5 September 2024

Emma Jones

Authorised on behalf of Natural Resources Wales

Wales Permitting Centre
Cathays Park
King Edward VII Avenue
Cardiff
CF10 3NQ

Dear Emma,

RE: Notice requiring further information, Application number: PAN-0022125

Thank you for your Schedule 5 Notice 3 dated 8/8/24 requesting further information regarding the Groundwater Risk Assessment provided in support of an environmental permit to discharge treated sewage effluent to land at Llyn Gwynant Campsite.

We have summarised the issues you have raised below together with our response to each issue.

In the interest of attempting to reach agreement, or at least narrow the points of difference on these issues, we kindly request a video conference with your technical expert(s) to discuss these matters. Please nominate your appropriate expert(s) and a series of dates/times that are convenient for your team to attend this session.

1. Groundwater Receptor and Environmental Standard

You have stated that our assessment "…*has focused on the Afon Glaslyn surface water body whereas* G*roundwater itself should be considered a receptor".* You have also requested a comparison of groundwater quality data in down-gradient boreholes with the relevant environmental standard or MRV.

We sought clarity on this aspect and Peter Garden relayed our query (via email on 30/8/24) asking why the groundwater quality within the relatively confined 300 m distance extending downgradient from the irrigation field to surface water (the Afon Glaslyn) is of concern given our assessment has shown there is a very minor (and undetectable) effect on the downgradient Afon Glaslyn. We queried NRW's concern with regards to any very localised non-hazardous pollutant (e.g. ammonium-nitrogen) impact, particularly considering any impacted groundwater is entirely confined within the property boundary. We queried whether NRW was concerned with the stygofauna within the groundwater system, or some other aspect? We requested guidance on this aspect from your expert.

On 1/9/24 Asta Smith responded "…*groundwater is the water stored in soil and rocks underground that are known as aquifers. It is a critical and often forgotten part of the water cycle. Groundwater is a vital*

resource, sustaining our springs, rivers, and wetlands, providing habitats for lots of species. It can be abstracted for drinking water or for use by industry and farms by using boreholes with pumps. Groundwater currently supplies about 5% of the public water supply in Wales but in rural areas, groundwater may be the only viable water source for isolated properties."

We don't disagree with this definition of groundwater; however, our query as to the basis for requiring concentrations of non-hazardous pollutants in the localised downgradient groundwater system to be less than the drinking water standard (DWS) or some minimum reporting value has not been addressed.

We are not disputing the need to protect groundwater resources generally, and certainly not where there is potential for adverse impact on any downgradient receiving environment or groundwater user. However, again, our conceptual groundwater model shows that the shallow groundwater from the wastewater irrigation field flows to the Afon Glaslyn, which intercepts the shallow groundwater to the west of the site, and with the lake intercepts the shallow groundwater to the south. We have also noted that the impermeable clay layer approximately 2 m below ground level provides an aquitard to prevent migration of the shallow groundwater to deeper aquifers. Therefore, any impacted groundwater is expected to be entirely confined within the site boundary and therefore the proposed discharge will have no adverse effect on groundwater beyond the site boundary. Furthermore, and again our risk assessment has outlined this, there are no downgradient groundwater users, with the nearest groundwater user being the Campsite water supply borehole located 300 m upgradient and abstracting from rock at a depth of 110 m.

We also note that the fine-grained shallow strata at the site (silt and clay) would not be considered a superficial aquifer in terms of the British Geological Survey definition of a superficial aquifer as "permeable, unconsolidated (loose) deposits, e.g. sands and gravels"[1]. To repeat commentary again from our risk assessment report, the shallow strata at the site would more appropriately be considered non-productive strata.

2. Attenuation and Dilution Model

While as discussed above we question why groundwater concentrations of non-hazardous pollutants downgradient of the irrigation field must achieve DWS, we have provided a theoretical assessment of attenuation and dilution in the groundwater system using the Environmental Agency's Infiltration Worksheet V3.0 (released March 2022). Our assessment of ammonium-nitrogen attenuation and dilution using this model and applying site specific data is presented as Attachment 1.

Please note that this assessment worksheet tool only assesses attenuation and dilution in the groundwater system and does not model ammonium-nitrogen uptake to the pasture crop within the overlying soil horizon of the 0.5 hectare irrigation field. As our assessment has outlined, ammonium-nitrogen is being removed from this system as harvested grass crop which is carted offsite (i.e. the irrigation field comprises of a cut-and-carry pasture system). Therefore, for this campsite irrigation system, which our risk assessment has noted is a seasonable operation with peak discharge times coinciding with periods of peak grass growth, the concentration of substance in discharge will not be the same as the concentration of the substance entering the infiltration system (i.e. refer to Infiltration Worksheet cell D11).

Further groundwater quality monitoring data is required to confirm the upgradient groundwater concentration used in the modelling (which has thus far been based on one sample only collected from

[1] https://www.bgs.ac.uk/datasets/aquifer-designation-data/

the existing upgradient borehole) and to compare this modelled downgradient concentration with monitoring data.

3. Monitoring Boreholes

We are supportive of ongoing monitoring of groundwater quality upgradient and downgradient of the irrigation field, even if a groundwater compliance point is not appropriate in this instance.

A layout plan showing the location of the 3 existing boreholes and 3 additional proposed boreholes is attached as Attachment 2. Please note that the naming of the monitoring boreholes/wells has been updated from previous reporting.

The existing Boreholes (MW2, M3 and MW4) have been used to assess groundwater flow direction and travel time as outlined in our risk assessment report. A sketch drawing of the construction of these existing boreholes is provided as Attachment 3, including proposed modifications to add bentonite and sealed and lockable surface boxes flush with ground level.

Additional Boreholes are proposed to be drilled as follows:

1. MW1 – Upgradient
2. MW5 – 100m downgradient of Irrigation Field
3. MW6 – 200m downgradient of Irrigation Field

These boreholes are proposed to be installed in October 2024 by Dragon Drilling Ltd using a hollow stem auger drilling method. These boreholes will be constructed in accordance with Environment Agency Guidance on the design and installation of groundwater quality monitoring points Science Report SC020093, January 2006. We request feedback from NRW regarding the proposed borehole locations prior to their installation.

Once installed, boreholes will be purged to develop the boreholes and water quality samples will be collected and sent to an analytical laboratory. As per Section 6.2 of our risk assessment repot, proposed test parameters are ammonium-nitrogen and orthophosphate as P. Bi-annual groundwater sampling is proposed. Please provide any feedback on the proposed sampling parameters and frequency.

4. Alternative Proposal for a Direct Surface Water Discharge

As an alternative to a land discharge, in early 2023 we understand that Peter Garden queried whether a permit for direct discharge of treated wastewater to surface water (the Afon Glaslyn) could be granted. We understand that feedback at this time was that a permit for a surface water discharge would not be granted, however no technical explanation for this response was provided.

While we consider the proposed land irrigation of treated wastewater to provide the best option to minimise adverse impacts on the receiving environment, for our records we request that you please provide an explanation was to why a surface water discharge cannot be granted subject to appropriate assessment of environmental effects demonstrating that impacts are suitably minor.

Yours sincerely,

Dan Garden	Tom Garden
Environmental Engineer	Hydrogeologist

Attachments:

1. Environment Agency Infiltration Worksheet (V3.0) – Ammonium-Nitrogen Attenuation and Dilution Model
2. Monitoring Borehole Layout Plan
3. Existing Borehole Details

Attachment 1: Environment Agency Infiltration Worksheet (V3.0) – Ammonium-Nitrogen Attenuation and Dilution Model

Groundwater risk assessment for treated effluent discharges to infiltration systems

Infiltration Worksheet , Release v3.0

Date of Workbook Issue: March 2022

This worksheet has been produced in combination with the document: H1 Annex J5 User Manual version 2.0 (Environment Agency, 2014).

IMPORTANT: To enable MS Excel worksheet, click the Microsoft Office Button  c. Excel Options, click Add-Ins. In the Manage box, select Excel Add-ins. Click Go. Select **Analysis ToolPak** and **Analysis ToolPak-VBA** (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Llyn Gwynant Campsite**			
Site Address:	**Nant Gwynant, LL554NW**			
Completed by:	**DG, TG**			
Date:	**4-Sep-24**		**Version:**	**2**
Substance	**Ammonium**			
Environmental Standard (C_T)	**0.5**	**mg/l**	**Origin of C_T:**	**DWS**

This spreadsheet has been developed as a tool to assist groundwater risk assessment for effluent discharges to infiltration systems. The following worksheets are available:

Site details entered on this page are automatically copied to each worksheet.
The worksheet uses the following colour coding:

	Worksheet option with pull down menu
	Data entry
	Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
	Data carried forward from an earlier worksheet
	Calculation

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

Infiltration Worksheet

Infiltration System

This sheet allows user to enter effluent concentration and details of infiltration system

Substance		**Ammonium**		From introduction sheet
Compliance value or environmental standard	C_T	**5.00E-01**	**mg/l**	From introduction sheet

Input Parameters	Variable	Value	Unit	Source of parameter value	
Standard entry					
Concentration of substance in discharge (entering infiltration system)	C_e	2.30E+00	mg/l	Average daily leaching losses to GW at 2.3 mg/L with proposed wastewater discharge at 5 mg/L and 55% removal in irrigation area via plant (grass) uptak	
Type of treatment plant		**Treatment plant**			
Water use and percolation rate (for use only with septic tanls and package treatment plants)					
Number of persons	p				*Not valid for this treatment plant option*
Water use		1.80E+02	litres/person/day		*Not valid for this treatment plant option*
Percolation rate	Vp		s/mm		*Not valid for this treatment plant option*
Specify discharge (Q1) or calculate based on use (Q2)		**Specified discharge Q1**			
Discharge rate	Q1	1.42E+01	m^3/d	Table 2 of GWRA	
Calculated discharge	Q2	0.00E+00	m^3/d		*Value specifed by user and not calculated*
Area of drainage fied and hydraulic loading					
Specify area of drainage field or calculate based on percolation rate		**Specify**			
Enter area of drainage field	A	5.00E+03	m^2	Area specified in Table 4 of GWRA	
Calculated area of drainage field	A	0.00E+00	m^2		*Value specifed by user and not calculated*
Calculated infiltration rate	Inf	2.84E-03	m/d		

Site being assessed:	Llyn Gwynant Campsite
Completed by:	DG, TG
Date:	4-Sep-24
Version:	2

Infiltration Worksheet

Attenuation unsaturated zone

This sheet calculates attenuation factor for the unsaturated zone; concentration at base of unsaturated zone and discharge consent limit

Contaminant		**Ammonium**		From introduction sheet
Compliance value or environmental standard	C_T	**5.00E-01**	mg/l	From introduction sheet
Concentration of substance in substance in discharge (entering infiltration system)	C_e	**2.30E+00**	mg/l	From infiltration sheet

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Drainage Layer					
Infiltraton rate	**Inf**	**2.84E-03**	**m/d**	From infiltration sheet	
Thickness of drainage layer	S_1	1.00E+00	m	Assuming water table at 1mbgl	
Water filled porosity	θ_1	3.00E-01	fraction	Estimate for silt.	
Bulk density	ρ_1	1.60E+00	g/cm^3	Estimate for silt.	
Calculated dispersivity	D_1	1.00E-01	m	calculated	
Option to select degradation	**Degradation occurs - sorbed and dissolved phases**				
Half life for degradation of substance	$t_{1/2}$	7.30E+02	days		
Calculated decay rate	λ_1	9.50E-04	days^{-1}	calculated (very low value set if no degradation)	*Calculated from half life (above)*
Enter method of defining partition co-efficient (using pull down list)	**User specified value for partition coefficient**				
Entry if specify partition coefficient (option)					
Soil water partition coefficient	Kd_1	1.00E+00	l/kg		
Entry for organic chemicals (option)					
Fraction of organic carbon (in soil)	foc_1	1.00E-02	fraction		*Not valid - User specified value used*
Organic carbon partition coefficient	Koc_1	1.00E+01	l/kg		*Not valid - User specified value used*
Soil water partition coefficient used in assessment	**Kd_1**	**1.00E+00**	**l/kg**	*Specified value*	
Retardation factor	Rfu_1	6.33E+00			
Unretarded travel time (no dispersion)	tu_1	1.06E+02	d		
Unretarded travel time (with dispersion)	tu_1	9.51E+01	d		
Retarded travel time (with dispersion)	tr_1	6.02E+02	d		
Attenuation factor	AFu_1	1.82E+00			
Unsaturated Zone					
Thickness of unsaturated zone below drainage field	S_2	1.00E+00	m	Assuming water table at 1mbgl	
Water filled porosity	θ_2	2.00E-01	fraction	Assumed at 0.2	
Bulk density of unsaturated zone	ρ_2	1.60E+00	g/cm^3	Guess	
Calculated dispersivity	D_2	1.00E-01	m	calculated	
Option to select degradation	**Degradation occurs - sorbed and dissolved phases**				
Half life for degradation of substance	$t_{1/2}$	7.30E+02	days		
Calculated decay rate	λ_2	9.50E-04	days^{-1}	calculated (very low value set if no degradation)	*Default value of 1/10^99 used*
Fraction of rapid flow through unsaturated zone	B	0.00E+00	fraction		
Enter method of defining partition co-efficient (using pull down list)	**User specified value for partition coefficient**				
Entry if specify partition coefficient (option)					
Soil water partition coefficient	Kd_2	1.00E+00	l/kg		
Entry for organic chemicals (option)					
Fraction of organic carbon (in soil)	foc_2	1.00E-02	fraction		*Not valid - User specified value used*
Organic carbon partition coefficient	Koc_2	1.00E+01	l/kg		*Not valid - User specified value used*
Soil water partition coefficient used in assessment	**Kd_2**	**1.00E+00**	**l/kg**	*Specified value*	
Retardation factor	Rfu_2	9.00E+00			
Unretarded travel time (no dispersion)	tu_2	7.04E+01	d		
Unretarded travel time (with dispersion)	tu_2	6.34E+01	d		
Retarded travel time (with dispersion)	tr_2	5.70E+02	d		
Attenuation factor	AFu_2	1.77E+00			
Total unretarded travel time	$tu_1 + tu_2$	1.76E+02	d		
Total retarded travel time	$tr_1 + tr_2$	1.30E+03	d		

Attenuation factor and discharge consent limit

Drainage layer attenuation factor	**AFu_1**	**1.82E+00**	
Unsaturated zone attenuation factor	**AFu_2**	**1.77E+00**	
Concentration at base of drainage layer	**C_{dl}**	**1.26E+00**	**mg/l**
Concentration at base of unsaturated zone	**C_{wt}**	**7.15E-01**	**mg/l**
		and	

Site being assessed:	Llyn Gwynant Campsite
Completed by:	DG, TG
Date:	4-Sep-24
Version:	2

Infiltration Worksheet

Dilution

This sheet calculates the dilution factor for groundwater dilution below the drainage field.
Substance concentration in groundwater and discharge consent limit

Substance		**Ammonium**		From introduction sheet
Compliance value or environmental standard	C_T	**5.00E-01**	**mg/l**	From introduction sheet
Source concentration	C_e	**2.30E+00**	**mg/l**	From infiltration sheet
Concentration at base of drainage layer	C_{wt}	**7.15E-01**	**mg/l**	From atten_unsatzone sheet

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	2.84E-03	m/d	From infiltration sheet	
Area of drainage field	A	5.00E+03	m^2	From infiltration sheet	
Entry for groundwater flow below site					
Length of drainage field in direction of groundwater flow	L	8.00E+01	m	**Survey Plan**	
Saturated aquifer thickness	da	3.00E+00	m	**From Test Pits, Blue Clay**	
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.00E-01	m/d	**Freeze & Cherry 1979 (Table 2.2, silt)**	
Hydraulic gradient of water table	i	3.70E-02	fraction	**From piezometric survey May 2023**	
Width of drainage field perpendicular to groundwater flow	w	6.25E+01	m	**Survey Plan**	
Background concentration of substance in groundwater up-gradient of site	Cu	4.00E-02	mg/l	**From upgradient monitoring at detection imit**	
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz	5.00E+00	m		*Not valid - Value calculated*
Calculated mixing zone thickness	Mz	3.00E+00	m		
Groundwater flow (mixing zone) below drainage field	Gw	0.69	m^3/d		

Dilution factor and discharge consent limit

Dilution Factor	**DF**	**1.048855634**		
Headroom Factor	**HF**	**1.044947183**		
Unsaturated zone attenuation factor	**AFu**	**1.77E+00**		From infiltration sheet
Concentration in groundwater below drainage field	C_{gw}	**6.83E-01**	**mg/l**	
		or		
Environmental Permit limit value	EPL_2	**1.681231515**	**mg/l**	

Site being assessed:	Llyn Gwynant Campsite
Completed by:	DG, TG
Date:	4-Sep-24
Version:	2

Concentration immediately downgradient of drainage field exceeds target concentration

Infiltration Worksheet

Attenuation in saturated zone

This sheet calculates attenuation factor for the saturated zone; substance concentration at downgradient compliance point and discharge consent limit

Input Parameters	Variable	Value	Unit	Source
Substance		Ammonium		From introduction sheet
Compliance value or environmental standard	C_T	5.00E-01	mg/l	From introduction sheet
Source concentration	C_o	2.30E+00	mg/l	From infiltration sheet
Dilution Factor	DF	1.05E+00		from dilution sheet
Unsaturated zone attenuation factor	AFu	1.77E+00		From atten_unsatzone sheet

	Variable	Value	Unit	Source of parameter value
Concentration in groundwater below drainage field	Cgw	6.83E-01	mg/l	from dilution sheet
Option to select degradation		No degradation occurs		
Half life for degradation of substance	hlz	7.00E+02	days	
Calculated decay rate	λ	1.00E-99	$days^{-1}$	calculated (very low value set if no degradation)
Width of drainage field	w	6.25E+01	m	from dilution sheet
Mixing zone thickness	Mz	3.00E+00	m	from dilution sheet
Bulk density of aquifer materials	ρ	1.80E+00	g/cm^3	*Estimate for silts*
Effective porosity of aquifer	n	1.00E-02	fraction	*Estimate for silts*
Hydraulic gradient	I_{corr}	7.94E-01	fraction	from dilution sheet (adjusted)
Hydraulic conductivity of saturated aquifer	K	1.00E-01	m/d	from dilution sheet
Distance to compliance point	x	1.00E+02	m	
Option to select time		Use steady state (recommended)		
Enter time	t	1.00E+02	days	time variable options only
Time since pollutant entered groundwater	t	1.00E+99		
Parameters values determined from options				
Partition coefficient	Kd	0.00E+00	l/kg	*see options*
Longitudinal dispersivity	ax	4.42E+00	m	*see options*
Transverse dispersivity	az	4.42E-01	m	*see options*
Vertical dispersivity	ay	4.42E-02	m	*see options*

Calculated Parameters	Variable	Value	Unit
Groundwater flow velocity	v	7.94E+00	m/d
Retardation factor	Rf	1.00E+00	fraction
Decay rate used	λ	1.00E-99	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	I_{corr}	7.94E-01	fraction
Rate of contaminant flow due to retardation	u	7.94E+00	m/d
Attenuation factor	AFs	1.46E+00	fraction

Attenuation and Dilution factors and discharge consent limit

Dilution Factor	DF	1.05E+00		
Unsaturated zone attenuation factor	AFu	1.77E+00		
Saturated zone attenuation factor	AFs	1.46E+00		
Concentration in groundwater at compliance point	C_{dcp}	0.481474429	mg/l	below compliance value
		or		
Environmental Permit limit value	EPL_3	2.45E+00	mg/l	Discharge limit for discussion with Environment Agency
Distance to compliance point		100	m	

Concentration at compliance point below target concentration

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Soil water partition coefficient — Kd — 0.00E+00 — l/kg

Define dispersivity (click brown cell and use pull down list)

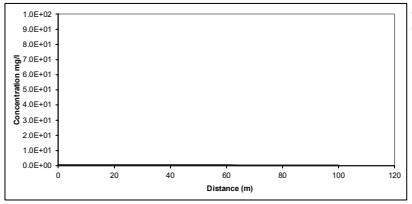
Dispersivity based on Xu & Eckstein (1995)

		Enter value	Calc value	Xu & Eckstein
Longitudinal dispersivity (m)	ax	1.00E-12	1.00E+01	4.42E+00
Transverse dispersivity (m)	az	1.00E-12	1.00E+00	4.42E-01
Vertical dispersivity (m)	ay	1.00E-12	1.00E-01	4.42E-02

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x



Calculated concentrations for distance-concentration graph

From calculation sheet

Distance m	Concentration mg/l
0	6.8E-01
5.0	6.83E-01
10.0	6.82E-01
15.0	6.77E-01
20.0	6.68E-01
25.0	6.55E-01
30.0	6.41E-01
35.0	6.27E-01
40.0	6.12E-01
45.0	5.98E-01
50.0	5.84E-01
55.0	5.72E-01
60.0	5.59E-01
65.0	5.48E-01
70.0	5.37E-01
75.0	5.26E-01
80.0	5.16E-01
85.0	5.07E-01
90.0	4.98E-01
95.0	4.90E-01
100.0	4.81E-01

Site being assessed:	Llyn Gwynant Campsite
Completed by:	0
Date:	0-Jan-00
Version:	0

Infiltration Worksheet

Summary of calculations for concentration of substance in groundwater

No input required,values taken from previous worksheets

Summary of compliance data, attenuation and dilution factors

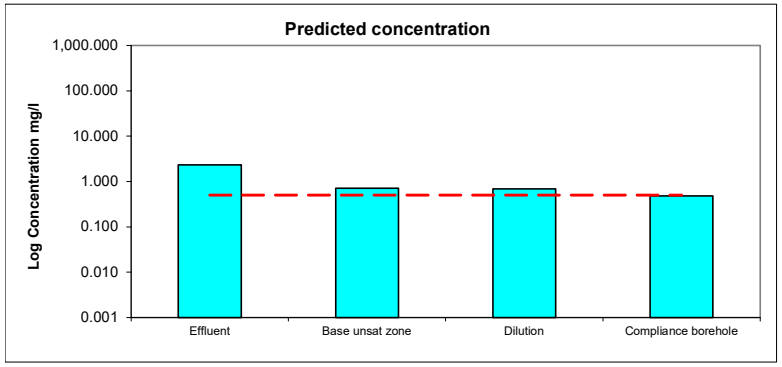
Substance		**Ammonium**	
Effluent concentration	C_e	2.30E+00	mg/l
Compliance value or environmental standard	C_T	0.50	mg/l
Distance to compliance point		100.00	m
Attenuation factor - unsat zone	AFu	1.77E+00	
Dilution Factor	DF	1.05E+00	
Attenuation factor- sat zone	AFs	1.46E+00	

Predicted concentrations at compliance point based on proposed effluent concentration

Concentration at base of unsaturated zone	C_{wt}	7.15E-01	mg/l	Attenuation in unsaturated zone only
Concentration in groundwater below drainage field	C_{gw}	6.83E-01	mg/l	Dilution taken into account
Concentration in groundwater at compliance point	C_{dcp}	4.81E-01	mg/l	Attenuation in saturated zone taken into account

Provisional Environmental Permit limit values

Based on attenuation in unsaturated zone	EPL_1	1.61E+00	mg/l	
Based on attenuation in unsaturated zone and dilution	EPL_2	1.68E+00	mg/l	
Based on dilution and attenuation in unsaturated and saturated zone	EPL_3	2.45E+00	mg/l	**Discharge limit for discussion with Environment Agency**



Simple hydrogeological calculations

(These calculations are provided to allow additional hydrogeological calculations to be undertaken if required)

Parameter	symbol		unit	justification
Hydraulic conductivity	K	1.00E+00	m/d	Literature value
Hydraulic gradient	i	3.70E-02	unitless	May 2023 piezometric survey
Effective porosity of aquifer	n	1.00E-02	fraction	Estimate
Thickness of saturated aquifer	b	2.00E+00	m	from test pits
Width of aquifer perpendicular to flow	w	1.00E+02	m	survey
Distance to receptor	x	1.00E+02	m	Distance to drain
Bulk density of aquifer materials	ρ	1.80E+03	g/cm^3	
Soil-water partition co-efficient	Kd	0.00E+00	l/kg	
Retardation factor of pollutant	R	1		

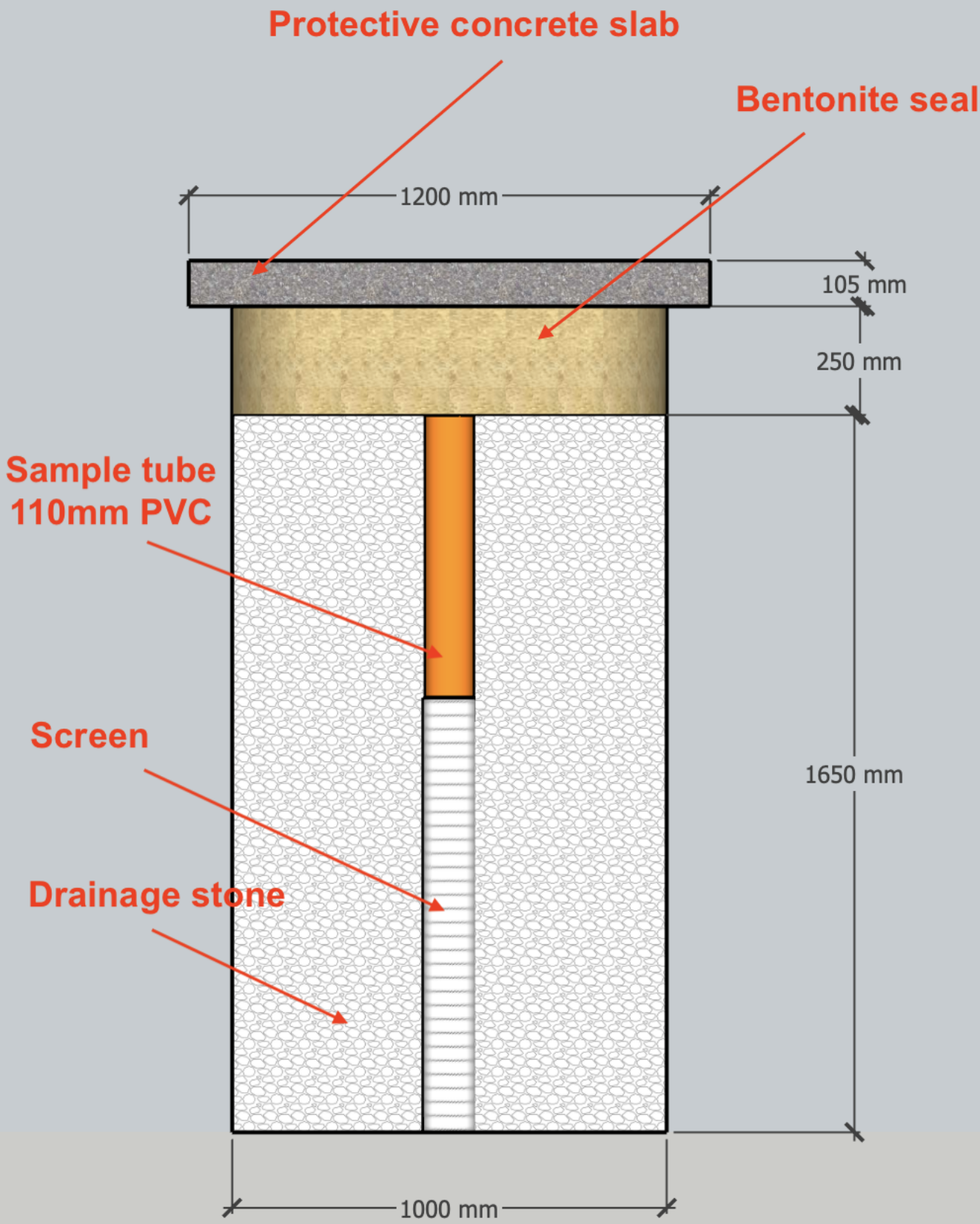
Groundwater flow velocity	v(GW)	4.29E-05	m/s	3.70E+00	m/day	1.35E+03	m/year
Time for groundwater to reach receptor	t(GW)	2.33E+06	seconds	2.70E+01	days	7.40E-02	years
Rate of groundwater flow through aquifer	Q	8.57E-05	m^3/s	7.41E+00	m^3/day	2.70E+03	m^3/year

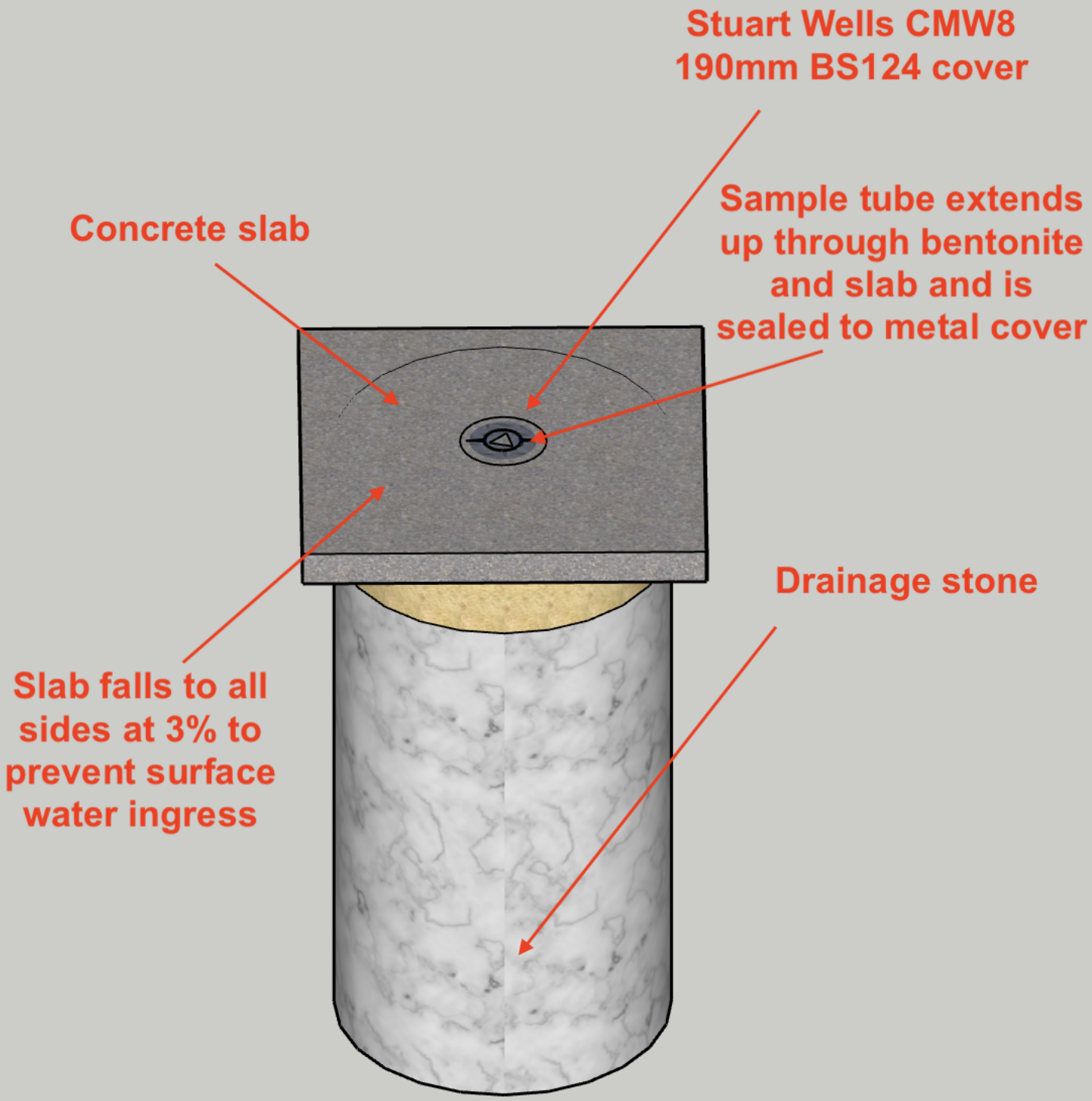
Contaminant flow velocity	v(contam)	4.29E-05	m/s	3.70E+00	m/day	1.35E+03	m/year
Time for contaminant to reach receptor	t(contam)	2.33E+06	seconds	2.70E+01	days	7.40E-02	years

Attachment 2: Monitoring Borehole Layout Plan


N
MW6
MW5
MW4
MW3
MW2
MW1
Afon Glaslyn
Camping Fields
Llyn Gwynant
0
50
100 m
Legend
Disposal Area
Small Streams
Drains
Calculated Groundwater Flow Direction (May 2023)
Predicted Groundwater Flow
Monitoring Wells
Existing
Proposed

Attachment 3: Existing Borehole Details


Protective concrete slab
Bentonite seal
1200 mm
105 mm
250 mm
Sample tube
110mm PVC
Screen
Drainage stone
1650 mm
1000 mm


Stuart Wells CMW8
190mm BS124 cover
Concrete slab
Sample tube extends up through bentonite and slab and is sealed to metal cover
Drainage stone
Slab falls to all sides at 3% to prevent surface water ingress