

# **AMP3 uCSO Strategy**

**Bodedern P.Stn. UCSO**

**November 2001**

**Report No. RE-Li01-201-01**

**Client:** Galliford Northern  
**Project:** Bodedern P.Stn.  
**Title:** Peak Spill Calculation Report

|                                |                          |                          |                         |                               |  |
|--------------------------------|--------------------------|--------------------------|-------------------------|-------------------------------|--|
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| 0A                             | Draft Report       | B.Edisbury                       | C.Horne      | C.Horne                       |  |
| 01                             | Final Report       | B.Edisbury                       | C.Horne      | C.Horne                       |  |
|                                |                    |                                  |              |                               |  |
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**1. INTRODUCTION**

Forthview have been commissioned by Galliford Northern to undertake the hydraulic analysis associated with the Welsh Water AMP3 uCSO programme.

This report considers the Bodedern catchment in particular the following overflow, which has been identified for improvement due to aesthetic impact:

Bodedern P.Stn. Overflow (DCWW reference No.DC3101701)  
E.A.Consent reference CG0187501

Details and schematics of this overflow are provided later in the report.

Due to the size of the catchment and the aesthetic only impact, it was agreed with the Environment Agency (meeting 28<sup>th</sup> November 2000), that a hydraulic model was not required. A pipe full calculation was therefore used to determine the peak flows into the overflow chamber and in turn the expected peak spill flow through the existing overflow.

This report details the survey work and calculations undertaken to determine the pipe full flows into the chamber, calculated peak spill flow and outlines possible options to upgrade the overflow.

**2. EXISTING CATCHMENT DETAILS**

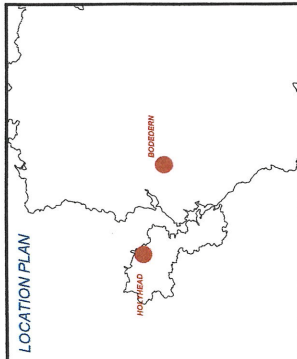
The overall catchment area draining to the Bodedern P.Stn. and the existing sewer network are shown on figures 1 and 2.

The catchment network consists of a combined/foul sewer system draining to the pumping station where the uCSO required to be upgraded under AMP3 is located.

Pumped flows from the pumping station are pumped direct via a 100mm diameter rising main to the Bodedern WwTW. Both the WwTW and the overflow discharge into the Alaw.

Access to the Pumping Station is via a track from the B5109

An approximate population of the total catchment draining to the pumping station based on address point data and allowing a figure of 2.4 persons per address point is 768 persons (320 seed points)



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|       |             |          |      |



Forthview Ltd  
 Northfields House  
 Elm Street Business Park  
 Burnley, Lancs  
 BB10 1FD  
 Tel: 01282 714142 Fax: 01282 714344

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**Figure 1  
 Catchment Plan**

Date - Aug. 2001

Drawn - B.E.

Scale - N.T.S.

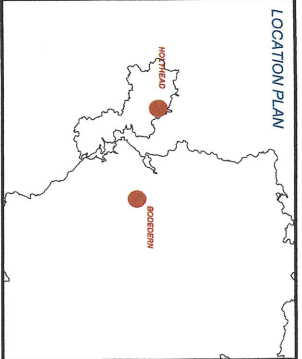
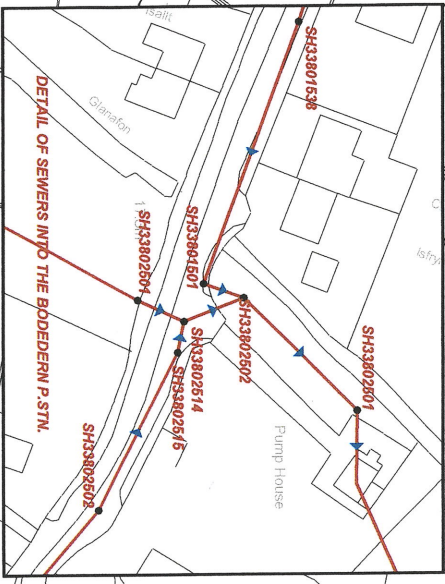
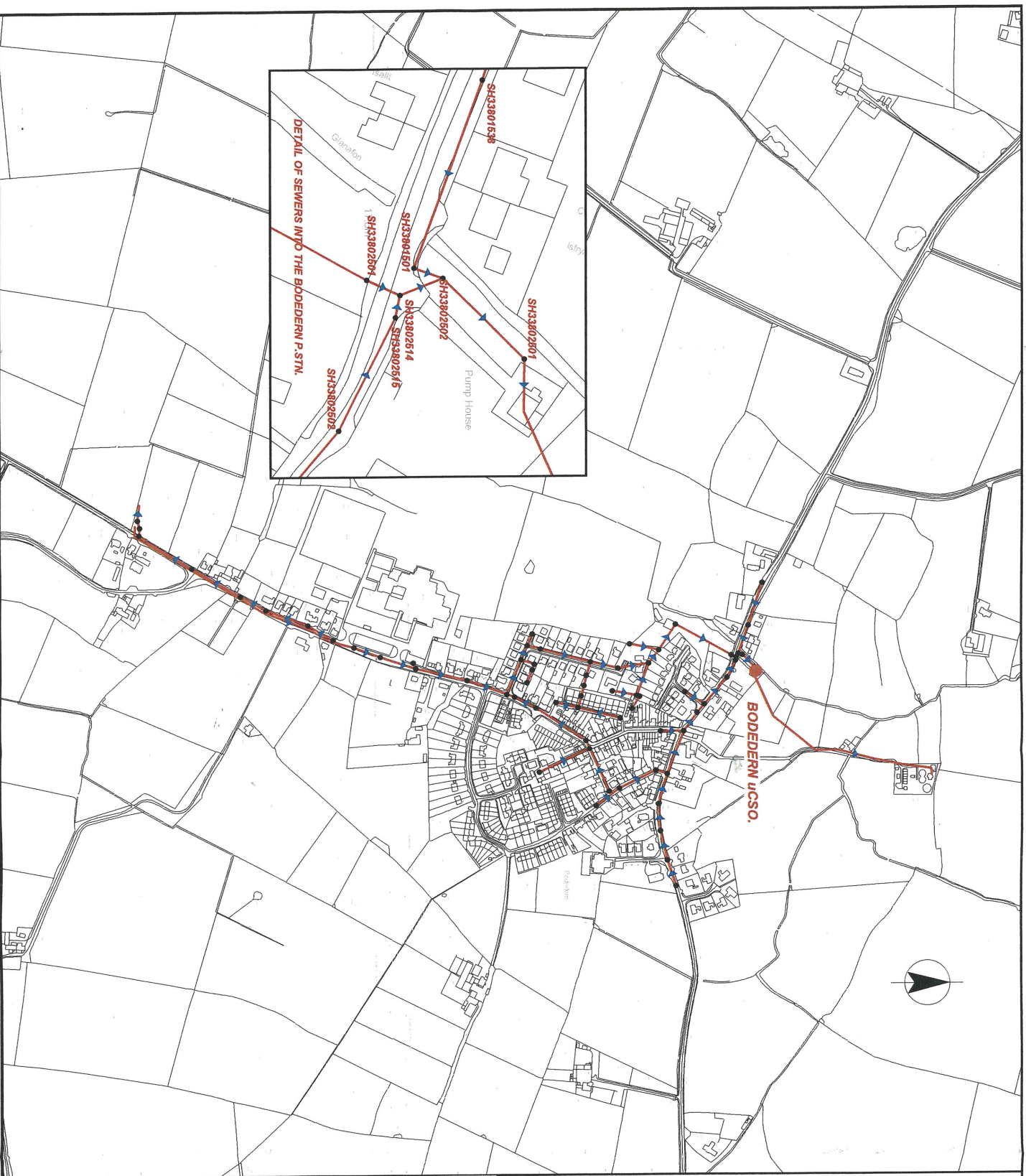
Checked - H.B.

Figure - 001

Approved - C.H.

File Reference - L160-004\MapInfo\Workspace\Fig001





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|       |             |          |      |



**Forthview Ltd**  
 Northdige House  
 Elm Street Business Park  
 Burnley Lanes,  
 BB10 1PD  
 Tel: 01282 714143 Fax: 01282 714444

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**Figure 2**  
**Existing Sewer Network**

|  |                 |
|--|-----------------|
| Date - Aug 2001                                | Drawn - B.E.    |
| Scale - N.T.S.                                 | Checked - H.B.  |
| Figure - 002                                   | Approved - C.H. |
| File Reference - LR0-004MappInWkspSpace\Fig002 |                 |

### 3. MANHOLE SURVEY DATA

A manhole survey of chambers upstream and downstream of the pumping station was undertaken by Invek Surveys during August 2001.

From the survey the following information was obtained: -

- a) The 300mm diameter incoming sewer to the pumping station bifurcates with dry weather flows passing through a comminutor before entering the station wet well. Flows above a depth of approximately 250mm spill over through a 30mm manual raked bar screen before discharging into the wet.
- b) Recorded inflow into the station during the manhole survey was found to be approximately 2.30 l/s, which compares favourably with the calculated dry weather flow of 2.56 l/s.
- c) The overflow is located within the pumping station wet well and consists of a 610mm length weir, approximately 0.7m below the cover level. A 100mm diameter pipe from the weir discharges flows to the adjacent watercourse
- d) The pipe full capacity of the existing overflow pipe was calculated to be 73.8 l/s

#### Survey Photographs



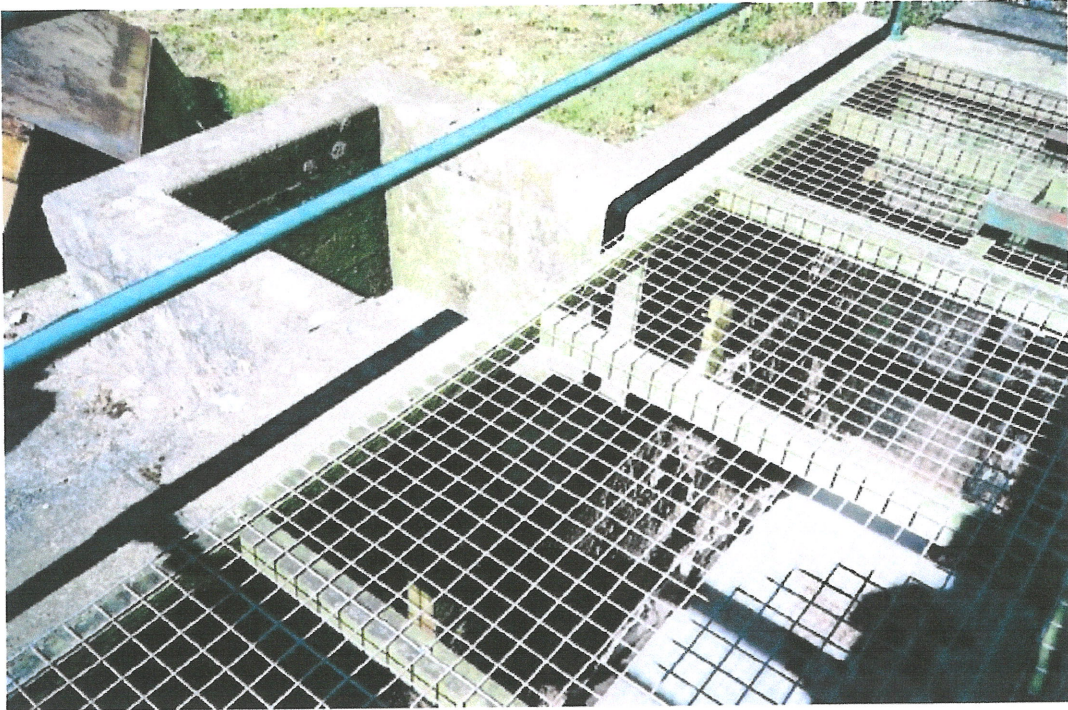
Photograph No.1 - Bodedern Pumping Station Compound



Photograph No.2 - Plan view of bifurcation chamber and macerator /screening chamber



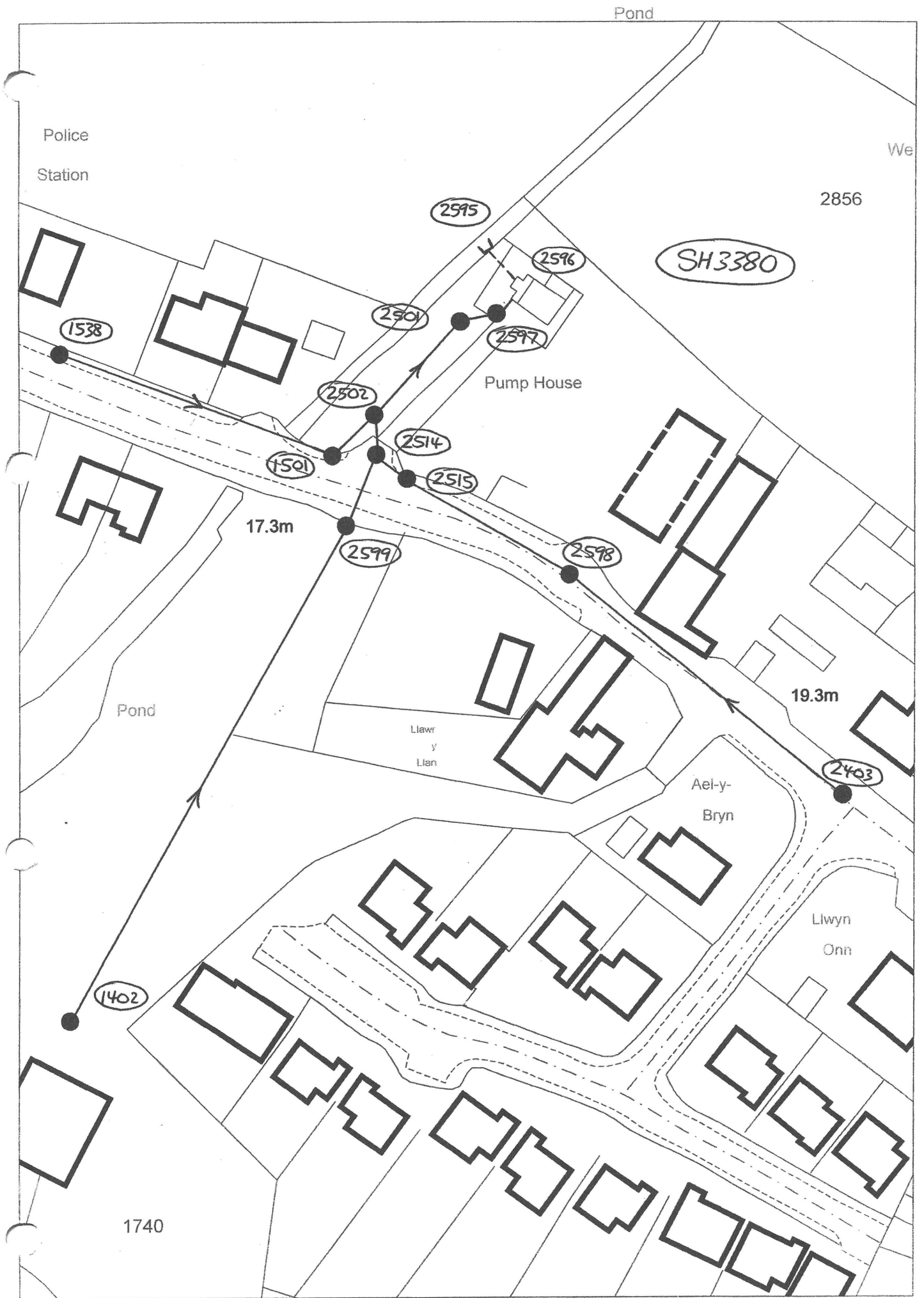
Photograph No.3 – View of chamber SH33802597, 300mm diameter inlet pipe to bifurcation chamber, overflow pipe to manually raked bar screen shown to the left.



Photograph No.4 – Overflow chamber from wet well.



Photograph No.5 – Overflow weir from wet well



#### 4. PEAK SPILL CALCULATION

Details of the hydraulic analysis and calculated Dry Weather and Formula A flows are provided below and on the attached figure 3.

a) Calculation of Formula A (SOCA) –

Population used for calculation based on address point data for the area.

Address points upstream of UCSO = 320 No.

Allowing for 2.4 persons per address point, estimated population = 768 No.

Allowing for an infiltration rate of 60% of dry weather flow.

Allowing for a maximum of 180 litres/head/day water consumption.

$$\begin{aligned}
 \text{Dry weather flow} &= PG+I+E \\
 &= (768 \times 180) + ((768 \times 180) 0.6) + 0 \\
 &= 138,240 + 82,944 + 0 \\
 &= 221,184 \text{ l/day} \\
 &= 2.56 \text{ l/s (infiltration assumed at 0.96 l/s)}
 \end{aligned}$$

$$\begin{aligned}
 \text{SOCA for the UCSO} &= (PG+I+E) + 1360P + 2E \\
 &= (221,184) + (1360 \times 768) + 0 \\
 &= 221,184 + 1,044,480 \\
 &= 1,265,664 \text{ l/day} \\
 &= 14.65 \text{ l/s}
 \end{aligned}$$

b) Peak spill flow through overflow based on the following –

Total capacity of incoming pipes – capacity of pumping station

$$\begin{aligned}
 &= (20.2 \text{ l/s} + 79.2 \text{ l/s}) - 15.4 \text{ l/s} \\
 &= 84 \text{ l/s}
 \end{aligned}$$

The following conditions have been considered in the determination of maximum inflows to the uCSO: -

Pipe full capacity = 99 l/s inflow

Surcharge conditions = 126 l/s inflow

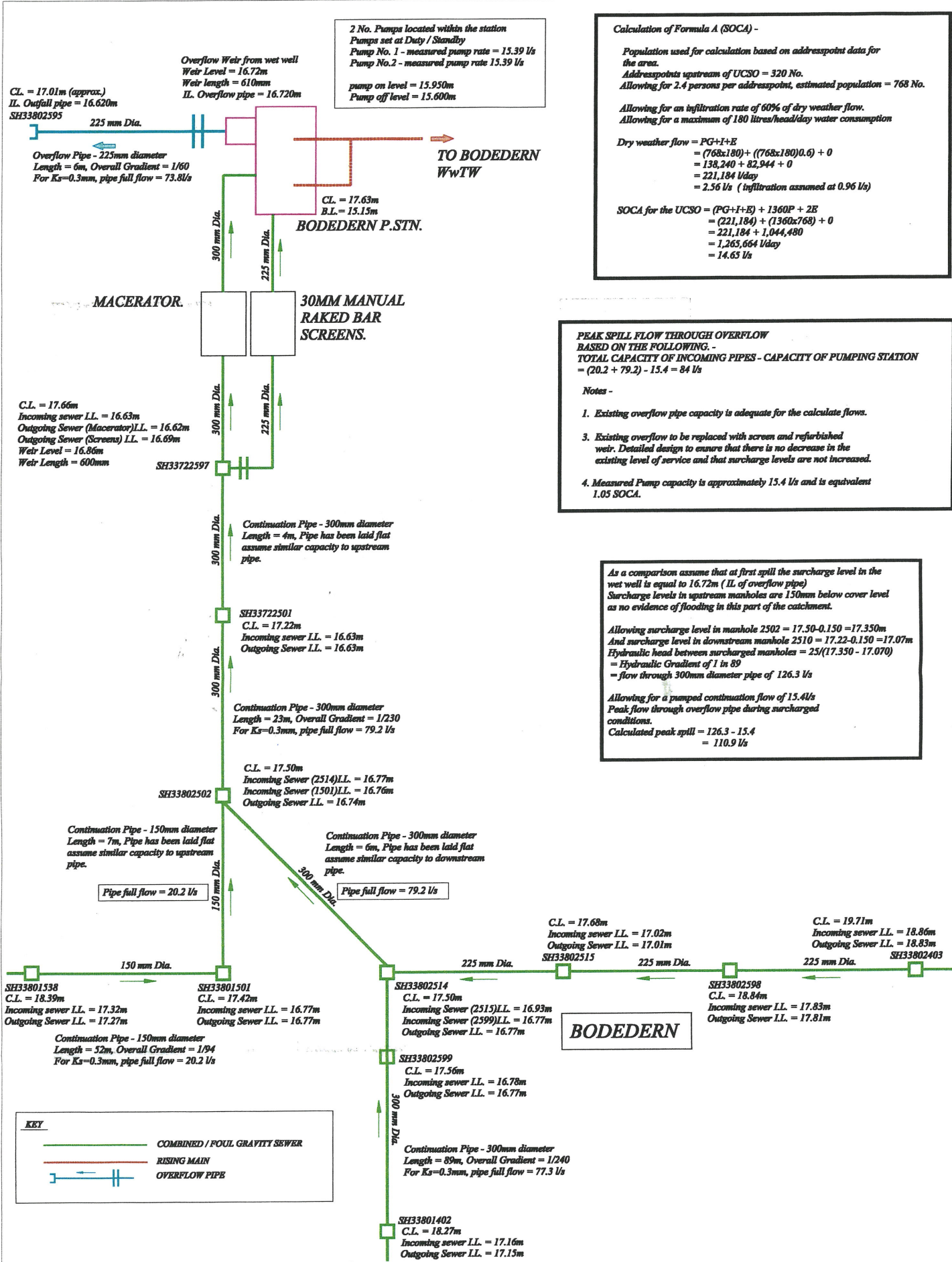
From the survey data, the pumped continuation flow before the overflow begins to spill can be assessed as being approximately 15.4l/s.

Allowing for a continuation flow of 15.4l/s, calculated peak flows through a proposed screen based on pipe full capacity = 84 l/s.

Calculated flows under surcharge conditions do not allow for head losses through the screens and macerator and can therefore be above actual flows.

**5 CONCLUSIONS**

- a) Proposed screens to be installed within the combined sewer overflow are designed to take a peak spill of 84 l/s.
- b) Screen chamber to be designed to ensure no reduction in the existing level of service.
- c) All proposed screens to be 6mm solid separation.



2 No. Pumps located within the station  
 Pumps set at Duty / Standby  
 Pump No. 1 - measured pump rate = 15.39 l/s  
 Pump No. 2 - measured pump rate 15.39 l/s  
 pump on level = 15.950m  
 Pump off level = 15.600m

Calculation of Formula A (SOCA) -  
 Population used for calculation based on addresspoint data for the area.  
 Addresspoints upstream of UCSO = 320 No.  
 Allowing for 2.4 persons per addresspoint, estimated population = 768 No.  
 Allowing for an infiltration rate of 60% of dry weather flow.  
 Allowing for a maximum of 180 litres/head/day water consumption  
 Dry weather flow = PG+I+E  
 = (768x180) + ((768x180)0.6) + 0  
 = 138,240 + 82,944 + 0  
 = 221,184 U/day  
 = 2.56 l/s (infiltration assumed at 0.96 l/s)  
 SOCA for the UCSO = (PG+I+E) + 1360P + 2E  
 = (221,184) + (1360x768) + 0  
 = 221,184 + 1,044,480  
 = 1,265,664 U/day  
 = 14.65 l/s

PEAK SPILL FLOW THROUGH OVERFLOW  
 BASED ON THE FOLLOWING -  
 TOTAL CAPACITY OF INCOMING PIPES - CAPACITY OF PUMPING STATION  
 = (20.2 + 79.2) - 15.4 = 84 l/s  
 Notes -  
 1. Existing overflow pipe capacity is adequate for the calculate flows.  
 3. Existing overflow to be replaced with screen and refurbished weir. Detailed design to ensure that there is no decrease in the existing level of service and that surcharge levels are not increased.  
 4. Measured Pump capacity is approximately 15.4 l/s and is equivalent 1.05 SOCA.

As a comparison assume that at first spill the surcharge level in the wet well is equal to 16.72m (I.L. of overflow pipe)  
 Surcharge levels in upstream manholes are 150mm below cover level as no evidence of flooding in this part of the catchment.  
 Allowing surcharge level in manhole 2502 = 17.50-0.150 = 17.350m  
 And surcharge level in downstream manhole 2510 = 17.22-0.150 = 17.07m  
 Hydraulic head between surcharged manholes = 25/(17.350 - 17.070)  
 = Hydraulic Gradient of 1 in 89  
 = flow through 300mm diameter pipe of 126.3 l/s  
 Allowing for a pumped continuation flow of 15.4l/s  
 Peak flow through overflow pipe during surcharged conditions.  
 Calculated peak spill = 126.3 - 15.4  
 = 110.9 l/s

**BODEDERN P. STN UCSO.**  
**FIGURE 3 - NETWORK SCHEMATIC**  
 REVISION A AUGUST 2001

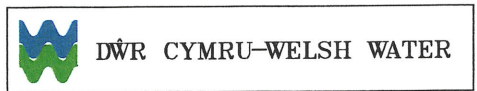


Figure Reference 1173 W&A/2000/0001/0001