

APPENDIX 4

ENVIRONMENTAL PERMIT



Mr Andrew Edwards, Mrs Elaine Edwards
and Mrs Pauline Edwards
Orchard Court
Bodenham
Herefordshire
HR1 3JA

Our ref: EPR/UP3639UX/V003

Date: 4 December 2012

Dear Sir or Madam

Your permit variation is complete

Permit reference: EPR/UP3639UX/V003

Operator: Mr Andrew Edwards, Mrs Elaine Edwards and Mrs Pauline Edwards

Facility: Maund Court, Bodenham, Hereford, Herefordshire, HR1 3JA

Our determination of your application to vary your permit is complete. We're satisfied that you can continue to carry out your activities in accordance with the variation, without harm to the environment or human health. I enclose a notice showing the changes to your permit. Please keep this in a safe place with your other permit records.

This letter contains web links to other documents. If you aren't able to access these phone our Customer Contact Centre for help.

If you're not already familiar with our document 'How to comply with your environmental permit' please look at it, as this will help you understand how to meet the conditions of the permit. You can find this on our website at <http://publications.environment-agency.gov.uk/pdf/GEHO0410BSFX-e-e.pdf>

Please look at the table below and note any of the information or actions that apply to your permit.

If...	then..
the variation means you are now carrying out a waste operation or activity and need to submit quarterly waste returns on waste movements	you can get the forms you need from our website http://www.environment-agency.gov.uk/business/topics/waste/32176.aspx
Note This does not apply to permits that only have stand alone water discharge or groundwater activities.	If you do not have web access phone our Customer Contact Centre
you need to submit other returns	send these to your area office. Speak to your area officer to check local arrangements.
your variation has added an installation to your permit for the first time	we've enclosed the pollution inventory letter, notice and fact sheet



Rights of appeal

If you are not happy with any permit condition that has been imposed by the variation you may appeal to the Secretary of State for permits in England or Welsh Ministers for permits in Wales. If you want to appeal any condition imposed as a result of your application you must make your appeal no later than six months from the date of the variation notice. If you want to appeal any condition we've added as an Environment Agency initiated variation you must make your appeal no later than two months from the date of the notice.

Further information about making an appeal and the forms you will need are available from the Planning Inspectorate website or from the contact details below.

For England:

The Planning Inspectorate, Environment Appeals, Room 3/25 Hawk Wing, Temple Quay House,

2 The Square, Temple Quay, Bristol, BS1 6PN. Phone: 0117 3728726

Email: environment.appeals@pins.gsi.gov.uk

For Wales:

The Planning Inspectorate, Crown Buildings, Cathays Park, Cardiff, CF10 3NQ.

Phone: 029 2082 3866 / 389, Fax: 029 2082 5150, Email: wales@pins.gsi.gov.uk

You must send written notice of the appeal and the documents listed below to the Secretary of State or Welsh Ministers to the respective Planning Inspectorate address above. At the same time you must send us a copy of the notice and documents to

Victoria Balmer, Appeals Coordinator, Environment Agency, National Permitting Service, Knutsford Road, Latchford, Warrington, WA4 1HG.

Phone: 01925 542456

Email : victoria.balmer@environment-agency.gov.uk

The documents are:

- a statement of the grounds of appeal;
- a copy of any relevant application;
- a copy of any relevant environmental permit;
- a copy of any relevant correspondence between the appellant and the regulator;
- a copy of any decision or notice which is the subject matter of the appeal; and
- a statement indicating whether you wish the appeal to be in the form of a hearing or dealt with by way of written representations.

You may withdraw an appeal by notifying the Secretary of State or Welsh Ministers in writing and sending a copy of that notification to us.

If you have any questions about this permit phone our Customer Contact Centre on 03708 506 506. They will put you in touch with a local area officer.

Yours sincerely

Adam Grange
Permitting Support Advisor

Notice of variation with introductory note

Environmental Permitting (England & Wales) Regulations 2010

Maund Court Poultry Unit

A Edwards, E Edwards and P
Edwards (Trading as H.R Edwards &
Son)
Maund Court
Bodenham
Hereford
Herefordshire
HR1 3JA

Variation notice number
EPR/UP3639UX/V003

Permit number
EPR/UP3639UX

Maund Court Poultry Unit Permit number EPR/UP3639UX

Introductory note

This introductory note does not form a part of the notice

The following notice gives notice of the variation of an environmental permit.

This variation is to increase the number of poultry places from 229,000 to 420,000 broilers. Houses 1,3 and 4 will be extended and an additional house (house 6) will be built. All sheds will be retrofitted with high velocity roof fans and heat exchanger units. Each house will retain its gable end fans for use during hot weather (>22oC). There will also be additional facilities for feed storage and dirty water containment. An improvement condition has been incorporated into the permit to ensure a drainage plan is submitted as soon as locations of dirty water storage systems etc have been finalised. All heat exchanger condensate will be directed to the dirty water storage systems. The Site Condition Report has been amended to incorporate the additional area of land necessary to extend the site and a revised installation plan is included in Schedule 4 of this notice.

There are eight relevant nature conservation sites located within 2 kilometres of the installation. Three Special Sites of Scientific Interest (SSSI's) within 5km of the installation and one Special Area of Conservation (SAC) within 10 km of the installation. From detailed modelling it appears that the proposed development at Maund Court Poultry Unit, including retro fitting high level, high speed ventilation and heat exchangers to the existing sheds will be an overall environmental benefit, and shows a lower process contribution of ammonia emissions to the surrounding protected sites than the existing scenario at the farm.

The schedules specify the changes made to the original permit.

The status log of a permit sets out the permitting history, including any changes to the permit reference number.

Status log of the permit		
Description	Date	Comments
Application EPR/UP3639UX/A001	Duly made 31/01/2007	Application for an intensive farming poultry installation permit.
Permit determined EPR/UP3639UX/V002	11/12/2007	Issued to A Edwards, P Edwards and E Edwards Trading as H R Edwards & Son
Application EPR/UP3639UX/V002	Duly made 24/08/2010	Streamlined application to increase poultry numbers to 229,000 broilers.
Permit determined EPR/UP3639UX/V002	23/09/2010	Issued to A Edwards, P Edwards and E Edwards Trading as H R Edwards & Son
Application EPR/UP3639UX/V003	Duly made 05/09/2012	Application to increase numbers to 420,000 broilers and extend the site
Permit determined EPR/UP3639UX/V003	04/12/2012	Issued to A Edwards, P Edwards and E Edwards Trading as H R Edwards & Son

End of introductory note

Notice of variation

Environmental Permitting (England and Wales) Regulations 2010

The Environment Agency in exercise of its powers under regulation 20 of the Environmental Permitting (England and Wales) Regulations 2010 varies

Permit number
EPR/UP3639UX

Mr Andrew Edwards of Orchard Court, Bodenham, Herefordshire, HR1 3JA;
Mrs Elaine Edwards of Orchard Court, Bodenham, Herefordshire, HR1 3JA;
and.
Mrs Pauline Edwards of Maund Court, Bodenham, Herefordshire, HR1 3JA.
("the operator"),

to operate a regulated facility at

**Maund Court
Bodenham
Herefordshire
HR1 3JA**

to the extent set out in the schedules.

The notice shall take effect from 04/12/2012

Name	Date
Eirian Macdonald	04/12/2012

Authorised on behalf of the Environment Agency

Schedule 1 – conditions to be deleted

None

Schedule 2 – conditions to be amended

The following tables are amended as a result of the application made by the operator

Table S1.1 Activities

Activity listed in Schedule 1 of the EP Regulations	Description of specified activity	Limits of specified activity
Section 6.9 A(1)(a) Rearing of poultry intensively in an installation with more than 40,000 places	The rearing of poultry in a facility with a capacity for 420,000 broiler places.	From receipt of birds, raw materials and fuels onto the site, to removal of birds and associated wastes from site
Directly Associated Activity		
Carcass incineration	Operation of an Incinerator for carcass disposal Animal Health and Veterinary Laboratories Agency (AHVLA) approved < 50 kg/hr.	From receipt of raw materials, fuels and input of carcasses to release of combustion products to air and associated wastes removed from site

Table S1.2 Operating techniques

Description	Parts	Date Received
Application EPR/UP3639UX/V001	The responses to sections B2.3.1, B2.3.2, B2.3.3, B2.6.1, B2.6.2, B2.6.3, B2.7.1 and B2.7.2 in the Application.	31/12/07
Application Determined EPR/UP3639UX/V002	Streamlined application to increase numbers to 229,000 broilers.	24/08/2010
Application EPR/UP3639UX/V003	The responses to Section C2 of application form and referenced supporting documentation including site condition report and revised site plan.	16/08/2012 and 05/09/2012

Table S1.3 Improvement programme requirements

Reference	Requirement	Date
IC3	A finalised site layout plan incorporating house 6 shall be submitted to the Environment Agency for approval.	04/02/2013
IC4	A finalised site drainage plan incorporating house 6 shall be submitted to the Environment Agency for approval.	04/02/2013

Table S4.1 Point source emissions to air – emission limits and monitoring requirements

Emission point ref. & location	Parameter	Source	Limit (incl. unit)	Reference period	Monitoring frequency	Monitoring standard or method
Roof fan outlets on poultry houses 1-6 as shown on the site layout plan in Appendix 1 of Application EPR/UP3639UX/V003	---	Poultry houses 1-6	---	---	---	---
Gable end fan outlets on poultry houses 1-6 as shown on the site layout plan in Appendix 1 of Application EPR/UP3639UX/V003	---	Poultry houses 1-6	---	---	---	---
Chimney from carcass incinerator as shown on the site layout plan in Appendix 1 of Application EPR/UP3639UX/V003	---	Carcass incinerator	---	---	---	---
Exhaust from generator as shown on the site layout plan in Appendix 1 of Application EPR/UP3639UX/V003	---	Generator	---	---	---	---
Vent from oil tank as shown on the site layout plan in Appendix 1 of Application EPR/UP3639UX/V003	---	Diesel Tank	---	---	---	---

Table S4.2 Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Emission point ref. & location	Parameter	Source	Limit (incl. unit)	Reference Period	Monitoring frequency	Monitoring standard or method
Off-site swale/pond located to the west of poultry house 2, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Roof water from poultry houses 1 & 2 intercepted by french drains prior to discharge	---	---	---	---
Off-site ditch located to the south of poultry houses 3-6, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Roof water from poultry houses 3 – 6 intercepted by french drains prior to discharge	---	---	---	---
Off-site swale/pond located to the west of poultry house 2, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Water draining from yard adjacent to houses 1 & 2 (excluding poultry house wash out periods)	---	---	---	---
Off-site swale/pond located to the south of poultry houses 3-6, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Water draining from yard adjacent to houses 3 - 6 (excluding poultry house wash out periods)	---	---	---	---

Table S4.3 Point source emissions to land— emission limits and monitoring requirements						
Emission point ref. & location	Parameter	Source	Limit (incl. Unit)	Reference period	Monitoring frequency	Monitoring standard or method
Off-site swale/pond located to the west of poultry houses 1 & 2, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Roof water from poultry houses 1 & 2 intercepted by french drains prior to discharge	---	---	---	---
Off-site ditch located to the south of poultry houses 3-6, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Roof water from poultry houses 3 – 6 intercepted by french drains prior to discharge	---	---	---	---
Off-site swale/pond located to the west of poultry house 2, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Water draining from yard adjacent to houses 1 & 2 (excluding poultry house wash out periods)	---	---	---	---
Off-site soak away / ditch located to the south of poultry house 3, as shown on drainage plan in Appendix 1 of Application EPR/UP3639UX/V003.	---	Water draining from yard adjacent to houses 3 - 6 (excluding poultry house wash out periods)	---	---	---	---

Schedule 3 – conditions to be added

The following conditions are added as a result of the application made by the operator

2.6 Pre-operational conditions

- 2.6.1 The activities shall not be brought into operation until [the measures specified in schedule 1 table S1.6 A have been completed].
- 2.6.2 The operations specified in schedule 1 table S1.6 B shall not commence until the measures specified in that table have been completed.

The following tables are added as a result of the application made by the operator

Table S1.6A Pre-operational measures

Reference	Pre-operational measures –
PO1	At least 14 days before stocking poultry house 1 with 39,500 poultry places house 3 with 77,000 poultry places and house 4 with 77,000 poultry places the operator shall inform the Environment Agency that the dirty water storage system is complete, that the houses meet Best Available Techniques (BAT) and the high velocity roof fans and heat exchangers are in place.

Table S1.6B Pre-operational measures for future development

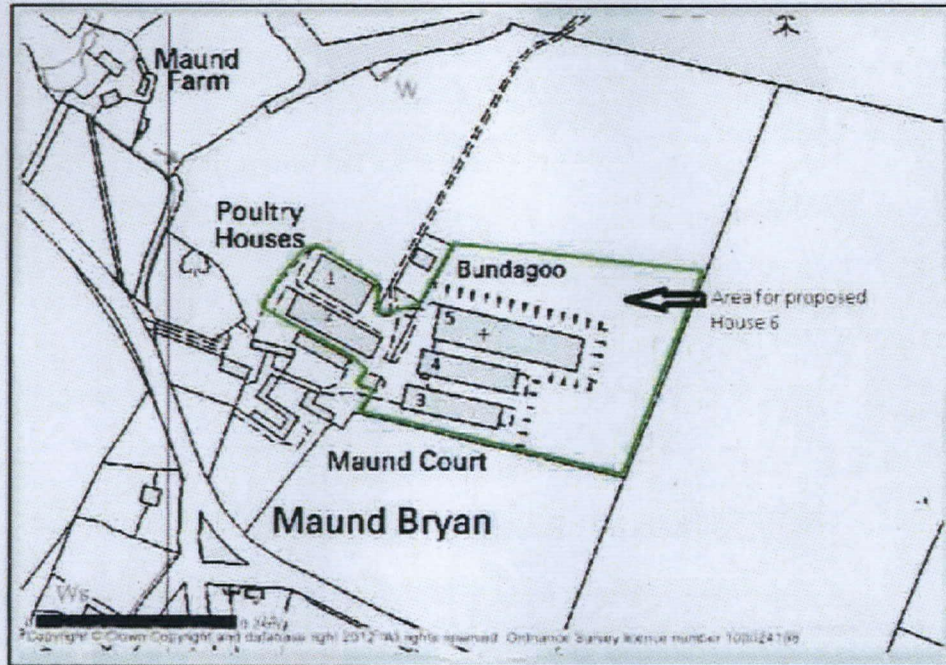
Reference	Operation –	Pre-operational measures
3	Stocking of house 6 up to 150,000 poultry places.	At least 14 days before stocking poultry house 6 the operator shall inform the Environment Agency that the dirty water storage system is complete, that the houses meet Best Available Techniques (BAT) and the high velocity roof fans and heat exchangers are in place.

Schedule 6 - Interpretation

"Animal Health" is the government agency that licences small on farm incinerators; formerly known as the State Veterinary Service.

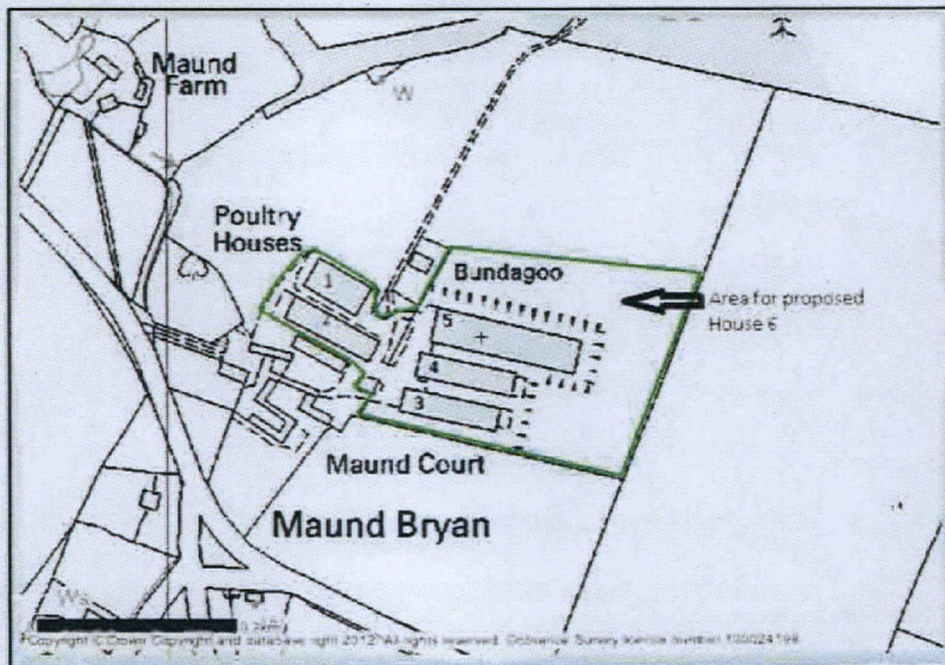
Schedule 4 – amended plan

Amended plan attached



Schedule 4 – amended plan

Amended plan attached



APPENDIX 5

DRAINAGE DETAILS

WASHING WATER AND ATTENUATION OF HEAVY RAINFALL AT MAUD COURT, BODENHAM, HEREFORDSHIRE, HR1 3JA

PROPOSALS

There are at present 5 broiler houses (Nos. 1-5) on a largely rectangular site arranged in 2 rows. A sixth house is planned on the northern side and significant extensions to houses 3, 4. Planning Permission for a small extension to number 1 and 3 have already been granted. The whole site falls markedly from north to south but levels out in the field between the unit and the public road to the south. The land will need levelling for the new house and the extensions to 3 and 4. Currently the drainage from houses 1 and 2 is via a swale to the roadside ditch. The current roof drainage to the ditch from houses 3, 4 and 5 will be maintained and continue while the clean water drainage from the new house 6 and the extensions to houses 3 and 4 will be to an attenuation pond and from there to the roadside ditch.

The present overall "hard" concrete/roof areas measure:-

Houses 1, 3 & 4 – 3 x 73m x 18m	=	3,942 m ²
House 2 46m x 24m	=	1,104 m ²
House 5 110m x 26m	=	2,860 m ²
Main concrete yards outside 3, 4 and 5		
78m x 15m (mean)	=	1,170 m ²
Rectangular area outside House 1 31m x 11m	=	341 m ²
Yard outside House 2 down to entrance		
48m x 11m mean	=	528 m ²
Strip between houses 1 and 2 70m x 6.5m	=	455 m ²
Strip to the south of House 2 44m x 5m	=	220 m ²
Yard at the back of house 2 25m x 9m	=	225 m ²
Total		10,845 m ²

The new development including the new house No. 6 and extensions to houses 1, 3 and 4 together with the associated yards will have a "hard" concrete yard/roof area as follows (see plan):-

House 1 (slightly extended) 55m x 18m	=	990 m ²
House 2 46m x 24m	=	1,104 m ²
House 3 158m x 18m	=	2,844 m ²
House 4 158 x 18m	=	2,844 m ²
House 5 110m x 26m	=	2,860 m ²
House 6 158m x 36m	=	5,688 m ²
Extended Main concrete yards outside 3, 4, 5 and 6		
139m x 15m (mean)	=	2,085 m ²

Rectangular area outside House 1	31m x 11m	=	341 m ²
Yard outside House 2 down to entrance	48m x 11m mean	=	528 m ²
Strip between houses 1 and 2	70m x 6.5m	=	455 m ²
Strip to the south of House 2	44m x 5m	=	220 m ²
Yard at the back of house 2	25m x 9m	=	225 m ²
Yard at each end of house 6	2 x 10m deep x 36m wide	=	720 m ²
Yards at eastern end of extended houses 3 and 4	2 x 10m x 18m	=	360 m ²
Total		=	21,264 sq. m ²

The overall "hard" area will virtually double. The whole site slopes in both directions but over the piece of land for the new house No. 6 it falls by 5-6 m from east to west and similarly from north to south.

The grass between and around the buildings will be drained separately as now.

This report aims to:-

1. Design and size an attenuation system for heavy rainfall for house 6 and the extensions to houses 3 and 4.
2. Size a dirty water system needs for the new house and extensions, thereby keeping the clean roof water separate from the dirty washing water.

Our understanding is that any new development should not make drainage systems any worse and so I am developing a scheme for the new house and the extensions to houses 3 and 4 together with the respective service yards. It would be very difficult to upgrade the drainage for the existing houses.

SOIL TYPE

Land in this area is mapped as Bromyard series which is a very widespread soil type throughout Herefordshire. This is formed from Lower Old Red Sandstone which is an ancient siltstone laid down in a fairly deep sea during the Devonian age around 400 million years ago. It is a moderately heavy soil which is fairly well drained in its natural state. The soil texture is silty clay loam all the way down to 65 cm depth. There are very few stones in any part of the profile and the almost complete absence of mottling confirms that drainage is no more than slightly imperfect. In-field drainage is seldom required. Below 65 cm the parent siltstone is less well weathered, giving it a shale-like appearance and the texture is slightly lighter at silt loam.

The drainage and soil type suggest a surface system to the ditch as now.

CLEANING OUT

Clearing out for the whole unit and washing down will take about 6-8 working days when parts or all of the service areas (see plan) at the front or back of the houses will be dirty. The birds will come in and go out using these areas as will the feed/manure and dirty washing water.

The spent litter based on wood shavings or chopped straw will be cleared out by Bobcats and loaded directly into lorries parked just outside the doors. There is in practice very little spillage. To ensure poultry disease guidelines are adhered to and for bio security the litter will be taken away from the unit immediately. No manure will therefore be stored on site, even for a short period. House 6 will have a new service yard at each end and houses 3 and 4 will have new service yards at the eastern end.

The washing water will largely run from the house directly to the dirty water tanks and so mostly will not be affected by rainwater over a period of days. However when the litter is being taken out of the houses the service yards for a short period be fouled. As soon as a yard becomes clean rainwater will be diverted in to the clean water system, so avoiding catching and needing to tanker away unnecessary rain water. Slopes in the concrete yard levels avoid the need for sleeping policemen which are awkward to live with. The new yards will drain away from the houses and will be slightly dished to the middle around the manholes to make this work. (see sketch).

WASHING DOWN

With the power floated level unobstructed concrete floors and brushing down the floor after clearing out the litter there is very little solid matter to be carried away with the washing water. The washing water will run directly from the houses in to the dirty water tanks. A tank is envisaged at each end of house 6 and a tank can be shared for the extensions of houses 3 and 4. In practice there is little solid matter to block drains. However it is too far to expect the washing water to drain from one end of house 6 to the other end without potential blockages. Most of the houses will take about 8 hours to be fully washed down by a specialist contract gang, house 6 being nearer 2 days. There are likely to be two pressure washer pumps, with often one working in one house and one in another each operating 2 pressure washing lances. Each individual lance delivers about 15 litres per minute. They are likely to be running for 70% of the time and so the total volume of water used in an 8 hour day will be approx. 20 cu. metres. In practice because of the warm temperature of the concrete floor inside the houses some of this water evaporates.

We also need to allow for heavy rainfall on the concrete service areas during the cleaning out period. The unit will need 3 new similar sized dirty water tanks. If we allow for 25mm of rainfall during the working day the rainfall volume for each tank linked to House 6 will be:-

$$36\text{m} \times 10\text{m (mean width)} \times 25\text{mm} = 9 \text{ m}^3$$

The dirty water tanks will each therefore need to hold **29 m³** (6,380 gallons)

The tank to be shared by the extensions to houses 3 and 4 will need to serve each yard in addition to the washing water

$$2 \times 10\text{m} \times 18\text{m} \times 25\text{mm} = 9 \text{ m}^3$$

Combined with the washing water this again gives a total of **29 m³** (6,380 gallons)

Rainfall of this intensity is relatively uncommon so the volumes of water to be taken away on a daily basis will only rarely be significantly increased by piping in the service yard area. If exceptionally heavy rainfall should occur during the day the water can be tankered away by the contractor part way through the day and safely disposed of. A level indicator in the tanks, easily visible from the buildings and yards, would help to quickly identify that a tank needs emptying. The tanks will be emptied at the end of each working day and the washing water spread on the farm's own agricultural land.

Hence for 7 weeks in every 8 or 9 weeks the outside concrete will be clean.

Within each manhole in the service yards there will be two outfall drains, one to the dirty water tank and one directly to the clean water system and finally the attenuation/balancing pond and finally the ditch. These drains need to be clearly marked and blocked in one position or the other with a diverter valve. The farm, contractor's staff and the industry as a whole are well versed in this procedure with many other similar units.

Being on the edge of the concrete yards there will be ready access to the tanks and they will be much more than the necessary 10m from a ditch.

HOUSE VENTILATION

The present houses will over time be converted to high velocity ridge outlets with side wall inlets. The new houses and extensions will have high speed exhaust fans in the ridge which means that stale air is carried upwards at high speed and is not deflected down the roof line which encourages dust to settle. From experience there is unlikely to be any measurable volume of dust requiring the new house roofs to be periodically washed down in the future. Any odours also tend to be carried away from the site by the prevailing wind.

SITE DRAINAGE

The new house and house extensions plus the new service yards will cover a combined area of 9,798 m². Reference has been made to the soil type but if I consider the agricultural drainage figures for poorer, i.e. heavier land, a figure of 2.00 litres/sec/ha over ha this gives a site drainage figure of virtually 2 litres/second for the total new "hard" area. Normally with EA permission I have taken a flow of 2 litres/sec. as the minimum flow in to the ditch to limit the chances of blockages occurring.

RAINFALL DATA

The new houses and yards will have no gutters. The rain will fall in to French stone drains with a perforated drainage pipe in the bottom. (see sketch). Some infiltration in to the surrounding soil may occur but this has not been allowed for. For the northern drain on the side of new house 6 it may be sensible to line the sides of the drain with plastic to minimise the chance surface water from the field above entering the system.

The intensity of local rainfall for the 1 in 100 year storms can be summarised as follows:-

Storm Duration	Depth of Rainfall mm	Total Volume of Rainfall on 9,798 m ² m ³	Volume allowing an extra 20% for global warming m ³	Less volume draining away at 2 litres/sec. m ³	Buffer Pond requirement m ³
5 mins	13.4	131	158	0.2	158
15 mins	24.3	238	286	2	284
30 mins	32.0	313	376	4	376
60 mins	40.1	393	471	7	464
2 hours	48.5	475	570	14	556
3 hours	53.5	524	629	22	607
4 hours	57.0	558	670	29	641
6 hours	62.2	609	731	43	688
12 hours	71.9	704	845	86	759
24 hours	82.8	811	973	173	800
*30 hours	86.2	844	1,013	216	797
36 hours	89.7	878	1,054	259	795
48 hours	94.8	929	1,114	346	768
72 hours	102.4	1,003	1,204	518	686
96 hours	110.2	1,080	1,296	691	605
8 days	140.1	1,373	1,647	1,382	265
25 days	215.8	2,114	2,537	4,320	Nil

These figures have been obtained from the ADAS Officers on secondment from the Meteorological Office. * Estimated figures over the data provided.

There are it appears several periods when the excess over drainage to the ditch at 2 litres/sec. gives a similar figure peaking at about **800 m³** after 24 hours.

The balancing pond therefore needs to measure:-

$$\text{Surface area } 26\text{m} \times 26\text{m} = 676\text{m}^2$$

Depth 1.5m

Slope on side walls 1 in 1.5 satisfactory with grassed banks.

Base area $21.5\text{m} \times 21.5\text{m} = 462\text{ m}^2$

Volume to the surface mean $569^2 \times 1.3\text{m} = 853\text{ m}^3$

The extra volume will allow for rainfall on the pond itself. In addition there will be some soaking away in the balancing pond. The pond could be any shape to suit the site. For most of the time the pond will just be a grass depression in the ground. The pipe outfalls will be kept clear and managed by Mr. Andrew Edwards.

Based on a design flow of 2 litres/sec. and a fall of 1 in 150 the final pipe size in to the ditch will need to be of a 75mm diameter (Ref. Polypipe chart open Inlet corrugated plastic pipe). The pipe will be in use all of the time for the site drainage so any blockage should be readily spotted.

A purpose built and sized hydrobrake would minimise the chance of a blockage (e.g. Ref Hydro International www.hydrointernational.biz.) The intake pipes would need to be sized and specified at the design and manufacturing stage together with the required outflow of 2.0 litres/sec. Basically a hydrobrake consists of an inlet, an outlet and a baffled "volute" through which water is introduced tangentially. The outlet opening is 3-6 times greater than for conventional flow thus reducing the chance of blockages. In this case a hydrobrake is not thought to be necessary with the size of pipe suggested. A blockage is unlikely.

BUILDING DRAINS

Drainage pipe laid in a stone trench with a 1 in 200 fall will deliver up to:-

65mm	1.3 litres/sec (4.7 cu. metres/hour)
75mm	1.7 litres/sec (6.3 cu. metres/hour)
85mm	2.25 litres/sec. (8.10 cu. metres/hour)
100mm	3.2 litres/sec. (11.5 cu. metres/hour)
115mm	4.5 litres/sec (16.2 cu. metres/hour)
135mm	6.8 litres/sec (24.4 cu. metres/hour)
155mm	9.5 litres/sec (34.2 cu. metres/hour)
180mm	16 litres/sec (57.6 cu. metres/hour)
210mm	22 litres/sec. (79.2 cu. metres/hour)
250mm	31 litres/sec. (111.6 cu. metres/hour)
300mm	50 litres/sec. (180 cu. metres/hour)
350mm	76 litres/sec (274 cu. metres/hour)
400mm	130 litres/sec (468 cu. metres/hour)

Ref. Polypipe flow chart Restricted and open inlet -corrugated plastic pipes

The design needs to cope with the 30 minute storm of rain 1 in 100 years plus 20% for global warming. For each half roof also serving an equal share of the yards at each end the area (3,204 m²) the resulting rainfall volumes are:-

Storm Duration	Intensity mm/hr (Depth of Water mm)	Volume of runoff on roof area of 3,204 m ² m ³	Volume allowing an extra 20% for global warming	Discharge through 300mm over this period m ³	*Volume surplus if any m ³ 300mm	Discharge through a 350 mm pipe over this period m ³	Volume surplus if any m ³ 350mm
15mins	99.2 (24.8 mm)	79.5	95.4	45	50.4	69	26.4
30mins	65.2 (32.6mm)	104.5	125.3	90	35.3	137	Nil
1 hour	40.9 (40.9mm)	131.0	157.3	180	Nil	274	Nil

A 300mm pipe is not large enough and so a 350mm pipe will be needed. The pipe could be graduated such as first 1/3rd 250mm, 2nd 1/3rd 300mm and the final 1/3rd 350mm. These will need to run down individually to the pond unless a ditch was constructed to act as a carrier.

The extensions to houses 3 and 4 are substantially smaller and only 1 service yard is involved for each house. The ½ roof areas plus ½ the surface yard totals 855 m².

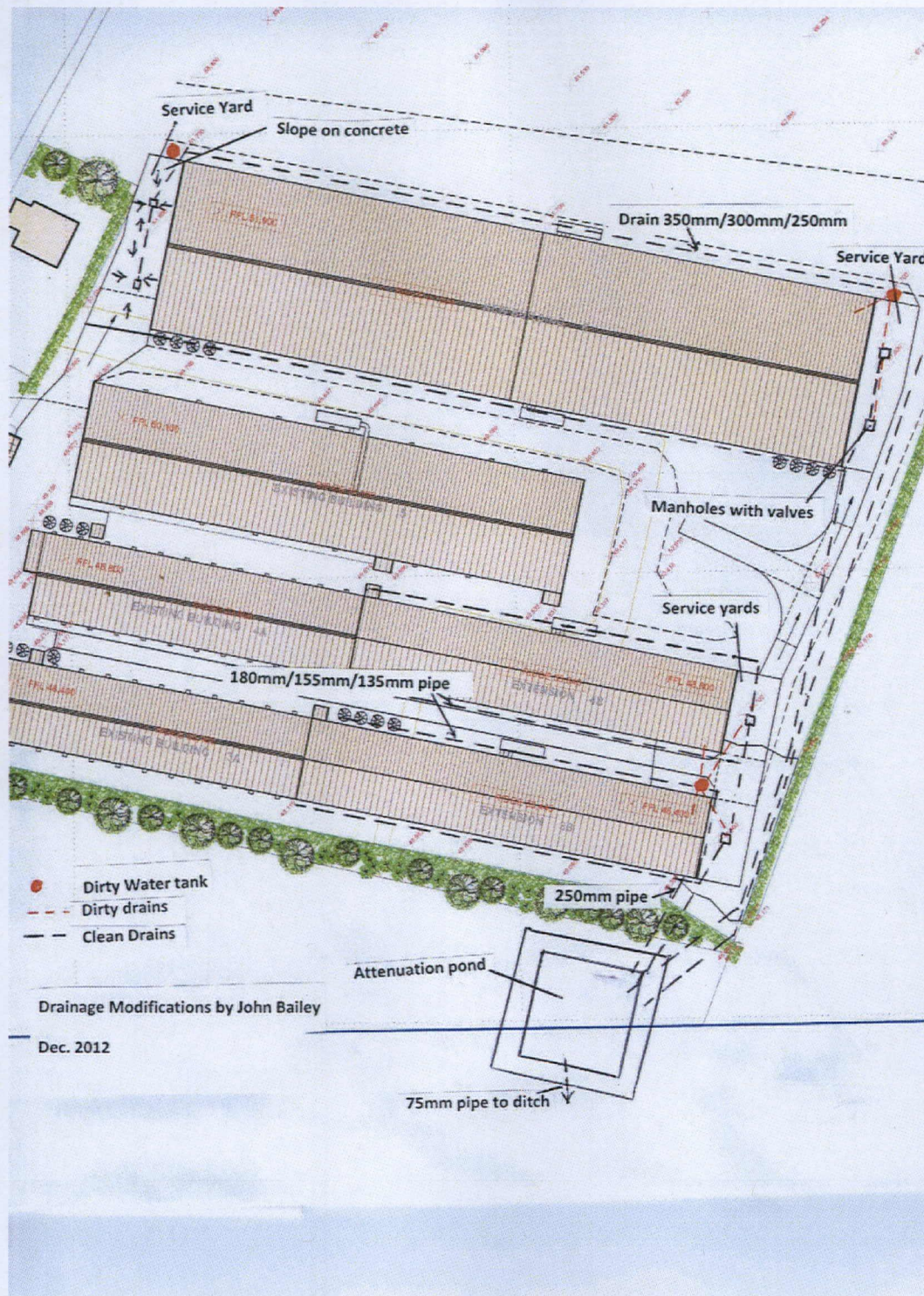
Storm Duration	Intensity mm/hr (Depth of Water mm)	Volume of runoff from 855m ² m ³	Volume allowing an extra 20% for global warming	Discharge through 180mm pipe over this period m ³	Volume surplus if any m ³ 180mm	Discharge through a 210mm pipe over this period m ³	Volume surplus if any m ³ 210mm
15mins	97.2 (24.3)	20.8	24.9	14.4	10.5	19.8	5.1
30mins	64.0 (32.0)	27.4	32.8	28.8	4.0	39.6	Nil
1 hour	40.1 (40.1)	34.3	41.1	57.6	Nil	79.2	Nil

In addition there is the void capacity within the stone surrounding the drains. The volume for each pipe will be 85m long x 400mm wide x 650mm mean depth = 22 cu. metres. If there is a 20% void area in the stone this will give the further 4 cu. metres of temporary storage capacity making the 180mm pipe just adequate. There will be 4 of these for the 2 houses. Again they could be graduated with the first 1/3rd 135mm, the second 1/3rd 155mm and the final 1/3rd 180mm. They could be linked to direct the water to the attenuation pond i.e. 2 x 180mm feeding a single 250mm pipe (see sketch).

SUMMARY

With the above drainage and balancing pond in place the heaviest rainfall falling in 100 years on the new developments can be safely contained and metered in to the roadside ditch as the rainfall and so the surplus water subsides.

John Bailey
Acorus Mechanisation Consultant
December 2012



APPENDIX 6

**ODOUR MODEL
REPORT**