

Ref 5.8E.3

# New Merthyr Works Capacity Assessment

September 2018

## Background

Design teams have been scoping the design of the new Merthyr water treatment over the past two years and have based initial designs on a nominal works delivery of 225MI/d with cost sensitivity undertaken over the range 200-250MI/d capability. The 225 MI/d flowrate has been based upon the original design capacities of the water treatment plants that the new works will replace, Pontsticill, Llwynon and Cantref. This capacity has been checked against the abstraction licence constraints from the reservoirs from which the works will be supplied but not against future demand needs. A cost statement is now required for inclusion within the PR19 business plan. This high-level review looks at the potential future requirements of the works.

There are six important issues to consider regarding sizing the new Water Treatment Works;

- Raw water resource availability & licencing using Taf Fechan and Taf Fawr, (sufficient water available to treat 250 &/or 225 MI/d based annual abstraction licences without daily limits but constrained by rule curve)
- Water Treatment capacity that can meet the additional demand of Nantybwhch and Carno in future, (to be determined)
- Ability to distribute the water through the strategic network (currently a constraint but is planned for improvement in AMP9 and beyond)
- Resilience of our water supply to customers, the new site provides the opportunity to provide resilience to SEWCUS and following strategic network improvements to Felindre WTW and the area to the West of Cardiff
- The ability to maintain the new site in future by removing assets/processes from service for periods of several months. The multi-streamed design of the new site will allow this
- Ability to optimise operational costs and supply our customers with a resilient treated water supply optimised from least cost sources

## Design capacity principles

For PR19, it is proposed to replace the capacity of Pontsticill, Llwynon and Cantref works. The option to close a further two sites Nantybwhch and Carno also need to be considered. The future capacity requirement of the new WTWs relates to:

- The availability of raw water resources to supply the new Merthyr WTW using Taf Fechan and Taf Fawr impounding reservoirs. There is sufficient water available to treat 250 &/or 225 MI/d based annual abstraction licences without daily limits but constrained by rule curve, which means that this is only available limited periods each year.
- Improved Resilience which will be further enhanced through future network development which could allow increased use of the new WTWs. Demand on the new works is currently constrained by:
  - The ability to send treated water past the Tongwynlais SRV;
  - If the network constraint were removed at Tongwynlais SRV then the minimum use of the Sluvad and Court treatment works including the minimum turndown of Sluvad and the need to supply the Chepstow area from Court Farm.
  - To meet any future demand through the potential West-East-West link, a strategy for the development of the strategic network is planned during AMP7 to identify strategic mains links and requirements to increase resilience of the South Wales.

- The need for resilience against other works outages at any time of the year e.g the loss of Sluvad or Court Farm. This also relates to the network and the ability to serve the SRVs beyond Tongwynlais.

Table 1 provides the current works capacities and the annual licence divided by 365 as an indication of the available water resource. There are no daily licence conditions related to the Taff Fawr or Fechan reservoirs so the peak abstraction licences will not constrain the new works sizing.

Works	Reservoir source	Average annual Licensed volume (MI/d)	Current reported peak available capacity (MI/d)	Maximum design capacity (MI/d)
Pontsticill WTW	Upper Neuadd Lower Neuadd Pontsticill	109.4	85	105
Llwynon WTW	Beacons Cantref Llwynon	93.4	55	88
Cantref WTW	Beacons Cantref		21	32
		202.8	161	225
Nantybwhch WTW	Shon Sheffrey	30	25	30
Carno WTW	Upper and Lower / Carno	9.1	5	9
		39.1	30	39
Totals		241.8	191	264

Table 1 – Overview of current raw water licences and WTW capacities

The SEWCUS water resources model has been used to confirm that the total current available capacity across SEWCUS with existing network constraints is sufficient to meet future demands. The draft WRMP also confirms that SEWCUS Distribution Input is predicted to fall over the next 30 years.

The annual average Taff reservoir licence is unlikely to impact upon the works sizing with average licence only likely to be met in the wettest of years if a high percentage of the total SEWCUS demand were to be met from the new works. This can be confirmed through water resource modelling under specific scenarios.

- The new site will be a maintenance enabler for existing sites as well as providing a design which will enable existing sites and the new works to be taken out of service for months at a time for maintenance activities including refurbishment and replacement. The ability to significantly reduce the outputs from Court Farm or Sluvad for months at a time will provide this opportunity. The new WTW will need to be maintained and sized to enable future removal of assets off line for periods of at least 6 months for refurbishment and replacement
- The ability to minimise cost by using the Taff reservoir water resource when available. The critical demand periods are:
  - Normal Winter demand – At this time we will want to maximise the use of the upland resources as this provides our least cost water.
  - Peak Spring demands – This is the peak demand period during which we would not normally be constrained by our water resource availability through the rule curves on the upland reservoirs.
  - During the summer period, we would normally restrict the output from the upland works to preserve water resource, therefore, peak works output would not normally be needed.

#### The current position and possible future scenarios:

Tables 2 & 3 below show future SEWCUS network development scenarios that could affect the demand on the new works. With current configuration of the network the new works capacity (sustainable output) does not need to be greater than 175.7 MI/d (assuming the future closure of Nantybwhch and Carno). However,

future network development could allow greater use of the new WTW's and cost saving to be made and more importantly provide additional system resilience. Scenario calculations are based upon the total SEWCUS demand minus the demand that will need to be met by the other existing WTWs. The maximum works output for the demand scenarios can be seen in Table 2 below. The WTW outputs that will result in the maximum and minimum demand for the new works can be seen in Table 3 below.

Demand Scenario	May average	May peak demand	Winter average	Demand met by other works	Notes
SEWCUS total (MI/d)	370	400	360		
<b>Merthyr works flow requirement with various network scenarios</b>					
Base line*	<b>203</b>	<b>233</b>	<b>193</b>	<b>167</b>	* With no Tongwynlais constraints on Llwynon output and Sluvad supporting Chepstow demand
With Court Farm supporting Chepstow demand	<b>173</b>	<b>203</b>	<b>163</b>	<b>197</b>	As current with Court Farm meeting Chepstow demand
Following Talybont mains refurb	<b>163</b>	<b>193</b>	<b>153</b>	<b>207</b>	Baseline with Talybont mains refurb
As above with additional demand from East West link**	<b>193</b>	<b>223</b>	<b>183</b>	<b>177</b>	**Assuming an East West link with a capacity of 30MI/d

Table 2 – Demand Scenarios considered to review maximum demand for the new WTW output

Works	New WTW Maximum Output Scenario	Comments	New WTW Minimum Output Scenario
Tynywaun	7	Winter recent actual (Jan 2018)	7
Maerdy	10	Winter recent actual (Jan 2018)	10
Hirwaun	4	Winter recent actual (Jan 2018)	4
Sluvad	95	Minimum permissible rate of Sluvad	120
Nantybwich	14		14
Talybont	35	Winter recent actual (Jan 2018)	35
Cwmtillery	1.9	Winter recent actual (Jan 2018)	1.9
Court Farm	0	Assuming Sluvad will feed Chepstow in the maximum output scenario	90

Table 3 – Potential future SEWCUS development scenarios

With re-configuration to allow Llwynon water to meet demand past the Tongwynlais SRV and Sluvad works able to meet Chepstow demand then demand on the new works could be up to 230MI/d with a Winter/Spring average demand of around 200MI/d.

- Once the Talybont trunk mains have been refurbished, Talybont would be used to meet more demand and this figure would drop to between 200 and 170MI/d.
- Conversely, the development of the West-East-West resilience link could add an additional demand of c30MI/d which would need to be provided from the new WTWs.

Other factors which should be considered are that:

- The design capacity of WTW does not provide a sustainable output of the equivalent volume. It should be assumed that the new works will need to be sized achieve this at 10% greater than demand
- Building a WTW that can supply the area currently supplied by Nantybwich and Carno should they both close in the future would increase the average demand by c14 MI/d. Assuming that all except the feed for Rassau demand only could be fed by the new WTW if required
- If all the WTW were to operate at the maximum independent outputs, using 2017 values, including Carno and Nantybwich, demand could reach 194MI/d (Cantref, Llwynon, Pontsticill) + 30 MI/d (Carno & Nantybwich) = 224MI/d. In the short term this would only occur when recovering from a significant event that has reduced network storage across the area
- Ability to replenish the new works clear water storage tank as well as the network service reservoirs following a period of high winter demand similar to that experience during the Feb/Mar period 2018

Greater capacity and the installation of strategic pipelines would provide resilience against a loss of Sluvad, Court Farm and Talybont WTW during peak demand periods and would include Felindre should an East West link be built in future.

The lower limit for the new works capacity relates to the amount of water resource available. This will be constrained through the use of a new rule curve on the total Taff Fawr, Taff Fechan reservoirs. The current rule curves limit treatment to around 60MI/d during dry periods.

### Potential Operational Cost Savings

A high level assessment has been undertaken regarding the relative cost of high level new Merthyr WTW vs' the low level works of Sluvad and Court Farm. An annual potential cost saving by having the 225 MI/d and 250 MI/d WTW has been calculated assuming that water is available and can be distributed from the new WTW, see Table 3 below. It should be noted that the saving is derived using raw water pumping costs only.

Capacity of WTW	Number of days water available	Avoided raw water pumping at Wye Transfer and Prioress Mill (assume 50:50 split between sites)	Annual potential Opex cost saving (assume 10p per kW/h)	Potential 10 year cost benefit
225 MI/d	90	25	£96,850	£968,510
250 MI/d	90	50	£193,700	£1,937,000

Table 3 – High level review of potential operational cost savings

### Benefits and Constraints for the range of nominal WTW capacities

Table 4 below provides a summary of the benefits and constrains of three WTW capacities which have been considered as the potential size range for the new Merthyr WTW.

WTW Capacity	Benefits	Constraints	WTW construction cost against 225MI/d WTW
200 MI/d	<ul style="list-style-type: none"> <li>Meets current demand</li> </ul>	<ul style="list-style-type: none"> <li>Limits future resilience support</li> <li>Would be at its limit following network improvements and the ability to support Cardiff growth</li> <li>Will limit resilience capability once an East West link has been constructed</li> </ul>	-c£7m
225 MI/d	<ul style="list-style-type: none"> <li>Meets current and future demand</li> <li>Provides additional capacity for resilience support</li> <li>Operational cost optimisation using gravity sources</li> <li>Enables maintenance</li> <li>Would be large enough to supply demand should Nantybwhch and Carno be closed in future</li> <li>Will not require a change to the current abstraction licence</li> </ul>	<ul style="list-style-type: none"> <li>Raw water use limited to 225 MI/d when available</li> <li>Higher construction costs</li> </ul>	£185.4m
250 MI/d	As for 225 MI/d above + <ul style="list-style-type: none"> <li>Additional capacity for operational cost optimisation from gravity sources</li> <li>Ability to provide additional resilience of 25MI/d</li> </ul>	<ul style="list-style-type: none"> <li>Raw water use limited to 250 MI/d when available</li> <li>Higher construction costs</li> <li>Reliant on additional network improvements to utilise additional available water</li> </ul>	+c£10m

Table 4 – Benefits and Constraints of the New WTW Capacity

### Conclusion

Subject to review it is suggested that the 225 MI/d option will provide the most cost effective solution. At a review session on 10<sup>th</sup> April 2018 with key Welsh Water stakeholders the new WTW capacity of 225 MI/d was agreed.

A WTW of this capacity will provide; short term resilience issues including extreme weather events as well as for the longer term to allow maintenance at the new WTW and other sites, the opportunity to optimise

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operational costs by maximising the use of gravity sources as well as improving resilience of the water supply across the SEWCUS and wider South Wales area.