CROWNHILL TOPSOIL – DRAINAGE STRATEGY

Unit 1009, Caerwent Army Training Estate, Caerwent

Document Control:

01	13/01/20	Provide further details on drainage in response to NRW Schedule 5 Notice.
Rev.	Date	Description

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Date:	12/02/19	14/02/19	04/03/19
Signature:			

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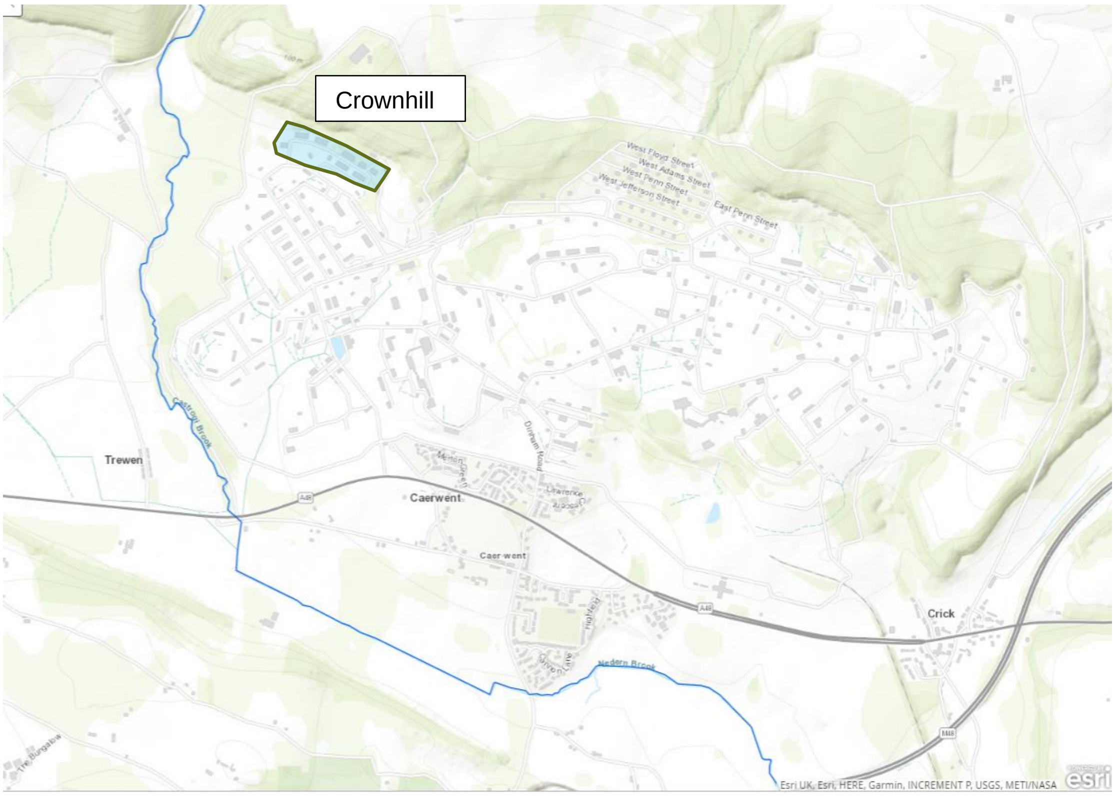
Site Sensitivity:

Crownhill Topsoil and Aggregates site at Unit 1009 of the Caerwent Army Training Base, is underlain by a Principal Aquifer which is designated as an SPZ1 Source Protection Zone.

The underlying soils and strata beneath the site have been risk assessed as being permeable and a risk rating in respect of the underlying aquifer, has therefore been assigned to the site as High, without appropriate controls in place to mitigate the risks from the operation of an inert waste management facility.

There is no active surface water drainage at the site. Operational areas of the site are either surfaced with concrete or compacted stone. Some areas are soils covered with vegetation. Surface water runoff either infiltrates into non-hard surfaced areas of the site, or flows into a drainage ditch running along the sites southern boundary, which starts in the centre of the site and flows to the west into the Army Training Base drainage system. This finally drains into the Castrogi Brook approximately 450m to the east of the base. This merges with the Nedern Brook, which discharges into the Servern Estuary SSS SAC approximately 4.5km to the south.



Route of Castrogi / Nedern Brook

This drainage strategy therefore proposes controls to safeguard the underlying aquifer, the surface water drainage system within the Army Training Base, the Castrogi Brook and downstream controlled waters. This is to be achieved by, hydraulically isolating all wastes / materials which have potential to leach contaminants into the underling aquifer, specifying pollution control measures to remove contaminants from water prior to discharge into the surface water system and to ensure runoff is efficiently collected and channelled to these treatment locations.

Inert wastes will be stored in the open on a combination of permeable and impermeable surfaces. Runoff from these areas will be treated for suspended solids and hydrocarbons as these are the key identified pollutants. Contaminated wastes will not be permitted on the site and hence there is no potential for soils to leach contaminants. If contaminated soils are admitted to site, they will either be removed immediately or, if they have been tipped and the delivery vehicle has left site, will be moved the quarantine building where they can be hydraulically isolated and will be removed from site as soon as possible.

Despite the presence of the SPZ1 underlying the site and the requirements this places on the design and operation of the facility, the site is ideally located in terms of access to the trunk road network and distance from sensitive residential receptors.

Drainage Strategy Rational

This Strategy has been prepared in line with Pollution Prevention Guidelines 3 (PPG3) Use and design of oil separators in surface water drainage systems (this has been withdrawn but much of the information is still relevant), the ‘Approach to Groundwater Protection’ guidance and position statement G4 and with the Oil Storage (Wales) regulation. This Strategy should be used in conjunction with Drawing Number EV170606/CHD03 – Site Drainage.

Crownhill Topsoil propose to operate an Inert Waste Management Facility at Unit 1009 of the Caerwent Army Training Base. This facility will store and process inert construction and demolition wastes into recycled soils and aggregates

Drainage from areas which are not used for the storage or processing of waste and which are not trafficked by vehicles will be diverted away from the site to minimise the volume of water to be treated.

Drainage at the site takes the form of kerbed concrete surfaced areas, covering an area of approximately 12,000m^2. These areas are drained using surface drainage, where runoff is allowed to flow along the kerb line across the site and then into the relevant attenuation pond. An open above ground system has been used as a piped system is susceptible to blockage due to the build-up of soils due to the nature of the use of the site. Kerbs are standard 914 x 125 x 255mm bullnosed concrete kerbs in straights and radiuses. The average upstand (height of kerb exposed above the adjacent concrete surface) is between 50mm and 70mm. Due to the level nature of the concrete roadways, flows along the kerb line, spread across the slab as opposed to raising against the kerbs. There is therefore no evidence of kerbs being over topped.

Crownhill Topsoil took possession of the site following it being vacated by WormTech Ltd, who had used it for the production of compost from biodegradable / green landscape, kitchen and food waste. During operation by WormTech, all of the gullies within the eastern section of the site had been filled with concrete. Crownhill have blocked the remainder of the manholes at the site to ensure that all runoff is above ground and visible.

Topsoil and Recycled Aggregates:

Crownhill Topsoil's principal activity is the processing of inert construction excavation and demolition wastes to provide recycled topsoil and aggregates to the construction industry and for the commercial residential market. They provide a range of different quality soils, sands and aggregates to private and commercial customers.

The site also stores small volumes of quarried products which can be supplied in small volumes to local builders and residents who would not be able to receive aggregates in large volumes direct from quarries.

The table below outlines the Waste Codes for materials intended to be processed under this activity:

Waste types accepted by Crownhill Topsoil and Aggregates	
Exclusions **Wastes having any of the following characteristics shall not be accepted:** • **Consisting solely or mainly of dusts, powders or loose fibres** • **Hazardous wastes** • **Wastes in liquid form**	
Waste Code	**Description**
01	**WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**
01 04	**wastes from physical and chemical processing of non-metalliferous minerals**
01 04 08	waste gravel and crushed rocks other than those mentioned in 01 04 07
01 04 09	waste sand and clays
10 11	**wastes from manufacture of glass and glass products**
10 11 12	clean glass other than those mentioned in 10 11 11
10 12	**wastes from manufacture of ceramic goods, bricks, tiles and construction products**
10 12 08	waste ceramics, bricks, tiles and construction products(after thermal processing)
10 13	**wastes from manufacture of cement, lime and plaster products and articles and products made from them**
10 13 14	waste concrete only
15	**WASTE PACKAGING**

15 01	**packaging**
15 01 07	clean glass only
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	**concrete, bricks, tiles and ceramics**
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles and ceramics
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	**wood, glass and plastic**
17 02 02	clean glass only
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 02	road base and road planings (other than those containing coal tar) only
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF SITE WASTE WATER TREATMENT PLANTS AND PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION / INDUSTRIAL WASTE**
19 12	**wastes from the mechanical treatment of wastes**
19 12 05	clean glass only
19 12 09	minerals (for example sand, stones)
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 01	**separately collected fractions**
20 01 02	clean glass only
20 02	**garden and park wastes**
20 02 02	soil and stones

Process

Most of the raw materials for the process are construction and demolition wastes and excavated soils sourced through construction works. A key control in the process is a duty of care check on the site from which wastes are received. This includes a site inspection for indicators of contamination, a review of any ground investigations undertaken for the site and additional ground investigation, sampling and testing if required. Please refer to the Crownhill Topsoils and Aggregates Environmental Management System for further information on the waste acceptance process for the site.

Once a duty of care check has been undertaken and materials have been proven to be free of contamination, the materials are imported to the facility. Materials are inspected immediately prior to and following tipping and prior to the tipping vehicle leaving the facility. This inspection includes a visual and olfactory assessment for signs of contamination, i.e. sheens, odours, foreign objects within the materials the inclusion of materials which have potential for contamination, including fly ash, slag, etc.

If materials are suspected of being contaminated they are quarantined, re-loaded onto the delivery vehicle and removed from site. Any costs incurred within this are recharged to the Client as per the standard Crownhill Topsoil Terms and Conditions.

Materials are stored in managed stockpiles to a maximum volume of 40,000 tonnes. Stockpiles of feed materials, soils and aggregates are stored on a combination of permeable soft covered areas, semi-permeable compacted stone surfaces and concrete slabs (the integrity of these concrete slabs cannot be assured, with cracks and possible joint defects noted during surveys and should hence be considered to be semi-permeable). No more than 75,000 tonnes of materials will be stored or processed per annum.

Crushing and screening equipment is then used to grade and blend the materials to form the end products. Processed topsoil is stored within a large building with a concrete slab floor and walls on all sides, which is weatherproof. These are tested to BS5228 for Topsoil and to ensure compliance with the Specification of Highway Works. Feedstocks with a higher percentage of fines is stored within buildings as they are moisture sensitive. Feedstock and processed aggregates are stored in the open, on concrete or compacted stone surfaced areas.

This material will then be sold back into the construction industry, either collected from the facility by the client or delivered directly using our own fleet of vehicles.

Contaminants of concern from the inert waste area are:

- Silt – mobilised during the storage and processing of materials;
- Hydrocarbons – from diffuse sources, including delivery vehicles and plant operated at the site (considered to be minor but with a high-risk potential if a major spillage or leakage were to occur. Delivery vehicles and most plant movements are confined to concrete surfaced areas;
- Hydrocarbons – from the storage of fuels and oils on site.

Drainage Requirements for Processes and Site Areas:

The land rises to the north of the site and hence the site falls by approximately 3m from the north to the south. The site has therefore been constructed in two levels, with a 3m high batter between the northern section and the southern section. The site also falls to the east and the west from a point 20m west of Building 3. Runoff therefore flows in a loop around the site, in a clockwise direction for the east of the site and an anti-clockwise direction for the western side of the site.

We have divided the site into two distinct catchments across two discharge points. The western side of the site drains to the west and the eastern section to the east. Both sections drain into the ditch running along the eastern side of the site. For a layout of the drainage, please refer to Drawing Number EV170606/CHD03 – Drainage Plan in Appendix 2.

Some measures have been put in place to limit the volume of clean rainwater runoff which flows into waste / materials storage and handling areas. This is limited to the use of soakaways by a lack of alternative surface water discharge points within the northern section of the site. Rainfall runoff from buildings has been diverted so that is flows off the edge of the slab surrounding the building, onto permeable areas, where it can infiltrate. During periods of very wet weather when soils are saturated, this infiltration is minimal.

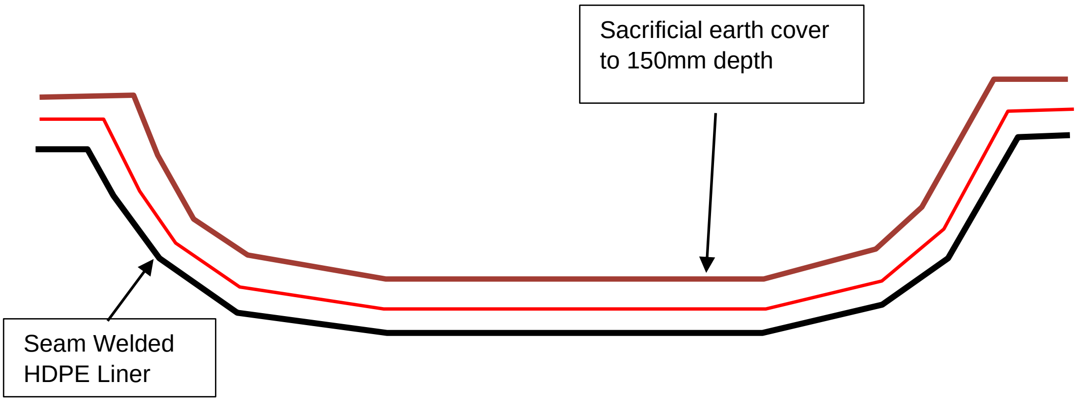
Runoff from impermeable and semi-permeable areas, flows along site surfaces onto the concrete roadway, which forms a loop around the entire site. This is cambered with a constant cross fall and hence runoff gathers against the kerbline and flows along the site access roads. Runoff is then directed into attenuation ponds.

There are three ponds for each section of the site and these have been sized to allow sufficient attenuation to remove suspended solids prior to discharge.

These ponds are lined with a 1mm HDPE liner to prevent the ingress of runoff into the ground. Water from the eastern attenuation ponds is discharged into drainage channel to the SW of the site via a full retention hydrocarbon separator.

Attenuation Pond Design

Pond design has been dictated to an extent by the available areas and the topography of the site. Ponds are largely rectangular to prevent short-circuiting and better facilitate removal of accumulated sediment. Due to the sensitivity of the underlying SPZ1 Source Protection Zone, the ponds have been lined using an impermeable 1.0mm thick HDPE Liner, which has been covered with a 150mm deep sacrificial soil layer.



Cross Section through sediment pond illustrating HDPE Liner with sacrificial earth cover (not to scale)

The Crownhill Topsoil and Aggregates facility accepts a broad range of inert materials. This will result in a wide range of particle sizes being mobilised by works at the site. We have therefore assumed that particles to be settled will be a combination of sand, silts with some clay particles. The ponds have been designed to remove all but the smaller <0.05 microns, particles which will be colloidal and will remain in suspension for a significant period of time.

To aid design of the ponds water samples were taken from the inlet to the previous small attenuation pond, installed by WormTech (the previous site tenants), during a period of heavy rainfall on 21/11/16 and settlement tests were undertaken on these. Sample bottles were shaken to ensure all suspended solids were suspended in the water column. The time taken for the particulates to settle 100mm (the distance a particle is required to sink between the point at which it enters the attenuation pond to prevent it being carried over the outlet) It was found that heavier sand particles settled quickly (4 seconds) whereas smaller silt particles took 16 minutes to settle with colloidal clay taking several days.

For the design of the ponds we have assumed that all rainfall onto the site, becomes surface water runoff i.e. all runoff from building roofs will flow onto site. We have used a rainfall intensity of 11.66mm/hr based on an M100-6hr rainfall of 70mm.

Eastern Section of Site:

The eastern area of the site is approximately 13,200m^2. This will give a maximum runoff of 42l/s into the ponds. Particulate settlement is a function of surface area and not volume. Therefore, assuming runoff from the site spreads evenly across the surface area of the pond, to attain a residence period of 16 minutes the pond would need to accommodate 40m^3 within the top 100mm of the pond. This would require a pond with a surface area of 400m^2. This is not a precise calculation as it is unlikely that a suspended particulates would spread evenly across the pond and takes not account of movement within the water column due to turbulence or wind effects on the surface. Ponds have been sized to have a surface area of 550m^2.

Sufficient capacity needs to be maintained within the ponds for the accumulation of silt. The ponds should therefore be constructed to a depth of 400mm. This will provide an attenuated discharge volume to the ditch of approximately 36l/s, during a 1 in 100 year sustained storm event.

Western Section of Site:

The western area of the site is approximately 7,400m^2. This will give a maximum runoff of 23.8/s into the ponds. Particulate settlement is a function of surface area and not volume. Therefore, assuming runoff from the site spreads evenly across the surface area of the pond, to attain a residence period of 16 minutes the pond would need to accommodate 22.8m^3 within the top 100mm of the pond. This would require a pond with a surface area of 228m^2. This is not a precise calculation as it is unlikely that a suspended particulates would spread evenly across the pond and takes not account of movement within the water column due to turbulence or wind effects on the surface. Ponds have been sized to have a surface area of 540m^2.

Sufficient capacity needs to be maintained within the ponds for the accumulation of silt. The ponds should therefore be constructed to a depth of 400mm below outfall invert level. This will provide an attenuated discharge volume to the ditch from the eastern ponds of approximately 32.8l/s and 17.1l/s from the western ponds, during a 1 in 100 year sustained storm event (depending on pipe roughness coefficient and the fall of the pipe (assumed a 1m fall between the pond outfall and the discharge point and have made no allowance the effects of the manhole)). The outlet pipe from the pond will be 150mm diameter with a maximum discharge rate of 52l/s. A minimum freeboard of 200mm will be required to allow the ponds to accommodate short duration intense rainfall events up to 65mm/hr for a period of 15 minutes. This intensity of rainfall is unusual. This would cause the ponds to rise above the soffit of the pond outfall reducing the efficiency of the outfall but the pond would not over top.

Interceptor Design:

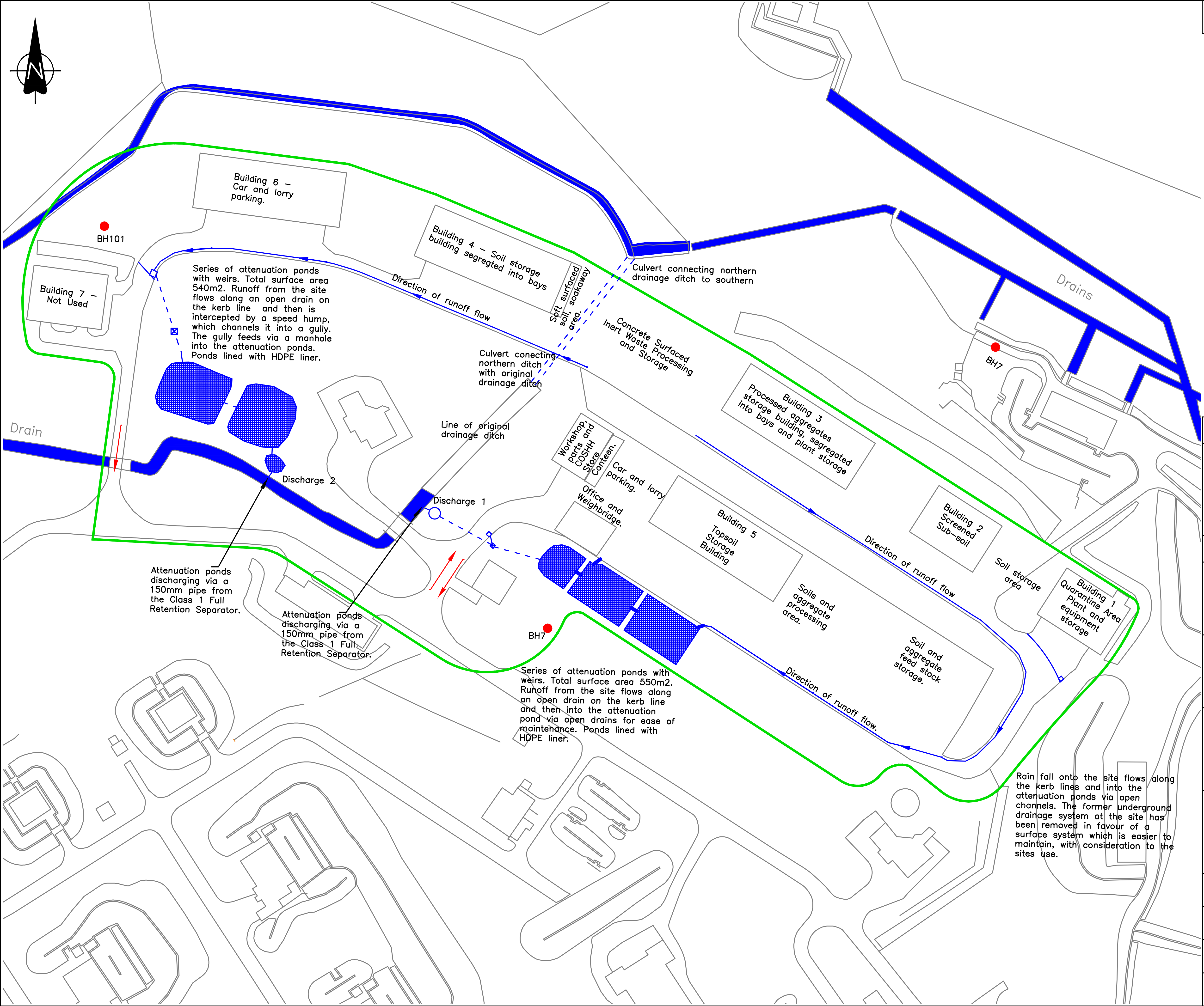
A Class 1Full Retention Hydrocarbon Interceptor is to be installed at the discharge points from the ponds. The area draining into the eastern drainage system is approximately13,200m^2 but flow is limited to 52l/s by the 150mm pipe from the attenuation pond, with the pond buffering rainfall inflow above this. Hence an allowance has been made for a flow of 80l/s which will require an interceptor measuring approximately 6m x 2.8m diameter. This has an oil capacity of 800l and a silt capacity of 8m^3. This will be fitted with a level alarm which will be calibrated on installation and serviced annually. The interceptors will be emptied and serviced annually.

Discharge Point:

Natural Resource Wales have raised concerns regarding the discharge of site runoff into the open drain across the southern boundary of the site, as this ditch is ephemeral and during periods when soils within the ditch are not saturated there is potential for discharged runoff to percolate into the soils and subsequently into the underlying aquifer, which is designated as an SPZ1. Crownhill are unsure whether these concerns stem from the belief that Crownhill would be processing green wastes / compost from the former Wormtech operations at the site. This is not the case and the site will be operated as an Inert Waste Recovery Facility.

In the case that site runoff cannot be discharged into the open ditch, Crownhill have committed to piping the ditch to the start of the culvert into the Castrogi Brook. This would take the form of 513m of 350mm diameter twin wall plastic pipe, with chambers located a changes in line and level.

Appendix 1 – Drainage Plan



DRAWING NUMBER	REVISION
EV/170606/CHD03	01

KEY:

- SITE BOUNDARY
- LINE OF CULVERT
- GULLY
- MANHOLE
- CLASS 1 FULL RETENTION HYDROCARBON SEPARATOR
- GROUNDWATER MONITORING BOREHOLE

ATTENUATION PONDS LINED WITH 1mm HDPE LINER.

REVISIONS

REV	DATE	DESCRIPTION	DRWN	CHKD
01	01/20	Additional information requested within a NRW Schedule 5 Notice	JG	SS

STATUS
INFORMATION

CLIENT
CROWNHILL
UNIT 1009 CAERWENT
ARMY TRAINING ESTATE
CALDICOT
NP26 5XL

PROJECT
CROWNHILL TOPSOIL AND AGGREGATES

TITLE
DRAINAGE PLAN

SCALE	DESIGNED
NTS	J. GREGORY
PROJECT NUMBER	DRAWN
EV170606	G. WILLIAMS
DATE	CHECKED
MARCH 2019	J. GREGORY
DRAWING NUMBER	REVISION
EV170606/CHD03	REVISION REF. 01