Ref: P19-144 Vivod Licensing \ Cover Letter Impoundment.docx

29 October 2019

Permitting Receipt Centre
Natural Resrources Wales
Ty Cambria
29 Newport Road
Cardiff
CF24 0EY

Dear Sir/Madam,

VIVOD ESTATE

APPLICATION FOR A TECHNICAL VARIATION OF EXISTING IMPOUNDMENT LICENCE (WA/067/0005/005)

Please find enclosed a technical variation application on behalf of Vivod Estate for their impoundment licence (WA/067/005/005).

The application is to vary Section 3 to update the manner and extent of impoundment in line with the supplied drawings with this variation.

Enclosed is:

- Application form WRA and WRE along with associated Figures and continuation sheet for further information.
- A letter of authorisation from Vivod Estate allowing Envireau Water to sign forms relating to the impoundment licence variation application and liaise with National Resources Wales on their behalf.

Please contact us on 01332 871882 to arrange payment of the £1,500 application fee.

We look forward to receiving the varied licence in due course but in the meantime if you would like to discuss any aspect of the application then please do not hesitate to contact us.

Please also ensure that a draft licence is sent to Envireau Water before final sign off, so we are able to check it prior to finalisation and all correspondence regarding the application is directed to Envireau Water so we are able to respond promptly.

Yours faithfully,

Lee Clarke

Lee Clarke MSc CGeol FGS
Principal

Envireau Water (Wales)
PO Box 215, Mold, CH7 9EH

t 01824 780922

e wales@envireauwater.co.uk
w www.envireauwater.co.uk

VIVOD PARTNERSHIP
PLAS YN VIVOD
LLANGOLLEN
NORTH Wales
DENBIGHSHIRE LL20 7LS
Telephone: (01978) 860 235
vivodholdings@gmail.com

7th October 2019

Permitting Receipt Centre
Natural Resrources Wales
Ty Cambria
29 Newport Road
Cardiff
CF24 0EY

Dear Sir/Madam,

VIVOD ESTATE

APPLICATION FOR A TECHNICAL VARIATION OF EXISTING IMPOUNDMENT LICENCE (WA/067/0005/005)

We hereby authorise Envireau Water of Cedars Farm Barn, Market Street, Draycott, Derbyshire, DE72 3NB to represent and sign on our behalf, forms relating to an application for a variation of impoundment licence WA/067/0005/005 at Vivod Estate, Llangollen, Denbighshire, LL20 7LS

Yours faithfully,

RJ Best

Robert John Best

Director

On the day of the NRW site visit on 01/05/2019, the flows in the watercourse were low. Vivod Estates had concerns regarding feeding enough water to their domestic supply and had places and obstruction at the impoundment location to divert water to the domestic supply feed. However, this had essentially cut off flow in the watercourse. Subsequently, Vivod Estates removed the obstruction and partially opened up a valve at the impoundment to allow greater flow down the watercourse, to provide a temporary solution.

Envireau Water have undertaken an assessment of this temporary solution to show that the abstracted flow is compliant in regards to water volumes abstracted. This was presented and discussed at the meeting with NRW on 18/07/2019. During the meeting, it was discussed that a report should be produced to demonstrate that the water volumes abstracted are compliant, this has been submitted to NRW and is provided in Appendix A. Additionally, a permanent solution was discussed which would involve an application to vary the licences.

This application is to vary abstraction licence WA/067/0005/005 update Section 3, the manner and extent of impoundment, where the existing approved designs are to be changed to comply with licence conditions. This application should be considered in conjunction with the applications to vary licence 24/67/5/0020/S and WA/067/0005/002.

Form WRE Section 2 – Impoundment Details

To allow abstraction to occur, Vivod Brook has been impounded by a wide weir structure with a smaller weir (hereafter referred to as the small impoundment weir) cut into the wide weir (See Figure 2, Photo 1). The impoundment structure allows water to be abstracted by an Off-take Channel that has been engineered to the side of the impoundment structure. The impounding structure also has a valve that can be opened to allow flows to pass. This impounding structure has been in place since 1922.

The Off-take Channel has two entrances, each with drop down boards that can restrict flows (see Figure 2, Photo 2). These drop boards are currently set at 5cm above the invert of the Off-Take Channel entrances, the entrances are currently 2cm below the invert level of the small impoundment weir. Currently flows within the channel are controlled by a valve. NRW have specified that they do not want the flows in the watercourse controlled by a valve on a permanent basis, therefore although the impoundment structure has been in operation since 1922 an alternative method of control is required. Based on Envireau Water's assessment, this can be achieved with modifications to the existing impoundment structure. This will be different to the arrangement detailed in the impoundment licence.

The proposed impoundment structure utilises the existing structure by raising the invert of the Hydroelectric Power Off-take Channel to 3.5cm above the inverts of the small impoundment weir and domestic water supply offtake. The invert for the domestic water supply is to be set at the same level as the small impoundment weir.

A schematic plan of the proposed structure is provided in Figure 3 with a cross section of the wide weir, small impoundment weir and Off-takes provided in Figures 4 and 5. A 2mm wire 10mm aperture vertical fish screen will be installed in front of the Off-take Channel drop boards.

Form WRE Section 3 – Description of impoundment

The change to the impoundment structure is not expected to cause a change in the wetted perimeter or submerged area.

The ponded area created by the existing impoundment structure is unlined and this will not be altered.

The impoundment and the offtakes will comprise of broad crested weirs.

The crest level of the wide weir and small impoundment weir are 290.28mAOD and 290.1mAOD respectively. This is taken from a bed level of 290mAOD.

The estimation of flows at the existing impoundment structure and offtake channels has been undertaken using the area-velocity methodology followed by calibration with a Manning's model to develop a ratings equation. This methodology is described in the compliance report provided in Appendix B. The same methodology has been used to calculate flows for the proposed impoundment structure.

Table 2 shows the calculated simultaneous flow rate at the domestic supply offtake, the HEP offtake and the watercourse flows for a range of watercourse Q values for the proposed impoundment structure. A requirement of the impoundment structure under the HEP abstraction licence WA/067/0005/002 is no more than 70% of the flow within Vivod Brook may be abstracted when flows are above 7 l/s. Flows must not be taken below 7 l/s or above 42 l/s. The percentage of flow abstracted above 7 l/s is also presented in Table 2.

A further requirement is that there needs to be sufficient flow in the domestic offtake to provide the domestic supply. The minimum flow requirement for the domestic supply has been calculated as circa. 1.8 l/s.

To achieve the above, it is proposed that:

- The domestic supply offtake has the same invert level as the small impoundment weir. When flows are equal to or less than 9.6 l/s (i.e. equal to or less than 3.5cm water depth at the small impoundment weir), the drop board is set to a gap of 18mm to restrict flows at the domestic offtake to a maximum of 1.8 l/s.
- The HEP offtake invert is set 3.5cm above the invert of the small impoundment weir so that abstraction for the HEP can only occur when flows are above the 7 l/s HOF condition.
- When the water depth at the small impoundment weir rises to 4cm (equivalent to 16 l/s or Q73), the drop board for the domestic supply is manually raised to a 50mm gap to allow more water to be abstracted for the HEP but also provides a high flow restriction.
- The HEP offtake drop board gap is set to 50mm to provide a high flow restriction.
- The combined high flow restriction when the small impoundment weir reaches its maximum capacity (i.e. a 18cm weir water depth or c. 92 l/s or c. Q12) for the domestic and HEP offtakes is c. 41 l/s.
- Once the capacity of the small impoundment weir have been reached, the watercourse will spill over the wider impoundment weir. The maximum capacity of the wide weir is estimated as 1.4 cumecs.

Table 2 Estimated flows for the proposed impoundment structure and abstraction offtake.

Q value	Watercourse Flow Upstream of Impoundment (l/s)	Water depth at small impoundment weir (cm)	Flow over small impoundment weir (l/s)	Flow over wide weir (l/s)	Total flow in watercourse downstream of weir (l/s)	Flow in domestic offtake (l/s)	Flow in HEP offtake (l/s)	Total Flow in offtake channel (l/s)	% of flow abstracted above 7l/s
>99.9	2.2	1	1.2	0	1.2	1.0	0.0	1.0	
99.9	3.9	1.4	2.2	0	2.2	1.7	0.0	1.7	
93.5	8.0	3	6.2	0	6.2	1.8	0.0	1.8	
91.2	8.8	3.25	7.0	0	7.0	1.8	0.0	1.8	
88.8	9.6	3.5	7.8	0	7.8	1.8	0.0	1.8	69
72.7	16.0	4	9.6	0	9.6	6.0	0.4	6.4	70
59.2	23.6	5	13.5	0	13.5	8.4	1.7	10.1	61
46.9	31.4	6	17.9	0	17.9	9.3	4.2	13.5	55
37.9	39.4	7	22.7	0	22.7	10.8	5.9	16.7	52
30.8	47.7	8	27.9	0	27.9	12.2	7.6	19.8	49
25.4	56.2	9	33.4	0	33.4	13.5	9.3	22.8	46
20.9	64.9	10	39.2	0	39.2	14.8	10.9	25.7	44
6.2	125.6	17	84.9	0	84.9	21.3	19.4	40.7	34

Table 2 shows the proposed structure meets the abstraction licence requirements set out in the abstraction licence variation applications.

Form WRE Section 4 – Fish and Eel Passage

No fish or eel passage is present. The abstraction offtakes are at the side of the watercourse.

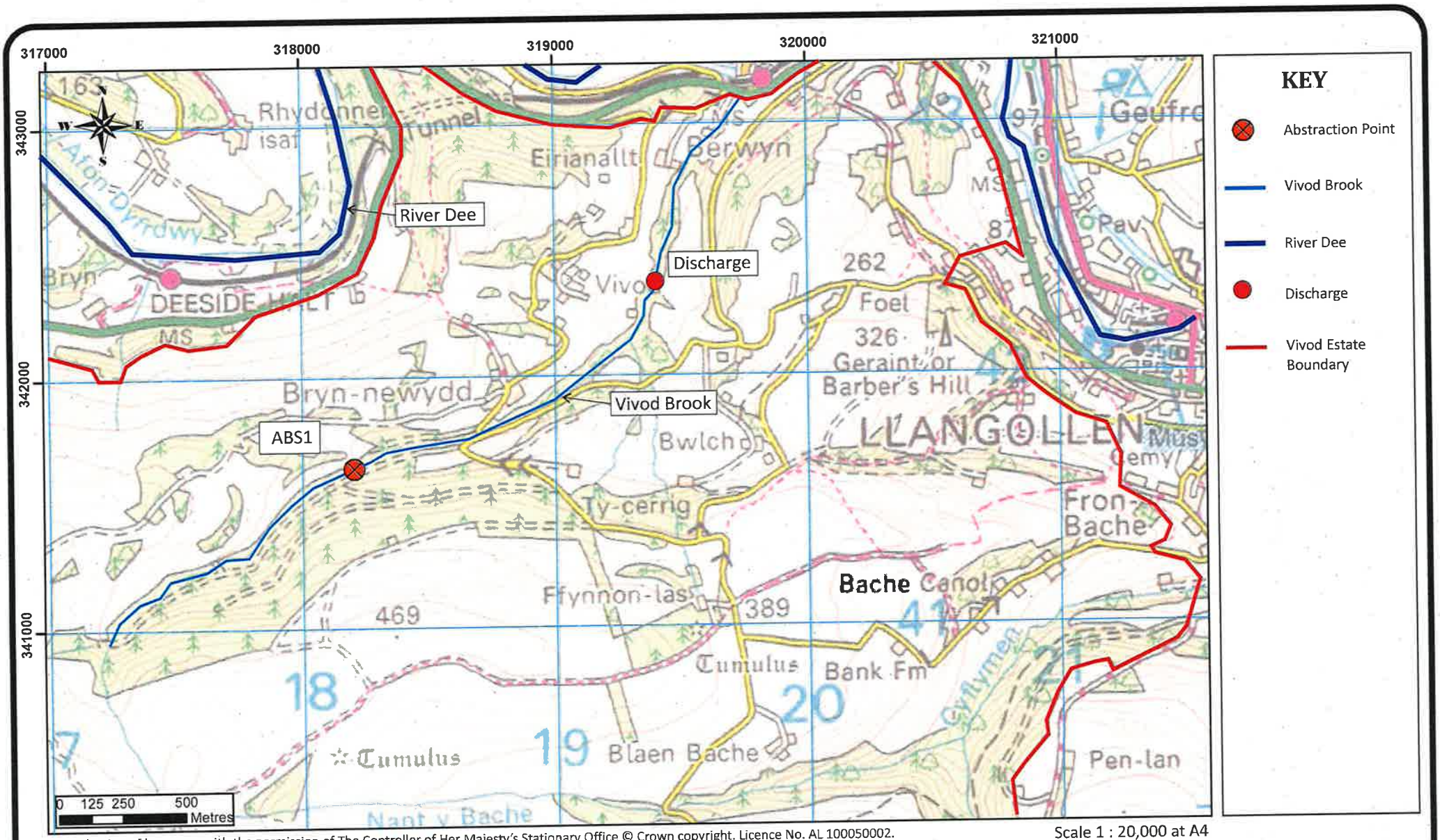
A vertical, rigid, 2mm wire 10mm aperture fish screen will be provided at the offtake structure.

A rocky pool will be created below the impoundment structure as shown on Figure 3 to provide a refuge for fish at the impoundment.

This will require working within the watercourse. It is noted that these works will not be undertaken between 17th October and 15th May to protect fish species present in the watercourse.

Envireau Water
29/10/19

FIGURES



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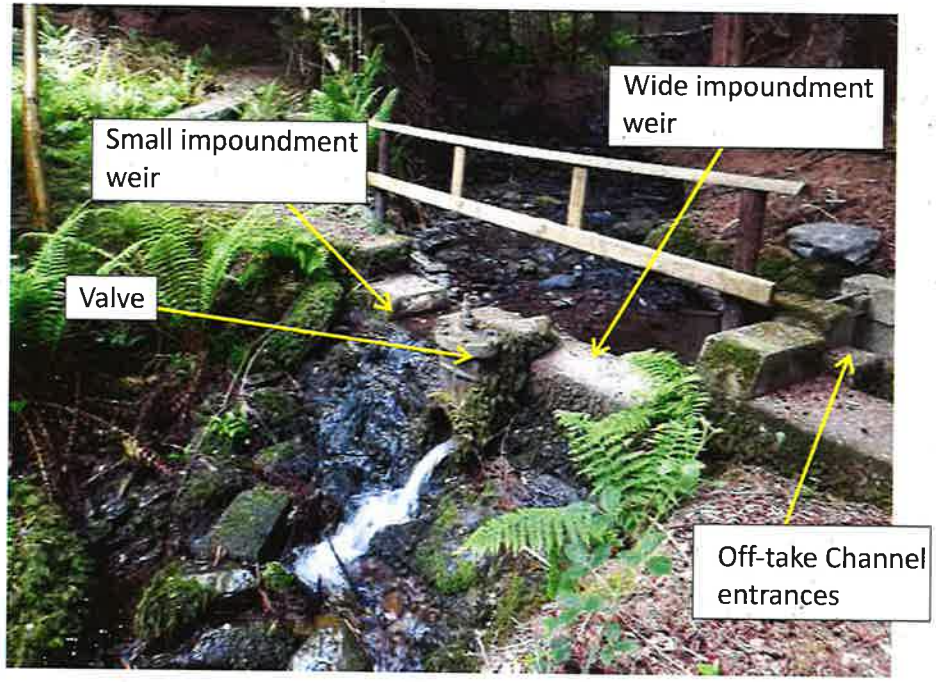
Scale 1 : 20,000 at A4

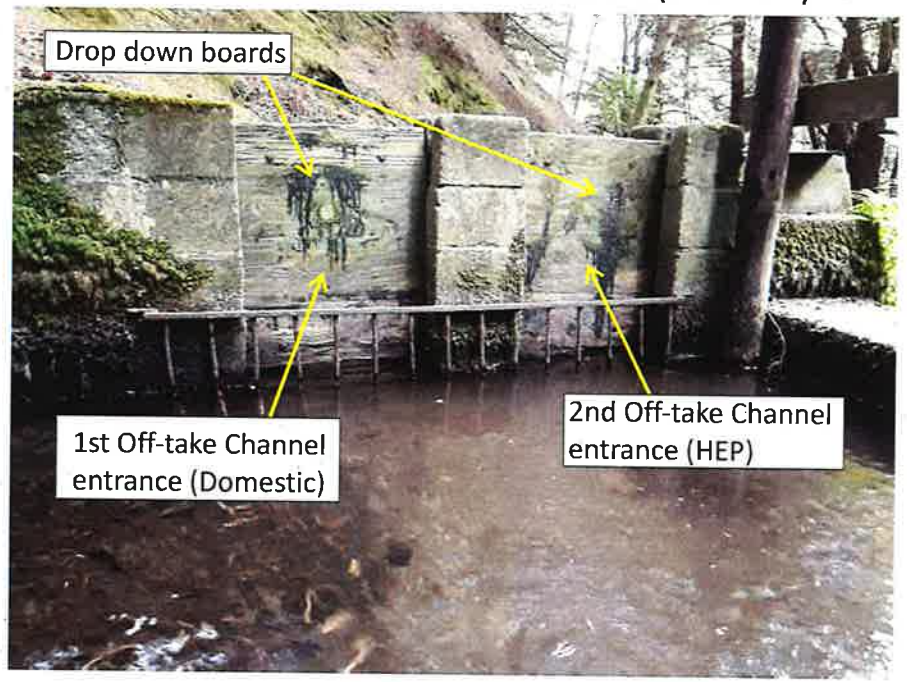
envireau WATER

Ref: P19-144 - Vivod Licensing \ FIG 1 Impoundment Date: 08/10/2019	**Vivod Estates**
Figure 1	Site Setting and Abstraction Location

Existing Impounding Structure (Photo 1)



Off-take Channel entrances (Photo 2)



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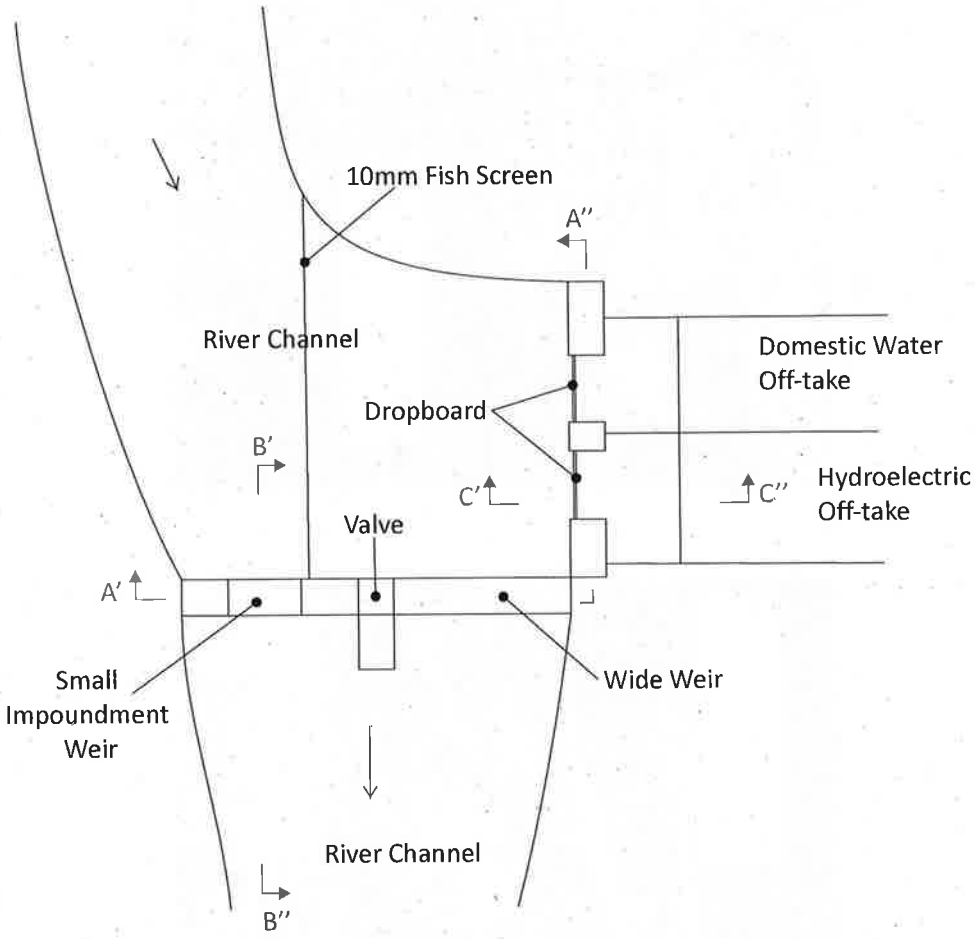
Ref: P19-144 - Vivod Licensing \ FIG 2 Impoundment Date: 08/10/2019	**Vivod Estates**
Figure 2	Photographs of Existing Arrangements

Plan



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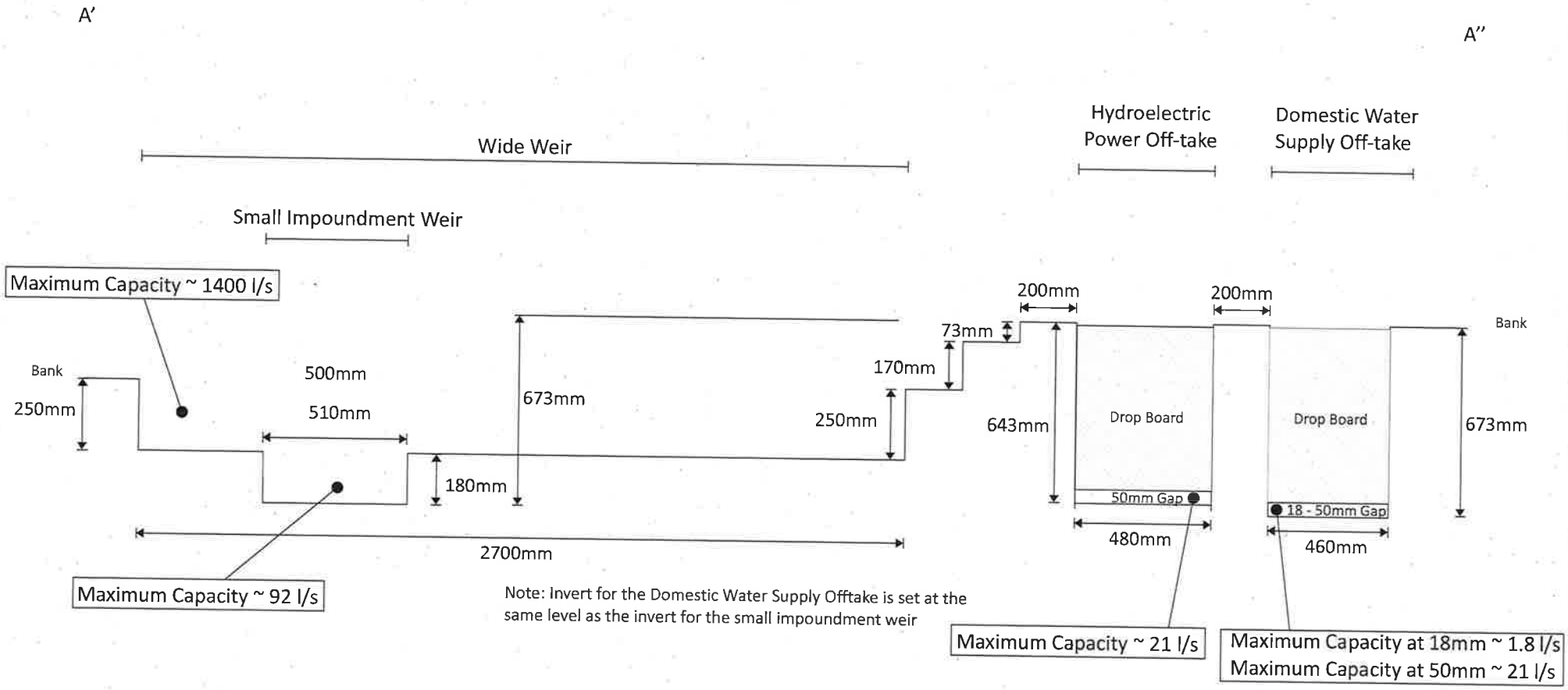
Cross sections shown on Figures 4 and 5

envireau WATER

Ref: P19-144 - Vivod Licensing \ FIG 3 Impoundment Date: 09/10/2019	**Vivod Estates**
Figure 3	Plan Schematic of Impoundment Structure



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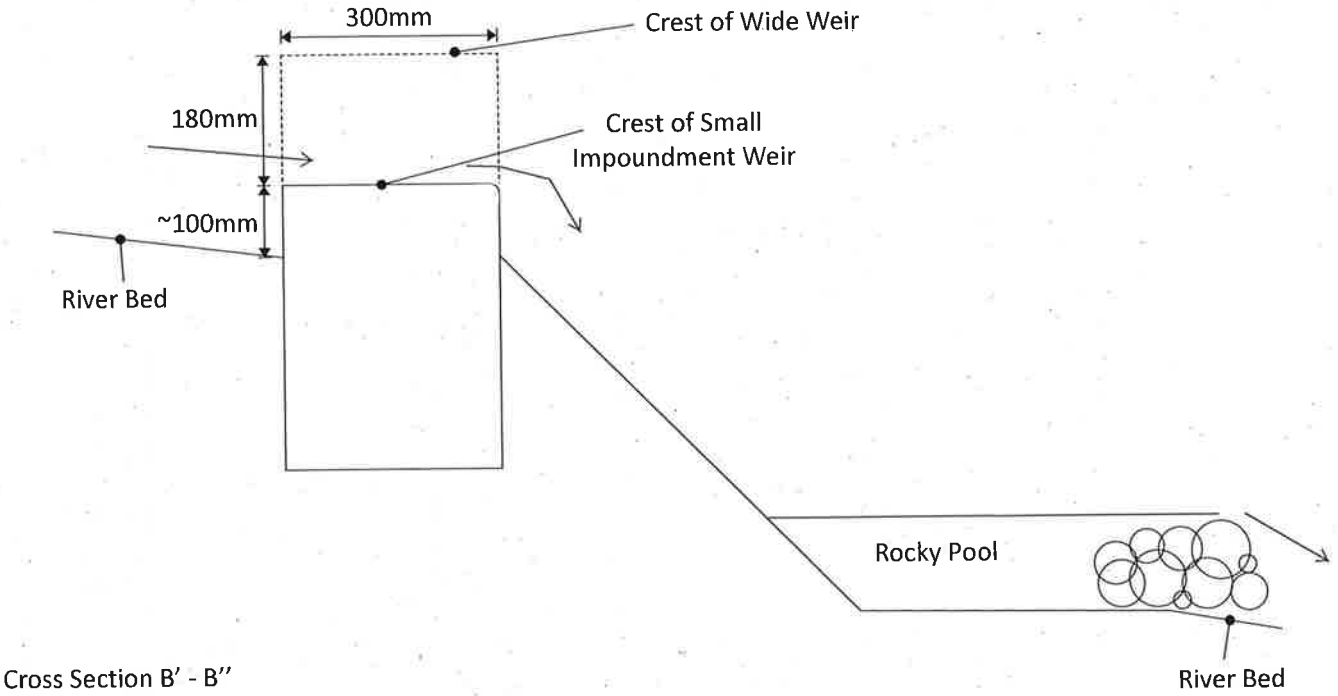
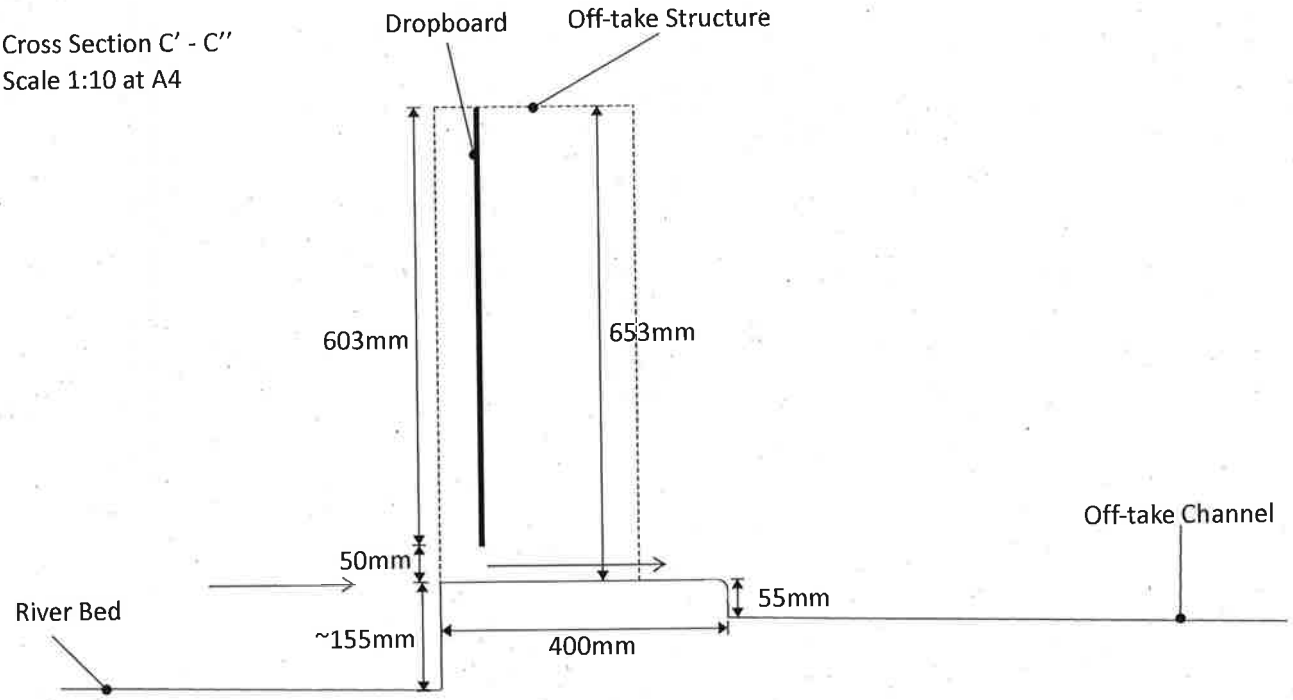
envireau WATER

Ref: P19-144 - Vivod Licensing \ FIG 4 Impoundment Date: 08/102019	**Vivod Estates**
Figure 4	Cross Section of Proposed Alterations to the Existing Impoundment Structure



Cross Section B' - B''
Scale 1:10 at A4

Cross Section C' - C''
Scale 1:10 at A4



envireau WATER	Ref: P19-144 - Vivod Licensing \ FIG 5 Impoundment Date: 08/10/2019	**Vivod Estates**
	Figure 5	Cross Section of Impoundment Structure & HEP Off-take Structure

APPENDIX A
ENVIREAU WATER VIVOD BROOK COMPLIANCE REPORT

COMPLIANCE REPORT

VIVOD ESTATES

For

Vivod Estate
Vivod
Llangollen
LL20 7LS

By

Envireau Water
Cedars Farm Barn
Market Street
Draycott
Derbyshire
DE72 3NB

Tel: 01332 871882
E mail: info@envireauwater.co.uk
Web: www.envireauwater.co.uk

Ref: P19-144 Vivod Licensing \ RPT 1 Comp Rep r2.docx
August 2019

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APPENDICES

Revision	Details	Completed by	Date	Checked by	Date
REV01	Final Draft	LC	6/08/2019	JED	08/08/2019
REV02	Final	LC	29/08/2019		

COMPLIANCE REPORT

VIVOD ESTATES

1 INTRODUCTION

Vivod Estates have requested that Envireau Water assess their compliance with their licences to abstract water from the local watercourse for the purpose of domestic supply and hydroelectric power. This request is subsequent to Vivod Estates receiving Compliance Assessment Reports (CAR's) from Natural Resource Wales (NRW) in relation to these licences. The CAR's are provided in Appendix A. The CAR's were issued on 21/05/2019 following a site inspection by NRW on 01/05/2019. NRW have undertaken a further site visit on 18/06/2019.

The CAR's were issues due to breaches in the licence conditions principally relating to the quantities of water abstracted; hands off flow conditions and the set-up of the off-take impoundment.

Envireau Water have reviewed the CAR's and undertook a site visit on 04/06/2019 to assess and understand the abstraction system in greater detail. Subsequently, a meeting has been held with NRW on 18/07/2019 to discuss the CAR's along with present and future requirements for the licences.

On the day of the NRW site visit on 21/05/2019, the flows in the watercourse were low. Vivod Estates had concerns regarding feeding enough water to their domestic supply and had placed an obstruction at the impoundment location to divert water to the domestic supply feed. However, this had essentially cut off the flow in the watercourse. Subsequently, Vivod Estates removed the obstruction and partially opened up a valve at the impoundment to allow greater flow down the watercourse, to provide a temporary solution.

Envireau Water have undertaken an assessment of this temporary solution to show that the abstracted flow is compliant in regards to water volumes abstracted. This was presented and discussed at the meeting with NRW on 18/07/2019. During the meeting, it was discussed that a report should be produced to demonstrate that the water volumes abstracted are compliant. Additionally, a permanent solution was discussed which would involve applications to vary the permits.

During discussions, it was noted that due to fish ecological constraints, any "works in rivers" would not be possible from mid-October until Spring 2020. In agreement with Envireau Water, NRW acknowledged that getting an application in; getting it determined and completing works would not be possible before mid-October. Therefore, it was agreed that so long as a report was produced demonstrating that the existing arrangement was compliant in regards to water volumes abstracted and an application was forthcoming, then the existing arrangement would be acceptable until works in the river could be conducted in Spring 2020.

This report provides data to show that the existing arrangements are compliant in relation to water volumes abstracted. However, the impoundment structure is not compliant under the existing licence on the basis of how it is set up. Variations to the licences will be required to provide a permanent solution.

2 BACKGROUND

2.1 Vivod Estate Licences

Vivod Estates have been abstracting water from the Vivod Brook for their domestic supply and hydroelectric power since 1860 (or earlier) and 1922, respectively. Vivod Estates currently hold three licences to impound and abstract and water from the Vivod Brook at NGR SJ 18204 41637. Details of the licences are provided in Table 1

Table 1 Licence Details

Licence Type	Licence No.	Date of Issue	Expiry Date	Type of Use	Abstraction Quantities
Abstraction (Full)	24/67/5/0020/S	23/10/1967	None	Domestic Water Supply	5,575 m^3/annum 15 m^3/day
Abstraction (Full)	WA/067/0005/002	18/08/2010	31/3/2027	Micro HydroElectric Power	42 l/s 151 m^3/hr 3,629 m^3/day 798,336 m^3/annum
Impoundment	WA/067/0005/005	18/8/2010	None	To allow abstraction of water from watercourse	

The licence to abstract water for Micro Hydroelectric Power is an all year round abstraction but with the following conditions applied:

1. From 1 April to 31 December each year, the quantity of water abstracted shall not exceed 50% of the available natural flow in the Vivod Brook in excess of 7 litres per second.

2. From 1 January to 31 March each year, the quantity of water abstracted shall not exceed 70% of the available natural flow in the Vivod Brook in excess of 7 litres per second.

The value of 7 l/s equates to the Annual Q95 value (Table 3).

An instantaneous flow rate for the domestic supply is not stated on the licence. Based on an abstraction of 15m^3/day, the average instantaneous flow rate equates to 0.18 l/s.

2.2 Hydrological Catchment

The Vivod Brook is located in a steep sided V-shaped valley originating at NGR SJ 17300 40590 at an elevation of c.503m AOD out-falling to the River Dee at NGR SJ 19795 43180 at an elevation of c.100mAOD. Catchment descriptors derived from the Flood Estimation Handbook (FEH) Web Service (Ref.1) for Vivod Brook for 1) up to the abstraction point and 2) to the confluence with the River Dee are provided in Table 2.

The watercourse is a generally 1.5 to 2m wide with a rocky / gravelly substrate. The watercourse gradient is steep resulting in a series of cascading, riffle and rock pool and small drop pool features as it descends the valley.

Table 1 FEH Catchment Descriptors

Catchment Descriptors	Abbreviation	Catchment Values	
		To the abstraction point	To the R. Dee
Catchment area draining to the Site	AREA	1.91km^2	4.92km^2
Mean Catchment Altitude	ALTBAR	444m	350m
Base Flow Index (BFI) associated with each HOST soil class (0:1)	BFIHOST	0.4950	0.5340
Standard Percentage Runoff (SPR) associated with each HOST soil class (10-53%)	SPRHOST	39.14%	36.2%
Proportion of time that catchment soils are defined as 'wet' (soil moisture deficit of less than 6mm)	PROPWET	0.510	0.510
Standard Average Annual Rainfall (SAAR) (1961 – 1990)	SAAR	1091	1039
Extent of urban and suburban land within catchment	URBEXT$_{2000}$	0.0	0.0

The average gradient of the brook from:

1. the top of the watercourse to the River Dee is circa. 9.95% (a fall of 405m over 4.05km);
2. the top of the watercourse to the abstraction point is circa. 11.5% (a fall of 213m over 1.85km).

The catchment size to the abstraction point (1.91km^2) and the gradient of the watercourse indicates that the licence condition: "the quantity of water abstracted shall not exceed 70% of the available natural flow in the Vivod Brook in excess of 7 litres per second"; should be applicable all year round, based on NRW policy.

LowFlows data has been produced using the Wallingford HydroSolutions Limited software (Ref. 2) to assess the low flows in Vivod Brook at the point of abstraction. The data presents the mean monthly and annual and monthly flow duration values. A summary of the flows is provided in Table 3 and 4.

Table 3 **Annual and Monthly Flow Duration Values**

Month	Q (l/s) by Percentile											
	5	10	20	30	40	50	60	70	80	90	95	99
Annual	138	101	67	49	37	29	23	17	13	9	7	5
January	175	140	107	87	72	60	50	42	34	26	21	17
February	166	131	91	68	54	44	37	31	26	21	18	14
March	136	105	76	61	50	41	33	27	22	18	15	11
April	94	72	50	40	34	29	25	22	18	15	12	10
May	71	53	37	29	24	20	17	15	12	11	9	8
June	43	34	25	20	16	14	12	11	9	8	7	6
July	42	28	19	16	13	11	10	9	8	7	6	5
August	71	48	30	22	17	13	11	9	8	6	5	4
September	91	64	41	30	22	17	14	11	9	7	6	5
October	143	108	75	59	46	36	28	22	15	10	8	5
November	161	129	95	72	59	48	40	32	25	18	13	8
December	183	144	106	84	68	54	45	37	30	23	19	13

Table 4 **Mean Monthly Flow Values**

Mean Flows	Flow (l/s)
Annual	45.40
January	77.90
February	64.90
March	55.30
April	38.20
May	27.80
June	19.00
July	16.40
August	22.90
September	29.60
October	52.70
November	65.70
December	75.90

3 SITE ASSESSMENT

3.1 General Off-take Arrangements

Envireau water undertook a site visit on 04/06/2019. Figure 2 shows an overview of the current abstraction arrangements. To allow abstraction to occur, Vivod Brook has been impounded by a wide weir structure with a smaller weir (hereafter referred to as the small impoundment weir) cut into the wide weir (see Figure 3, Photo 1). The impoundment structure allows water to be abstracted by an Off-take Channel that has been engineered to the side of the impoundment structure. The impounding structure also has a valve that can be opened to allow flows to pass. This impounding structure has been in place since 1922.

The Off-take Channel has two entrances, each with drop down boards that can restrict flows (see Figure 3, Photo 2). These drop boards are currently set at 5cm above the invert of the Off-Take Channel entrances. 30m downstream the Off-take Channel funnels flows into a 300mm pipe (see Figure 3, Photo 4). Immediately prior to the pipe is an overflow pipe which directs flows back to the watercourse in the event of surcharging. This pipe follows the valley contour for some 520m before reaching an Off-take Chamber (see Figure 3, Photo 5). The maximum capacity of this pipe (assuming no blockages or restrictions) is estimated (using Pipeflow Wizard software (Ref.3)) to be circa. 80 l/s.

The Off-take Chamber splits the flow into two separate pipes. One pipe goes to the Micro Hydroelectric scheme and the other to the domestic supply.

The Off-take Chamber is designed to allow flows to pass over a filter mat (see Figure 3, Photo 6) placed on the floor of the chamber. Beneath the filter mat is the domestic supply off-take. This allows the water going to the domestic supply to be filtered, although this also provides a restriction to the amount of water passing into the domestic supply due to the permeability of the matting. The filter mat is also self-cleaning based on the amount of flow within the Off-take Chamber. Therefore, there is a minimum flow that is required at the Off-take Chamber in order for the system to be able to provide the domestic supply. The flow from the chamber goes directly to the domestic supply with no intervening holding tank.

The 300mm pipework connecting the Off-take Channel to the Off-take Chamber has been in situ for many years and is prone to damage from treat roots, which has led to sections of the pipe being replaced. However, overall, the pipe is leaky and not all the abstracted flow from the brook makes it to the chamber. Leakage water infiltrates to ground and will make its way back to the brook.

3.2 Channel dimensions and flow measurements

During the site visit, measurements of the watercourse, off-take structures, channels and pipes were taken. A key observation is that the invert level for the two Off-take Channel entrances are circa. 2cm below the invert level for the impounding weir. Therefore, should river levels fall sufficiently, a situation may arise where flows are diverted down the offtake channel and with no flow to the watercourse.

On the day of the site visit, this had been counteracted by partially opening the valve on the impounding structure. The invert for the valve is lower than the two Off-take Channel entrance inverts, thereby allowing flows down the watercourse.

To ascertain the flows at the watercourse and Off-take Channel, a series of velocity measurements were taken using a Valeport Model 801 Electromagnetic Flow Meter. Measurements were taken at the watercourse upstream of the impoundment structure, at the impoundment weir, at the two Off-take Channel entrances and the Off-take Channel.

Water levels were low, which made taking readings difficult. However, measurements were repeated several times which showed consistency in the velocities recorded with small standard deviations observed in the readings. A minimum of 5 cross profile velocities were recorded over the span of the watercourse and channels for each location measured.

4 ABSTRACTION ASSESSMENT

4.1 Estimation of Flows

The dimensions and velocity readings taken on the day of the site visit by Envireau water were processed to generate a flow rate using the area-velocity methodology. The results of the analysis are provided in Table 5.

Table 5 Processed Flow Values

Location	Channel Width (m)	Average Velocity over span (m/s)	Flow (l/s)
Upstream of impoundment structure	1.2	0.13	21.2
1st Off-take Channel entrance	0.46	0.29	3.4
2nd Off-take Channel entrance	0.48	0.29	3.5
Off-take Channel	0.88	0.1	7.0
Small impoundment weir	0.51	0.14	1.1

The Off-take Channel is regular for circa. 5m from the off-take to the entrance of the 300mm pipe, and provided the greatest control on measuring velocities and calculating the flow, and has provided a high level of confidence in the calculated flow. The calculated flow in the Off-take Channel tallies well with the combined calculated flows at the 1st and 2nd Off-takes Channel entrances, providing confidence in these results.

Measuring the flow passing through the valve was not possible due to the amount of water passing through and therefore was estimated at 13.2 l/s by subtraction of the measured flow at the Off-take Channel entrances and the small impoundment weir.

The results showed that on the day of the site visit, a total of 14.3 l/s was passing down Vivod Brook. The quantity of water abstracted was 49% of the available natural flow in the Vivod Brook, in excess of 7 l/s. Therefore, at this point in time, the abstracted volume was compliant with the licence conditions.

4.2 Estimation of Minimum Flow Requirement

In addition to estimating channel flows, an experiment was carried out to assess what the minimum flow requirement would be at the Off-take Chamber to allow the set up for the domestic supply to be functional. To provide greater control over the low flows going down the Off-take Channel, one of the Off-take Channel entrances was closed off, so that abstracted water only flowed through one off-take entrance.

As discussed, the pipe transfer from the abstraction to the Off-take Chamber is leaky and therefore, it was expected that there are losses in the system. Therefore, the experiment was started at a flow rate that is known to provide enough water to the Off-take Chamber to allow the domestic supply off-take to function.

The principal of the experiment was to sequentially reduce the amount of flow going down the Off-take Channel to see what the depths and flows were at the Off-take Chamber and ascertain whether this flow was sufficient to allow the domestic abstraction to occur given the restrictions at the Off-take Chamber.

To achieve this, the measurements recorded on the day of the site visit along with the results of the area-velocity analysis were used to calibrate a Manning's calculation for flow in a channel (in this instance the opening of the offtake structure). This allowed estimates of flow to be made for different water levels at the offtake structure. The water levels at the offtake structure were then controlled by allowing more water to pass down the Vivod Brook by opening the valve at the impoundment structure.

The experiment was started with an abstraction of 3.5 l/s falling to approximately 0.7 l/s. Time was allowed for flows to adjust within the offtake chamber based on the estimated velocities for flows, which suggested lag times of up to 90 minutes.

Table 6 **Flow experiment results**

Abstraction rate (l/s)	Depth in offtake chamber (cm)	Average velocity in chamber (m/s)	Estimated Flow in chamber (l/s)	Loss of flow in the transfer pipework (l/s)	Flow rate sufficient for domestic supply offtake to function
3.5	10.5	0.037	2.9	0.6	Yes
1.8	8	0.023	1.4	0.4	Yes
0.7	4	0. 013	0.5	0.2	No

Based on the above experiment, the minimum abstraction rate to allow the domestic supply off-take to function is circa. 1.8 l/s, to give a flow rate at the domestic off-take of 0.2 l/s.

4.3 Estimation of Flows for Different Flow Regimes

The results of the assessment for the data collected on the day of the site visit showed the abstraction to be compliant when the flow in the watercourse was at 21 l/s and the valve in the impoundment structure was partially opened. However, this does not show whether the abstraction is compliant for higher or lower flows in the watercourse. Therefore, an assessment has been undertaken to estimate the abstraction rates at the Off-take Channel entrances and the flows down the watercourse at the valve and small impoundment weir for different natural flow rates in the watercourse. This estimation of flows can then be used to assess whether the abstraction is compliant.

The assessment was undertaken by calibrating a Manning's calculation for each of the flows measured at the Off-take Channel entrances and the small impoundment weir; using this calibration to produce depth/flow trendlines; and building a simple model combining the equations from the different trendlines to give flows at the Off-take Channel entrances and small impoundment weir. The model assumes that the drop boards at the Off-take Channel entrances are set at 5cm above the entrance inverts.

Similarly, the flow through the valve at the impoundment structure has been estimated for various water levels. This is based on calibrating a pipe flow equation for the flows and water levels on the day of the site visit using the Pipeflow Wizard software (Ref.3). Various flow rates through the valve were then estimated to provide a trendline for which the equation was input into the model.

The current arrangement is presented in the form of a line diagram on Figure 4. Figure 4 shows that increasing the flows to circa. 42 l/s and 114 l/s changes the quantity of water abstracted in excess of 7 l/s to 50% and 38%, respectively. This shows that the existing arrangement is currently compliant for the existing abstraction licences.

4.4 Issues arising for the Existing Arrangements

The existing arrangement is compliant in relation to abstracted flows with the use of the valve. However, although the impoundment structure has been in operation since 1922, the current arrangement is not compliant with what is set out in the impoundment licence issued in 2010 or the description of how water is abstracted in the HEP abstraction licence.

NRW have specified that they do not want the flows in the watercourse controlled by the valve on a permanent basis, therefore an alternative method of control is required. Based on Envireau Water's assessment, this can be achieved with modifications to the existing impoundment structure. This would be different to the arrangement detailed in the impoundment licence and therefore a variation to the impoundment licence will be required. This will negate the need for using the valve and will also encompass a fish screen for the abstraction, also requested by NRW.

As stated in the introduction of this report, in discussions with NRW, it was acknowledged that works in the watercourse could not be carried out post mid-October due to fish ecological constraints. Therefore, on the basis that this doesn't provide enough time for a licence variation to be approved through the NRW system, it is proposed that the existing arrangement is maintained on a temporary basis and a licence variation is submitted in time to allow works to proceed in the Spring of 2020.

The existing arrangement has the valve in a fixed positon i.e. it is not manually adjusted. However, this results in no ability to abstract water for flows below 7 l/s, and hence no water being available for the domestic supply in this situation. Therefore, it is proposed that during periods when the flows in the natural watercourse are below 7 l/s, that the valve is manually adjusted to restrict flows further.

A flow depth of 1cm at the Off-take Channel's entrances would allow an abstraction of 1.4 l/s. This would provide enough flow to the Off-take Chamber to feed the domestic supply. The valve would then need to be reset to its current position once flows in the watercourse were raised above 7 l/s.

As part of this assessment, the catchment to the abstraction point and the gradient of the watercourse indicates that a 70% hands of flow condition could be applied to the HEP abstraction all year round. Therefore, it is proposed that a variation is put forward to vary this condition within the HEP abstraction licence.

This assessment has also established that there is a minimum flow requirement for the abstraction in order provide the domestic supply. Therefore, it is also proposed that a variation to the abstraction licence is put forward to reflect this. The approach to this will need to be discussed and agreed with NRW.

5 WHAT THIS MEANS FOR VIVOD

- The above assessment has shown the existing arrangement is compliant in relation to abstraction rates, however, it is not compliant in relation to the impoundment licence and the description of how water is abstracted in the HEP abstraction licence.

- The use of the valve at the impoundment structure is only a temporary measure and an alternate set-up for the abstraction need to be put forward as part of an application to vary the existing licences. The variations will consist of proposals to:

    - Alter the set-up of the existing off-take and impoundment structure and disregard the use of the valve.
    - Increase the hands off flow condition to –

        "For all year round, the quantity of water abstracted shall not exceed 70% of the available natural flow in the Vivod Brook in excess of 7 litres per second"
    - A special condition placed on the domestic supply abstraction allowing up to 1.8 l/s to be abstracted for flows less than 7 l/s in the watercourse.

- With the use of the valve in a set position as per the existing arrangement, the domestic supply cannot be achieved for flows less than 7 l/s. Therefore to protect the supply and as a temporary measure, it is proposed that during low flows and when the domestic supply is threatened that the valve is manually adjusted to allow up to 1.8 l/s to be abstracted. Once natural flows have increased, the valve should be returned to its current position.

Envireau Water
29/08/19

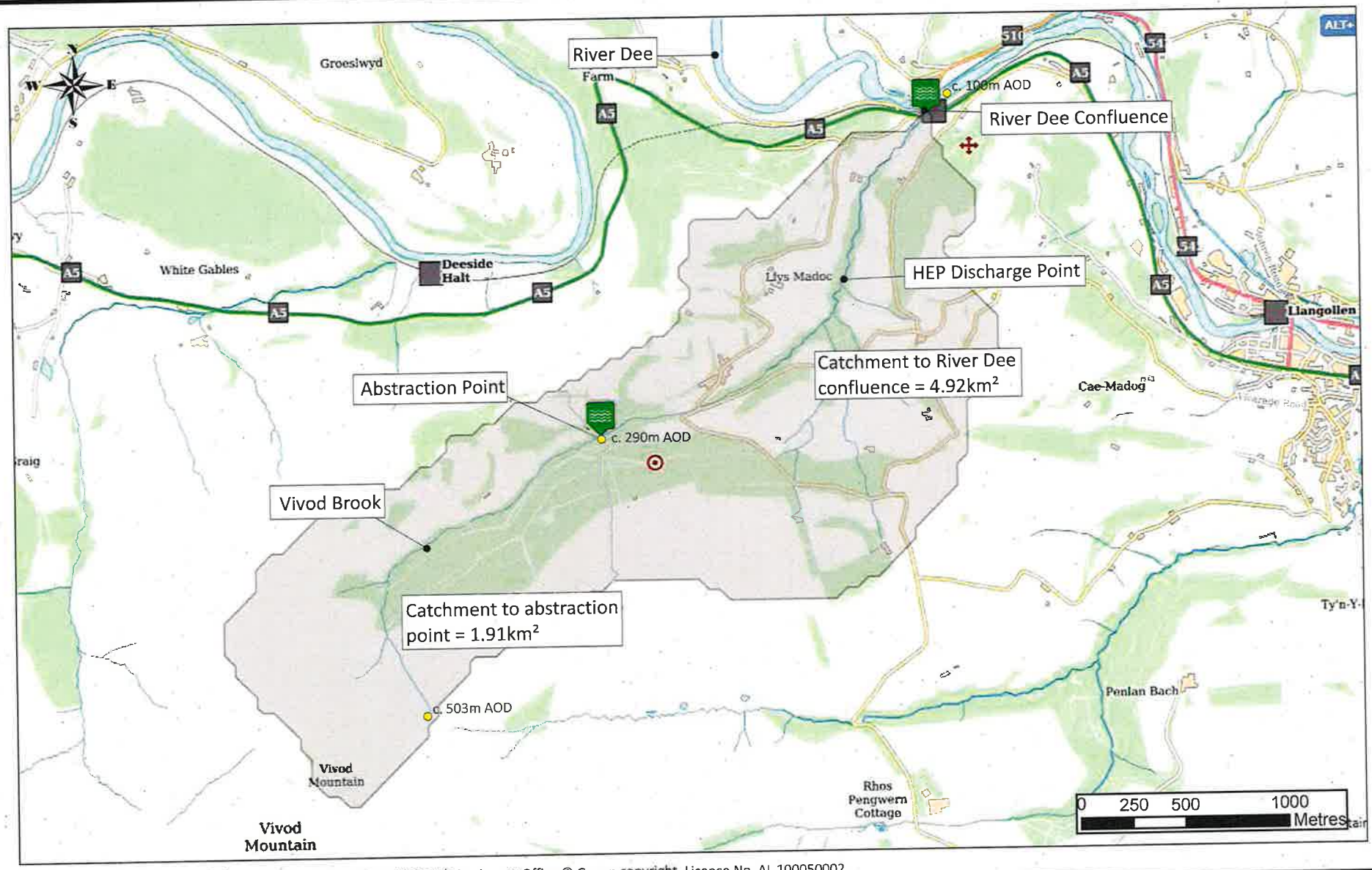
REFERENCES

Ref.1 CEH. (2018). Flood Estimation Handbook Web Service. https://fehweb.ceh.ac.uk/

Ref.2 Wallingford HydroSolutions Limited. https://www.hydrosolutions.co.uk/

Ref.3 Pipeflow Wizard. https://www.pipeflow.com/pipe-flow-wizard-software

FIGURES



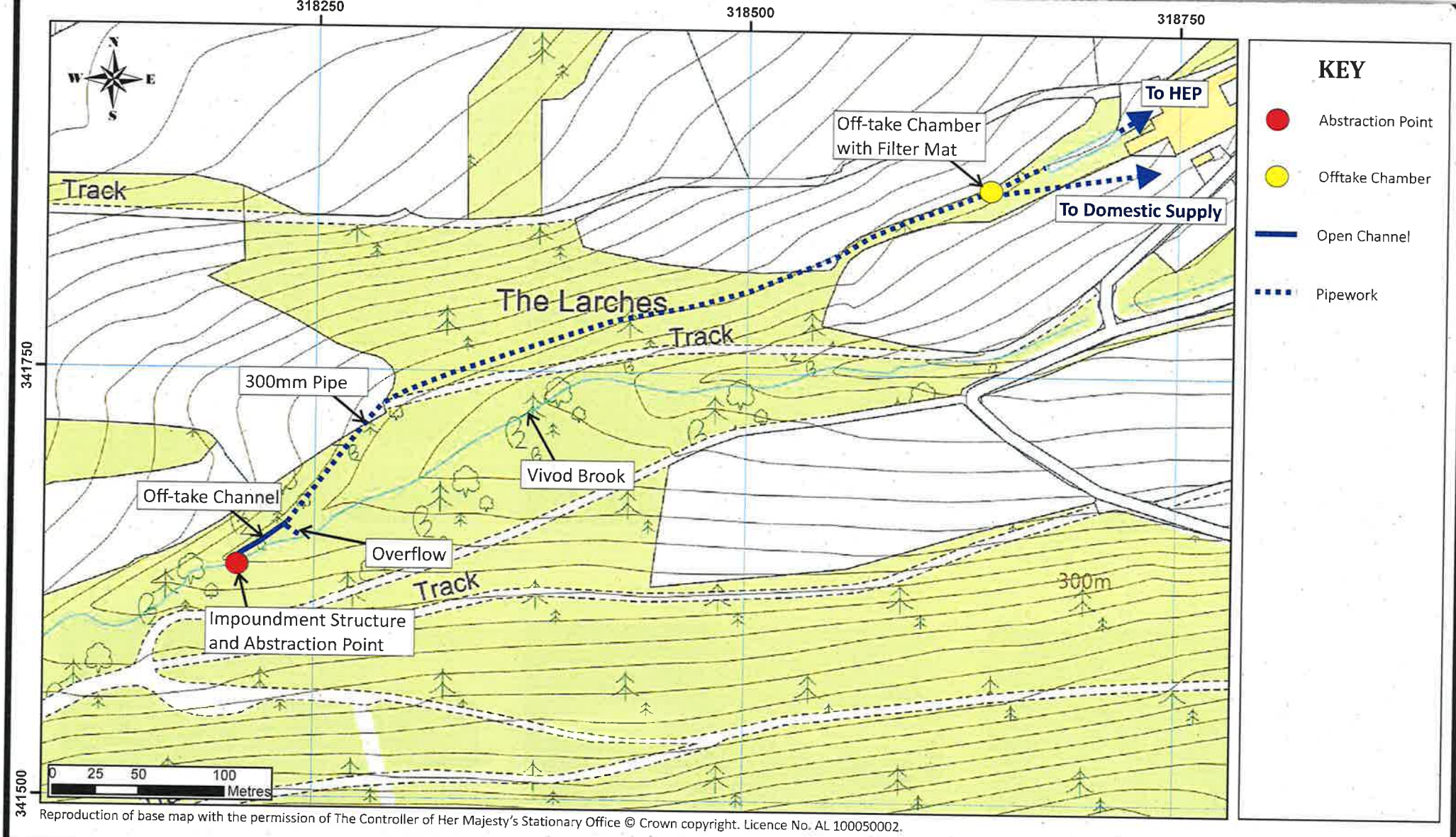
envireau WATER

Ref: P19-144 - Vivod Licensing
Date: 05/08/2019

Vivod Estates

Figure 1

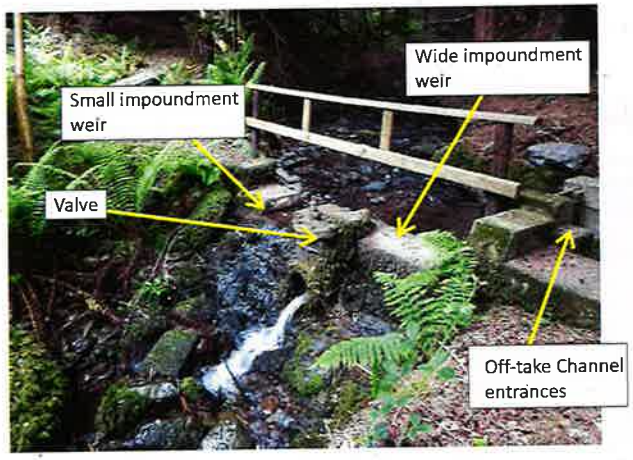
Vivod Brook FEH Catchment Boundary



envireau WATER

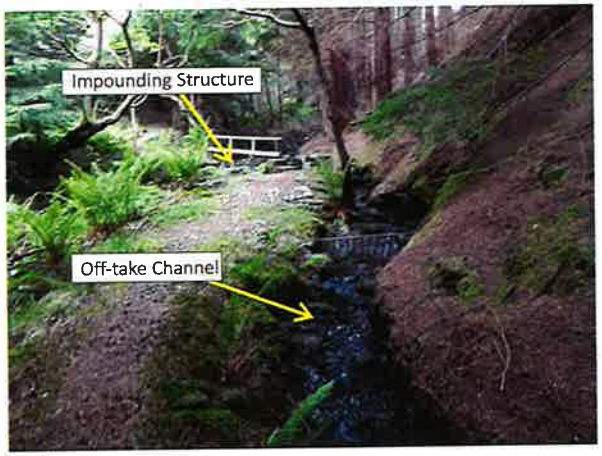
Ref: P19-144 - Vivod Licensing Date: 05/08/2019	**Vivod Estates**
Figure 2	Abstraction Overview

Impounding Structure (Photo 1)

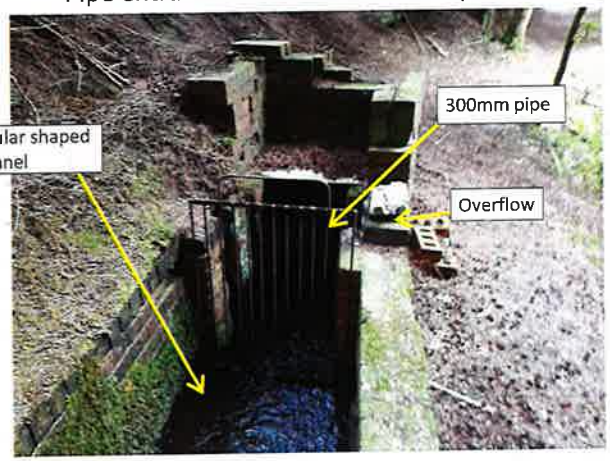


Off-take Channel entrances (Photo 2)

Off-take Channel (Photo 3)



Pipe entrance at Off-take Channel (Photo 4)



Domestic supply Off-take Chamber (Photo 5)

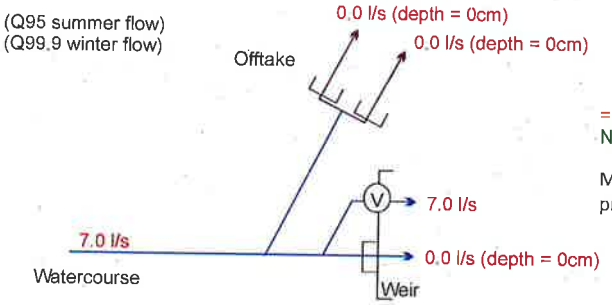
Filter mat in Off-take Chamber (Photo 6)

envireau WATER

Ref: P19-144 - Vivod Licensing Date: 05/08/2019	**Vivod Estates**
Figure 3	Photographs of Existing Arrangements

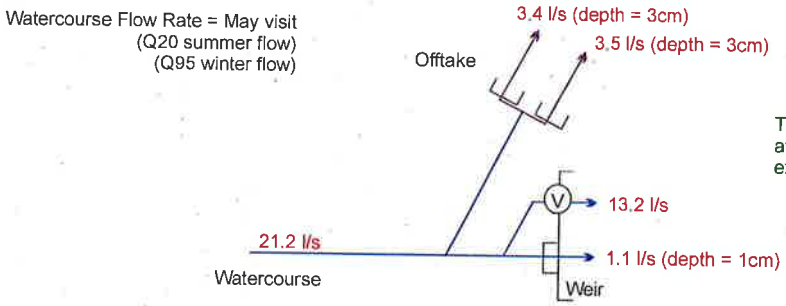
Existing Arrangement with Valve

- Watercourse small weir invert set ~ 2cm higher than 1st and 2nd Off-take Channel entrance inverts

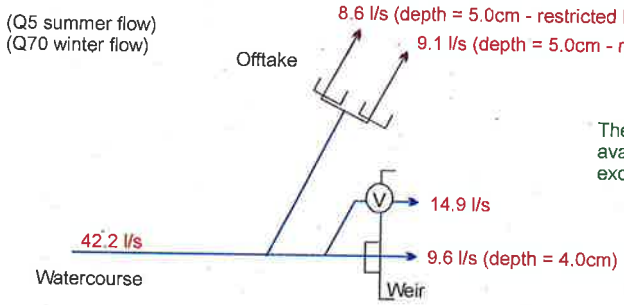


= No domestic abstraction achieved
Natural flow in watercourse maintained.

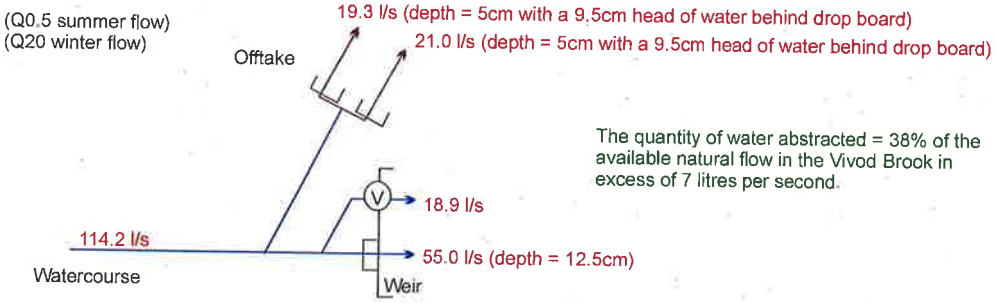
Manual adjustment of valve required to provide up to 1.8 l/s for the domestic supply



The quantity of water abstracted = 49% of the available natural flow in the Vivod Brook in excess of 7 litres per second.



The quantity of water abstracted = 50% of the available natural flow in the Vivod Brook in excess of 7 litres per second.



The quantity of water abstracted = 38% of the available natural flow in the Vivod Brook in excess of 7 litres per second.

envireau WATER

Ref: P19-144 Vivod Licensing Date: 06/08/2019	**Vivod Estate**
Figure 4	Line Diagram for Existing Arrangement

APPENDIX A

NRW COMPLIANCE ASSESSMENT REPORTS (CAR_NRW0035130; CAR_NRW0035128; & CAR_NRW0035142)

Cyfoeth Naturiol Cymru Natural Resources Wales

Compliance Assessment Report

Report ID: CAR_NRW0035128

This form will report compliance with your permit as determined by an NRW officer					
Site		Permit Ref	WA/067/0005/002		
Operator/Permit holder	R J Best				
Regime	Water Abstraction				
Date of assessment	01/05/2019	Time in	12:10	Out	13:30
Assessment type	Site Inspection				
Parts of the permit assessed	Weir intake at SJ1820441637				
Lead officer's name	Rees-Jones, Jenny				
Accompanied by	Brannan, Callum				
Recipient's name/position	Mr W Best/ Licence Holder (1 of 3)	Date issued	21/05/2019		

Section 1 – Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations or the licence under the Water Resources Act 1991 as amended by the Water Act 2003. A detailed explanation is captured in "Compliance Assessment Report Detail" (Section 2) and any actions you may need to take are given in the "Action(s)" (section 4). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS Scores can be consolidated or suspended where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit conditions and compliance summary	CCS Category	Condition(s) breached
A1 - Specified by permit	C3	9.3i - Further conditions, 50% flow split 1 April - 31 December.
	C3	9.2 - further conditions, no abstraction should take place that would reduce immediately downstream watercourse below 7 litres per second
	C3	9.4 - Further conditions, construct, operate and maintain intake works so as to ensure compliance with licence conditions.
	C3	3.1 - means of abstraction, refers to drawings submitted 07/05/2010

KEY: See Section 5 for breach categories, suspended scores will be indicated as such.
A = Assessed or assessed in part (no evidence of non-compliance), **X** = Action only,
O = Ongoing non-compliance, not scored.

Number of breaches recorded	4	Total compliance score (see section 5 for scoring scheme)	16

If the Number of breaches recorded is greater than zero, please see Section 3 for our proposed enforcement response

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- The part(s) of the permit that were assessed (eg. Maintenance, training, combustion plant, etc)
- Where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- Any non-compliances identified
- Any non-compliances with directly applicable legislation
- Details of any multiple non-compliances
- Information on the compliance score accrued inc.
- Details of advice given
- Any other areas of concern
- Any actions requested
- Any examples of good practice
- A reference to photos taken

Condition 3.1 of the abstraction licence references drawings submitted on 07/05/2010. The drawings show the intake arrangement, which facilitates abstraction for this licence for purposes of hydroelectric power generation, and for abstraction licence 24/67/5/20 for the purpose of water supply to several dwellings. The drawings show the modification of an old impoundment, which we understand to have been in place since the 1920s. The old impoundment has a penstock through it, supposedly to provide downstream flow historcally. At the time of the visit this penstock was not passing water through. Water is mainly diverted to the left (looking downstream) down a leat which flows for a short distance above ground before going under ground.

The designs show two orifices cut in a barrier at the top of the leat: one for domestic supply and one to supply the turbine. The drawings show the flow to the domestic supply, via an orifice measuring 40mm x 26mm, to deliver 0.1762 litres per second (daily limit = 3350 gallons per day = 15.23 ML/d = instantaneous rate of 0.1762 litres per second, referenced on page 3 of the drawings submitted on 07/05/2010), set below the level of the hands off flow notch.

The designs show the orifice providing flow to the turbine should measure 475mm wide x 191mm deep.

The hands off flow notch and residual flow (flow split) notch appear to be cut into weir plates on the drawings. The designs say that weir plates are to be cut from rustless steel, and to be changed as per flow split conditions. The hands off flow notch is shown on the diagrams as the next lowest point measuring 200mm x 107mm. The residual flow notches, are designed to be situated so that their crest is level with the top of the hands off flow notch, and measuring 302mm wide x 191mm deep (summer, 50% of flow) and 504mm wide x 191mm deep (winter, 30% of flow). The residual flow crests should be level with the crest of the abstraction notch / orifice for the turbine.

Upon arriving at site we saw that a notch had been cut into the old concrete weir but there was no metal plate. The concrete notch measured 515mm wide x 175mm deep (below the level of the original crest). This appears to be 11mm wider than the summer residual flow notch in the drawings but 16mm shallower than in the drawings. There was no hands off flow notch. The notch was boarded up with a length of white plastic, which was impeding most of the flow down the natural course of the watercourse. I estimate that less than 1 litre per second was flowing down the watercourse, and there was very little flow in the watercourse immediately downstream. The rest of the flow was going down the leat.

It was difficult to see the abstraction orifices as they were below the water, but the arrangement appeared to consist of two wooden gates slotted into a concrete and concrete block structure at the top of the leat. The crest on which the wooden gates were resting were measured to be approximately 170mm below the original crest level that the residual flow notch had been cut into, although it was difficult to accurately measure as it was below the level of the water. This is roughly level with the residual flow crest.

Condition 9.2 states that no abstraction shall take place when the flow in the Vivod Brook immediately downstream of the authorised point of abstraction is equal to or less than 7 litres per second. There was clearly less than 7 litres per second and the flow in the leat was clearly much higher than the flow of 0.1762 litres per second.

Condition 9.3 states that from 1 April to 31 December each year, the quantity of water abstracted shall not exceed 50% of the available natural flow in the Vivod Brook in excess of 7 litres per second. As previously stated, the flow in the leat was considerably higher than the 0.17 litres per second designed to be abstracted through the notch cut into the leat barrier for the domestic abstraction, and less than 1 litre per second was being allowed downstream.

Condition 9.4 requires the Licence Holder to construct, operate and maintain the intake works so as to ensure compliance with the licence conditions.

No screen visible (as per condition 9.8 of licence). Difficult to see as under water. Licence holder to confirm whether there is a screen in place.

Mr Best explained that if only the amount licensed to be abstracted by 24/67/5/20 for water supply to the estate was released down the leat then it would soak into the ground before it arrived at the reservoir. If more water than the licensed amount is required to be abstracted in the current setup, then the licence holder either needs to apply for an upward variation to this licence or to find an alternative way of transferring the water abstracted for domestic supply without it being lost to the ground. Mr Best explained that there is no alternative water supply to the part of the estate that the abstraction feeds, but that there is an alternative supply of electricity. With this in mind, the licence holder should cease abstraction for hydroelectric power until it is possible to comply with the flow regime licensed by WA/067/0005/002 and 005. Given that there is no alternative water supply to the properties listed in 24/67/5/20, please ensure that you make arrangements to comply with this licence by no later than 31/08/19 (see impoundment CAR_NRW0035130, and supply to properties CAR_NRW0035142). If you think that this is not achievable please contact NRW as

soon as possible. Until all three licences WA/067/0005/002 and 005 and 24/67/5/20 are complied with, no more water should be abstracted at the weir, than is necessary to provide the licensed quantity of water at the properties and for the purpose listed in licence 24/67/5/20 . Advised Mr Best on 01/05/19 that he may need to seek consultant advice.

It is advisable in future to speak to Natural Resource Wales should you feel that you are having problems complying with any NRW licence.

Enforcement action is now being considered for the above offences.

For photographs please see impoundment inspection report CAR_NRW0035130.

Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	**Report ID: CAR_NRW0035128**

This form will report compliance with your permit as determined by an NRW officer

Site		Permit Ref	WA/067/0005/002
Operator/Permit holder	R J Best	Date	01/05/2019

Section 3 – Enforcement Response

You must take immediate action to rectify any non-compliance and prevent repetition.
Non-compliance with your permit conditions constitutes an offence and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below.

We will now consider what enforcement action is appropriate and notify you, referencing this form.

Section 4 – Action(s)

This section summarises the actions identified during the assessment along with the timescales for when they will need to be completed.

Criteria Ref.	CCS Category	Action required/advised	Due Date
See Section 1 above			
A1	C3	Comply with flow split as per licence. Abstraction under this licence (for HEP) should not take place until this is secured.	31/05/2019
A1	C3	Ensure hands of flow as per licence. Abstraction under this licence (for HEP) should not take place until this is secured.	31/05/2019
A1	C3	Cease abstraction under this licence (for electricity generation) until intake is constructed and operated as per licence drawings (either current licence or variation).	31/05/2019
A1	C3	Cease abstraction under this licence (for electricity generation) until intake is constructed and operated as per licence drawings (either current licence or variation).	31/05/2019

Section 5 – Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- Advise on corrective actions verbally or in writing
- Require you to take specific actions verbally or in writing
- Issue a notice
- Require you to review your procedures or management system
- Change some of the conditions of your permit
- Decide to undertake a full review of your permit

Any breach of a permit condition is an offence and we may take legal action against you

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and/or suspension or revocation of the permit.

See our Enforcement and Civil Sanctions guidance for further information

This report does not relieve the site operator of the responsibility to

- Ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- Ensure you comply with other legislative provisions which may apply

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance that could have a major environmental effect	60
C2	A non-compliance which could have a significant environmental effect	31
C3	A non-compliance which could have a minor environmental effect	4
C4	A non-compliance which has no potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

Section 6 – General information

Data protection notice

The information on this form will be processed by the Natural Resources Wales (NRW) to fulfil its regulatory and monitoring functions and to maintain the relevant public register(s). The NRW may also use and/or disclose it in connection with:

- Offering/providing you with its literature/services relating to environmental matters
- Consulting with the public, public bodies and other organisations (eg. Health and Safety Executive, local authorities) on environmental issues
- Carrying out statistical analysis, research and development on environmental issues
- Providing public register information to enquirers
- Investigating possible breaches of environmental law
- Assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Regulations request

The NRW may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The NRW will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within fifteen working days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with officer's line managers using the informal appeals procedure. If you wish to raise your dispute further through our official Complaints and Commendations procedure, phone our general enquiry number 0300 065 3000 (Mon to Fri 08.00 – 18.00) and ask for the Customer Contact team or send an email to enquiries@naturalresourceswales.gov.uk. If you are still dissatisfied you can make a complaint to the Public Services Ombudsman for Wales. For advice on how to complain to the Ombudsman phone their helpline on 0845 607 0987.

Welsh Language
If you would like this form in Welsh please contact your Regulatory Officer.

Cyfoeth Naturiol Cymru
Natural Resources Wales

Compliance Assessment Report

Report ID:
CAR_NRW0035130

This form will report compliance with your permit as determined by an NRW officer

Site		Permit Ref	WA/067/0005/005		
Operator/Permit holder	R J Best				
Regime	Water Abstraction				
Date of assessment	01/05/2019	Time in	12:10	Out	13:30
Assessment type	Site Inspection				
Parts of the permit assessed	Weir intake at SJ1820441637				
Lead officer's name	Rees-Jones, Jenny				
Accompanied by	Brannan, Callum				
Recipient's name/position	Mr W Best/ Licence Holder (1 of 3)	Date issued	21/05/2019		

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Permit conditions and compliance summary	CCS Category	Condition(s) breached
A1 - Specified by permit	C3	4.4iv - further conditions, maintain impoundment to prevent leakage and be free from obstruction
	C3	4.1ii - further conditions, during periods of abstraction for HEP, flow passing impoundment should comply with abstraction licence WA/067/0005/002.
	C3	3.1i - manner and extent of impoundment, refers to drawings submitted 07/05/2010
	C3	4.4i - further conditions, construct, operate and maintain impoundment to ensure licence compliance.

KEY: See Section 5 for breach categories, suspended scores will be indicated as such.
A = Assessed or assessed in part (no evidence of non-compliance), **X** = Action only,
O = Ongoing non-compliance, not scored.

Number of breaches recorded	4	**Total compliance score** (see section 5 for scoring scheme)	16

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Section 2 – Compliance Assessment Report Detail

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- Details of any multiple non-compliances
- Information on the compliance score accrued inc.
- Details of advice given
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- Any actions requested
- Any examples of good practice
- A reference to photos taken

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The designs show two orifices cut in a barrier at the top of the leat: one for domestic supply and one to supply the turbine. The drawings show the flow to the domestic supply, via an orifice measuring 40mm x 26mm, to deliver 0.1762 litres per second (daily limit = 3350 gallons per day = 15.23 ML/d = instantaneous rate of 0.1762 litres per second, referenced on page 3 of the drawings submitted on 07/05/2010), set below the level of the hands off flow notch.

The designs show the orifice providing flow to the turbine should measure 475mm wide x 191mm deep.

The hands off flow notch and residual flow (flow split) notch appear to be cut into weir plates on the drawings. The designs say that weir plates are to be cut from rustless steel, and to be changed as per flow split conditions. The hands off flow notch is shown on the diagrams as the next lowest point measuring 200mm x 107mm. The residual flow notches, are designed to be situated so that their crest is level with the top of the hands off flow notch, and measuring 302mm wide x 191mm deep (summer, 50% of flow) and 504mm wide x 191mm deep (winter, 30% of flow). The residual flow crests should be level with the crest of the abstraction notch / orifice for the turbine.

Upon arriving at site we saw that a notch had been cut into the old concrete weir but there was no metal plate. The concrete notch measured 515mm wide x 175mm deep (below the level of the original crest). This appears to be 11mm wider than the summer residual flow notch in the drawings but 16mm shallower than in the drawings. There was no hands off flow notch. The notch was boarded up with a length of white plastic, which was impeding most of the flow down the natural course of the watercourse. I estimate that less than 1 litre per second was flowing down the watercourse, and there was very little flow in the watercourse immediately downstream. The rest of the flow was going down the leat.

It was difficult to see the abstraction orifices as they were below the water, but the arrangement appeared to consist of two wooden gates slotted into a concrete and concrete block structure at the top of the leat. The crest on which the wooden gates were resting were measured to be approximately 170mm below the original crest level that the residual flow notch had been cut into, although it was difficult to accurately measure as it was below the level of the water. This is roughly level with the residual flow crest.

Condition 3.1ii says that the licence holder shall install a "rocky ramp" fish access structure subject to condition 4.4 to the satisfaction of the Agency. Condition 4 says that the licence holder shall finalise the design of the "rocky ramp" fish access structure during the scheme construction phase and that this must be approved by the local fisheries officer before the scheme is commissioned and becomes operational. I am unable to find evidence that a structure was ever approved by the Agency or NRW. Could the licence holder please confirm whether they think that this was ever approved and give details.

Condition 4.1ii states that during periods of abstraction for the purpose of micro hydroelectric power generation as authorised by abstraction licence WA/067/0005/002, the flow passing this impoundment shall comply with the conditions of that licence. Several conditions of the abstraction licence were not being complied with. Please see CAR_NRW0035128 for details of abstraction licence inspection.

Condition 4.4iv says that the licence holder shall maintain the impoundment licence to prevent leakage and be free from obstruction at all times. The notch that should have provided downstream flow was blocked, so as to ensure adequate downstream flow. The impoundment licence does not allow for this to be blocked. It appeared that the wooden gate structure was allowing more water through than the flow regime licensed in the abstraction licence, and licence 24/67/5/20. It should be ensured that the wooden gates do not allow leakage.

Mr Best explained that if only the amount licensed to be abstracted by 24/67/5/20 for water supply to the estate was released down the leat, then it would soak into the ground before it arrived at the reservoir. If more water than the licensed amount is required to be abstracted in the current setup, then the licence holder either needs to apply for an upward variation to this licence or to find an alternative way of transferring the water abstracted for domestic supply without it being lost to the ground. Mr Best explained that there is no alternative water supply to the part of the estate that the abstraction feeds, but that there is an alternative supply of electricity. With this in mind, the licence holder should cease abstraction for hydroelectric power until it is possible to comply with the flow regime licensed by WA/067/0005/002 and 005. Given that there is no alternative water supply to the properties listed in

24/67/5/20, please ensure that you make arrangements to comply with this licence by no later than 31/08/19. If you think that this is not achievable please contact NRW as soon as possible. (*Until this date, or until alternative arrangements have been made to comply with licence 24/67/5/20, whichever is soonest, the impoundment must be operated so as to allow abstraction of no more water than is required to provide supply to the properties and the purposes listed in licence 24/67/5/20. Please contact me by 31/05/19, stating how you propose to operate the impoundment to achieve interim arrangements). Advised Mr Best on 01/05/19 that he may need to seek consultant advice.

Enforcement action is now being considered for the above offences.

Residual flow notch blocked by board. No hands off flow notch. This notch should pass 7 litres per second plus 50% of the flow in the watercourse downstream.

Water flowing down leat. This should allow 50% of the flow above 7 litres per second. This should also allow the domestic supply of 3350 gallons per day, which is an average flow of 0.18 litres per second. Therefor the impoundment should allow more flow to the watercourse, than to the leat.

Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	**Report ID: CAR_NRW0035130**

This form will report compliance with your permit as determined by an NRW officer

Site		Permit Ref	WA/067/0005/005
Operator/Permit holder	R J Best	Date	01/05/2019

Section 3 – Enforcement Response

You must take immediate action to rectify any non-compliance and prevent repetition.
Non-compliance with your permit conditions constitutes an offence and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below.

We will now consider what enforcement action is appropriate and notify you, referencing this form.

Section 4 – Action(s)

This section summarises the actions identified during the assessment along with the timescales for when they will need to be completed.

Criteria Ref.	CCS Category	Action required/advised	Due Date
See Section 1 above			
A1	C3	Keep free from blockages and leaks, with the exception of those required to secure supply as per 24/67/5/20 until arrangement in place. See note *.	31/05/2019
A1	C3	Cease abstraction under WA/067/0005/002 until flow passing impoundment complies with conditions.	31/05/2019
A1	C3	Construct and operate intake as per licence drawings (either current licence or variation). Cease abstraction for HEP under WA/067/0005/002 until intake compliant. For impoundment for 24/67/5/20 see note *.	31/05/2019
A1	C3	Make arrangements to secure compliance with 24/67/5/20 so as to prevent non-compliance with this impoundment licence. Apply for variation to impoundment licence if necessary.	31/08/2019

Section 5 – Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- Advise on corrective actions verbally or in writing
- Require you to take specific actions verbally or in writing
- Issue a notice
- Require you to review your procedures or management system
- Change some of the conditions of your permit
- Decide to undertake a full review of your permit

Any breach of a permit condition is an offence and we may take legal action against you

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and/or suspension or revocation of the permit.

See our Enforcement and Civil Sanctions guidance for further information

This report does not relieve the site operator of the responsibility to

- Ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- Ensure you comply with other legislative provisions which may apply

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance that could have a major environmental effect	60
C2	A non-compliance which could have a significant environmental effect	31
C3	A non-compliance which could have a minor environmental effect	4
C4	A non-compliance which has no potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

Section 6 – General information

Data protection notice

The information on this form will be processed by the Natural Resources Wales (NRW) to fulfil its regulatory and monitoring functions and to maintain the relevant public register(s). The NRW may also use and/or disclose it in connection with:

- Offering/providing you with its literature/services relating to environmental matters
- Consulting with the public, public bodies and other organisations (eg. Health and Safety Executive, local authorities) on environmental issues
- Carrying out statistical analysis, research and development on environmental issues
- Providing public register information to enquirers
- Investigating possible breaches of environmental law
- Assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Regulations request

The NRW may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The NRW will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within fifteen working days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with officer's line managers using the informal appeals procedure. If you wish to raise your dispute further through our official Complaints and Commendations procedure, phone our general enquiry number 0300 065 3000 (Mon to Fri 08.00 – 18.00) and ask for the Customer Contact team or send an email to enquiries@naturalresourceswales.gov.uk. If you are still dissatisfied you can make a complaint to the Public Services Ombudsman for Wales. For advice on how to complain to the Ombudsman phone their helpline on 0845 607 0987.

Welsh Language
If you would like this form in Welsh please contact your Regulatory Officer.

Cyfoeth Naturiol Cymru
Natural Resources Wales

Compliance Assessment Report

Report ID:
CAR_NRW0035142

This form will report compliance with your permit as determined by an NRW officer

Site	Abstraction from the Vivod Brook near Bryn-Newydd, Llangollen	Permit Ref	24/67/5/0020		
Operator/Permit holder	R J Best				
Regime	Water Abstraction				
Date of assessment	01/05/2019	Time in	12:10	Out	13:30
Assessment type	Site Inspection				
Parts of the permit assessed	Weir intake at SJ1820441637				
Lead officer's name	Rees-Jones, Jenny				
Accompanied by	Brannan, Callum				
Recipient's name/position	Mr W Best/ Licence Holder's Son	Date issued	21/05/2019		

Section 1 – Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations or the licence under the Water Resources Act 1991 as amended by the Water Act 2003. A detailed explanation is captured in "Compliance Assessment Report Detail" (Section 2) and any actions you may need to take are given in the "Action(s)" (section 4). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS Scores can be consolidated or suspended where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit conditions and compliance summary	CCS Category	Condition(s) breached
A1 - Specified by permit	C3	Quantities of water authorised to be abstracted

KEY: See Section 5 for breach categories, suspended scores will be indicated as such.
A = Assessed or assessed in part (no evidence of non-compliance), **X** = Action only,
O = Ongoing non-compliance, not scored.

Number of breaches recorded	1	**Total compliance score** (see section 5 for scoring scheme)	4

If the Number of breaches recorded is greater than zero, please see Section 3 for our proposed enforcement response

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- The part(s) of the permit that were assessed (eg. Maintenance, training, combustion plant, etc)
- Where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- Any non-compliances identified
- Any non-compliances with directly applicable legislation
- Details of any multiple non-compliances
- Information on the compliance score accrued inc.
- Details of advice given
- Any other areas of concern
- Any actions requested
- Any examples of good practice
- A reference to photos taken

Visited weir intake to also inspect Abstraction Licence WA/067/0005/002 and Impoundment Licence WA/067/0005/005 for hydroelectric power..

For detailed comments on intake please see inspection form CAR_NRW0035130.

This licence 24/67/5/20 (also written as 24/67/5/0020) and 24/67/5/22 (24/67/5/0022) are both licensed to abstract below 20m3 of water per day, but aggregate to 30.9 m3 per day from the same source of supply (the River Dee), so they remained licensed rather than exempt.

This licence is for 15.23 m3 of water per day to be abstracted to supply to Vivod Hall, 15 cottages, Tyn y Celyn Farm, Penvivod and Tynewydd from Vivod Brook via a gravity feed pipeline.

Water is abstracted under this licence and the above abstraction licence for hydroelectric power. Water flows through a weir arrangement down a leat. The leat goes under ground and is transferred to supply the properties and to the hydropower turbine.

A daily quantity of 15.23m3 gives and instantaneous quantity of 0.1762 l/s. During the visit it was clear that the aggregate volume that was being abstracted was greater than this quantity plus the 50% flow split above 7 l/s allowed by the hydropower abstraction licence WA/067/0005/002.

After visiting the intake we went to Vivod Hall and spoke with Billy Best.

Mr Best explained that if only the amount licensed to be abstracted by 24/67/5/20 for water supply to the estate was released down the leat then it would soak into the ground before it arrived at the reservoir. If more water than the licensed amount is required to be abstracted in the current setup, then the licence holder either needs to apply for an upward variation to this licence or to find an alternative way of transferring the water abstracted for domestic supply without it being lost to the ground. Mr Best explained that there is no alternative water supply to the part of the estate that the abstraction feeds, but that there is an alternative supply of electricity. With this in mind, the licence holder should cease abstraction for hydroelectric power until it is possible to comply with the flow regime licensed by WA/067/0005/002 and 005. Given that there is no alternative water supply to the properties listed in 24/67/5/20, please ensure that you make arrangements to comply with this licence by no later than 31/08/19. If you think that this is not achievable please contact NRW as soon as possible. Until alternative arrangements have been made to abstract only the licensed quantity, no more water should be abstracted at the weir than is necessary to provide the licensed of water at the properties and for the purpose listed in the licence. Advised Mr Best on 01/05/19 that he may need to seek consultant advice.

Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	**Report ID: CAR_NRW0035142**

This form will report compliance with your permit as determined by an NRW officer			
Site	Abstraction from the Vivod Brook near Bryn-Newydd, Llangollen	Permit Ref	24/67/5/0020
Operator/Permit holder	R J Best	Date	01/05/2019

Section 3 – Enforcement Response

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Section 4 – Action(s)

This section summarises the actions identified during the assessment along with the timescales for when they will need to be completed.

Criteria Ref.	CCS Category	Action required/advised	Due Date
See Section 1 above			
A1	C3	Licence holder to make arrangements to comply with licence quantities	31/08/2019

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Welsh Language
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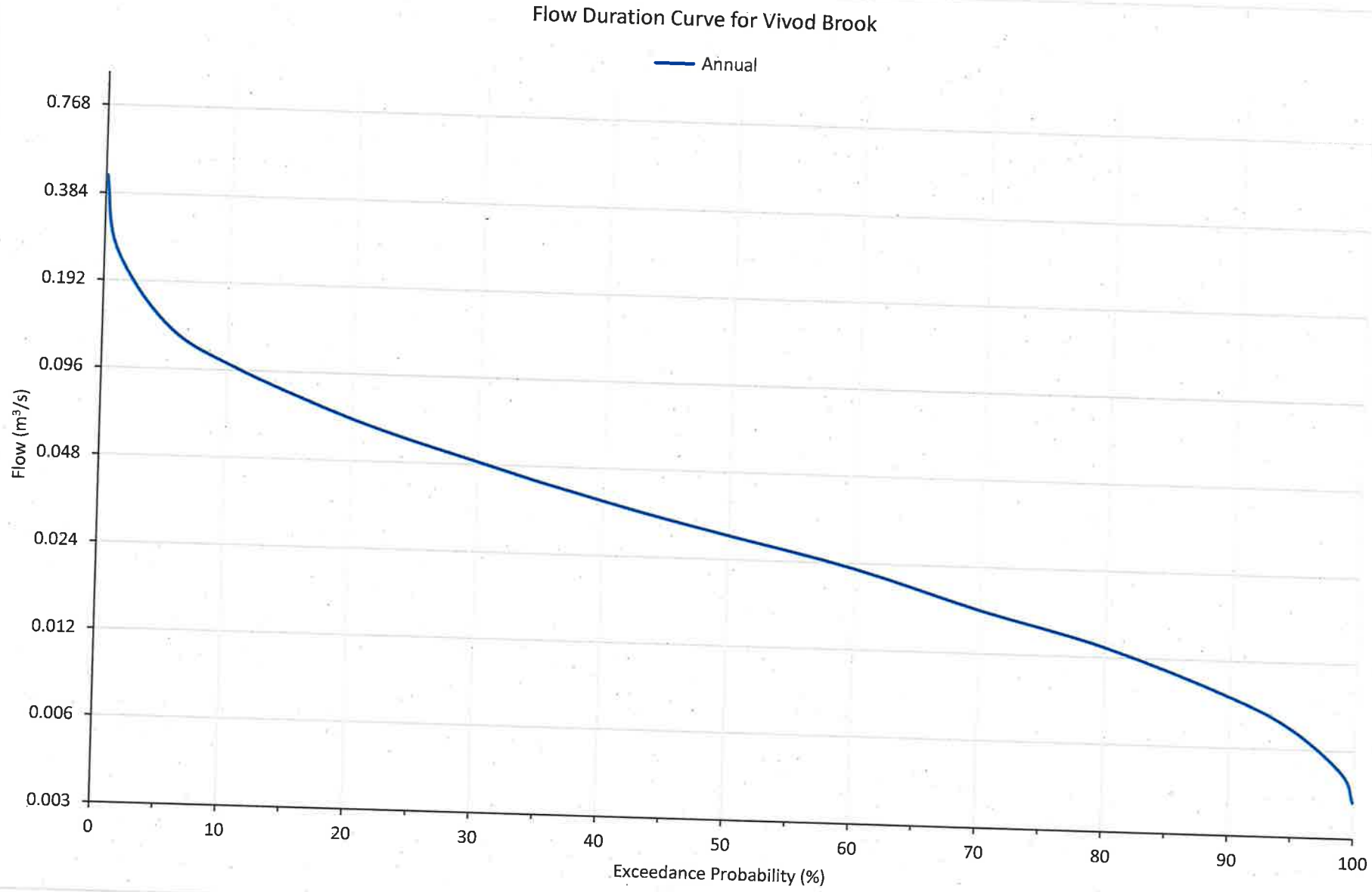
APPENDIX B
VIVOD BROOK LOWFLOWS2 OUTPUT

Table 1 - Annual and Monthly Flow Duration Values

Month	Q (l/s) by Percentile											
	5	10	20	30	40	50	60	70	80	90	95	99
Annual	138	101	67	49	37	29	23	17	13	9	7	5
January	175	140	107	87	72	60	50	42	34	26	21	17
February	166	131	91	68	54	44	37	31	26	21	18	14
March	136	105	76	61	50	41	33	27	22	18	15	11
April	94	72	50	40	34	29	25	22	18	15	12	10
May	71	53	37	29	24	20	17	15	12	11	9	8
June	43	34	25	20	16	14	12	11	9	8	7	6
July	42	28	19	16	13	11	10	9	8	7	6	5
August	71	48	30	22	17	13	11	9	8	6	5	4
September	91	64	41	30	22	17	14	11	9	7	6	5
October	143	108	75	59	46	36	28	22	15	10	8	5
November	161	129	95	72	59	48	40	32	25	18	13	8
December	183	144	106	84	68	54	45	37	30	23	19	13

Table 2 - Mean Monthly Flow Values

Mean Flows	Flow (l/s)
Annual	**45.40**
January	**77.90**
February	**64.90**
March	**55.30**
April	**38.20**
May	**27.80**
June	**19.00**
July	**16.40**
August	**22.90**
September	**29.60**
October	**52.70**
November	**65.70**
December	**75.90**


Flow Duration Curve for Vivod Brook
Annual
0.768
0.384
0.192
0.096
0.048
0.024
0.012
0.006
0.003
Flow (m³/s)
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)