Application for Environmental Permit EPB3.5 (Version 4)

Buckles Farm, Kaber, Kirkby Stephen. Cumbria

Pre Application Ref.EPR/GP3001LP/A001

BF Appendix 6 Swale Design Criteria

Reflecting on the Eden District Council’s policy and the general acceptance across Cumbria that all major developments with potential surface water run off needs *to attenuate rainwater flows*, this aspect is taken into consideration in the surface water management design.

The requirements of the EA to treat *lightly contaminated surface water* is additional to this requirement but core to the PPC permitting process.

Consideration was given to the range of “SUDs” structures but all apart from swales involves the presence of permanent or semi- permanent water. This is not acceptable in a free range area for biosecurity reasons (ie attraction of wild fowl) and therefore a swale system, adapted to have a greater surface area (and less deep) is believed to be appropriate for this installation.

There are therefore two ‘types’ of SUDs necessary for the site but both addressed through the construction of “swales”:-

1. SUDs to balance flows from the site of clean water discharging preferentially to soakaway with a high level overflow to the river network / field drainage system not requiring treatment (eg. clean roof water) and
2. SUDs to treat lightly contaminated surface water from areas intermittently contaminated to a small degree. Eg. concrete pads at each end of the house, below extraction fans, front concrete pads and (for the proposed site), drainage beneath the scratch areas.)

The principle being proposed for houses 2a and 2b, is that clean roof water will be directed to the secondary swale and either soaks away or in the event of heavier storms, discharges to the watercourse.

Drainage from all other areas, considered as “lightly contaminated” will discharge to the primary swale which has no overflow. This will ensure that any “first flush” is retained, absorbed onto grass and subsequently metabolised. In the event of protracted rainfall events the first swale will fill up and overflow at a high level to the secondary swale. Inlet water at this stage will be low in contamination and therefore overflow is taken close to the inlet end. The process follows that of storm sewage management with similar analogies.

The existing unit is already served by a swale, built with the poultry unit in 2013. The proposed site will have a separate swale system. The new one will be sited to the north western end of the site and in an east west orientation.

Surface Areas to be treated.Proposed houses 2a and 2b

**Roof water**

1 No (new) buildings. Roof area = 111.7m x 24m = = 2680.0 m2

1 No. egg packing Central Services = 24m x 9.6 m = 230.4 m2

1 No. (new) covered manure store = 30m x 15m = 450.0 m2

**Total =3360.4m2**

**Front yard surface water**.(east end)

Concrete pad at the front of the site. Measures approx.

20m x 5m = 100m2

**Front yard surface water**.(east end)

Stone apron + concrete pad, all drained.

At front of site. This will measure 24m x 15m **= 360m2**

**West Gable end Concrete pads**

1 No. 24m x 6m wide = 144m2  **= 144m2**

**Scratch area**

2 No. (one each side of building 112m x 7m= 560m2 x 2 **=** **1568m2**

**Total area to be treated is therefore** :- **5432.4m2**

Volume to be treated = 5432 x 0.02m (rainfall) = **108.64 m3**

Treatment Factor=1

Swales will therefore have capacity for and treat :- **108.64m3**

It is planned to have two No. swales serving the 2 new houses. Therefore each will *nominally* be **54m3.**

Depth of swales proposed is less than the nominal 600mm because the siting of the swale is adjacent to the *free range* and there is a need for it to be dry most of the time.

Increasing the surface area and therefore promoting evaporation and evapo-transpiration is preferred.

Max working depth of 0.4m has been chosen to speed up drying process.

Cross section of swale (below) is = 0.4m max depth x 3.2m wide (total width is 4.4m)) =**1.28m2** (1:3 slope)

1

0.4m

3

1.2m

2.00m

1.2m

Total length of swale is 108.64/1.28 = **84.88m long, (**Divided by 2 each is 42.44m long)

In isolation the roof water does not need treatment and requires only buffering of flows.

Area of roof is 3360.4m and with rainfall of 0.02m Volume of swale just for roof is 67m3 .. With same cross section of 1.28m2 ,length needs to be 52.5, say 53m long.

It is suggested therefore that the first swale basin is 84.88-53m **= 31.88 (say 32m long)**

and the second swale **= 53m. long**

\* Depth dimensions are all below invert level of inlet pipe to allow free fall into swale.

*Overall design*

* *Two swales, to the north east of new house, towards the northern end but in ground above water table.*
* *First swale 32m long, 2nd 53m long*
* *Cross- section of 1:3 batter, 40 cm max. depth, base 2.0m.*
* *Inlet pipe is 400mm above base level and protected by stone cill. Inlet diam. pipe approx. 300mm diameter.(smooth walled pipe)*
* *Weir installed at inlet end sealed into base and sides to effect equal distribution of flow across the swale*
* *Check dam provided half way along 2nd swale at 27m from inlet.*
* *Outlet pipe at base of swale also sat on stone cill (150mm diam.)*
* *Max. Fall along swale 1 in 200*
* *Overflow weir between blind ended 1st swale and second swale with a final outfall set at invert level equivalent to maintaining 0.4m depth.*

Design Criteria and Method of build

Excavate to 750mm store soil separately.(must be >550mm below invert of inlet pipe.)

Make side slopes no greater than 1:3.

Excavate 2.0m wide floor. Line sides and base with top soil to a depth of 150mm to 200mm on the base. Compact. Overall final depth from swale base to invert level of inlet pipe, needs to be > 400mm.to ensure free fall from pipe. Floor will need compaction, based on natural free draining nature of native soil. Suggest 1 No. check dam half way along second swale at 27m

Outlet drain at distal end from inlet of 2nd swale to be at ground level and connected to main farm drainage ditch network that leads to Bracken Gill.

Compact sides with vehicle movement to reduce permeability.

Spread top soil over all swale and add fertiliser or lime to attain correct ph.(BS 3992: 1994” general purpose topsoil spec.

Grass the swale with a mixture that requires little maintenance and provides a dense, well - knit sward.

Eg. Mixture of 70% creeping red fescue, 20% smooth stalked meadow grass and 10% creeping bent. *(Apply seed at 24 gms. /m2 or 240 Kg / Ha.)*

Assuming 1m grass apron around each, total area / swale is:-

6.4m x 85 =544m2 in total

Requires 544x 24g =13,056gms or 14 Kg seed.

**Existing swale**

Design criteria for existing swale unknown and therefore the theoretical size is compared with actual.

**Roof water**

1 No buildings. Roof area = 169m x 15.3m = = 2586 m2

**Total =2586m2**

**East yard surface water**.(east end)

Concrete pad at gable end. Measures approx.

15.3m x 5m =**76.5m2**

**West gable end**

Stone apron + concrete pad, all drained.

This will measure 10m x 15m **= 150m2**

**Scratch area**

2 No. (one each side of building)

1. 169m x 7m **=** **1183m2**

2. 169m x 20m **=3380m2**

**Total area to be treated is therefore** :- = **7376 m2**

Volume to be treated = 7376 x 0.02m (rainfall) = **147.5 m3**

Treatment factor of 1. Therefore volume to be treated is 148m3

Existing swale has volume of approx. 69m3 which is approx. half the recommended size. However, the efficacy of this swale and the operational observation of the swale quickly soaking away after storm events rather than overflowing, suggests that this facility provides satisfactory treatment.

It should be noted that the northern scratch area is extensive and accounts for approx. half the total area whereas the level of droppings on the outer part of this, adjacent to the free range is likely to be only lightly contaminated. A normal width for reasonable collection would be 7m. This would reduce the capture area to 6578 m2 and a volume of 131m3  Further, it should be recognised that the existing swale serves half a roof area that does not require treatment because of ‘high velocity roof fans’ serving that half of the house.

It is suggested therefore, that this remains as originally designed and installed pending further routine monitoring which will establish the need for extension at some time in the future.