMP process and provide an early benchmark to support and encourage the sector in the development of DWMPs. We believe that DWMPs will build on our existing sewerage management planning processes and also our experiences with working with other flood risk management stakeholder to deliver multiple flood risk solutions through partnership working.

This paper provides initial feedback on the application of the risk based catchment screening with the aim that it will support the implimentation of gold standard DWMP publications to support future investment decisions ahead of PR24.

Setting up catchments

In line with the DWMP Framework the Severn Trent and Hafren Dyfrdwy wastewater regions have been reviewed to determine the Level 2 Strategic Planning Areas (L2SPA). As recommended in the framework these are based on river basin management districts (RBMD). Across our regions there are 13 RBMD but to align to WwTW catchment boundaries we have split one RBMD (to recognise the size and complexity of the Birmingham and Black Country urban areas) and tweaked some RBMD areas to ensure WwTW are not split across several areas. The resultant L2SPA regions are shown below:

[2] https://www.stwater.co.uk/regulatory-library/2020-2025-submission-documents/ (see Appendix 9)

Figure 1: Plan showing Level 2 Strategic Planning Areas

We found the process of assigning L2SPA was relatively straightforward but relied on ensuring our waste water treatment works catchment boundaries were an accurate representation of the network to ensure remote/pumped parts of a wastewater network to be included in the same L2SPA. Fortunately a review of our WwTW catchments undertaken earlier in 2018 for regulatory reporting helped this exercise. These WwTW boundaries form the basis of our Level 3 Tactical Planning Units (L3TPU) but for the purpose of our PR19 DWMP 'Lite' we were not able to breakdown our larger catchments into smaller spatial areas, referred to as Level 4 Local Planning Needs (L4LPN) areas. Having greater granularity will allow RBCS to be applied to larger catchments to be give greater focus to BRAVA assessments. Our next step is to take larger catchments and split them into smaller L4 sub-areas covering between 2,000 to 10,000 populations as this will help identification of problem areas.

Approach

The basic approach to undertaking RBCS is simple, as it just requires data to be allocated to WwTW areas so that each catchment can be assessed against each indicator criteria. This approach is no different to the catchment screening Severn Trent applied within its sewerage management planning processes to ensure problematic catchments are given priority when it comes to understanding its long term wastewater planning needs. However the difference with the DWMP is that all companies will be required to apply the same approach to ensure screening consistency across the industry.

The initial step was to take the various datasets required by each indicator and then geocode them so that they could be tagged to the appropriate L3TPU WwTW catchments. As many of these datasets had already being used to inform investment decisions based on 'hot spot' analysis, the majority of the incident datasets were already geocoded. Whilst analysis indicated some grid references were incorrect the 'error band' was acceptable albeit there are opportunities to improve

accuracy. Using our proprietary GIS software each incident was tagged so that the criteria for each indicator could be assessed to determine whether each L3TPU 'passed' or 'failed'.

One issue we did come across was normalisation of the data, in particular flooding and pollution incidents. Flooding indicators are normalised using connected population but as each of our WwTW has their domestic and trade equivalent populations calculated annually for regulatory reporting purposes this was not a problem, however there were some issues with pollutions which use length of public sewer. The pollution indicator has its incident numbers normalised to align with the same approach applied by the Environmental Performance Assessment (EPA)[3]. This EPA measure is calculated at a company level and includes all public sewer lengths, including foul/combined, surface water sewers, rising mains and assets which transferred under the Private Drains and Sewers Act 2011 (PDaS). However whilst WwTW boundaries can be used to allocate sewer lengths to each L3TPU catchment only a fraction of the PDaS sewers have been mapped across the industry and so normalisation is not possible below company level. As a result normalisation relied on the 37,000km of our calculated PDaS sewers being notionally assigned to L3TPU catchments based pro-rata of non-PDaS sewers. In theory this approach is not expected to have a detrimental impact on the RBCS but will clearly need to be reviewed as additional PDaS asset intelligence becomes available.

Application of indicators

Below is initial feedback on the application of each indicator. However it needs to be noted that our RBCS was undertaken in a very short window due to the simultaneous development of the DWMP Framework and delivery of our PR19 Plan, both of which were published in the first week of September 2018.

1) Wastewater 1 in 50 year resilience:

   This is a new Common Performance metric but a level of subjectivity is needed to determine the vulnerability band for each L3TPU catchment. The outputs from this metric is percentage of population at risk in catchments with high or medium vulnerability bands (i.e. bands 5, 4 and 3) but the analysis is subject to the accuracy/completeness of hydraulic modelling and appraisal of which one of five vulnerability bands a catchment falls within. When it comes to the RBCS the indicator only triggers if part of a L3TPU catchment is within bands 5 or 4 and does not consider whether the percentage of population at risk within a catchment is higher than average. However it is commonly acknowledged within the industry that this metric will evolve and that as a result it is likely to change the DWMP indicator criteria. Currently this indicator is in 'Tier 2' which means that on its own a failure will not trigger BRAVA and so for the purposes of initial screening is considered appropriate, however this indicator will need to evolve. Across the Severn Trent/Hafren Dyfrdwy area 18% of our catchments 'failed' this indicator.

   It does however need to be borne out that this metric is not about making capacity within wastewater system large enough to accommodate a 1 in 50 year rainfall event. What it is intended to do is to give greater focus on understanding how the wastewater network interacts with upstream surface water connectivity with a view that effective managing/removal of surface water inflow will 'protect' the underground piped network from extreme events and thereby provide higher levels of resilience. Clearly this provides opportunities to work closely with other flood risk management authorities to deliver common goals which is one of the fundamental underlying principles of a DWMP.

[3] https://www.ofwat.gov.uk/wp-content/uploads/2017/12/WatCoPerfEPAmethodology_v3-Nov-2017-Final.pdf

Hence whilst it is accepted that this metric/indicator will evolve we are of the firm opinion that this is a good indicator to include within the DWMP.

2) Intermittent discharge impacts upon bathing or shellfish waters:
   Not applicable to Severn Trent or Hafren Dyfrdwy as we have no coastal discharges

3) Continuous or intermittent discharge impacts upon other sensitive receiving waters:
   This assessment uses the Natural England's Designated Sites system or Natural Resources Wales Actions Database to identify whether there are envisaged to be continuous or intermittent discharges which may be having a detrimental impact on sensitive waters.

   This indicator relies on visually eyeballing SSSI sites and designations to identify which L3TPU catchment may be contributing to the NE/NRWs concerns. Due to the geographical nature of many SSSI locations (e.g. a long length of the River Teme is covered by a single SSSI boundary) a manual approach was required to identify discharge locations upstream of sites of concern. However as there are only 11 SSSIs within Severn Trent region identified on the Natural England's Designated Sites system falling within the indicators criteria this was not onerous. Subsequent analysis identified 63 L3TPU catchments with outfalls into SSSIs where it has such discharges are through to be having a detrimental impact. It was not possible to undertake NRW analysis as access to their database was not available at the time of the RBCS.

   Whilst further work is needed to understand how NE/NRW identify these site the fact they have been identified through the RBCS will allow more detailed discussions to be had as part of BRAVA.

4) Storm Overflow Assessment Framework (SOAF):
   This was an easy indicator to assess as it was a direct identification of any L3TPU catchments which had been identified through the 21st Century Drainage framework as having high frequency/high impact CSO spills. The methodology behind these assessments will improve on completion of the ongoing event duration monitoring (EDM) installation programme due for completion by 2020.

5) Capacity Assessment Framework (CAF):
   This indicator is aligned to the 21st Century Drainage sewer surcharge performance mapping, commonly known as '10km CAF hexagon maps'. This methodology is aimed at ranking catchments based on the percentage of pipes modelled to surcharge in a 2 year rainfall event. Due to model coverage this analysis was comprehensive across our regions to identify catchments which met the criteria of being within a 10km hexagon categorised as 5 or 4 (in full or part).

   However the 10km hexagons are very high level, especially when taking into account that each hexagon covers an area of 65km^2 and that the actual 'sewered' areas which sit underneath them only represents 11.4% of the total Severn Trent boundary and less than 1% of the overall Hafren Dyfrdwy region. Further work is therefore needed to understand how these surcharge assessments can be used but for the purposes of our initial RBCS 247 (25%) of catchments failed this indicator. Going forward there may be scope to normalise the CAF methodology using connected population or length of sewer.

6) Internal sewer flooding:
   This metric considered both hydraulic incidents and incidents caused due to serviceability issues (blockages, collapses and equipment failure) as a single entity but internally there would be benefit to separate the two measures. The reason for

separating the two elements is that if the flood risk were principally associated with blockages then the focus of the BRAVA options are likely to need sewerage company interventions, whereas hydraulic incidents are likely to require engagement with other flood risk management authorities. The latter would benefit from understanding wider surface water management in a catchment which is more likely to lead to wider partnership opportunities which could lead to multi agency interventions to reduce surface water flood risk in general to improve resilience.

Overall this measure was easy to assess with 12% of catchments 'failing' but as the analysis in based on the last 3 years performance further work is needed to check if measures have already been put in place to mitigate the risk (e.g. proactive sewer cleansing programmes and first time root cause resolution). It is therefore envisaged that the investment decisions Severn Trent have made over the past few years to achieve upper quartile flooding performance will result in fewer catchments failing the internal and external flooding indicators once mitigation measures have been taken into account.

7) External sewer flooding:
   Same as internal flooding.

8) Pollution incidents (category 1, 2 and 3):
   This indicator was easy to apply as it used the same data used to inform the Environmental Performance Assessment (EPA). The only complication was that the incidents were normalised based on 10,000km of sewer but as the EPA measure requires the 37,000km of PDaS sewers (40% of the overall sewers length) splitting down to each L3TPU this proved difficult as the actual location of these PDaS assets is unknown. Consequently we have had to pro-rata these assets based on known sewer lengths.

9) WwTW quality compliance:
   This was a direct link to Environmental Performance Assessment (EPA) annual returns which were already being reported at a WwTW level.

10) WwTW flow compliance:
    This indicator was straightforward as it used measured flows compared to dry weather flow permit conditions.

11) Storm overflow spills:
    This measure has associations with discharges to sensitive waters, SOAF and the WIINEP. For the purposed on our PR19 DWMP 'Lite' we duplicated the SOAF indicators pending collation of further data to assess sewer overflow permit performance. It is felt that this indicator may need further review to ensure it does not duplicate other measures.

12) Other Risk Management Authority drainage systems:
    The aim of this indicator is to identify catchments where there are risks due to interdependencies with other RMA drainage systems / receiving waterbodies. However it could be argued that <u>all</u> combined/surface water sewers have an interaction as they either receive upstream flows from surface water (e.g. highways) or rely of a free outfall info a receiving waterbody (either from surface water sewer outfalls, sewer overflow discharges or WwTW outlets) and so are affected during times of abnormally high water levels. This measure could therefore include 100% of catchments which is not the intention. However for the purposes of our initial assessment we based this on 'big ticket' interactions, for example where we have known sewer performance issues in

Worcester when the River Severn is in spate or where we are aware of multi-agency partnership opportunities. However as only 3% of our catchments 'failed' this indicator this may suggest further criteria clarification is needed.

13) Planned residential new development:

Residential population forecasting is problematic and whilst we have a team of catchment planners who are tasked with engaging with local planning authorities in the development of their local plans this can be a black art. We are however aware from high level discussions through the recent Water Resource Management Plan that there is expected to be an acceleration in new development in the next 5 years with 180,000 homes expected to connect to our sewerage network between 2020 and 2025. For the purpose of our PR19 DWMP 'Lite' we used the same residential forecasts used to inform our PR19 WwTW plans. This has identified that 223 of our L3TPU catchments, representing 23% of our catchments, with residential population projected to be above the threshold curve set out in the DWMP framework. Through our existing sewerage management planning processes we are already aware of the pressures being posed from large levels of planned development and these are being taken into account when developing wastewater strategies. It is envisaged that DWMPs will provide a more formalised approach to developing long term strategies but overall the indicator is showing to be beneficial.

14) The Water Industry National Environmental Programme (WIINEP):

This was a direct link to our AMP7 drivers needed to meet environmental obligations set out in WIINEP3.

15) Sewer collapses:

This measure required historic sewer collapses normalising by sewer length and the same approach with regard to PDaS assets was used for collapses. Calculation of this indicator was straightforward with 10% of catchments 'failing'. This was also a Tier 2 indicator (due to it principally being a sewerage company issue) and so would not trigger BRAVA on its own.

16) Sewer blockages:

Similar comments to collapses. The use of hot spot analysis to prioritise catchments already forms part of our investment decisions and so will help inform subsequent BRAVA assessments.

Overall findings

The outputs from our initial RBCS indicate that 504 (50%) of our L3TPU catchment would trigger BRAVA. As you would expect the larger catchments have more issues and so trigger BRAVA whilst smaller catchments have typically less issues.

The chart below summarises the percentage of catchments (by population equivalent (PE) size band) which 'fail' each indicator.

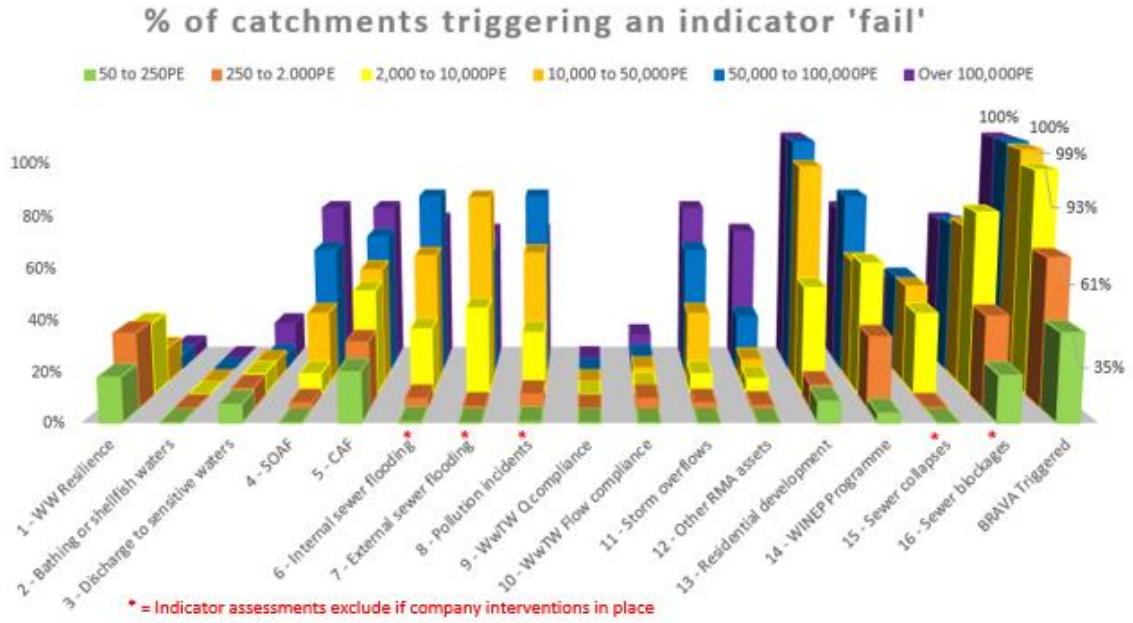

Figure 2: Analysis of reasons for indicator 'failures' based on size of WwTW

The outputs of the RBCS indicates that in terms of connected population 73% of connected population is covered by the 36 WwTW over 50,000 population, all of which trigger BRAVA. Whilst only 50% of our catchments trigger BRAVA the ones that do result in 99% of the connected population being covered, hence there may be scope to raise BRAVA thresholds to ensure effort in producing DWMPs is proportionate.

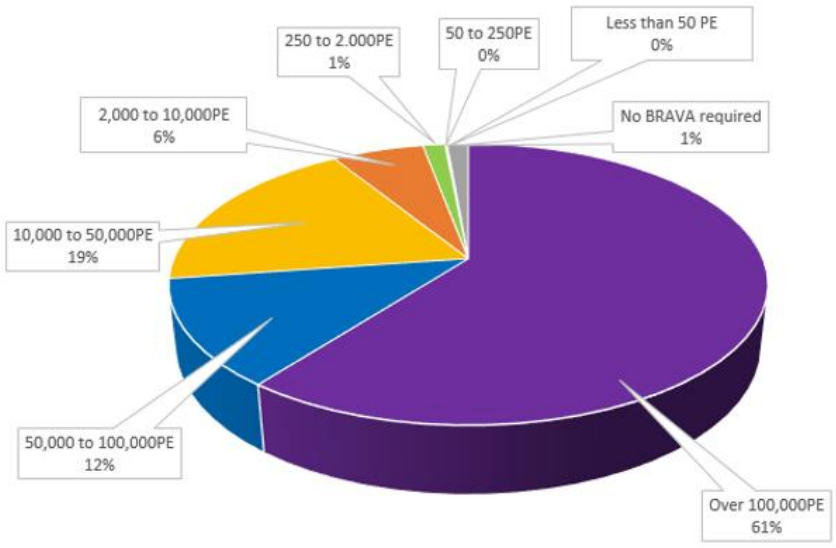

Figure 3: Pie chart showing distribution of catchment sizes triggering BRAVA

The majority of the smaller WwTW catchments only trigger BRAVA because of a single Tier 1 'failure'. The graph shown in Figure 4 shows that raising the threshold to exclude catchments with only a single failure would remove 48 catchments from progressing to BRAVA but would only exclude a connected population of less than 25,000. Raising the threshold to exclude catchments with 2 failures would remove a further 102 catchments, collectively serving 118,000 people. As such, raising the threshold to 3 or more 'failures' would reduce the number of catchments proceeding to BRAVA to 354 (from 504) but would have negligible impact on connected population being assessed (equivalent to around 1.4% of the total wastewater connected population). The next steps however will be to undertake further analysis to understand what the failure indicators for

the 150 catchments are and to understand whether a simpler assessment could be followed but still following the BRAVA principles outlined in the DWMP Framework.

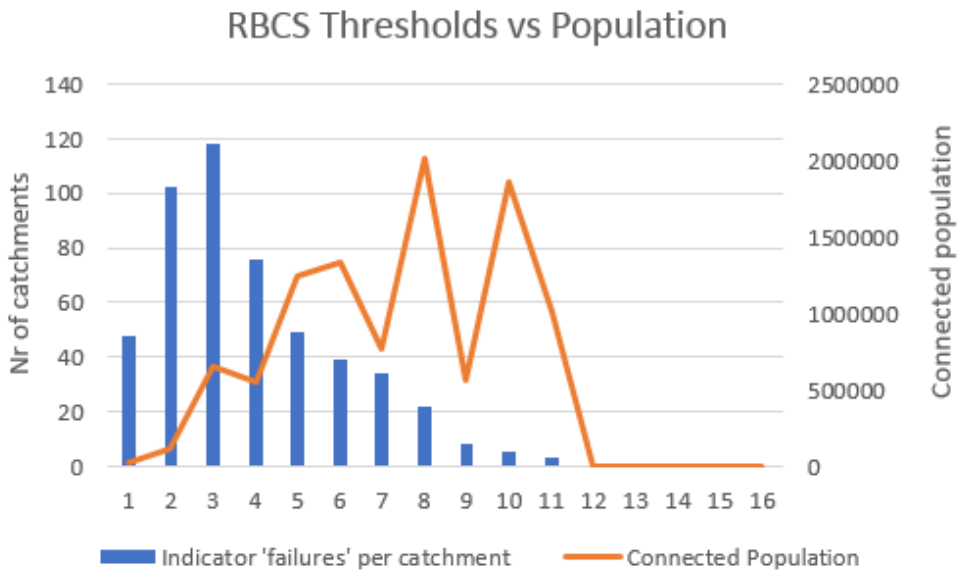

Figure 4: Graph showing implications of raising RBCS indicator thresholds and impact on connected populations

Conclusions

Overall it was found that the application of the RBCS indicators is relatively easy to apply, however the concern is the number of catchments which subsequently need to proceed to BRAVA. One option could be to raise the threshold on the number of indicators which need to 'fail' in order to trigger BRAVA. This would ensure greatest effort is applied to catchments with greatest connected population coverage but it needs to ensure that customers in smaller catchments are not overlooked just because they are small. However until we have had time to interrogate the results in more detail and apply the BRAVA methodology to case study catchments this is impossible to say how this could affect the quality of the overall DWMP objectives.

Through the development of the DWMP Framework Severn Trent/Hafren Dyfrdwy have been fully supportive of the DWMP process and are looking forward to working with industry representatives to ensure implementation challenges are overcome to ensure effective DWMP publication by 31st December 2022.