# Land West of Pease Bay Leisure Park, Cockburnspath, Scottish Borders

## Flood Risk & Drainage Assessment

784-A117626

Verdant Leisure Ltd

April 2021

Prepared on Behalf of Tetra Tech Limited. Registered in England number: 01959704

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# Contents





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# 1.0 INTRODUCTION

## 1.1 PURPOSE OF THIS REPORT

Tetra Tech Ltd have been appointed by Verdant Leisure Ltd to undertake a Flood Risk & Drainage Assessment (FRDA) of land to the west of Pease Bay Leisure Park near Cockburnspath. The FRDA is required in support of a full planning application to Scottish Borders Council (SBC) for a change of use of land and road and plot layout to form an extension to the leisure park. The proposed development comprises 19 no. holiday homes, vehicular access and parking, and landscaping on greenfield land to the west of the existing caravan park. For the purpose of this assessment 'the site' herein refers to the land to the west of Pease Bay Leisure Park proposed for development.

The proposed site layout is contained within Appendix A.

## 1.2 REQUIREMENT FOR THIS REPORT

Review of the SEPA Flood Extent Map indicates that a strip of land across the north of the site lies within the 1 in 200 year flood outline (i.e. the flood with a 0.5% chance of occurring in any single year) are potentially at medium to high risk of fluvial flooding from the Cockburnspath Burn. SEPA also define the 1 in 200 year flood as the functional floodplain.

In accordance with Scottish Planning Policy (SPP)[1] a Flood Risk Assessment (FRA) is required where developments are at medium to high risk of flooding.

## 1.3 SCOPE OF THIS REPORT

This FRA will be undertaken in accordance with SPP and SEPA technical guidance[2]. The FRA will consider the risk from all sources of flooding including coastal, watercourse (fluvial and tidal), surface water (pluvial), groundwater, reservoirs and drainage systems, taking into account the predicted effects of climate change.

The FRA must demonstrate that the proposed development is appropriate and will not increase the risk of flooding elsewhere. The FRA therefore include a Drainage Assessment, which will identify a surface water management regime for surface water runoff from the site such that flood risk to areas elsewhere is not exacerbated. The Drainage Assessment includes a foul drainage strategy.

[1] The Scottish Government (June 2014), *Scottish Planning Policy*
[2] SEPA (May 2018), *Technical Flood Risk Guidance for Stakeholders*

## 1.4 LIMITATIONS OF THE REPORT

This report has been prepared by Tetra Tech Ltd on behalf of Verdant Leisure Ltd in connection with the scope of the report as described in Section 1.3 above and taking into account the particular instructions and requirements set out in Tetra Tech's fee proposal and the Client's acceptance. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.

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# 2.0 BACKGROUND

## 2.1 EXISTING SITE

Pease Bay Leisure Park is located on the Scottish Borders coastline approximately 1.5km to the east of Cockburnspath village at postcode TD13 5YP. The site lies to the west of the existing leisure park. The central grid reference of the site is NT 79079 70767.

The site area is 1.2 ha and is covered largely by grass with clumps of gorse and brambles. It is considered greenfield land for the purpose of this assessment.

The site is bounded by Cockburnspath Burn to the north, the existing holiday park to the east, the access road to the south and a dwelling and farmland to the west.

Figure 1 below shows the existing site plan.

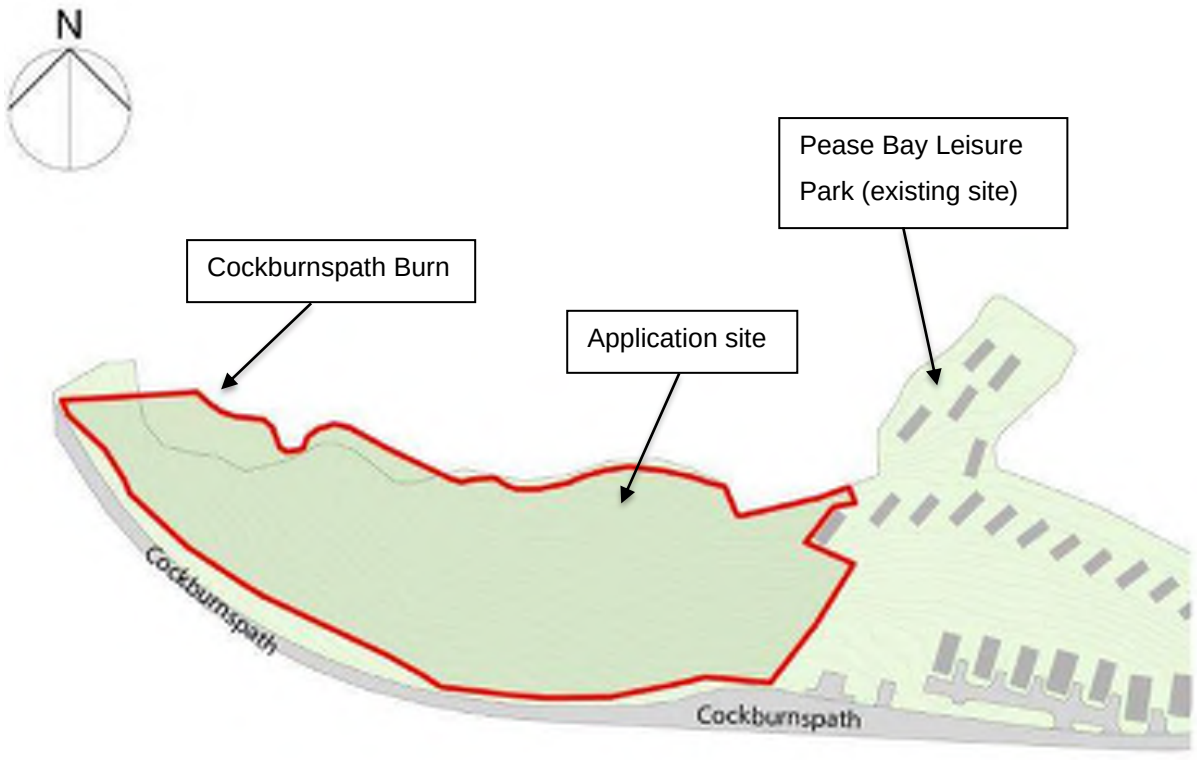


***Figure 1. Existing Site Plan***

The site falls steeply to the north towards the Cockburnspath Burn and the sea and to the east towards the Pease Burn. The high point of the site is approximately 46m AOD at the western extent, falling to 30m AOD in the south east corner and 15m AOD in the north east corner.

The topographical survey is contained within Appendix B.

## 2.2 EXISTING DRAINAGE

### 2.2.1 Principal Watercourses

The Cockburnspath Burn issues in the hills to the south west of Cockburnspath village and flows to the north east and then via a waterfall upstream of the site to the east along the northern site boundary and into Pease Bay. The catchment of the Cockburnspath Burn is approximately 4.8km$^2$.

The Tower Burn also issues in the hills to the south west of the site. It flows 300m to the south of the site and joins the Pease Burn, which flows northwards through the existing Pease Bay Leisure Park and into Pease Bay. The catchment of the Pease Burn and Tower Burn is approximately 21.5km$^2$.

### 2.2.2 Minor Watercourses

A review of Ordnance Survey (OS) mapping indicates that there are no minor watercourses within the site curtilage or in the local area.

## 2.3 SEWERS

### 2.3.1 Public Sewers

Sewer records obtained from Scottish Water indicate that there are no public sewers within the area.

### 2.3.2 Private Drains

As a greenfield site it is assumed that there are no drainage features on the site. The topographical survey shows the presence of manholes and gullies on the adjacent holiday park. Runoff from the roads and hardstanding on the existing leisure park is drained into both the Cockburnspath Burn and the Pease Burn.

## 2.4 GROUND CONDITIONS

Based on a review of British Geological Survey (BGS) online mapping, the site is partly underlain by Glaciofluvial Deposits of gravel, sand and silt overlying the Stratheden Group and Inverclyde Group (undifferentiated) of sandstone and argillaceous rocks (interbedded). The bedrock deposits are classified as a moderately productive aquifer.

# 3.0 FLOOD RISK

## 3.1 FLUVIAL & TIDAL FLOODING

For fluvial and tidal flooding the SPP introduces a risk framework that characterises areas for planning purposes by their annual probability of flooding from principal watercourses:

- Little or no risk area (annual probability of watercourse, tidal or coastal flooding is less than 0.1% AEP (1 in 1000)).
- Low to medium risk area (annual probability of watercourse, tidal or coastal flooding in the range 0.1% to 0.5% AEP (1 in 1000 to 1 in 200)).
- Medium to high risk area (annual probability of watercourse, tidal or coastal flooding greater than 0.5% AEP (1 in 200)).

A review of SEPA's online Flood Extent Map indicates that land in the north of the site lies within the 1 in 200 year flood extent associated with fluvial and tidal flooding from the Cockburnspath Burn.

Correspondence with SEPA, included within Appendix C, confirms that the site lies partly within the 1 in 200 year flood extent; however, SEPA do not hold flood level information at this location. The only historic flood information that SEPA hold at this location is from coastal sources with a high tide impacting land adjacent to the Pease Bay Leisure Park in December 2014 and a spring tide, storm surge and wave overtopping combined in December 2013 causing wave impacts at the leisure park and precautionary evacuation of the southern part of the leisure park.

SEPA's Depth and Velocity Map indicates that in both the medium and high flood risk scenarios the depth of flooding is less than 0.3m and the velocity of flood waters less than 1m/s. The mapping does not indicate that the site is at risk of flooding from coastal sources.

The fluvial flood risk is likely to increase in the future due to climate change. There is predicted to be a 40% increase in peak river flow allowance up to 2100 in the Forth Basin Region.

## 3.2 SURFACE WATER & OVERLAND FLOWS

Surface water flooding occurs where high rainfall events exceed the drainage capacity in an area (i.e. sewer system and/or watercourse), leading to flooding.

A review of SEPA's Flood Extent Map indicates that the risk of flooding from surface water is very low. The surface water flood risk is likely to increase in the future due to climate change. There is predicted to be a 35% increase in peak rainfall intensity up to 2100 in eastern Scotland.

## 3.3 GROUNDWATER FLOODING

Groundwater flooding occurs when groundwater emerges at the surface under conditions where the 'normal' range of groundwater levels and groundwater flows is exceeded.

A review of SEPA's online Groundwater Map indicates that the risk of flooding from groundwater is very low.

## 3.4 SEWER FLOODING

Sewer flooding occurs when intense rainfall overloads the sewer system capacity and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

There is no known history of flooding associated with overloading or blockage of sewers on site or in the vicinity, therefore the risk is considered to be low.

## 3.5 RESERVOIR FLOODING

There are no reservoirs within the site's catchment, therefore there is no risk of flooding from reservoirs.

## 3.6 SUMMARY OF FLOOD RISK

Northern areas of the site are shown on SPEA mapping to be at medium to high risk of fluvial and tidal flooding from the Cockburnspath Burn. Flood mitigation measures are proposed in Section 4.

The site at very low risk of flooding from surface water, groundwater and sewers. There is no risk of flooding to the site from the coast or reservoirs.

The proposals include the provision of new areas of hardstanding. It is therefore necessary to manage surface water runoff to avoid increasing the flood risk to areas elsewhere, taking into account the predicted future impacts of climate change. A surface water drainage strategy is proposed in Section 4.

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# 4.0 DEVELOPMENT PROPOSALS

## 4.1 PROPOSED DEVELOPMENT

The proposed development comprises 19 no. holiday homes, vehicular access and parking, and landscaping on greenfield land to the west of the existing caravan park.

The proposed site layout is contained within Appendix A.

## 4.2 PLANNING POLICY & GUIDANCE

### 4.2.1 Scottish Planning Policy

The central purpose of the SPP risk framework is to prevent further development which would have a significant probability of being affected by flooding or which would increase the probability of flooding elsewhere. Proposed developments should not be located in areas at medium to high risk from fluvial or coastal sources nor should new development take place if it would be at significant risk of flooding from any source or would materially increase the probability of flooding elsewhere. Generally, 'new caravan and camping sites' are not suitable within areas of medium to high risk[3].

### 4.2.2 Scottish Borders Local Development Plan

Policy IS8 (Flooding) of the Local Development Plan[4] states that development should be located in areas free from significant flood risk, should not materially increase the probability of flooding elsewhere and the ability of functional floodplains to convey and store flood water should be protected, and development should be located away from them.

Policy IS9 (SuDS) of the Local Development Plan states that surface water management for new development must comply with current best practice on SuDS. Development will be refused unless surface water treatment is dealt with in a sustainable manner that avoids flooding and pollution.

Policy ED8 (Caravan and Camping Sites) states that proposals for new and extended caravan and camping sites must be in locations free of flood risk.

[3] SPP, paragraph 263
[4] Scottish Borders Council (May 2016), *Local Development Plan Vol 1 Policies*

Policy EP15 (Development Affecting the Water Environment) states that waste must be dealt with without negative impacts to public health, the environment, and the quality of the nearby burn and coastal waters.

### 4.2.3 SEPA Land Use Vulnerability

SEPA's Flood Risk and Land Use Vulnerability Guidance[5] indicates acceptable land uses according to the risk of coastal, fluvial or surface water flooding in the location. Based on Table 1 of the guidance, the proposed development falls under 'holiday caravan, chalet, and camping sites' which is classified as 'Most Vulnerable Uses' land use. Based on Table 2 of the guidance, Most Vulnerable Uses are not suitable for development in medium to high risk flood risk areas within undeveloped and sparsely developed areas. More Vulnerable Uses may be suitable for development in low to medium flood risk areas if the risk from a 0.1% AP event can be alleviated through appropriate mitigation.

## 4.3 DEVELOPMENT AND FLOOD RISK

### 4.3.1 Flood Risk to the Development & Mitigation

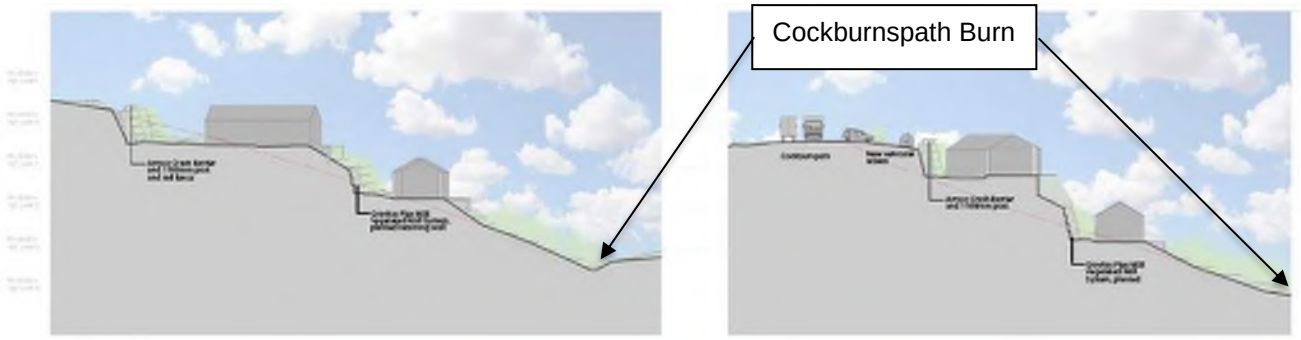
As described in Section 3, northern areas of the site are at medium to high risk of fluvial flooding from the Cockburnspath Burn. In order to comply with the national and local policy outlined above, all caravans should be located outside of the medium to high risk areas and within the low risk areas. The location of the caravans within the site has also taken into account comments received from SEPA and SCB to the previous planning application (ref. 19/01709/FUL).

SEPA have confirmed that there are no available flood levels for the Cockburnspath Burn, as stated within correspondence included in Appendix C. However, the cross sections shown in Figure 2 below (an extract of Appendix A) indicate that the caravans will be located a minimum of approximately 6m above the assumed bed of the Cockburnspath Burn.

It is therefore considered reasonable to assume that the caravans will be located well above the 1 in 200 year flood level, including an allowance for climate change, and above the 1 in 1000 year flood level in an area of low flood risk. The location of the caravans therefore adheres to Policy IS8 (Flooding) and Policy ED8 (Caravan and Camping Sites) of the Local Development Plan.

[5] SEPA (July 2018), *Flood Risk and Land Use Vulnerability Guidance*

*Figure 2. Proposed Site Cross Sections (Architects Plus)*




### 4.3.2 Flood Risk from the Development & Mitigation

The proposals include the provision of new areas of hardstanding. It is therefore necessary to manage surface water runoff to avoid increasing the flood risk to areas elsewhere. This is explored below.

## 4.4 SURFACE WATER MANAGEMENT

### 4.4.1 Drainage Hierarchy

In accordance with the Building standards technical handbook[6], surface water should be discharged to:

- a storage container with an overflow discharging to any of the 4 following options;
- a SuD system;
- a soakaway;
- a public sewer; or
- an outfall to a watercourse, such as a river, stream or loch or coastal waters, that complies with any notice and/or consent by SEPA.

#### 4.4.1.1 Discharge to Ground

Given the site's underlying geology outlined in Section 2.3, infiltration is unlikely to be feasible at this location.

#### 4.4.1.2 Discharge to Watercourse

It is proposed to discharge surface water to the Cockburnspath Burn forming the northern boundary of the site.

[6] Scottish Government (2019), *Building standards technical handbook 2019: non-domestic, Section 3.6*

#### 4.4.1.3 Discharge to Sewer

There are no known sewers within the site or in the local area, therefore discharge to sewer is not an option.

## 4.4.2 Pre and Post-Development Areas

The site is currently greenfield. The post-development areas have been calculated using the proposed site layout, found in Appendix A. The pre and post-development areas are shown in Table 1 below. It is important to note that only the proposed holiday caravans will be impermeable, with the proposed access road and footpath comprising crushed aggregate and therefore considered to be permeable.

***Table 1. Pre and Post-Development Areas***

| Status | Impermeable Area (ha) | Permeable Area (ha) |
|---|---|---|
| Pre-Development | 0 | 0.95 |
| Post-Development | 0.152 | 0.798 |

## 4.4.3 Pre and Post-Development Discharge Rates

The site is currently greenfield and drains at greenfield rates, which are shown in Table 2 below. Given the site's proximity to the sea, and the relatively small impermeable area proposed, it is proposed to drain surface water runoff at unrestricted rates into the Cockburnspath Burn to the north of the site, via a new outfall. The increase in flood risk to the existing leisure park to the east is considered to be negligible.

***Table 2. Pre and Post-Development Discharge Rates***

| Situation | Qbar (l/s) | 1 in 1 year (l/s) | 1 in 30 year (l/s) | 1 in 100 year (l/s) | 1 in 100 year + 35% CC (l/s) |
|---|---|---|---|---|---|
| Greenfield | 0.15 | 0.13 | 0.30 | 0.40 | - |
| Post-Development | - | 16.00 | 34.80 | 44.20 | 45.20 |

The post-development discharge rates have been calculated by modelling a simple filter drain, proposed as part of the drainage strategy, as discussed further below.

The results are contained in Appendix D.

## 4.4.4 Proposed Surface Water Drainage Strategy

It is proposed to drain surface water from the proposed access road and caravans into filter drains located alongside the access road and path. Surface water will reach the filter drains through the voids in the aggregate. The filter drains will then convey the surface water to a new outfall discharging into the Cockburnspath Burn.

As noted above, it is not considered necessary to provide attenuation given that the burn drains into the sea within the existing leisure park.

The proposed drainage plan is contained in Appendix E.

### 4.4.5 Surface Water Management During Construction

Details of how surface water runoff and potential pollution will be managed during the construction phase will be managed by the appointed Contractor and outline in their Construction Environmental Management Plan (CEMP) or similar.

The construction and operation of the site's drainage system must adhere to the General Bindings Rules (GBRs) under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 – more commonly known as the Controlled Activity Regulations (CAR) – and their further amendments of 2013 and 2017. The GBRs represent a set of mandatory rules which cover specific low risk activities. Activities complying with the rules do not require an application to be made to SEPA.

## 4.5 RESIDUAL FLOOD RISK & EXCEEDANCE ROUTES

The primary residual risk would be associated with a failure of the surface water drainage system. The risk of flooding would also increase if the drainage system is not maintained on a regular, ongoing basis. Exceedance flows will be directed to the site access road and soft landscaping, which fall to the Cockburnspath Burn.

# 5.0 SUSTAINABLE DRAINAGE

## 5.1 REVIEW OF SUDS OPTIONS

In order to comply with the SPP (Section 3.6) and The SuDS Manual (C753) the design of the surface water drainage system should seek to maximise the use of SuDS techniques. This section reviews the suitability of the different SuDS features to the proposed development site.

## 5.2 THE SUDS MANAGEMENT TRAIN

The main purpose of SuDS is to manage the surface water runoff generated by a development within the development site, attenuating additional flows generated by the introduction of impermeable areas whilst providing water quality treatment to the runoff and amenity and landscape benefits to the community. SuDS features can be categorised as follows:

- Source Control: manage runoff at its source
    - Water butts, green/brown roofs, permeable pavements, rainwater harvesting systems, bio-retention systems.
- Site Control: manage runoff generated by a wider area
    - Swales, ponds, infiltration devices, filter strip, French drains.
- Regional Control: manage runoff generated by several sites
    - Basins, ponds and wetlands

The following is an illustration of the SUDS principles and how they may be applied to a development via a SuDS Management Train.

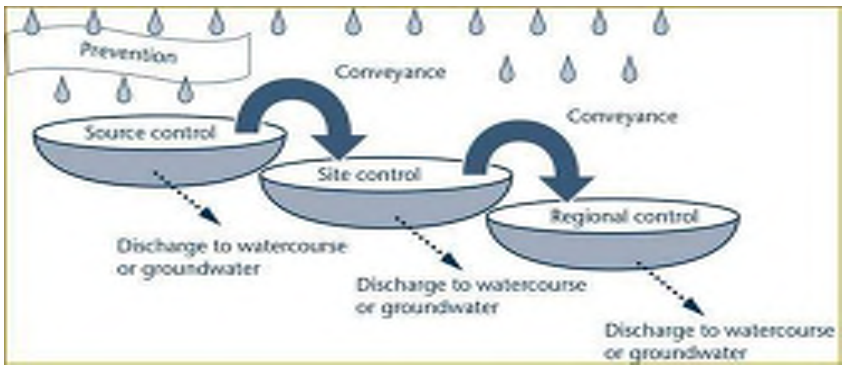



***Figure 3. SuDS Management Train***

Table 3 below summarises the suitability of the different SuDS elements for the proposed development.

***Table 3. Review of SuDS Elements for the Proposed Development***

| SuDS Element | Description | Applicability to the Site |
|---|---|---|
| **Source Control** | | |
| Water butts | Small storage tanks on each individual housing plot. | These could be used on individual caravans. |
| Rainwater harvesting | Recycling of water from roofs and impermeable areas. | Not appropriate given the type of proposed development. |
| Green roofs | Vegetated roofs that reduce runoff and remove pollutants. | Not appropriate given the type of proposed development. |
| Pervious surfaces | Pavements that allow surface water to flow into underlying layers of the pavement and either infiltrate or drain to an on-site drainage network. | Could be appropriate within the proposed car parking. |
| Rain gardens & bioretention systems | Shallow depressions with free draining soil and planted with vegetation that withstands occasional flooding. | Not appropriate given the type and layout of the proposed development. |
| **Site & Regional Control** | | |
| Filter drains | Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground. | Could be lined in order to convey runoff to an outfall. |
| Swales | Vegetated channels to convey store and treat runoff. | Not appropriate due to insufficient space. |
| Detention basins & ponds | Shallow areas of open space that temporarily hold water and collect silt. | Not appropriate due to insufficient space. |
| Infiltration basins | Shallow depression that stores runoff before it infiltrates into the subsoil. | Not appropriate given the underlying ground conditions. |
| Infiltration devices | Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground. | Not appropriate given the underlying ground conditions. |

Table 4 identifies that there is limited scope for incorporating SuDS into the proposed development given the type of development proposed and space constraints. However, where possible, SuDS will be incorporated into the proposed site layout in line with Policy IS9 (SuDS) of the Local Development Plan. Additional SuDS features may be considered during the detailed design stage.

## 5.3 WATER QUALITY

The drainage design should seek to effectively mitigate the pollution risks associated with the land use.

Step 1 of the 'Simple index approach' outlined in The SuDS Manual (CIRIA C753) is to identify the pollution hazard indices for the proposed land uses. These are set out in Table 4 below, which is an extract of Table 26.2 of The SuDS Manual.

***Table 4. Pollution Hazard Indices***

| Land Use | Pollution Hazard Level | Total Suspended Solids (TSS) | Metals | Hydro-carbons |
|---|---|---|---|---|
| Individual property driveways, residential car parks | Low | 0.5 | 0.4 | 0.4 |

Step 2 of the Simple index approach is to select SuDS features with a total pollution mitigation index that equals or exceeds the pollution hazard index. Table 26.3 of The SuDS Manual states the various mitigation indices for discharges to surface waters. The mitigation indices for the potential SuDS systems, where stated in The SuDS Manual, are shown below in Table 5.

***Table 5. SuDS Mitigation Indices***

| SuDS Element | TSS | Metals | Hydro-carbons |
|---|---|---|---|
| Compacted Type 1 Road | 0.7 | 0.6 | 0.7 |

It is acknowledged that compacted Type 1 material is not a SuDS features but it is considered to function in a similar way to permeable paving. The mitigation indices presented in Table 5 are for permeable paving. Based on Table 5 above, it can be seen that runoff from the site would receive sufficient treatment via the Compacted Type 1 material. This adheres to Policy IS9 (SuDS) of the Local Development Plan.

## 5.4 DRAINAGE & SUDS MAINTENANCE

SuDS require regular maintenance to keep them working effectively. It is assumed that drainage and SuDS on the site will be non-adoptable and therefore the responsibility of the Client or a delegated management company. The management company will perform such maintenance tasks similar to those outlined in Table 6 below.

A management and maintenance schedule should be submitted to and approved by Scottish Borders Council prior to construction.

***Table 6. Example Maintenance Tasks and Frequency Required***

| SuDS Element | Maintenance Task | Recommended Frequency |
|---|---|---|
| Permeable Paving | • Brushing and vacuuming<br>• Weed removal<br>• Rehabilitation of surface and upper substructure<br>• Remediation of depressions and cracked blocks<br>• Remediation of landscaping. | • Every 12 months<br>• Every 12 months<br>• As required<br>• As required<br>• As required |
| Filter Drains | • Inspect surface and remove litter<br>• Inspect pre – treatment systems, inlets and perforated pipe<br>• Remove silt and sediment<br>• Wash and/or replace filter medium<br>• Clear blockages | • Monthly<br>• Every 6 months<br>• Every 12 months<br>• Every 5 years<br>• As Required |

# 6.0 FOUL DRAINAGE

## 6.1 EXISTING FOUL DRAINAGE

The existing leisure park is served by an existing package treatment plant that discharges into the sea via the Pease Burn, however this plant is at capacity and therefore it is proposed to provide a new plant to serve the additional caravans.

## 6.2 PROPOSED FOUL DRAINAGE

### 6.2.1 Foul Volume Assessment

The proposals include the provision of 19 new caravans. In accordance with British Water Flows and Loads 4, a foul flow allowance of 150 litres per person per day should be used to assess the volume of foul flows being generated by the proposed caravans. To provide a conservative assessment, it is assumed that there could be 4 people in each caravan.

***Table 7. Foul Flow Volumes***

| No. of Static Caravans | Population Equivalent | Maximum Foul Volume ($m^3/d$) | Average Foul Flow (l/s) |
|---|---|---|---|
| 19 | 76 | 11.4 | 0.13 |

### 6.2.2 Proposed Treatment and Discharge

A new package treatment plant is proposed to treat the flows generated by the additional caravans.

Initial consultation with SEPA (prior to the cyber-attack in December 2020) identified that the level of dilution provided by Cockburnspath Burn during dry weather is relatively low. It is therefore proposed instead to discharge the effluent directly into the sea through the existing outfall from the existing package treatment plant. The effluent is to be disinfected by an UV filtration system situated immediately downstream of the package treatment plant.

Following the cyber-attack, the initial consultations with SEPA were not able to progress. It is therefore proposed to replicate the water quality requirements that are set by the current licence to the effluent by the additional caravans.

The proposed package treatment plant will therefore treat foul flows so that the concentrations required to the existing discharge are also achieved in the effluent from the proposed package treatment plant. This is in line with the requirements set out in SEPA's Guidance WAT-RM-13 'Microbiological Discharges', which indicate that

the treatment provided by package treatment plant is adequate for new discharges where PE is between 15 and 100.

a) BOD: 20 mg/l;
b) Suspended Solids: 100 mg/l;
c) PH: to be between 5.0 and 9.0.

As noted above, UV filtration will be provided in order to minimise the presence of faecal bacteria within the effluent being discharged into the protected bathing waters. The discharge requirements to be met or exceeded at least 95% of the time are set out in Table 3 of Appendix 2 of SEPA WAT-RM-13, and are:

a) 100 intestinal enteroccoci per 100 ml as a 95%-ile;
b) 250 e-coli per 100 ml as a 95%-ile.

The proposed foul drainage arrangements are considered to adhere to Policy EP15 (Development Affecting the Water Environment) of the Local Development Plan.

The proposed drainage plan is contained in Appendix E.

# 7.0 CONCLUSIONS & RECOMMENDATIONS

## 7.1 CONCLUSIONS

Land in the north of the site lies within the 1 in 200 year flood extent associated with fluvial and tidal flooding from the Cockburnspath Burn, based on the SEPA Flood Extent Map. The predicted depth of flooding is less than 0.3m and the velocity of flood waters less than 1m/s. The site at very low risk of flooding from surface water, groundwater and sewers. There is no risk of flooding to the site from the coast or reservoirs.

In order to comply with the national and local policy, the proposed new caravans should be located outside of the medium to high risk areas and within the low risk areas.

There are no available flood levels for the Cockburnspath Burn. However, the caravans will be located a minimum of approximately 6m above the bed level of the Cockburnspath Burn. It is therefore considered reasonable to assume that the caravans will be located well above the 1 in 200 year flood level including climate change and in an area of low flood risk.

It is proposed to drain surface water from the proposed access road and caravans into filter drains located alongside the access road and path. The filter drains will convey the surface water to a new outfall discharging into the Cockburnspath Burn. It is not considered necessary to provide attenuation given that the burn drains into the sea within the existing leisure park.

Given the site's proximity to the sea, and the relatively small impermeable area proposed, it is proposed to drain surface water runoff at unrestricted rates into the Cockburnspath Burn. The increase in flood risk to the existing leisure park to the east is considered to be negligible.

A new package treatment plant is proposed to treat the flows generated by the additional caravans. Treated effluent will then be disinfected before being discharged into the bay via the existing outfall from the caravan site.

The development proposals adhere to the SPP and SBC policies IS8 (Flooding), IS9 (SuDS), ED8 (Caravan and Camping Sites) and EP15 (Development Affecting the Water Environment) of the Local Development Plan.

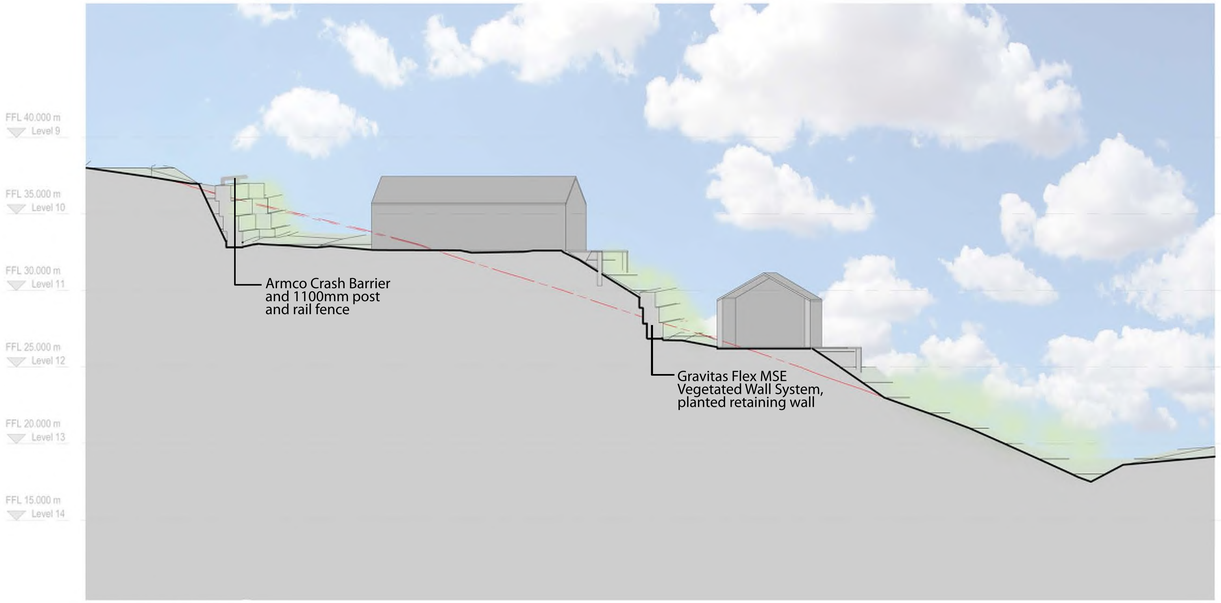
## 7.2 RECOMMENDATIONS

Additional SuDS features may be considered during the detailed design stage.

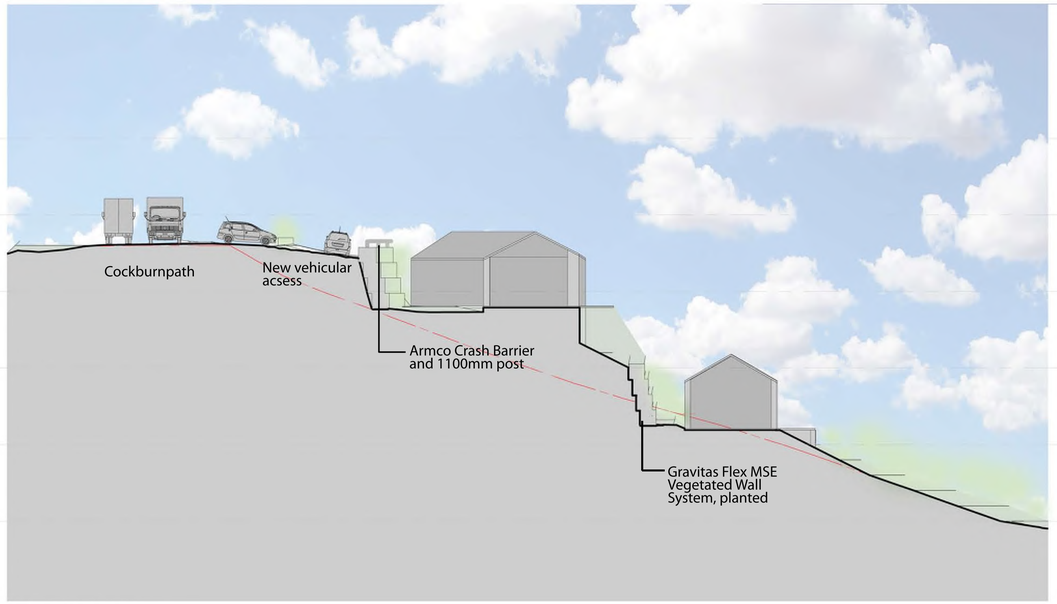
A drainage management and maintenance schedule should be submitted to and approved by SBC prior to construction.

# APPENDICES

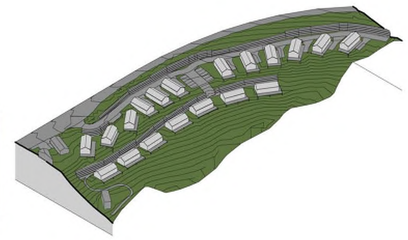
# APPENDIX A – PROPOSED SITE LAYOUT




## Section A-A




## Section B-B



## Isometric


# Proposed Design

## Pease Bay Holiday Park

0m 10m 20m 30m 40m 50m

VISUAL SCALE 1:500 @ A1

| revision | description | date | drawn | approved |
|---|---|---|---|---|
| RIBA stage | | | | |
| 3 - Spatial Coordination | Planning | | | |

ARCHITECTS PLUS

project: Pease Bay Holiday Park

client name: Tetra Tech (WYG)

drawing: Proposed Design

| drawn by | created on | plot date / time |
|---|---|---|
| AB | 16/04/2021 | 16/04/2021 12:59:20 |
| scale @ A1 | computer file | |
| As indicated | C:\Users\Abhin Bari\Desktop\Pease Bay\21001-Preliminary-Site.rvt | |
| drawing identifier | | revision |
| 21001 - 004 | | |

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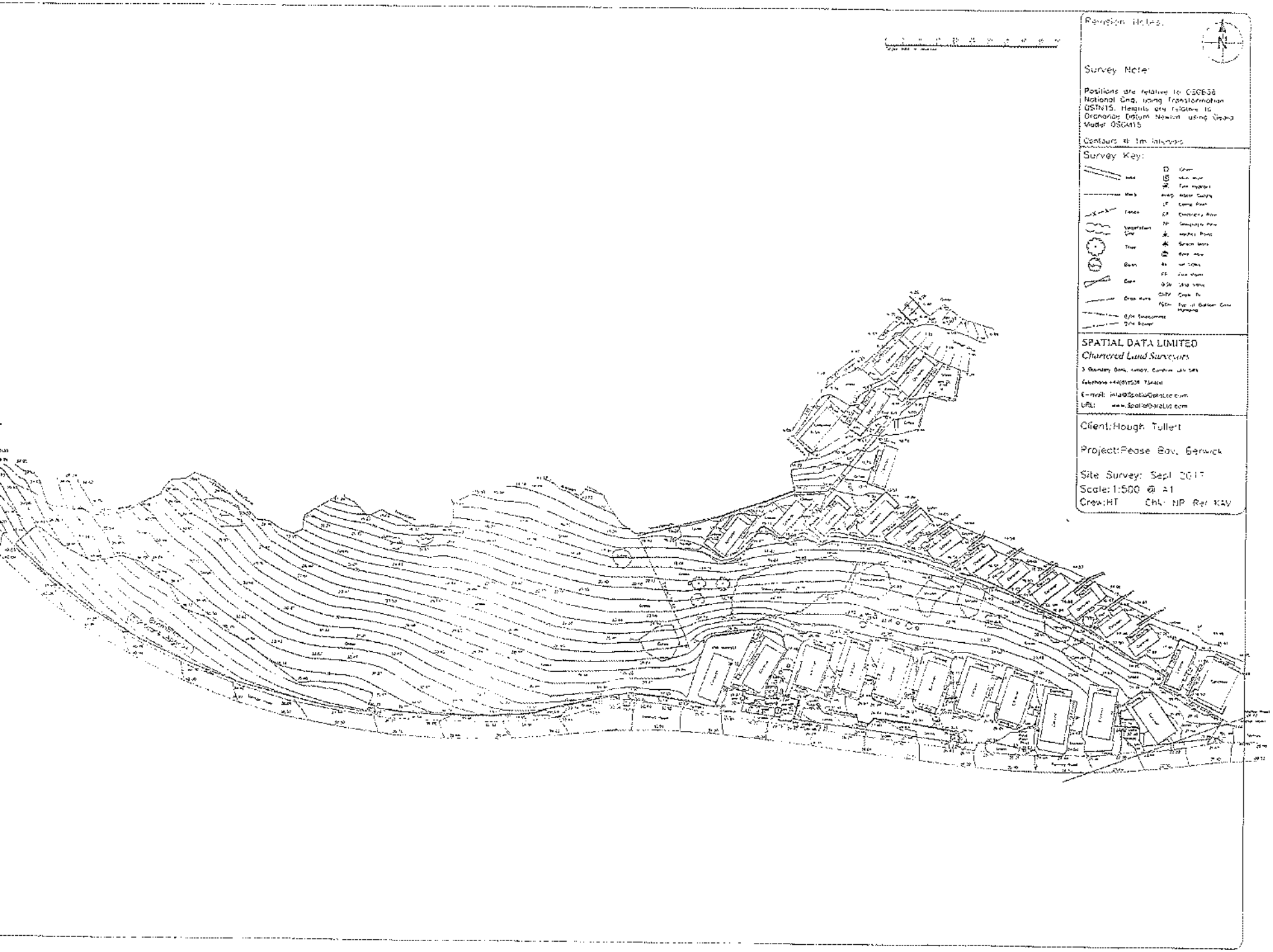
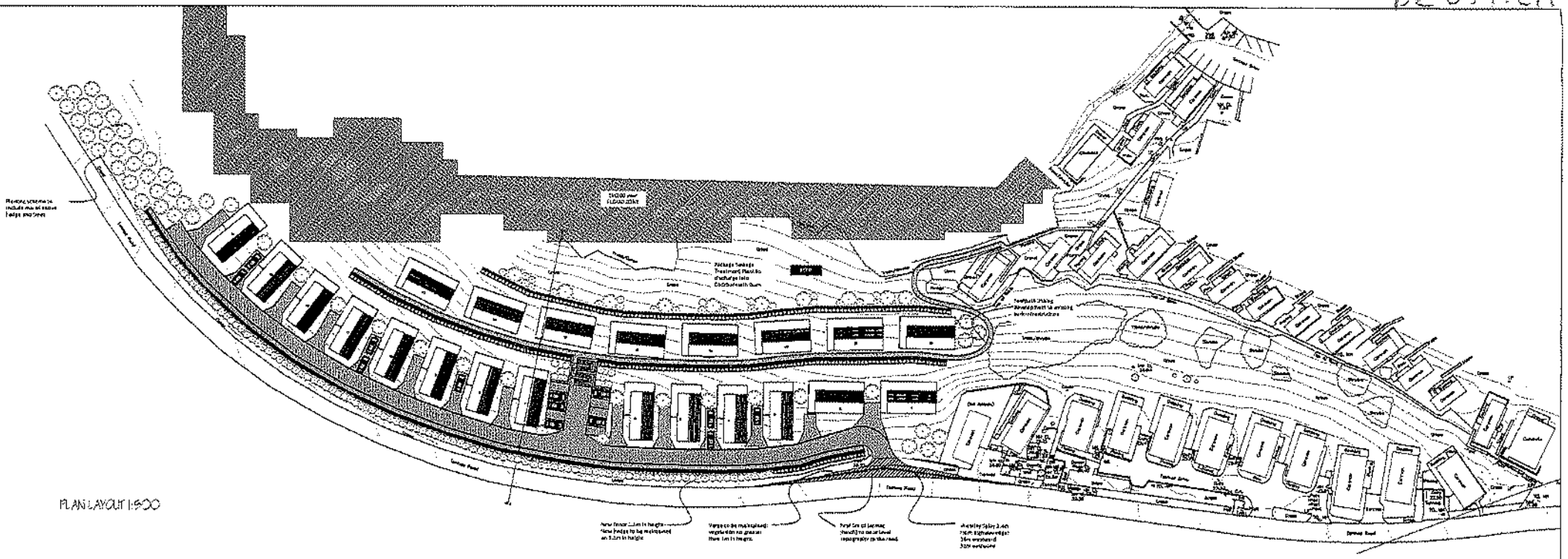
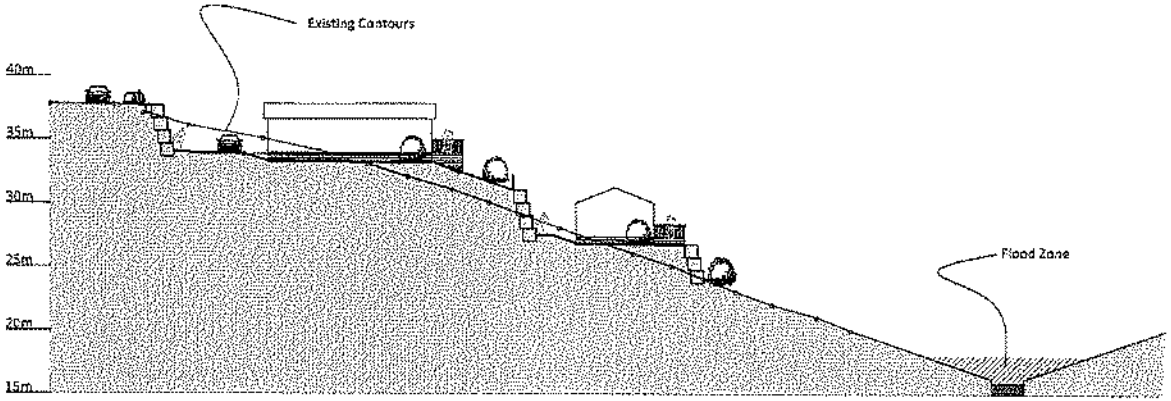
# APPENDIX B – TOPOGRAPHICAL SURVEY


Revision Notes:
Survey Note:
Positions are relative to OSGB36 National Grid, using Transformation OSTN15. Heights are relative to Ordnance Datum Newlyn using Geoid Model OSGM15
Contours at 1m intervals
Survey Key:
SPATIAL DATA LIMITED
Chartered Land Surveyors
Client:Hough Tullert
Project:Pease Bay, Berwick
Site Survey: Sept 2017
Scale:1:500 @ A1
Crew:HT Chk: NP Ref: KAV

DC 05/12/19



PLAN LAYOUT 1:500




SECTION 1:200

| | |
|---|---|
| DRAWING SIZE<br>PLAN 1:500 @ A1<br>SECTION 1:200 @ A1 | HOUGH TILLETT<br>[illegible] |
| DATE RECEIVED<br>04.06.2019 | TITLE<br>[illegible] |
| PROJECT NO.<br>[illegible] | DRAWING NO.<br>[illegible] |

# APPENDIX C – SEPA CORRESPONDENCE

## Armstrong, Ross

**From:** Evidence & Flooding Advice Helpdesk <advice@sepa.org.uk>
**Sent:** 13 July 2020 12:41
**To:** francisco.aguilar
**Subject:** Your SEPA E&F Advice Enquiry has been closed. Call Ref: [G:0324424]



SEPA
Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

Dear Francisco Aguilar

This confirms your enquiry **- Flood Data - Cockburnspath Burn - Pease Bay Holiday Park** has now been closed.
The final note added to the call was:

Further to your enquiry, I would comment that unfortunately we are unable to undertake site specific flood risk enquiries. However, I can provide any flood information we have which will provide a first indication of potential flood risk. We currently have no record of the area having been subject to any form of flooding.

Review of the SEPA Flood Map 200-year flood outline (i.e. the flood with a 0.5% chance of occurring in any single year) indicates that parts of the site lies within this envelope and as such is potentially at medium to high risk of fluvial flooding from the Cocksburnpath Burn. Unfortunately we do not hold flood level information at this location. Our maps are indicative only and do not give a detailed assessment of flood risk at a site specific level but rather identify areas where further information on flood risk may be required. A Flood Risk Assessment would be required to determine the predicted flood level at the site.

The only historic flood information we hold at this location is from coastal sources with a high tide impacting land adjacent to the holiday park in December 2014 and in December 2013 a spring tide, storm surge and wave overtopping combined to result in wave impacts at the site and precautionary evacuation of the southern part of the holiday park.

I would also recommend that you contact the Flood Risk Officers of Scottish Borders Council who, as Flood Prevention Authority, should be able to provide further information regarding flooding and flood alleviation in the area.

The SEPA Flood Maps have been produced following a consistent, nationally-applied methodology for catchment areas equal to or greater than 3km$^2$ using a Digital Terrain Model (DTM) to define river corridors and low-lying coastal land. The maps are indicative and designed to be used as a strategic tool to assess flood risk at the community level and to support planning policy and flood risk management in Scotland. For further information please visit http://www.sepa.org.uk/flooding/flood_maps.aspx.

If you do not consider that your enquiry has been resolved, please respond to this email and your call will be re-opened.

If your request was in relation to data, please be aware of our terms and conditions for data reuse.
Data Re-Use Statement
Thank you.

SEPA Evidence & Flooding Advice

# APPENDIX D – SURFACE WATER RUNOFF CALCULATIONS

## Summary of Results for 1 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 16.701 | 0.151 | 16.0 | 0.2 | O K |
| 30 min Summer | 16.689 | 0.139 | 14.7 | 0.2 | O K |
| 60 min Summer | 16.658 | 0.108 | 11.2 | 0.1 | O K |
| 120 min Summer | 16.628 | 0.078 | 8.0 | 0.1 | O K |
| 180 min Summer | 16.612 | 0.062 | 6.4 | 0.1 | O K |
| 240 min Summer | 16.599 | 0.049 | 5.4 | 0.1 | O K |
| 360 min Summer | 16.586 | 0.036 | 4.3 | 0.0 | O K |
| 480 min Summer | 16.579 | 0.029 | 3.7 | 0.0 | O K |
| 600 min Summer | 16.575 | 0.025 | 3.2 | 0.0 | O K |
| 720 min Summer | 16.572 | 0.022 | 2.9 | 0.0 | O K |
| 960 min Summer | 16.565 | 0.015 | 2.4 | 0.0 | O K |
| 1440 min Summer | 16.557 | 0.007 | 1.9 | 0.0 | O K |
| 2160 min Summer | 16.550 | 0.000 | 1.4 | 0.0 | O K |
| 2880 min Summer | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 4320 min Summer | 16.550 | 0.000 | 0.9 | 0.0 | O K |
| 5760 min Summer | 16.550 | 0.000 | 0.8 | 0.0 | O K |
| 7200 min Summer | 16.550 | 0.000 | 0.7 | 0.0 | O K |
| 8640 min Summer | 16.550 | 0.000 | 0.6 | 0.0 | O K |
| 10080 min Summer | 16.550 | 0.000 | 0.5 | 0.0 | O K |
| 15 min Winter | 16.701 | 0.151 | 16.0 | 0.2 | O K |
| 30 min Winter | 16.671 | 0.121 | 12.7 | 0.1 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 21.711 | 0.0 | 6.2 | 10 |
| 30 min Summer | 15.063 | 0.0 | 8.6 | 17 |
| 60 min Summer | 10.134 | 0.0 | 11.5 | 32 |
| 120 min Summer | 6.708 | 0.0 | 15.3 | 62 |
| 180 min Summer | 5.251 | 0.0 | 18.0 | 92 |
| 240 min Summer | 4.410 | 0.0 | 20.1 | 122 |
| 360 min Summer | 3.447 | 0.0 | 23.6 | 182 |
| 480 min Summer | 2.895 | 0.0 | 26.4 | 244 |
| 600 min Summer | 2.529 | 0.0 | 28.8 | 298 |
| 720 min Summer | 2.265 | 0.0 | 31.0 | 356 |
| 960 min Summer | 1.902 | 0.0 | 34.7 | 476 |
| 1440 min Summer | 1.479 | 0.0 | 40.5 | 718 |
| 2160 min Summer | 1.150 | 0.0 | 47.2 | 0 |
| 2880 min Summer | 0.962 | 0.0 | 52.6 | 0 |
| 4320 min Summer | 0.749 | 0.0 | 61.5 | 0 |
| 5760 min Summer | 0.626 | 0.0 | 68.5 | 0 |
| 7200 min Summer | 0.544 | 0.0 | 74.5 | 0 |
| 8640 min Summer | 0.486 | 0.0 | 79.7 | 0 |
| 10080 min Summer | 0.441 | 0.0 | 84.4 | 0 |
| 15 min Winter | 21.711 | 0.0 | 6.9 | 10 |
| 30 min Winter | 15.063 | 0.0 | 9.6 | 17 |

## Summary of Results for 1 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 16.637 | 0.087 | 8.9 | 0.1 | O K |
| 120 min Winter | 16.606 | 0.056 | 6.0 | 0.1 | O K |
| 180 min Winter | 16.590 | 0.040 | 4.7 | 0.0 | O K |
| 240 min Winter | 16.583 | 0.033 | 4.0 | 0.0 | O K |
| 360 min Winter | 16.574 | 0.024 | 3.1 | 0.0 | O K |
| 480 min Winter | 16.569 | 0.019 | 2.6 | 0.0 | O K |
| 600 min Winter | 16.564 | 0.014 | 2.3 | 0.0 | O K |
| 720 min Winter | 16.560 | 0.010 | 2.1 | 0.0 | O K |
| 960 min Winter | 16.555 | 0.005 | 1.7 | 0.0 | O K |
| 1440 min Winter | 16.550 | 0.000 | 1.3 | 0.0 | O K |
| 2160 min Winter | 16.550 | 0.000 | 1.0 | 0.0 | O K |
| 2880 min Winter | 16.550 | 0.000 | 0.9 | 0.0 | O K |
| 4320 min Winter | 16.550 | 0.000 | 0.7 | 0.0 | O K |
| 5760 min Winter | 16.550 | 0.000 | 0.6 | 0.0 | O K |
| 7200 min Winter | 16.550 | 0.000 | 0.5 | 0.0 | O K |
| 8640 min Winter | 16.550 | 0.000 | 0.4 | 0.0 | O K |
| 10080 min Winter | 16.550 | 0.000 | 0.4 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 10.134 | 0.0 | 12.9 | 32 |
| 120 min Winter | 6.708 | 0.0 | 17.1 | 62 |
| 180 min Winter | 5.251 | 0.0 | 20.1 | 90 |
| 240 min Winter | 4.410 | 0.0 | 22.5 | 124 |
| 360 min Winter | 3.447 | 0.0 | 26.4 | 184 |
| 480 min Winter | 2.895 | 0.0 | 29.6 | 240 |
| 600 min Winter | 2.529 | 0.0 | 32.3 | 306 |
| 720 min Winter | 2.265 | 0.0 | 34.7 | 360 |
| 960 min Winter | 1.902 | 0.0 | 38.9 | 478 |
| 1440 min Winter | 1.479 | 0.0 | 45.3 | 0 |
| 2160 min Winter | 1.150 | 0.0 | 52.9 | 0 |
| 2880 min Winter | 0.962 | 0.0 | 59.0 | 0 |
| 4320 min Winter | 0.749 | 0.0 | 68.8 | 0 |
| 5760 min Winter | 0.626 | 0.0 | 76.8 | 0 |
| 7200 min Winter | 0.544 | 0.0 | 83.4 | 0 |
| 8640 min Winter | 0.486 | 0.0 | 89.3 | 0 |
| 10080 min Winter | 0.441 | 0.0 | 94.6 | 0 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 1 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 14.700 | Shortest Storm (mins) | 15 |
| Ratio R | 0.256 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +0 |

## Time Area Diagram

Total Area (ha) 0.152

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.152 |

## Model Details

Storage is Online Cover Level (m) 17.500

## Pipe Structure

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 100.000 |
| Slope (1:X) | 15.000 | Invert Level (m) | 16.550 |

## Pipe Outflow Control

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Entry Loss Coefficient | 0.500 |
| Slope (1:X) | 15.0 | Coefficient of Contraction | 0.600 |
| Length (m) | 10.000 | Upstream Invert Level (m) | 16.500 |
| Roughness k (mm) | 0.600 | | |

## Summary of Results for 30 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 17.123 | 0.573 | 34.8 | 0.7 | O K |
| 30 min Summer | 17.032 | 0.482 | 31.8 | 0.6 | O K |
| 60 min Summer | 16.846 | 0.296 | 24.5 | 0.4 | O K |
| 120 min Summer | 16.712 | 0.162 | 17.2 | 0.2 | O K |
| 180 min Summer | 16.679 | 0.129 | 13.6 | 0.1 | O K |
| 240 min Summer | 16.660 | 0.110 | 11.4 | 0.1 | O K |
| 360 min Summer | 16.636 | 0.086 | 8.8 | 0.1 | O K |
| 480 min Summer | 16.621 | 0.071 | 7.2 | 0.1 | O K |
| 600 min Summer | 16.609 | 0.059 | 6.2 | 0.1 | O K |
| 720 min Summer | 16.600 | 0.050 | 5.5 | 0.1 | O K |
| 960 min Summer | 16.588 | 0.038 | 4.6 | 0.0 | O K |
| 1440 min Summer | 16.578 | 0.028 | 3.5 | 0.0 | O K |
| 2160 min Summer | 16.570 | 0.020 | 2.7 | 0.0 | O K |
| 2880 min Summer | 16.562 | 0.012 | 2.2 | 0.0 | O K |
| 4320 min Summer | 16.554 | 0.004 | 1.7 | 0.0 | O K |
| 5760 min Summer | 16.550 | 0.000 | 1.3 | 0.0 | O K |
| 7200 min Summer | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 8640 min Summer | 16.550 | 0.000 | 1.0 | 0.0 | O K |
| 10080 min Summer | 16.550 | 0.000 | 0.9 | 0.0 | O K |
| 15 min Winter | 17.124 | 0.574 | 34.8 | 0.7 | O K |
| 30 min Winter | 16.927 | 0.377 | 27.9 | 0.5 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 48.059 | 0.0 | 13.7 | 10 |
| 30 min Summer | 33.529 | 0.0 | 19.1 | 18 |
| 60 min Summer | 22.327 | 0.0 | 25.4 | 32 |
| 120 min Summer | 14.420 | 0.0 | 32.9 | 62 |
| 180 min Summer | 11.087 | 0.0 | 37.9 | 92 |
| 240 min Summer | 9.176 | 0.0 | 41.8 | 122 |
| 360 min Summer | 7.019 | 0.0 | 48.0 | 184 |
| 480 min Summer | 5.795 | 0.0 | 52.9 | 244 |
| 600 min Summer | 4.992 | 0.0 | 56.9 | 300 |
| 720 min Summer | 4.418 | 0.0 | 60.4 | 366 |
| 960 min Summer | 3.642 | 0.0 | 66.4 | 488 |
| 1440 min Summer | 2.773 | 0.0 | 75.9 | 716 |
| 2160 min Summer | 2.111 | 0.0 | 86.6 | 1100 |
| 2880 min Summer | 1.738 | 0.0 | 95.1 | 1420 |
| 4320 min Summer | 1.320 | 0.0 | 108.3 | 2128 |
| 5760 min Summer | 1.086 | 0.0 | 118.8 | 0 |
| 7200 min Summer | 0.933 | 0.0 | 127.6 | 0 |
| 8640 min Summer | 0.824 | 0.0 | 135.2 | 0 |
| 10080 min Summer | 0.742 | 0.0 | 142.1 | 0 |
| 15 min Winter | 48.059 | 0.0 | 15.3 | 10 |
| 30 min Winter | 33.529 | 0.0 | 21.4 | 18 |

. . .

Date 15/04/2021 15:54 | Designed by F.AGUILARFUERTES
File filter drain 1 in 30.SRCX | Checked by
Innovyze | Source Control 2018.1.1

## Summary of Results for 30 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 16.749 | 0.199 | 19.6 | 0.2 | O K |
| 120 min Winter | 16.672 | 0.122 | 12.8 | 0.1 | O K |
| 180 min Winter | 16.646 | 0.096 | 9.9 | 0.1 | O K |
| 240 min Winter | 16.631 | 0.081 | 8.2 | 0.1 | O K |
| 360 min Winter | 16.610 | 0.060 | 6.3 | 0.1 | O K |
| 480 min Winter | 16.597 | 0.047 | 5.2 | 0.0 | O K |
| 600 min Winter | 16.588 | 0.038 | 4.5 | 0.0 | O K |
| 720 min Winter | 16.582 | 0.032 | 4.0 | 0.0 | O K |
| 960 min Winter | 16.576 | 0.026 | 3.3 | 0.0 | O K |
| 1440 min Winter | 16.567 | 0.017 | 2.5 | 0.0 | O K |
| 2160 min Winter | 16.558 | 0.008 | 1.9 | 0.0 | O K |
| 2880 min Winter | 16.553 | 0.003 | 1.6 | 0.0 | O K |
| 4320 min Winter | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 5760 min Winter | 16.550 | 0.000 | 1.0 | 0.0 | O K |
| 7200 min Winter | 16.550 | 0.000 | 0.8 | 0.0 | O K |
| 8640 min Winter | 16.550 | 0.000 | 0.7 | 0.0 | O K |
| 10080 min Winter | 16.550 | 0.000 | 0.7 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 22.327 | 0.0 | 28.5 | 32 |
| 120 min Winter | 14.420 | 0.0 | 36.8 | 60 |
| 180 min Winter | 11.087 | 0.0 | 42.5 | 94 |
| 240 min Winter | 9.176 | 0.0 | 46.9 | 124 |
| 360 min Winter | 7.019 | 0.0 | 53.8 | 186 |
| 480 min Winter | 5.795 | 0.0 | 59.2 | 244 |
| 600 min Winter | 4.992 | 0.0 | 63.7 | 302 |
| 720 min Winter | 4.418 | 0.0 | 67.7 | 356 |
| 960 min Winter | 3.642 | 0.0 | 74.4 | 480 |
| 1440 min Winter | 2.773 | 0.0 | 85.0 | 728 |
| 2160 min Winter | 2.111 | 0.0 | 97.0 | 1096 |
| 2880 min Winter | 1.738 | 0.0 | 106.5 | 1432 |
| 4320 min Winter | 1.320 | 0.0 | 121.4 | 0 |
| 5760 min Winter | 1.086 | 0.0 | 133.1 | 0 |
| 7200 min Winter | 0.933 | 0.0 | 142.9 | 0 |
| 8640 min Winter | 0.824 | 0.0 | 151.5 | 0 |
| 10080 min Winter | 0.742 | 0.0 | 159.1 | 0 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 30 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 14.700 | Shortest Storm (mins) | 15 |
| Ratio R | 0.256 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +0 |

## Time Area Diagram

Total Area (ha) 0.152

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.152 |

## Model Details

Storage is Online Cover Level (m) 17.500

## Pipe Structure

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 100.000 |
| Slope (1:X) | 15.000 | Invert Level (m) | 16.550 |

## Pipe Outflow Control

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Entry Loss Coefficient | 0.500 |
| Slope (1:X) | 15.0 | Coefficient of Contraction | 0.600 |
| Length (m) | 10.000 | Upstream Invert Level (m) | 16.500 |
| Roughness k (mm) | 0.600 | | |

## Summary of Results for 100 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 17.456 | 0.906 | 44.1 | 1.1 | Flood Risk |
| 30 min Summer | 17.344 | 0.794 | 41.2 | 1.0 | Flood Risk |
| 60 min Summer | 17.028 | 0.478 | 31.6 | 0.6 | O K |
| 120 min Summer | 16.798 | 0.248 | 22.2 | 0.3 | O K |
| 180 min Summer | 16.715 | 0.165 | 17.6 | 0.2 | O K |
| 240 min Summer | 16.688 | 0.138 | 14.6 | 0.2 | O K |
| 360 min Summer | 16.657 | 0.107 | 11.1 | 0.1 | O K |
| 480 min Summer | 16.639 | 0.089 | 9.1 | 0.1 | O K |
| 600 min Summer | 16.627 | 0.077 | 7.9 | 0.1 | O K |
| 720 min Summer | 16.618 | 0.068 | 6.9 | 0.1 | O K |
| 960 min Summer | 16.602 | 0.052 | 5.7 | 0.1 | O K |
| 1440 min Summer | 16.585 | 0.035 | 4.3 | 0.0 | O K |
| 2160 min Summer | 16.576 | 0.026 | 3.3 | 0.0 | O K |
| 2880 min Summer | 16.570 | 0.020 | 2.7 | 0.0 | O K |
| 4320 min Summer | 16.559 | 0.009 | 2.0 | 0.0 | O K |
| 5760 min Summer | 16.555 | 0.005 | 1.8 | 0.0 | O K |
| 7200 min Summer | 16.550 | 0.000 | 1.4 | 0.0 | O K |
| 8640 min Summer | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 10080 min Summer | 16.550 | 0.000 | 1.1 | 0.0 | O K |
| 15 min Winter | 17.462 | 0.912 | 44.2 | 1.1 | Flood Risk |
| 30 min Winter | 17.171 | 0.621 | 36.2 | 0.8 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 62.036 | 0.0 | 17.7 | 10 |
| 30 min Summer | 43.678 | 0.0 | 24.9 | 18 |
| 60 min Summer | 29.093 | 0.0 | 33.2 | 32 |
| 120 min Summer | 18.651 | 0.0 | 42.5 | 62 |
| 180 min Summer | 14.260 | 0.0 | 48.8 | 92 |
| 240 min Summer | 11.746 | 0.0 | 53.6 | 122 |
| 360 min Summer | 8.924 | 0.0 | 61.0 | 184 |
| 480 min Summer | 7.330 | 0.0 | 66.8 | 240 |
| 600 min Summer | 6.288 | 0.0 | 71.7 | 302 |
| 720 min Summer | 5.545 | 0.0 | 75.9 | 362 |
| 960 min Summer | 4.545 | 0.0 | 82.9 | 480 |
| 1440 min Summer | 3.433 | 0.0 | 93.9 | 728 |
| 2160 min Summer | 2.592 | 0.0 | 106.4 | 1100 |
| 2880 min Summer | 2.122 | 0.0 | 116.1 | 1456 |
| 4320 min Summer | 1.598 | 0.0 | 131.1 | 2192 |
| 5760 min Summer | 1.305 | 0.0 | 142.7 | 2920 |
| 7200 min Summer | 1.115 | 0.0 | 152.6 | 0 |
| 8640 min Summer | 0.981 | 0.0 | 161.0 | 0 |
| 10080 min Summer | 0.880 | 0.0 | 168.5 | 0 |
| 15 min Winter | 62.036 | 0.0 | 19.8 | 10 |
| 30 min Winter | 43.678 | 0.0 | 27.9 | 18 |

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Innovyze | Source Control 2018.1.1

## Summary of Results for 100 year Return Period

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 16.869 | 0.319 | 25.5 | 0.4 | O K |
| 120 min Winter | 16.707 | 0.157 | 16.7 | 0.2 | O K |
| 180 min Winter | 16.672 | 0.122 | 12.8 | 0.1 | O K |
| 240 min Winter | 16.652 | 0.102 | 10.6 | 0.1 | O K |
| 360 min Winter | 16.629 | 0.079 | 8.0 | 0.1 | O K |
| 480 min Winter | 16.614 | 0.064 | 6.6 | 0.1 | O K |
| 600 min Winter | 16.602 | 0.052 | 5.6 | 0.1 | O K |
| 720 min Winter | 16.593 | 0.043 | 5.0 | 0.0 | O K |
| 960 min Winter | 16.584 | 0.034 | 4.2 | 0.0 | O K |
| 1440 min Winter | 16.574 | 0.024 | 3.1 | 0.0 | O K |
| 2160 min Winter | 16.565 | 0.015 | 2.3 | 0.0 | O K |
| 2880 min Winter | 16.558 | 0.008 | 1.9 | 0.0 | O K |
| 4320 min Winter | 16.550 | 0.000 | 1.4 | 0.0 | O K |
| 5760 min Winter | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 7200 min Winter | 16.550 | 0.000 | 1.0 | 0.0 | O K |
| 8640 min Winter | 16.550 | 0.000 | 0.9 | 0.0 | O K |
| 10080 min Winter | 16.550 | 0.000 | 0.8 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 29.093 | 0.0 | 37.1 | 32 |
| 120 min Winter | 18.651 | 0.0 | 47.6 | 62 |
| 180 min Winter | 14.260 | 0.0 | 54.6 | 92 |
| 240 min Winter | 11.746 | 0.0 | 60.0 | 120 |
| 360 min Winter | 8.924 | 0.0 | 68.4 | 178 |
| 480 min Winter | 7.330 | 0.0 | 74.9 | 240 |
| 600 min Winter | 6.288 | 0.0 | 80.3 | 306 |
| 720 min Winter | 5.545 | 0.0 | 85.0 | 366 |
| 960 min Winter | 4.545 | 0.0 | 92.9 | 482 |
| 1440 min Winter | 3.433 | 0.0 | 105.2 | 730 |
| 2160 min Winter | 2.592 | 0.0 | 119.1 | 1104 |
| 2880 min Winter | 2.122 | 0.0 | 130.0 | 1408 |
| 4320 min Winter | 1.598 | 0.0 | 146.9 | 0 |
| 5760 min Winter | 1.305 | 0.0 | 160.0 | 0 |
| 7200 min Winter | 1.115 | 0.0 | 170.9 | 0 |
| 8640 min Winter | 0.981 | 0.0 | 180.3 | 0 |
| 10080 min Winter | 0.880 | 0.0 | 188.7 | 0 |

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Innovyze | Source Control 2018.1.1

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 14.700 | Shortest Storm (mins) | 15 |
| Ratio R | 0.256 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +0 |

## Time Area Diagram

Total Area (ha) 0.152

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.152 |

## Model Details

Storage is Online Cover Level (m) 17.500

## Pipe Structure

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 100.000 |
| Slope (1:X) | 15.000 | Invert Level (m) | 16.550 |

## Pipe Outflow Control

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Entry Loss Coefficient | 0.500 |
| Slope (1:X) | 15.0 | Coefficient of Contraction | 0.600 |
| Length (m) | 10.000 | Upstream Invert Level (m) | 16.500 |
| Roughness k (mm) | 0.600 | | |

## Summary of Results for 100 year Return Period (+35%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 17.502 | 0.952 | 45.2 | 3.3 | FLOOD |
| 30 min Summer | 17.502 | 0.952 | 45.2 | 2.8 | FLOOD |
| 60 min Summer | 17.376 | 0.826 | 42.0 | 1.0 | Flood Risk |
| 120 min Summer | 16.976 | 0.426 | 29.7 | 0.5 | O K |
| 180 min Summer | 16.826 | 0.276 | 23.5 | 0.3 | O K |
| 240 min Summer | 16.750 | 0.200 | 19.6 | 0.2 | O K |
| 360 min Summer | 16.691 | 0.141 | 14.9 | 0.2 | O K |
| 480 min Summer | 16.668 | 0.118 | 12.4 | 0.1 | O K |
| 600 min Summer | 16.652 | 0.102 | 10.6 | 0.1 | O K |
| 720 min Summer | 16.641 | 0.091 | 9.4 | 0.1 | O K |
| 960 min Summer | 16.626 | 0.076 | 7.7 | 0.1 | O K |
| 1440 min Summer | 16.604 | 0.054 | 5.8 | 0.1 | O K |
| 2160 min Summer | 16.587 | 0.037 | 4.4 | 0.0 | O K |
| 2880 min Summer | 16.579 | 0.029 | 3.6 | 0.0 | O K |
| 4320 min Summer | 16.571 | 0.021 | 2.8 | 0.0 | O K |
| 5760 min Summer | 16.563 | 0.013 | 2.2 | 0.0 | O K |
| 7200 min Summer | 16.559 | 0.009 | 2.0 | 0.0 | O K |
| 8640 min Summer | 16.556 | 0.006 | 1.8 | 0.0 | O K |
| 10080 min Summer | 16.551 | 0.001 | 1.5 | 0.0 | O K |
| 15 min Winter | 17.502 | 0.952 | 45.2 | 3.5 | FLOOD |
| 30 min Winter | 17.501 | 0.951 | 45.2 | 1.7 | FLOOD |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 15 min Summer | 83.749 | 2.1 | 23.8 | 11 |
| 30 min Summer | 58.965 | 1.6 | 33.6 | 19 |
| 60 min Summer | 39.275 | 0.0 | 44.7 | 32 |
| 120 min Summer | 25.179 | 0.0 | 57.4 | 62 |
| 180 min Summer | 19.251 | 0.0 | 65.8 | 92 |
| 240 min Summer | 15.857 | 0.0 | 72.3 | 122 |
| 360 min Summer | 12.048 | 0.0 | 82.4 | 182 |
| 480 min Summer | 9.895 | 0.0 | 90.2 | 244 |
| 600 min Summer | 8.488 | 0.0 | 96.8 | 300 |
| 720 min Summer | 7.486 | 0.0 | 102.4 | 366 |
| 960 min Summer | 6.136 | 0.0 | 111.9 | 486 |
| 1440 min Summer | 4.635 | 0.0 | 126.8 | 726 |
| 2160 min Summer | 3.500 | 0.0 | 143.6 | 1100 |
| 2880 min Summer | 2.865 | 0.0 | 156.7 | 1456 |
| 4320 min Summer | 2.157 | 0.0 | 177.0 | 2136 |
| 5760 min Summer | 1.762 | 0.0 | 192.8 | 2912 |
| 7200 min Summer | 1.506 | 0.0 | 205.9 | 3552 |
| 8640 min Summer | 1.324 | 0.0 | 216.8 | 4336 |
| 10080 min Summer | 1.187 | 0.0 | 227.4 | 4976 |
| 15 min Winter | 83.749 | 2.3 | 26.7 | 11 |
| 30 min Winter | 58.965 | 0.5 | 37.6 | 19 |

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Innovyze | Source Control 2018.1.1

## Summary of Results for 100 year Return Period (+35%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Control (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 60 min Winter | 17.106 | 0.556 | 34.2 | 0.7 | O K |
| 120 min Winter | 16.803 | 0.253 | 22.4 | 0.3 | O K |
| 180 min Winter | 16.712 | 0.162 | 17.2 | 0.2 | O K |
| 240 min Winter | 16.685 | 0.135 | 14.2 | 0.2 | O K |
| 360 min Winter | 16.655 | 0.105 | 10.9 | 0.1 | O K |
| 480 min Winter | 16.637 | 0.087 | 8.9 | 0.1 | O K |
| 600 min Winter | 16.625 | 0.075 | 7.7 | 0.1 | O K |
| 720 min Winter | 16.616 | 0.066 | 6.8 | 0.1 | O K |
| 960 min Winter | 16.600 | 0.050 | 5.5 | 0.1 | O K |
| 1440 min Winter | 16.585 | 0.035 | 4.2 | 0.0 | O K |
| 2160 min Winter | 16.575 | 0.025 | 3.2 | 0.0 | O K |
| 2880 min Winter | 16.569 | 0.019 | 2.6 | 0.0 | O K |
| 4320 min Winter | 16.558 | 0.008 | 1.9 | 0.0 | O K |
| 5760 min Winter | 16.554 | 0.004 | 1.7 | 0.0 | O K |
| 7200 min Winter | 16.550 | 0.000 | 1.4 | 0.0 | O K |
| 8640 min Winter | 16.550 | 0.000 | 1.2 | 0.0 | O K |
| 10080 min Winter | 16.550 | 0.000 | 1.1 | 0.0 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Discharge Volume (m³) | Time-Peak (mins) |
|---|---|---|---|---|
| 60 min Winter | 39.275 | 0.0 | 50.1 | 32 |
| 120 min Winter | 25.179 | 0.0 | 64.3 | 62 |
| 180 min Winter | 19.251 | 0.0 | 73.7 | 92 |
| 240 min Winter | 15.857 | 0.0 | 81.0 | 124 |
| 360 min Winter | 12.048 | 0.0 | 92.3 | 184 |
| 480 min Winter | 9.895 | 0.0 | 101.1 | 238 |
| 600 min Winter | 8.488 | 0.0 | 108.4 | 300 |
| 720 min Winter | 7.486 | 0.0 | 114.7 | 368 |
| 960 min Winter | 6.136 | 0.0 | 125.4 | 486 |
| 1440 min Winter | 4.635 | 0.0 | 142.0 | 714 |
| 2160 min Winter | 3.500 | 0.0 | 160.9 | 1048 |
| 2880 min Winter | 2.865 | 0.0 | 175.5 | 1440 |
| 4320 min Winter | 2.157 | 0.0 | 198.2 | 2160 |
| 5760 min Winter | 1.762 | 0.0 | 215.8 | 2952 |
| 7200 min Winter | 1.506 | 0.0 | 230.7 | 0 |
| 8640 min Winter | 1.324 | 0.0 | 243.4 | 0 |
| 10080 min Winter | 1.187 | 0.0 | 254.7 | 0 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | Scotland and Ireland | Cv (Winter) | 0.840 |
| M5-60 (mm) | 14.700 | Shortest Storm (mins) | 15 |
| Ratio R | 0.256 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +35 |

## Time Area Diagram

Total Area (ha) 0.152

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.152 |

## Model Details

Storage is Online Cover Level (m) 17.500

## Pipe Structure

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Length (m) | 100.000 |
| Slope (1:X) | 15.000 | Invert Level (m) | 16.550 |

## Pipe Outflow Control

| | | | |
|---|---|---|---|
| Diameter (m) | 0.150 | Entry Loss Coefficient | 0.500 |
| Slope (1:X) | 15.0 | Coefficient of Contraction | 0.600 |
| Length (m) | 10.000 | Upstream Invert Level (m) | 16.500 |
| Roughness k (mm) | 0.600 | | |

# APPENDIX E – PROPOSED DRAINAGE PLAN

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PROPOSED PACKAGE TREATMENT PLANT
WPL HIPAF OR SIMILAR APPROVED
DISCHARGE REQUIREMENTS:
- BOD5: 20mg/l
- SS: 30mg/l
- NH4 (AMMONDIA):20mg/l
CL 15.000
IL 14.75

UV
DISINFECTION
UNIT

NEW OUTFALL TO
COCKBURNSPATH BURN
OUTFALL DETAILS TBC

EFFLUENT FROM PACKAGE
TREATMENT PLANT TO GO
THROUGH UV FILTRATION
PRIOR TO DISCHARGE
INTO THE SEA THROUGH
EXISTING OUTFALL

SW01
CL 37.00
IL 35.95

FW01
CL 38.400
IL 37.400

FW02
CL 37.100
IL 35.896

SW02
CL 35.00
IL 32.321

FW03
CL 35.000
IL 33.080 (B/D) (100ø)
IL 30.000 (150ø)

SW02A
CL 34.600
IL 28.922

SW03
CL 34.550
IL 28.465

FW04
CL 34.550
IL 29.199 (B/D)
IL 26.643

SW04
CL 27.50
IL 26.450

SW12
CL 34.400
IL 28.527

FW18
CL 27.700
IL 25.311

FW19
CL 27.550
IL 24.635

SW13
CL 28.000
IL 26.950

FW05
CL 27.500
IL 23.861 (150ø)
IL 23.911 (100ø)

FW06
CL 26.200
IL 23.240

SW05
CL 25.000
IL 23.950

FW07
CL 25.000
IL 22.209

SW06
CL 23.300
IL 22.250

FW04A
CL 32.000
IL 26.232 (B/D)
IL 24.000

FW17
CL 33.00
IL 27.038 (100ø)
IL 26.988 (150ø)

SW10
CL 17.500
IL 16.450

SW11
CL 30.000
IL 28.950

FW16
CL 29.230
IL 28.230

SW07
CL 21.000
IL 19.950

FW08
CL 23.300
IL 20.979

FW09
CL 21.000
IL 19.630

FW10
CL 20.700
IL 18.918 (B/D)
IL 16.000

SW08
CL 20.500
IL 19.450

FW11
CL 19.800
IL 15.593

FW12
CL 19.200
IL 15.397

FW14
CL 17.200
IL 14.881

FW15
CL 16.500
IL 14.70

FW13
CL 18.700
IL 14.951

SW09
CL 18.700
IL 17.650

0 5 10 15 20 25 m
SCALE 1:500

GENERAL NOTES.

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. PROPOSED LAYOUT INCLUDING PROPOSED SITE LEVELS PROVIDED BY ARCHITECHTS PLUS.
3. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE EARTHWORKS SPECIFICATION.
4. TOPOGRAPHICAL SURVEY PROVIDED BY SPATIAL DATA LIMITED.

PROPOSED PACKAGE TREATMENT PLANT DETAILS TO BE CONFIRMED AND SUBJECT TO AGREEMENT WITH SEPA

ALL LEVELS TO BE CONFIRMED

THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND SUBJECT TO FURTHER DETAILED DESIGN

LEGEND

- PROPOSED SURFACE WATER DRAINAGE
- SURFACE WATER PERFORATED PIPE
- PROPOSED FOUL DRAINAGE
- PROPOSED GRAVEL FILTER DRAIN
- EXISTING BURN

# PRELIMINARY ISSUE

| Rev | Description | Date | Drn | Chk | App |
|---|---|---|---|---|---|
| P01 | ISSUED FOR INFORMATION | 20.04.2021 | JJW | FA | RC |

Document Control

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TETRA TECH

Client

VERDANT LEISURE

Project Name

PEASE BAY HOLIDAY PARK

Sheet Title

PROPOSED DRAINAGE GA

| TTE Project Number | Drawn By | Date | Checked By | Date | Approved By | Date | Scale @ A1 | Suitability |
|---|---|---|---|---|---|---|---|---|
| A117626 | JJW | APR 21 | FA | APR 21 | JP | APR 21 | 1:500 | S0 |

| Client Project Number | Originator | Volume/System | Level/Location | Type/Code | Role | Number | Revision |
|---|---|---|---|---|---|---|---|
| A117626 - TTE - 00 - ZZ - DR - C - 0100 | | | | | | | P01 |



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