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BRISTOL WATER PR09



# **WR3g – Charterhouse Stand Alone Treatment Schemes Preliminary Design Report**

January 2009

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**Document issue details:****B&V project no.:** 121300-0400**Client's reference no.:** PR09**Distribution:**

Revision no.	Issue date	Issue status	Written	Checked	Reviewed
1		Initial draft	SB	AJW	
2	24/11/08	Second draft	AJW	SB	
3	13/1/09	Third draft	AJW	SB	JH

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## WR3g – CHARTERHOUSE STAND ALONE TREATMENT SCHEME

### 1. INTRODUCTION

Charterhouse spring is currently out of service due to high turbidity of the water and the associated risk of *cryptosporidium*. The existing pressurised membrane plant (capacity 2.2 MI/d) does not perform well with throughput greatly reduced at times of high turbidity. It is proposed to bring the spring back into service by constructing a submerged membrane treatment plant on the site. The plant will have a capacity of 4 MI/d. This will allow the winter abstraction to be maximised and hence maximise the annual yield without exceeding the existing daily licence.

#### 1.1 OS reference

Charterhouse Water Treatment Plant - proposed location for submerged membrane plant:

348694, 155980

ST 4855

### 2. DRIVER FOR SCHEME

The scheme is driven by a need to increase water resources.

The driver for the scheme as listed in the scheme database is:  
SDB2 - Growth - treatment/production

### 3. OPTIONS CONSIDERED

#### 3.1 Stand Alone Submerged Membrane Treatment Plant (selected option)

A 4MI/d capacity submerged membrane treatment plant will be installed. The existing low lift pumps will be replaced with new pumps to pump 4 MI/d to submerged membrane. A new high lift pump will be installed in the existing high lift pump house. The existing chlorination system will be used to marginal chlorinate the water.

#### 3.2 Greater Mendip (Maesbury) Treatment Works

**Option A:** Pumping all the Mendip sources to a single greater Mendip treatment works was investigated. Honeyhurst, Charterhouse, Holes Ash, Forum, Gurney Slade and Sherborne wells would be pumped to a single treatment works located at Maesbury.

**Option B :** A further option to pump only from Forum, Gurney Slade and Sherborne wells to a single smaller treatment works at Maesbury was also investigated.

Both options were rejected because of high capital and operational cost.

### 4. INTERACTION WITH OTHER SCHEMES

None anticipated.

## **5. GEOTECHNICAL SUMMARY**

### **5.1 Geology**

Charterhouse Treatment Works is located at the head of a steep south-facing valley near the top of the southern slope of the Mendip Hills, approx 4km NE of Cheddar. It is proposed to construct a submerged membrane treatment plant at the site. The site lies on the Avon Group Limestone and interbedded Mudstone, which dips to the south at between 25-30°. The junction with the overlying Black Rock Limestone occurs just to the south of the site.

### **5.2 Constructional aspects**

The existing membrane plant building will be extended on its northern side to accommodate the new plant. It is anticipated that this extension will entail some excavation in the limestone. Bedrock is expected to be fairly close to ground surface. The presence of in filled sinkholes in the limestone cannot be ruled out. Trenching for replacement pipework may also be in rock.

### **5.3 Recommendations for site investigation**

No further ground investigation is envisaged.

## **6. ENVIRONMENTAL DESK STUDY**

### **6.1 Scope**

This high-level environmental assessment has used the GIS data provided within the attached table. It is important to note that data is not provided for all environmental receptors that may be considered in an EIA screening. For example, information on Sites of Interest for Nature Conservation would need to be gathered following the Preliminary Environmental Assessment.

### **6.2 Overall assessment**

- Proposed extension of existing building to accommodate installation of a new submerged membrane treatment plant at Charterhouse WTW. Works to include associated pipework replacement and small-scale works to upgrade plant and machinery. The works do not fall within Schedule 1 and do not cover a sufficient area to exceed the indicative thresholds for Schedule 2 of the EIA Regs. '99. This would indicate that an EIA is unlikely to be required. However, as detailed below, the site is located within a sensitive area and the opinion of the local planning authority (LPA) should be sought to confirm whether they would require an EIA for this development.
- The site falls within the Mendip Hills Area of Outstanding Natural Beauty (AONB) which is a formally defined 'sensitive area' under the EIA Regs. The site is also 62m away from the Cheddar Complex Site of Special Scientific Interest (SSSI) and 62m from the North Somerset & Mendip Bats Special Area of Conservation (SAC). These are also designated 'sensitive areas'.
- The below ground works are not likely to require planning permission as they should fall within Bristol Water's permitted development rights. However, the extension of the building to house the new plant, and any separate temporary works compounds, may require planning permission and consultation should be sought with the LPA.
- If a planning application is required, but an EIA is not required, then a supporting statement should be submitted to the LPA to outline the environmental constraints and actions taken (such as surveys).

- *It is important to note that should an EIA be required by the LPA then all permitted development rights will be lost and a planning application would need to be submitted alongside the Environment Statement (report generated by the EIA).*

### 6.3 Summary of environmental constraints

- The nearest scheduled monument identified is a World War II bombing decoy complex which is 249m away. Although this is unlikely to be impacted upon by the Charterhouse works, it would be advisable to investigate the risk of uncovering unexploded ordinances (UXOs) during excavations.
- The proposed works are not on known contaminated land. However, they are identified as being on potentially contaminated land, which would require further assessment.
- The site is located within a Source Protection Zone 1.

### 6.4 Recommendations for future surveys/investigations

- Due to the close proximity of the works to an SAC, consultation with Natural England should be undertaken to establish if an Appropriate Assessment should be produced. An Appendix 11 (under the Habitats Directive) may need to be produced to assist this consultation. If Natural England consider that the proposal may have an impact upon the habitats or species protected by the SAC then a full Appropriate Assessment (Appendix 12) will be required.
- Although the project does not exceed the indicative thresholds for an EIA under Schedule 2, an EIA screening opinion will be required from the LPA as the site is within, or close to, a number of designated sensitive areas.
- The LPA will also need to be consulted regarding planning permission for the building extension.
- As the proposed works are located within an AONB, consideration should be given to the impacts of the building upon the landscape. Consultation with the LPA regarding landscape assessment may be required.
- Preliminary Environmental Assessment (PEA) will be required to identify specific environmental issues.
- A phase one habitat assessment / walkover survey will be required to identify potential protected species, invasive species and protected habitats.
- Once identified in the Phase One survey, protected species surveys will be required.
- It may be necessary to gather information on Local Sites of Interest for Nature Conservation before receiving a screening opinion. This information is held by Bristol Regional Environmental Records Centre (BRERC) who makes a minimum charge of £90 per enquiry.
- Landmark and geotechnical study may be required to assess land contamination status. If contamination is identified, further phase 1 and phase 2 land quality assessment studies may be required.
- As the site is located within a Source Protection Zone 1, special construction measures will be required to reduce the risk of transmitting polluting materials to groundwater used for abstraction.

## 7. HYDRAULIC REVIEW

### 7.1 Review

Hydraulic losses in the existing static mixer at the new flow of 4 MI/d must be taken into account to determine whether the existing pipework between submerged membrane plant and contact tank weir channel can carry the required flow rate. If the hydraulic loss in

static mixer is relatively high and the required flow rate is not achieved in the weir channel, the static mixer must be replaced with a new one.

## 7.2 Recommendations

It is recommended that membrane supplier be informed about the hydraulic losses in the static mixer for the new flow of 4 Ml/d in the detail design stage to determine the pump size in the treatment plant.

## 8. TECHNICAL DETAILS

### 8.1 Proposed plant

The existing pressurised membrane plant will be decommissioned and removed from the building. A new submerged membrane plant is to be installed to remove turbidity and *Cryptosporidium*. To install this proposed plant the existing membrane plant building will be extended as shown on the Drg. No. WR3g-001. A new micro strainer will be installed to the protect membrane from damage by gross solids. Refer to Drg WR3g-001. The existing chlorination system will be used for chlorination of treated water.

### 8.2 Process plant

The proposed submerged membrane plant will have a foot print of 23m x 10m. It will contain four cells and thirty six modules per cell.

Marginal chlorine (1mg/l) will be applied to treated water. A manually cleaned basket strainer with 2mm screens will be installed.

Submerged membranes are a DWI recognised barrier against cryptosporidium and there is therefore no requirement for DWI approved cryptosporidium monitoring. The membrane can also be used as a primary disinfectant meaning water requires marginal chlorination only. This is to be provided by the existing chlorination system.

The membranes are backwashed with air and water at regular intervals (e.g. 30 to 45 minutes) to dislodge solids build-up on the membranes, and chemically cleaned with hypochlorite or acid on a less frequent basis (e.g. every 28 days). Chemical waste coming from cleaning by acidic, alkaline or chlorinated cleaning agents will be neutralised in a neutralisation tank before being pumped to the neutralised waste holding tank.

Backwash waste water (up to 120m<sup>3</sup>/d) produced by the membrane plant will be discharged to a backwash storage tank and from there to the existing water course that was used to discharge backwash wastewater from the pressurised membrane treatment plant. The existing discharge consent will need to be reviewed.

The following process plant is proposed:

Equipment from Membrane supplier:

- Membrane cells
- Filtrate pumps
- Cleaning in place chemical tank
- Backwash water tank
- Air blower, compressor, air receiver
- CIP chemical storage (carboys) and dosing sets
- Media neutralisation unit

Additional equipment included with membrane plant

- CIP waste tank (holds untreated waste prior to treatment by the waste neutralisation unit).

Other equipment not included with membrane plant:

- 2mm pre-filter (manual basket filter on inlet pipe - single or dual perforated basket filter)
- Modifications to pipework
- Neutralisation tank feed pumps to Neutralisation Media Unit
- Neutralised waste storage tank for tanker pickup
- Backwash wastewater storage tank
- Flow and quality meters, other instrumentation

### **8.3 Pipeline size/ material data**

The outlet pipe from pumping storage section to the high lift pump chamber will be 200 mm diameter DI pipe.

### **8.4 Modification to the pumping plant**

The existing low lift pumps will be replaced with new pumps to pump 4 MI/d to submerged membrane.

A new high lift pump will be installed in the existing high lift pump house. The existing high lift pumps (3 Nos) along with the new pump will pump 4 MI/d at 99m head.

### **8.5 Other**

The existing spring water collection chamber is to be replaced with a chamber with a greater volume to act as a control volume. Details are to be confirmed.

## **9. BUILDABILITY**

The most significant buildability issues are as follows:

- 1) Working on existing site;
- 2) Working in a congested site.

## **10. RISKS AND OPPORTUNITIES**

The existing high lift pump suction tank (shown as 'Pumping Section' on the drawing) may not have sufficient capacity with the proposed increase in capacity of the high lift pumps. As such, the existing reservoir may need to be extended.

## **11. COST INFORMATION**

Costs are summarised in the table below (price base 2007/08):

Summary of Netts	£1,727,678
Summary of Contractors overheads & prelims	£665,556
Summary of design costs	£112,299
Summary of BW costs (excluding BW supervision)	£326,184
Contingency - to cover change of scope (10% of scheme total)	£283,172
BW costs	£ 93,447
<b>Scheme CAPEX Total (excl. OPEX costs)</b>	<b>£3,208,336</b>
<b>Scheme OPEX Total (pa)</b>	<b>£100,000</b>

More detailed cost information is included in the Cost schedule attached in Appendix 6.

Charterhouses treatment works will supply the Mast zone and will offset water currently pumped from Stowey to Mast. As such there will be a saving in pumping costs to Bristol Water but additional costs in running the new treatment works. The net effect is an operational cost estimated at £100,000 per annum.

## 12. PROGRAMME

Details of the programme are attached in Appendix 7.

## 13. CONCLUSIONS

The Water Resources Plan identifies the need to bring this source back into operation. This will require the construction of a submerged membrane plant to remove cryptosporidium oocysts from the water and deal with high turbidity. Installation of replacement low lift pumps and an additional high lift pump are also required.

## APPENDICES

Appendix 1 – General Arrangement Drawing

Appendix 2 – Environmental Constraints Map

Appendix 3 – Environmental Schedule

Appendix 4 – Geological Map

Appendix 5 – Risk Register

Appendix 6 – Cost Schedule

Appendix 7 – Outline construction programme