Atholl Associates

Flood Risk and Drainage

DRAINAGE STRATEGY REPORT: PROPOSED VILLAGE HALL, ST FILLANS, PERTHSHIRE

March 2022

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Revision Schedule:

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APPENDICES

PLANS

1.0 Introduction

Atholl Associates Ltd have been instructed by Denholm Partnership Architects, on behalf of St Fillans Community Council, to develop a drainage strategy in relation to a proposed development of a village hall at St Fillans, Perthshire. The proposed site is on the outskirts of the village, on land which lies to the south of the River Earn.

The proposed development is a change of use of a greenfield site, and will include a village hall and associated outdoor activity areas and car parking. The building will have toilets and kitchen facilities, and therefore requires to be served by a wastewater treatment and disposal system.

This report should be read in conjunction with our report on flood risk (AAFR/BC/196b March 2022), which sets out which areas are within the floodplain of the River Earn, and hence not suitable for placing elements of drainage.

Access roads and car parking will be gravel surfaced, and will have a loose-bound gravel construction to ensure they are permeable. Hence this will allow infiltration of surface water from roads and carparking direct to ground. For roof areas, attenuation, treatment and disposal by infiltration will be via an infiltration trench.

To enable the strategy to be developed, a topographical survey of the site has been undertaken, and drainage testing has been completed.

2.0 General Description of the Site

The site of the proposed community facility is approximately 0.95 hectares in extent, and sits on an area of ground which is in the form of a low mound, roughly triangular in shape, which lies on the southern side (right bank) of the River Earn. The site is bounded to the north by the River Earn, to the west by the eastern shore of Loch Earn, and to the south by a single-track unclassified road.

To the west of the site, lies the eastern end of Loch Earn, which is a substantial body of water with an extensive catchment area. The levels in the loch (and the stretch of the River Earn which runs past the site) are artificially raised by a weir approximately 100m downstream of the eastern end of the site, which is part of the intake works for a large hydro scheme built in the late 1950's and run by SSE. The weir is a fixed concrete structure several meters high. Adjacent to the weir is the intake to a tunnel connecting to Dalchonzie Power Station. There is also a fish ladder on the south side of the weir. Although the intake is capable of taking a substantial flow, it is assumed that (as is normal operating practice for hydro schemes), the worst-case scenario of a "hands off" flow will normally be the setting during any substantial flood event.

On the north side of the river is the small village of St Fillans. The site can be accessed directly from the village by an existing footbridge over the river. This footbridge is a relatively substantial structure, in a single clear span constructed of concrete.

The footbridge connects with a path which runs down the western boundary of the site, parallel with the loch shore and across a small causeway to link with the unclassified road. There is a second path leading from the bridge along the northern boundary of the site, i.e. along the right bank of the River Earn, again leading to a junction with the unclassified road.

The site is in part wooded but with an area of open ground roughly in the centre of the site. This open ground is essentially the higher part of the site. Ground levels on site range from 97.4m to 101.0m AOD. Significantly, to the south the site dips lower than the adjacent road, along a strip of marshy ground which includes some ponded areas. The largest of the ponds is at the western end of this feature, where the pond appears to be up to around 0.5m deep (based on surveyed levels). The main pond is approximately 50m long by 20m wide. The other ponded areas are relatively small, and appear to be the route of outflow from the pond eastwards to the River Earn.

Drainage of the majority of the site seems, based on topography, to be towards the ponds on the southern boundary. It would appear that the natural outlet from the main pond would have been towards the loch shore to the west. However this is blocked by the causeway on which the footpath is situated, raising the level of the pond sufficiently that it overflows to the east and towards the river.

Photograph 1 – General view of existing site looking east from western boundary fence

Photograph 2 – View looking eastwards over pond from near the south-eastern corner of the site.
The unclassified road on the southern boundary is visible on the right.

Photograph 3 – Looking north to centre of site, with drainage testing underway in TP1. The high point of the site is immediately behind (recommended location for main building)

The site is underlain by sands and gravels, predominantly finer sands, and appears to be potentially an area of old dunes due to wind-blown sand.

The location is as shown on Figure 1 below:

Figure 1 - Location Plan (Excerpt from Drawing 5342_-_Location Plan. See Plans section of this report)

The existing layout of touring pitches and camping ground are shown in Figure 2 below:

Figure 2 - Existing site layout (excerpt from Drawing 0722-01-War Memorial – see Plans section of this report)

Proposals for the site layout are as shown below in Figure 3. As previously discussed, the proposed development is a change of use of a greenfield site, and will include a village hall and associated outdoor activity areas and car parking.

The building will have toilets and kitchen facilities, and therefore requires to be served by a wastewater treatment and disposal system. It will also require associated infrastructure including access tracks and parking areas leading from the public road on the south side of the site.

Figure 3 - Proposed site layout (excerpt from Drawing 5342_SK03_ Block Plan – see Plans section of this report)

3.0 Drainage Impact Assessment

Based on available information, we can state the following:

- The site appears to have good natural drainage on the higher parts with little evidence of wet or saturated ground, or areas of reeds. However, the drainage from most of the site is predominantly towards the low-lying area of ground along the southern boundary. In this area, the ground is waterlogged, and has areas of permanent open water.

- The access road, car parking and roof drainage for the main building will be served by drainage which is designed in accordance with the principles of SuDS. Hence, there will be no net increase in runoff from the site, and no adverse impact on water quality in the receiving groundwater or watercourses.

- The new surface water drainage proposals for the surface water from the completed development should replicate the existing drainage patterns, with the important proviso that all rainfall up to and including rainfall associated with a 1-in-200-year storm should be retained onsite. This will therefore be if anything a betterment on the existing situation.

- In order to avoid any pollution associated with contaminants in runoff from the site, the collected runoff will be suitably treated in compliance with guidance set out by SEPA in terms of a system of treatment processes as per good SuDS design.

- There is a need for a foul disposal system since there will be toilets and kitchen facilities for those visiting the site. As there is no way of connecting with the Scottish Water sewer system on the other side of the River Earn in St Fillans, and given the large volume of dilution in the River Earn year-round, it is proposed to treat the sewage in a private wastewater treatment plant, and discharge this to the river. Given the large flows in the river and the relatively small flows produced by the foul system, by inspection, there will be no noticeable impact on flood flows or water quality from such a system.

Based on the above we would anticipate that existing drainage patterns will be retained, although there will be a reduction in runoff due to the storage and attenuation introduced by the SuDS system, and in theory there will be a reduction in initial flows due to the introduction of detention storage where gravel layers are introduced.

Flows in excess of the 1 in 200 year storm event will overflow the drainage system and will follow existing drainage patterns, meaning the excess flow will contribute to the ponds to the south of the site. It should be noted that these overland flows will be less than would currently flow during such a storm event, and that the intervening stretch of vegetated ground will act as a natural filter strip, providing ample treatment to remove grit and other solids.

An indicative sketch of existing drainage patterns is shown below in Figure 4, based on ground slopes of existing topography. It is assumed that groundwater flow will follow a similar pattern, and ultimately all surface water and groundwater will flow to the ponded area which ultimately overflows via an existing culvert to the River Earn.

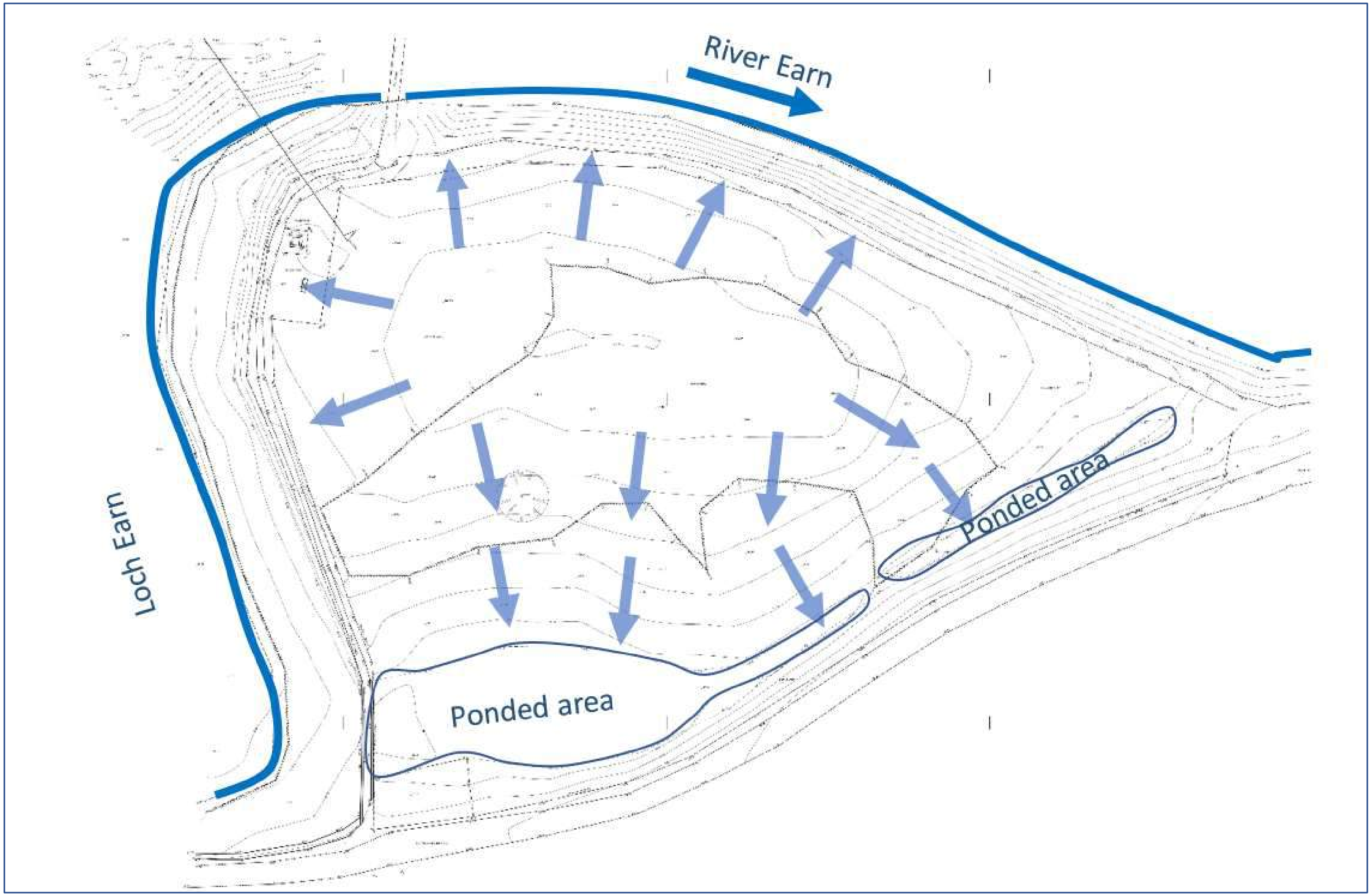


Figure 4 - Existing drainage patterns (indicative, based on surveyed topography)

4.0 Site Investigation

A site investigation was carried out in February 2022. The first day of the site work was mainly dry, but was immediately after a period of very wet weather. Over the second and third day of testing, the weather deteriorated with periods of wet weather, high winds and snow. Hence, very adverse conditions for drainage testing and therefore the results collated from testing are likely to be underestimations of infiltration capacity.

The objectives of the site investigation were to:

- Assess the permeability of the shallow superficial deposits to determine the suitability of infiltration systems for surface water.

- Determine the relative position of the water table

The area available for excavation during the site investigation was open ground with a short grass covering. This was in the central part of the site on the higher area of ground. The reason the testing was concentrated here is that there were significant areas of tree cover, and also that the lower areas of ground to the south were waterlogged and/or ponded.

Hence, a total of 3 trial pits (TPs) were excavated, along with one groundwater pit (GWP). Trial pit logs for each of the trial pits are enclosed within Appendix A, along with associated calculations. The locations of each pit are shown on Drawing AA-DD-196b-001 Trial Pit Location Plan in the Plans section of this report.

Percolation testing was completed in accordance with BRE 365. The results are contained in Appendix A, and show some variation in infiltration rates with depth, and across the site.

Overall, it was found that ground water was not present in trial pits. The GWP was excavated to a total depth of 2.5m BGL, and also showed no ground water ingress.

Permeability of soils was generally found to be relatively consistent and useful from surface level down to between 0.9m to 1.4m, with generally poorer infiltration below those levels. However, as this was affected partly by antecedent rainfall and ongoing heavy rain/snow on Day 2 and Day 3, the infiltration rates measured at lower levels were likely to be unrepresentative in some cases.

Drainage testing results are set out in Appendix A. The location of the trial pits with the calculated infiltration rates for each is set out in Drawing AA-DD-196b-001 Trial Pit Location Plan (see Plans section).

An excerpt from Drawing AA-DD-196b-001 Trial Pit Location Plan is shown below in Figure 5.

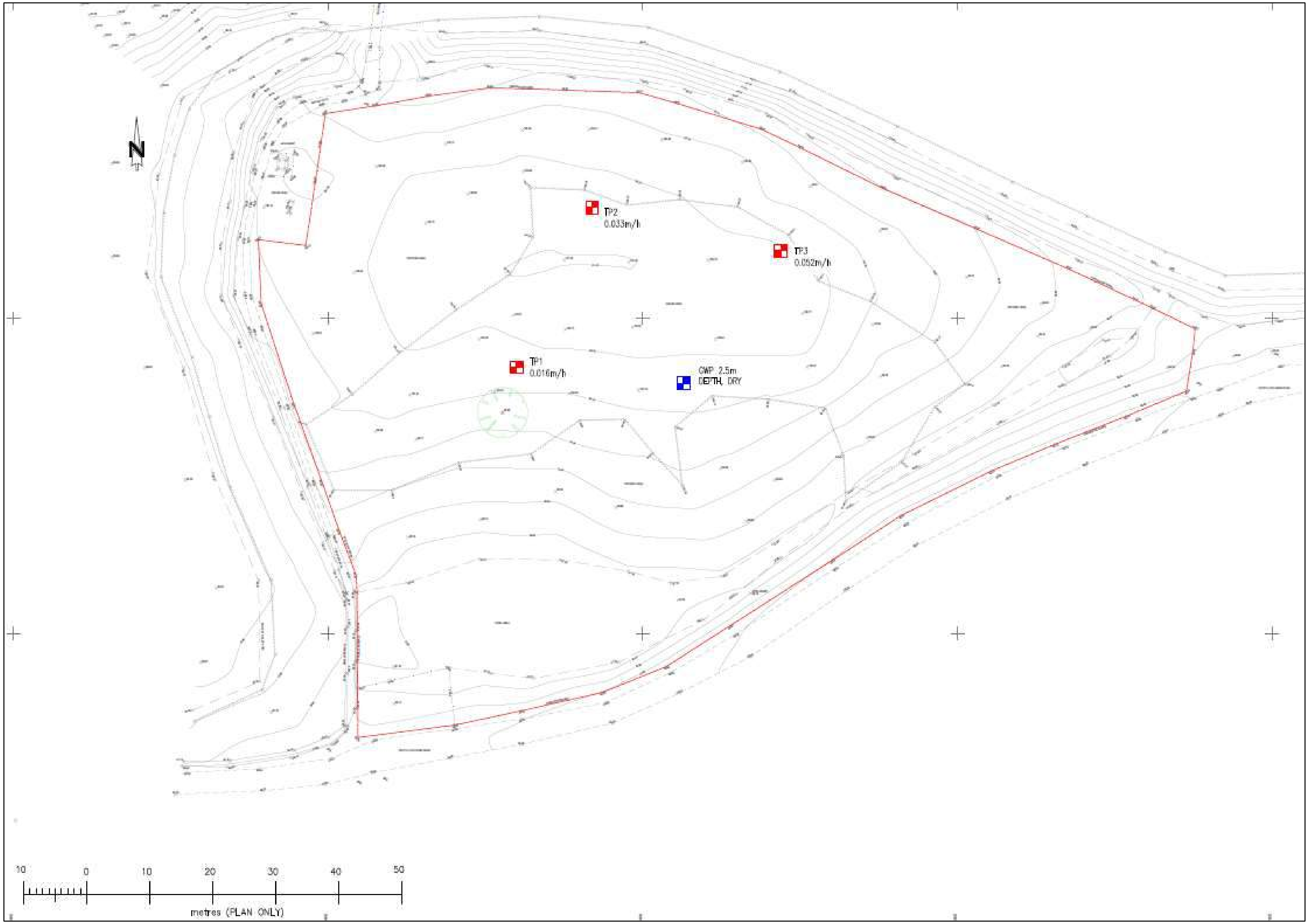


Figure 5 - Location of trial pits with infiltration rates, plus infiltration rates (excerpt from AA-DD-196b-001 Trial Pit Location Plan)

5.0 Drainage Strategy

5.1 Surface Water Drainage

This will consist of a system which collects and attenuates surface water from a combination of runoff from roof areas, parking areas, and access roads within the site. This will then be disposed of by infiltration.

An example of layout for roof areas and hardstanding has been established based on the findings of our FRA report (Ref. AADD/BC/196c, March 2022), combined with original draft layout proposals, and the findings of our drainage assessment. This is used to demonstrate a workable strategy, it should be noted this is not the final proposed layout, to be established by others. Based on these considerations, see drainage strategy (as set out in the Drawing AA-DD-196b-002 Drainage Strategy Plan) in Figure 6 overleaf:

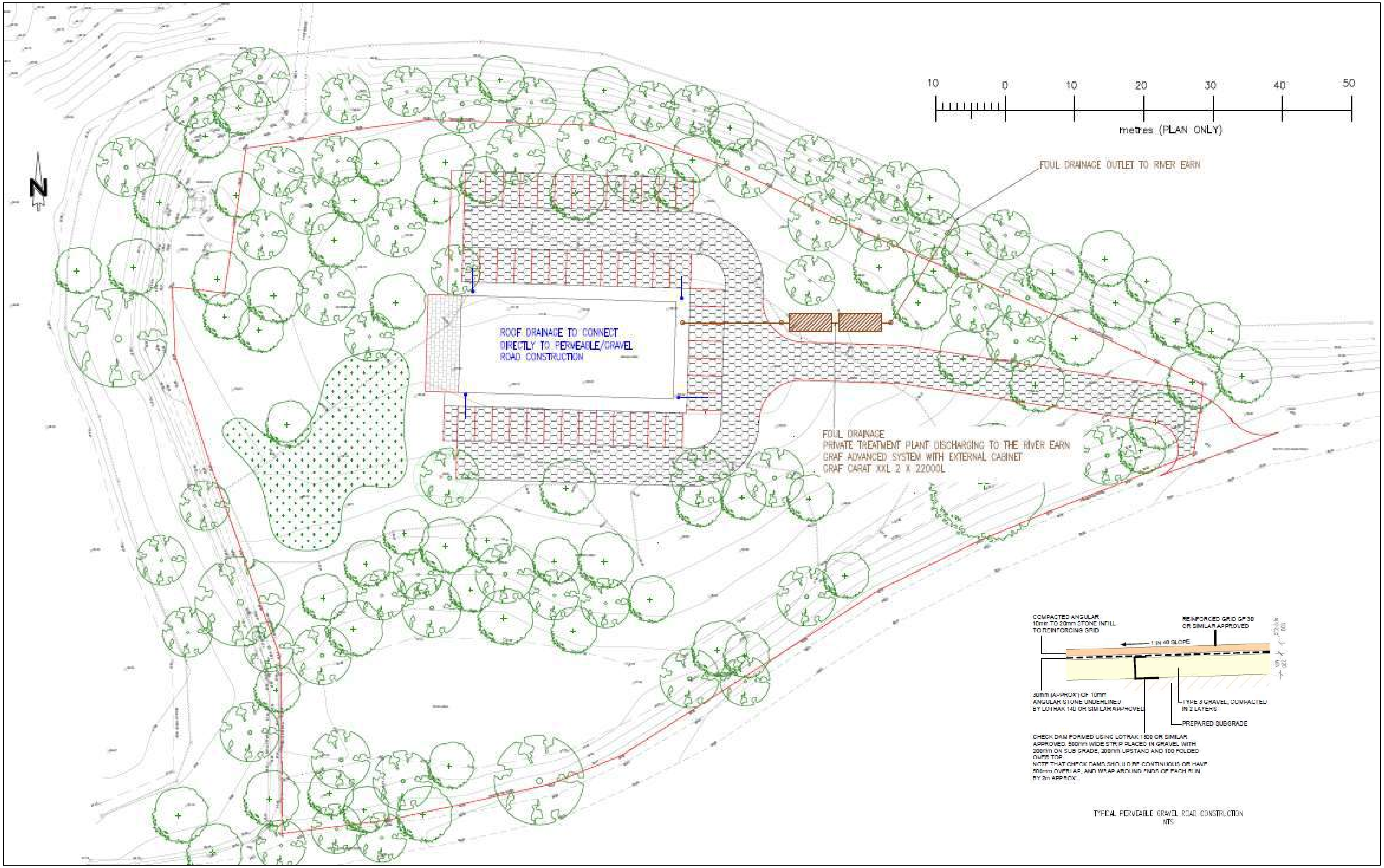


Figure 6 - Surface water drainage system, proposed permeable gravel surfacing with connected roof drainage, and showing foul drainage network and treatment plant location (excerpt from AA-DD-196b-002 Drainage Strategy Plan).

Surface water from contributing areas of roof will flow via connecting pipes to the subbases of the porous gravel parking areas, where the roof water will be distributed via a network of porous pipes, to be co-disposed by infiltration along with direct infiltration of rainfall from parking and road areas.

The gravel areas are nominally 300mm in depth, and are formed using gravel of a suitable grade for drainage applications, i.e. with a void ratio of 0.3 or more. Hence, these gravel areas do not in effect contribute runoff which needs to be disposed of, but rather there is storage in the gravel areas due to a void ration of 0.3.

Calculation of pre- and post-development surface water storage and infiltration

The design set out below and in Appendix B follows procedures and guidance set out in "Flood Risk and Flood Risk Assessment" *(Perth and Kinross Council, January 2021)*. In this context it is noted that the discharge of surface water from the site due to rainfall should be limited to the lesser of:

- 1 in 5 year greenfield runoff rate
- 4.0 l/s/ha

However in this case an infiltration-based drainage system is proposed. In practice, the drainage system will be designed to contain all runoff up to and including the 1-in-200-year storm event and dispose of it by infiltration. Hence, there will be significant betterment over the existing situation, where there is likely to be some runoff from the site.

The proposed layout of the designed system is set out in drawing AA-DD-196b-002 Drainage Strategy Plan, as well as in Figure 6 above. This will be adequate to ensure greenfield runoff rates are not exceeded for events up to and including the 1 in 200 year storm event. Overland flow for storm events in excess of the 200-year plus climate change event would follow the same path as existing exceedance flows but will be reduced.

Note that, as previously discussed, the proposed drainage system will provide betterment over existing drainage patterns, as there will at present be some direct runoff from the site surfaces for lesser events than the 1 in 200 year event.

However, for this reason, and as the overtopping of the drainage system would simply allow runoff to discharge to lower ground to the south in the same way as it does at present, the design does not include a factor of safety in the volume allowed for storage.

In the design of the interconnected system of gravel subbases, it is assumed that all parts of the gravel car parking areas and car park access roads will contribute storage.

Infiltration rates for the site are, as previously discussed, likely to be underestimated based on the testing carried out. However, it is proposed to base infiltration calculations on an average of the 3 infiltration rates set out in drawing AA-DD-196b-001 Trial Pit Location Plan, which is likely to be a conservative figure. Hence the average rate to be applied in the following calculations is 0.034m/h, (= 0.00001m/sec)

Current predictions of design rainfall for the St Fillans area for a range of return periods and durations has been obtained from the FEH Web Service, based on FEH 2013 data, and gives the following predicted rainfall depths:

VERSION "FEH Web Version 1.0.0 exported a 14:56:22 GMT Tue 01-Mar-22
Parameters
Rainfall mc FEH 2013
Calculatior Design rainfall
Calculatior Typical point in catchment
Calculatior Catchment GB 269900 724400 NN 69900 24400
Catchment 0.68 km**2
Fixed durat no
Annual ma yes

Duration h	Duration d	2 year rain	5 year rain	10 year rai	20 year rai	30 year rai	50 year rai	75 year rainfall	100 year r	150 year r	200 year r	500 year r	1000 year
0.25	0.010417	5.85	9.8	12.64	15.72	17.4	19.59	21.4	22.72	24.67	26.06	30.78	34.42
0.5	0.020833	8.41	14.19	18.45	22.75	25.4	28.78	31.44	33.36	36.23	38.32	45.34	50.94
0.75	0.03125	10.39	17.33	22.41	27.73	30.82	34.71	37.93	40.3	43.73	46.21	54.35	60.89
1	0.041667	11.88	19.91	25.69	31.6	35.06	39.55	43.17	45.77	49.55	52.27	61.31	68.56
1.25	0.052083	13.43	21.93	27.98	34.11	37.68	42.34	46.09	48.78	52.67	55.48	64.87	72.46
1.5	0.0625	14.92	23.65	29.85	36.11	39.74	44.5	48.32	51.06	55.02	57.9	67.52	75.36
1.75	0.072917	16.31	25.17	31.46	37.81	41.48	46.29	50.17	52.95	56.97	59.89	69.7	77.74
2	0.083333	17.62	26.54	32.9	39.31	43.01	47.86	51.79	54.61	58.68	61.64	71.61	79.82
3	0.125	21.68	31.25	37.99	44.7	48.65	53.75	57.92	60.94	65.26	68.41	79.07	87.99
4	0.166667	24.97	35.06	42.11	49.06	53.23	58.54	62.91	66.11	70.67	73.99	85.28	94.8
5	0.208333	27.82	38.33	45.67	52.86	57.19	62.73	67.26	70.56	75.37	78.87	90.83	100.87
6	0.25	30.35	41.22	48.82	56.25	60.73	66.48	71.14	74.55	79.58	83.27	95.87	106.37
9	0.375	36.71	48.55	56.69	64.83	69.71	76	81.14	84.91	90.51	94.66	108.93	120.79
12	0.5	41.91	54.51	63.12	71.85	77.09	83.86	89.46	93.59	99.7	104.25	119.93	132.94

Table 2 - FEH Web Service rainfall data for St Fillans area (FEH 2013 data)

Based on the above rainfall data and the aforementioned details for the proposed site, the following calculations were completed to check whether the proposed underdrains will have sufficient infiltration and storage capacity to contain the 1-in-30-year rainfall event, and to assess the amount of additional storage required to contain the 1-in-200-year storm event.

The total area of roof drainage to be served by the infiltration system is 434m^2, while the total area of carparking and car park access road immediately surrounding the proposed building is 1456m^2. Hence see calculation below in Table 3:

SURFACE WATER ATTENUATION CALCULATIONS
TRENCH 1

Development Location: Spires View, Kinkell Braes Caravan Park, St Andrews
Client: St Fillans Community Council

All gravel areas draining a combination of road drainage, roof drainage and parking area drainage as per layout drawing AA-DD-196b-002 Dra
All gravel subgrades to be designed to store up to 1 in 200 storm below ground.

Total area draining to SuDS	Impermeability factor	Impermeable area	M5-60min
m2	%	m2	m
1900	100	1900	0.01991

Minimum infiltration rate = 0.00001m/s (based on results for pits 1 to 3 as per drawing AA-DD-196b-001 Trial Pit Location Plan)

Total volume of subgrade = 1456 x 0.3 = 437m3
Wetted area of at 50% full = 1456m2
Outflow = as50 x f x D = 0.0146D

Design storage to cater for 1 in 30 year return period at various durations

A	B	C	D	E	F	G	H	J
Road/roof area	Storm duration	Net imp. Area (10% urban creep)	Design rainfall	Design rainfall	Design rainfall + 35% climate change allowance	Total volume inflow	Outflow	Required storage volume
(m2)	(min)	(m2)	(mm)	(mm/hour)	(mm)	(m3)	(m3)	(m3)
1900	15	2090	17.4	69.60	23.49	49.0941	13.14	35.9541
1900	30	2090	25.4	50.80	34.29	71.6661	26.28	45.3861
1900	45	2090	30.82	41.09	41.607	86.95863	39.42	47.53863
1900	60	2090	35.06	35.06	47.331	98.92179	52.56	46.36179
1900	75	2090	37.68	30.14	50.868	106.31412	65.7	40.61412
1900	90	2090	39.74	26.49	53.649	112.12641	78.84	33.28641
1900	105	2090	41.48	23.70	55.998	117.03582	91.98	25.05582
1900	120	2090	43.01	21.51	58.0635	121.352715	105.12	16.23272

Actual storage volume assuming 30% void ratio = 131m3, hence 1 in 30 rainfall is retained.

Time for emptying for half volume is less than 24 hours

Design storage to cater for 1 in 200 year return period at various durations

A	B	C	D	E	F	G	H	J
Total impermeable (road)	Storm duration	Net imp. Area (10% urban creep)	Design rainfall	Design rainfall	Design rainfall + 35% climate change allowance	Total volume inflow	Outflow	Required storage volume
(m2)	(min)	(m2)	(mm)	(mm/hour)	(mm)	(m3)	(m3)	(m3)
1900	15	2090	26.06	104.24	35.181	73.52829	13.14	60.38829
1900	30	2090	38.32	76.64	51.732	108.11988	26.28	81.83988
1900	45	2090	46.21	61.61	62.3835	130.381515	39.42	90.96152
1900	60	2090	52.27	52.27	70.5645	147.479805	52.56	94.91981
1900	75	2090	55.48	44.38	74.898	156.53682	65.7	90.83682
1900	90	2090	57.9	38.60	78.165	163.36485	78.84	84.52485
1900	105	2090	59.89	34.22	80.8515	168.979635	91.98	76.99964
1900	120	2090	61.64	30.82	83.214	173.91726	105.12	68.79726

During a critical 200 year storm there will be up to 95m3 storage required for a period of less than 2 hours.
Hence, a soakaway with nominal dimensions as set out above will have adequate storage (based on 0.3 void ratio) of 131m3
Hence no net runoff from the site will be generated by road plus roof drainage for any storm up to (and greater than) a 1 in 200 year event

Table 3 - Drainage calculation sheet for combined areas (roof, hardstanding, and road) draining to gravel car parking areas (see Drawing AA-DD-196b-002 Drainage Strategy Plan)

Hence, the proposed SuDS layout has been developed, as shown in Figure 6 above, and in Drawing AA-DD-196b-002. This will be adequate to ensure greenfield runoff rates are not exceeded for events up to and including the 1 in 200 year storm event. Overland flow for storm events in excess of the 200-year plus climate change event would follow the same path as existing exceedance flows.

Note that, as previously discussed, the proposed drainage system will provide betterment over existing drainage patterns, as there will at present be some direct runoff from the site surfaces for lesser events than the 1 in 200 year event.

5.2 Surface Water Quality/Treatment

A suitable train of treatment processes is incorporated into the system as set out in layout plans (see Plans section).

- **Roof areas** – as discussed above, roof areas of the main building are connected directly to an adjacent area of gravel car parking/subgrade, where water will be attenuated, filtered, and will infiltrate into underlying soil. The underlying soil layer from the base of the filter material to the underlying groundwater will in all cases be in excess of 0.5m, and – given the relatively slow infiltration rates in lower layers of soil and low potential pollution levels associated with the roof areas – will have suitable ability to provide good contaminant attenuation potential. Hence the SIA tool output summary overleaf (see Figure 7) confirms the suitability if the proposed disposal route.

SIMPLE INDEX APPROACH: SUMMARY TABLE

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Residential roofing				
Pollution Hazard Level	Very low				
Pollution Hazard Indices					
TSS	0.2				
Metals	0.2				
Hydrocarbons	0.05				
SuDS components proposed					
Component 1	None				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Groundwater protection type	Infiltration trench with suitable depth of filtration material underlain by 300 mm minimum depth of soils with good contamination attenuation potential	All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The infiltration trench must include a suitable depth filtration layer that provides treatment (ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20mm gravel). The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater		
Groundwater protection Pollution Mitigation Indices					
TSS	0.4				
Metals	0.4				
Hydrocarbons	0.4				
Combined Pollution Mitigation Indices					
TSS	0.4	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
Metals	0.4				
Hydrocarbons	0.4				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

Figure 7 - SIA tool summary sheet for roofwater disposal route

- **Access roads** – the network of roads used to access the site are to be formed with permeable gravel in a cellular matting, and are therefore effectively impermeable. Hence, the runoff from the roads will pass through the layers of gravel surfacing, subgrade, and geotextile, prior to infiltration into the underlying soil. The underlying soil layer from the base of the filter material to the underlying groundwater will in all cases be in excess of 0.5m, and – given the relatively slow infiltration rates and low potential pollution levels associated with the roof areas – will have suitable ability to provide good contaminant attenuation potential. Hence the SIA tool output summary overleaf (see Figure 8) confirms the suitability if the proposed disposal route.

SIMPLE INDEX APPROACH: SUMMARY TABLE

SEPA HR Wallingford ciria

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Residential parking				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Filter drain (where the trench is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Filter drains should be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events		
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.4				
Metals	0.4				
Hydrocarbons	0.4				
Groundwater protection type	Infiltration trench with suitable depth of filtration material underlain by 300 mm minimum depth of soils with good contamination attenuation potential	All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The infiltration trench must include a suitable depth filtration layer that provides treatment (ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20mm gravel). The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater		
Groundwater protection Pollution Mitigation Indices					
TSS	0.4				
Metals	0.4				
Hydrocarbons	0.4				
Combined Pollution Mitigation Indices		Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
TSS	0.6				
Metals	0.6				
Hydrocarbons	0.6				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

Figure 8 - SIA tool summary sheet for access road surface water disposal route

5.3 Foul Drainage Design

As the site is to have toilets and kitchen facilities to serve up to 140 people at once, there will be a need for a foul system of treatment and disposal.

The proposed system will consist of a system of foul drainage pipes connecting internal facilities to an external foul drainage pipe which will in turn be connected to a secondary treatment plant. A suitable specification has been agreed with a manufacturer as set out in Appendix B, and as referenced on drawing AA-DD-196b-002.

Details of the proposed layout are given in AA-DD-196b-002 Drainage Strategy Plan (see copy attached in Plans section), an excerpt of which are shown as Figure 6 (in section 5.1 above).

The predicted flows to be dealt with by the treatment plant has been estimated based on maximum anticipated occupancy of the hall during events, using Flows and Loads as a guide for typical flow rates and loads:

Proposed site:
(based on Flows and Loads tabulation)

140 visitors for an 8 hour event (say) is approximately	
Equivalent to "non-residential conference delegate"	= 60 litres per day
Average domestic flow per person	= 150 litres per day
Total population equivalent based on flow	= 140 x (60/150)
	= 56 PE

The actual numbers and length of usage per day need further investigation but it can be said that the specified treatment system can handle up to 100 PE, and therefore will be more than adequate.

As set out in the manufacturer's literature, the effluent quality achievable meets at least the BOD/SS standard of 20/20, and with NH4 values of 5mg/l or less. Given the dilution available in the River Earn at all times, the discharge consent should be easily licenced.

6.0 General Observations

- The findings in this report should be taken into account at the Planning and Building Warrant stages, when if required, further details will be added to the above details and attached drawings.

7.0 Conclusions

The proposed development can be drained satisfactorily if a system based on the design details set out here is constructed.

Based on the above, we support the proposals for this development, as it has been demonstrated that a satisfactory drainage system which meets the requirements of good drainage practice and following the principals of SuDS has been achieved.

8.0 References

i. Design Criteria Advice on Flooding and surface Water Management Plan Requirements. Fife Council, November 2020.

ii. Climate change allowances for flood risk assessment in land use planning. SEPA, April 2019

iii. Scottish Planning Policy, Scottish Government, Crown Copyright, December 2020

iv. Flows and Loads 4 – Code of Practice, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems, British Water 2013.

v. BRE Digest 365: Soakaway Design. The Building Research Establishment, 2003

vi. Sewers for Scotland - A technical specification for the design and construction of sewerage infrastructure. Version 4.0. Scottish water, October 2018.

vii. Flood Risk Assessment: Proposed village hall, St Fillans, Perthshire. Ref. AADD/BC/196c, Atholl Associates Limited, March 2022.

APPENDICES

Appendix A

Percolation test results and calculated percolation values

GENERAL

A total of 7 trial pits were excavated and tested. These were TP1 to TP7, as set out in the plan below.

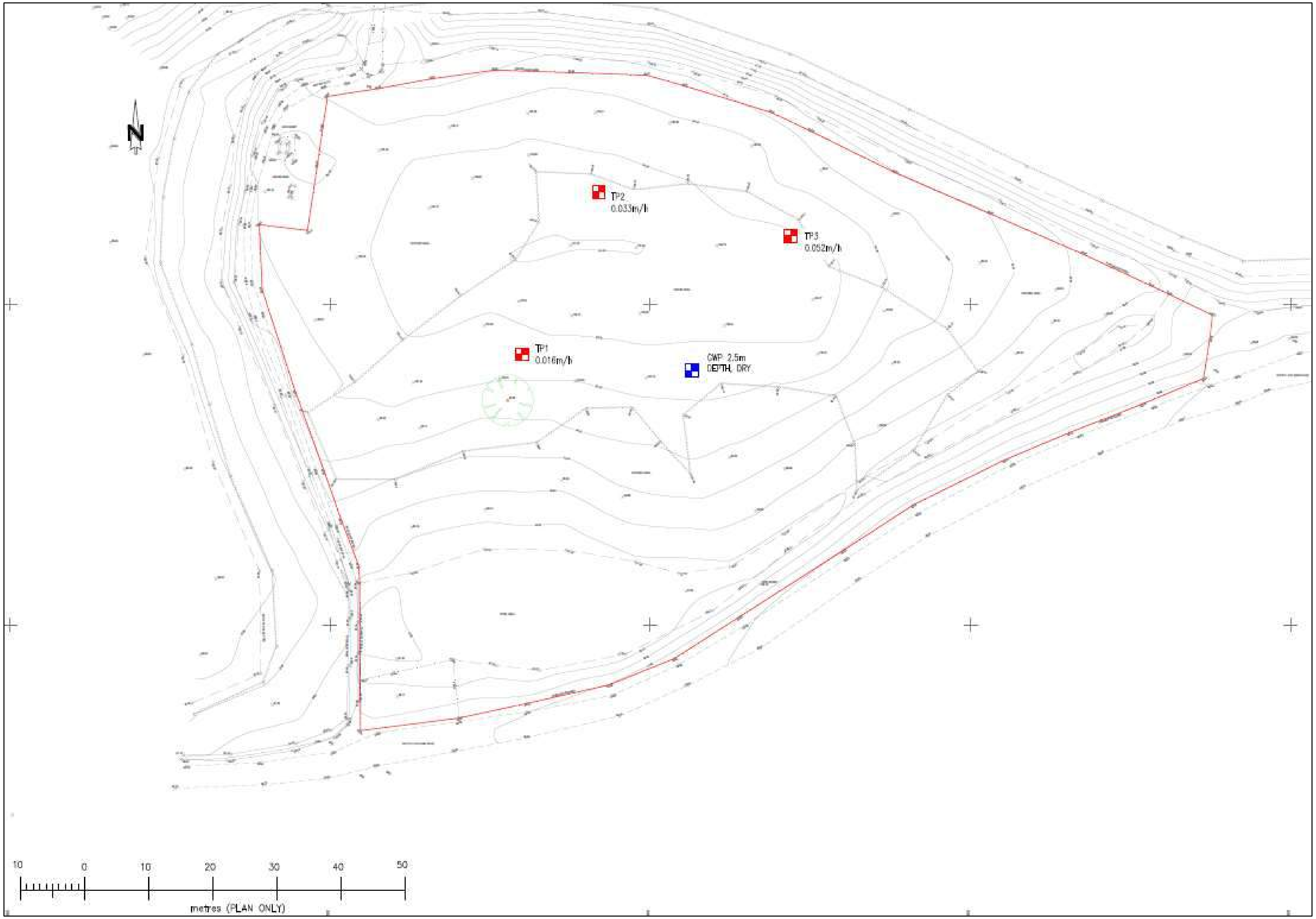


Figure A1 – Trial pit locations with contours of equal infiltration (excerpt from Drawing AA-DD-196b-001 Trial Pit Location Plan – see Plans section)

A Ground Water Pit was excavated in the centre of the site to a depth of 2.5m. As no groundwater was detected in TP5 after several hours on the first day of testing, it was subsequently backfilled. The location is as indicated in Figure A1 above.

The details of testing carried out on the trial pits is set out in the following pages:

	STORMWATER INFILTRATION TEST	Project No:		Sheet: 1 of 3
	PIT NO **TP1**	Project:	St Fillans	
		Engineer	Date	Checked	Date
		D Kane	22/02/2022		

TRIAL PIT LOG

DEPTH (BGL)	STRATA
0.4	Sandy gravellt topsoil
0.9	orange brown clayey gravelly sand
1.5	brown clayey gravelly sand

COMMENTS

	Test 1	Test 2	Test 3
Width (m)	0.60	0.60	0.60
Length (m)	1.40	1.40	1.40
Depth (m)	1.50	1.50	1.50

Note width and length taken at location
50% depth

DEPTH OF GROUND WATER 0m
(From TP excavated near this pit)

WEATHER: bright sun, high wind, odd shower
NOTES:
Sides : relatively stable, sand wash out
Water Ingress at...............................0m

Notes: recordings in italics added to artificially extend test to base to ensure accurate calculation

TEST 1

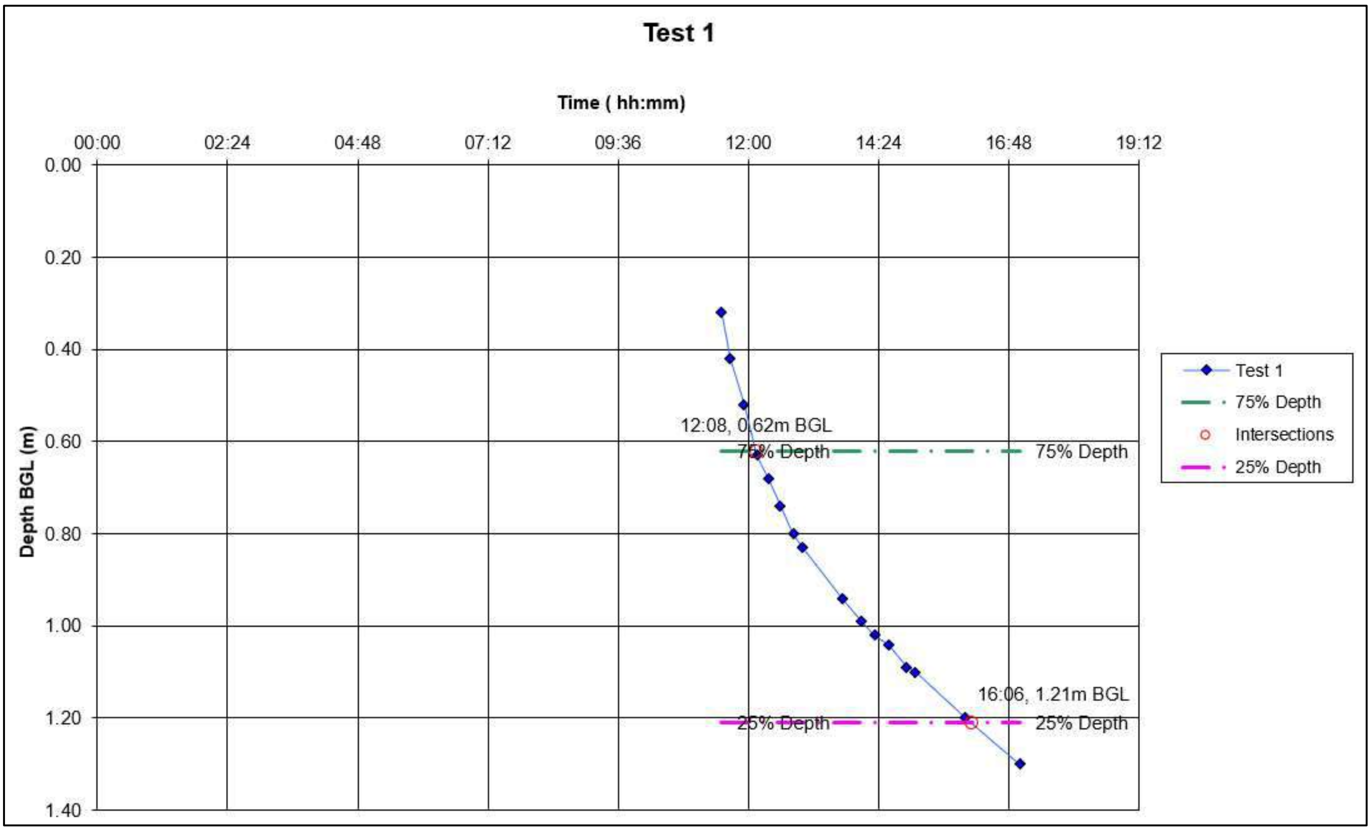
TIME	DEPTH (BGL)m
11:30	0.32
11:40	0.42
11:55	0.52
12:10	0.63
12:22	0.68
12:35	0.74
12:50	*0.80*
13:00	0.83
13:44	0.94
14:05	0.99
14:20	1.02
14:35	1.04
14:55	1.09
15:05	1.10
16:00	1.20
17:00	1.30
75% full	0.62m BGL
25% full	1.21m BGL
Tested past 25%=>OK	

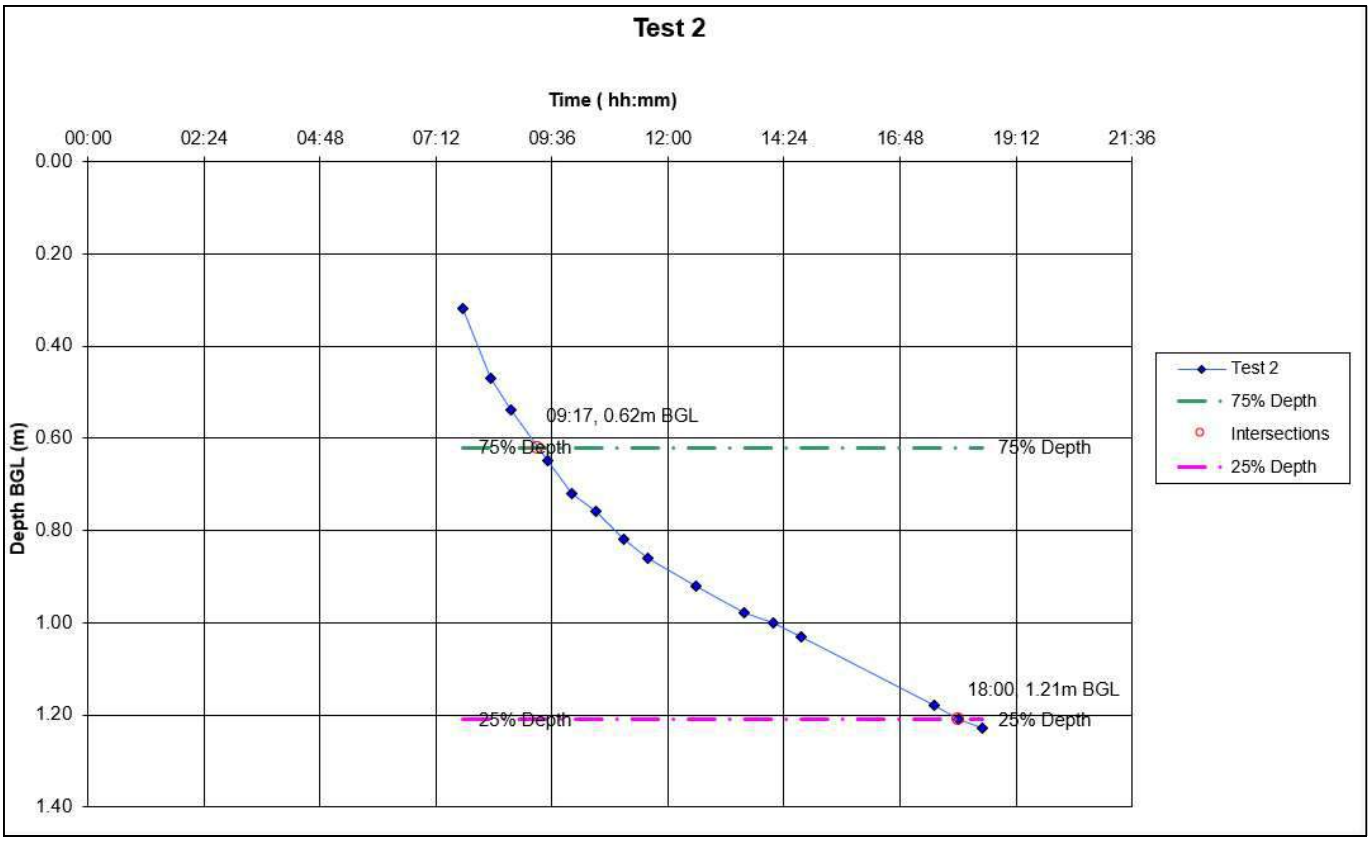
TEST 2

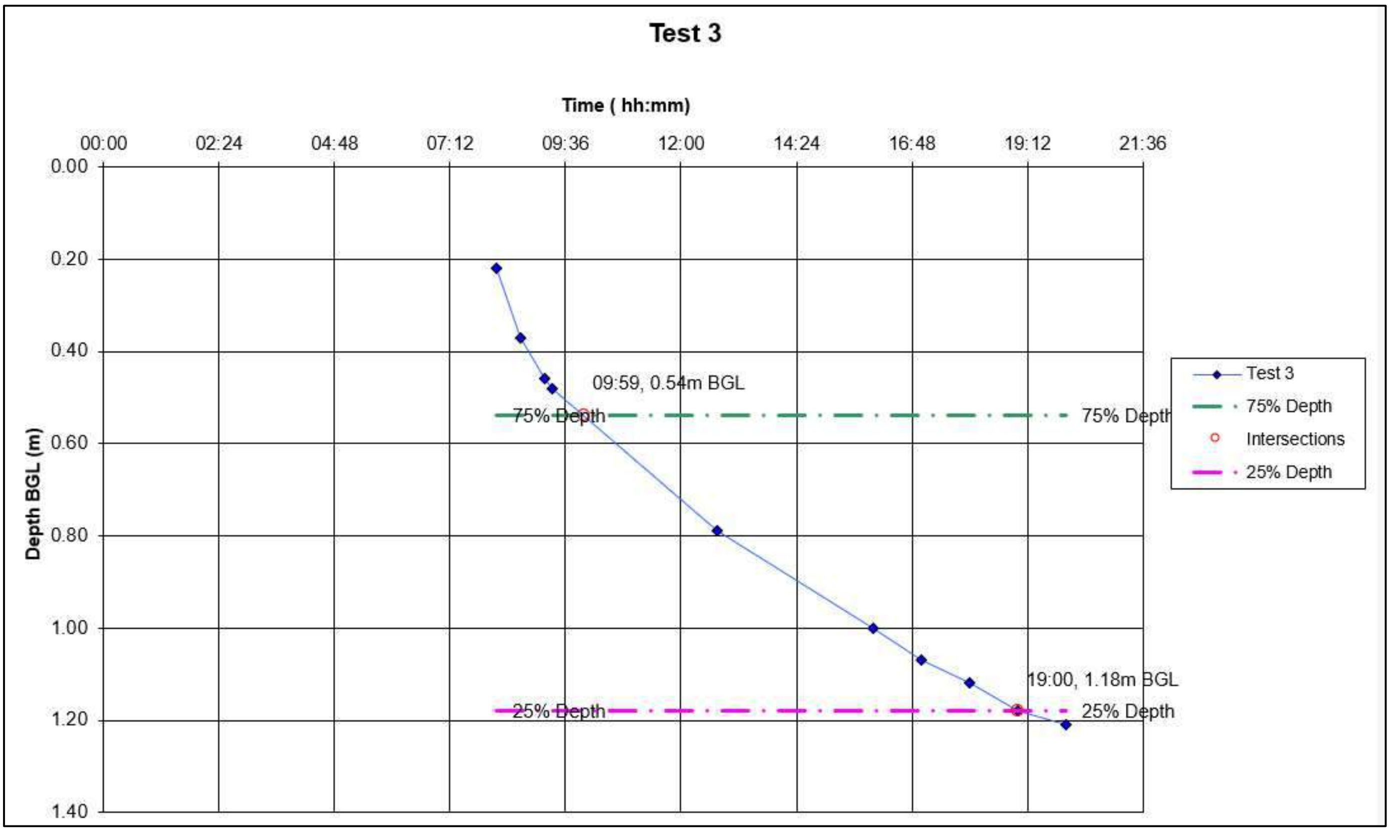
TIME	DEPTH (BGL)m
07:45	0.32
08:20	0.47
08:45	0.54
09:30	0.65
10:00	0.72
10:30	0.76
11:05	*0.82*
11:35	0.86
12:35	0.92
13:35	0.98
14:10	1.00
14:45	1.03
17:30	1.18
18:00	1.21
18:30	1.23
	very heavy rain all previous night and during test
75% full	0.62m BGL
25% full	1.21m BGL
Tested past 25%=>OK	

TEST 3

TIME	DEPTH (BGL)m
08:10	0.22
08:40	0.37
09:10	0.46
09:20	0.48
12:45	0.79
16:00	1.00
17:00	1.07
18:00	*1.12*
19:00	1.18
20:00	1.21
	very heavy snow lying on ground to approx 150mm on the site
75% full	0.54m BGL
25% full	1.18m BGL
Tested past 25% =>OK	


Test 1
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
19:12
Depth BGL (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
12:08, 0.62m BGL
75% Depth
75% Depth
16:06, 1.21m BGL
25% Depth
25% Depth
Test 1
75% Depth
Intersections
25% Depth


Test 2
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
19:12
21:36
Depth BGL (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
09:17, 0.62m BGL
75% Depth
75% Depth
18:00, 1.21m BGL
25% Depth
25% Depth
Test 2
75% Depth
Intersections
25% Depth


Test 3
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
19:12
21:36
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
Depth BGL (m)
09:59, 0.54m BGL
75% Depth
75% Depth
19:00, 1.18m BGL
25% Depth
25% Depth
Test 3
75% Depth
Intersections
25% Depth

Project No:	0	Sheet	2 of 2
Project			
0			
0			
Engineer	Date	Checked	Date
D Kane	22/02/2022	0	0

Testing Carried Out in Accordance with BRE Digest 365

Test 1

Test hole dimensions : 1.40 m long
0.60 m wide
0.98 m depth of water
ap_{50} = 2.8 m^2 (Surface area of test hole at 50% effective depth)
Vp_{75-25} = 0.4116 m^3 (Volume at 50% effective depth of test hole)
tp_{75-25} = 238 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 1.029E-05 m/s or 0.037 m/h

Test 2

Test hole dimensions : 1.40 m long
0.60 m wide
0.91 m depth of water
ap_{50} = 2.66 m^2 (Surface area of test hole at 50% effective depth)
Vp_{75-25} = 0.3822 m^3 (Volume at 50% effective depth of test hole)
tp_{75-25} = 523 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 4.579E-06 m/s or 0.016 m/h

Test 3

Test hole dimensions : 1.40 m long
0.60 m wide
0.99 m depth of water
ap_{50} = 2.82 m^2 (Surface area of test hole at 50% effective depth)
Vp_{75-25} = 0.4158 m^3 (Volume at 50% effective depth of test hole)
tp_{75-25} = 541 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 4.542E-06 m/s or 0.016 m/h

=> Infiltration for Design is the lowest value = 4.542E-06 m/s or 0.016 m/h

STORMWATER INFILTRATION TEST		Project No:		Sheet:	2 of 3
PIT NO **TP2**		Project:	St Fillans		
		Engineer	Date	Checked	Date
		D Kane	22/02/2022		

TRIAL PIT LOG

DEPTH (BGL)	STRATA
0.4	Sandy gravelly topsoil
0.9	orange brown clayey gravelly sand
1.3	brown clayey gravelly sand

COMMENTS

	Test 1	Test 2	Test 3
Width (m)	0.60	0.60	0.60
Length (m)	1.40	1.40	1.40
Depth (m)	1.30	1.30	1.30

Note width and length taken at location
50% depth

DEPTH OF GROUND WATER 0m
(From TP excavated near this pit)

WEATHER: bright sun, high wind, odd shower
NOTES:
Sides : relatively stable, sand wash out
Water Ingress at............................0m

Notes: recordings in italics added to artificially extend test to base to ensure accurate calculation

TEST 1

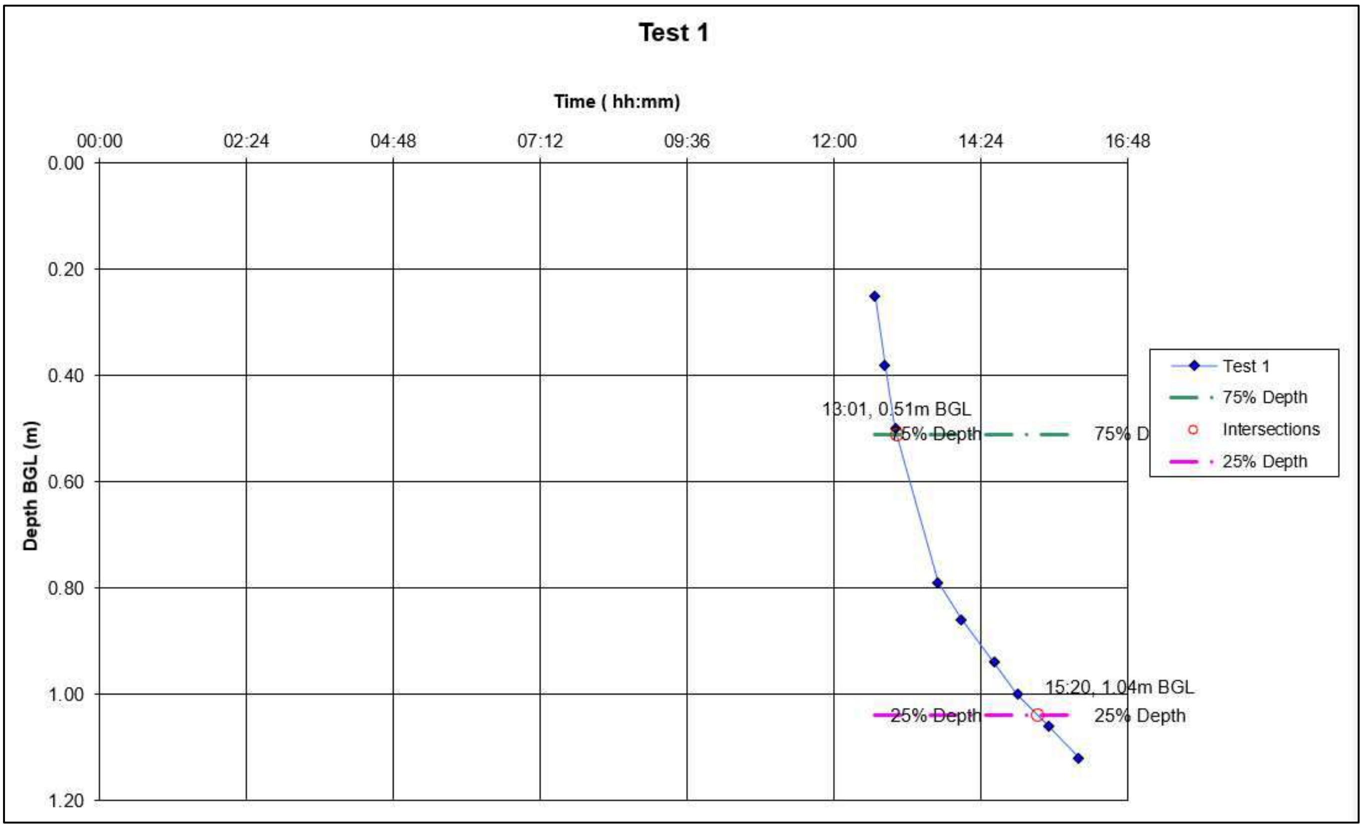
TIME	DEPTH (BGL)m
12:40	0.25
12:50	0.38
13:00	0.50
13:42	0.79
14:05	0.86
14:37	0.94
15:00	*1.00*
15:30	1.06
16:00	1.12
75% full	0.51m BGL
25% full	1.04m BGL
Tested past 25%=>OK	

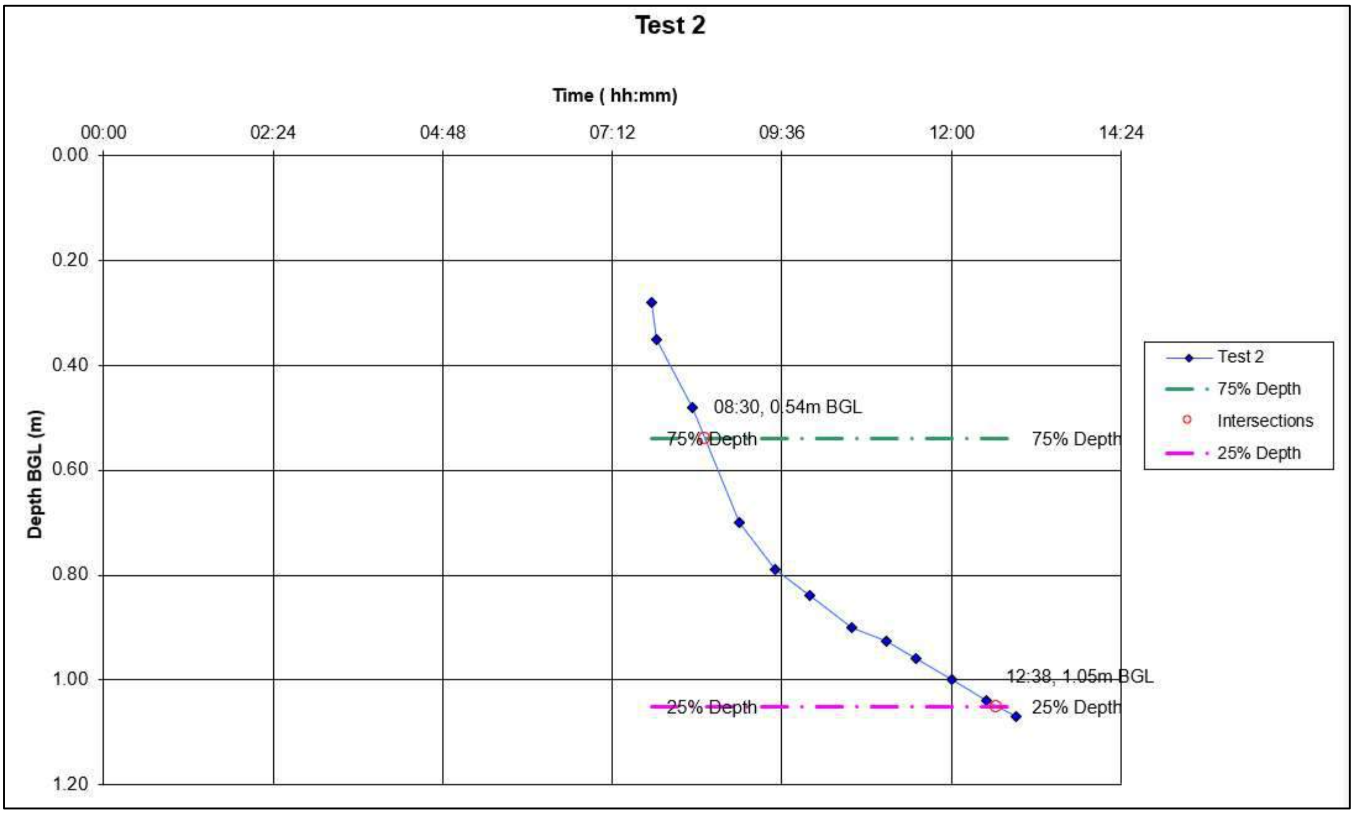
TEST 2

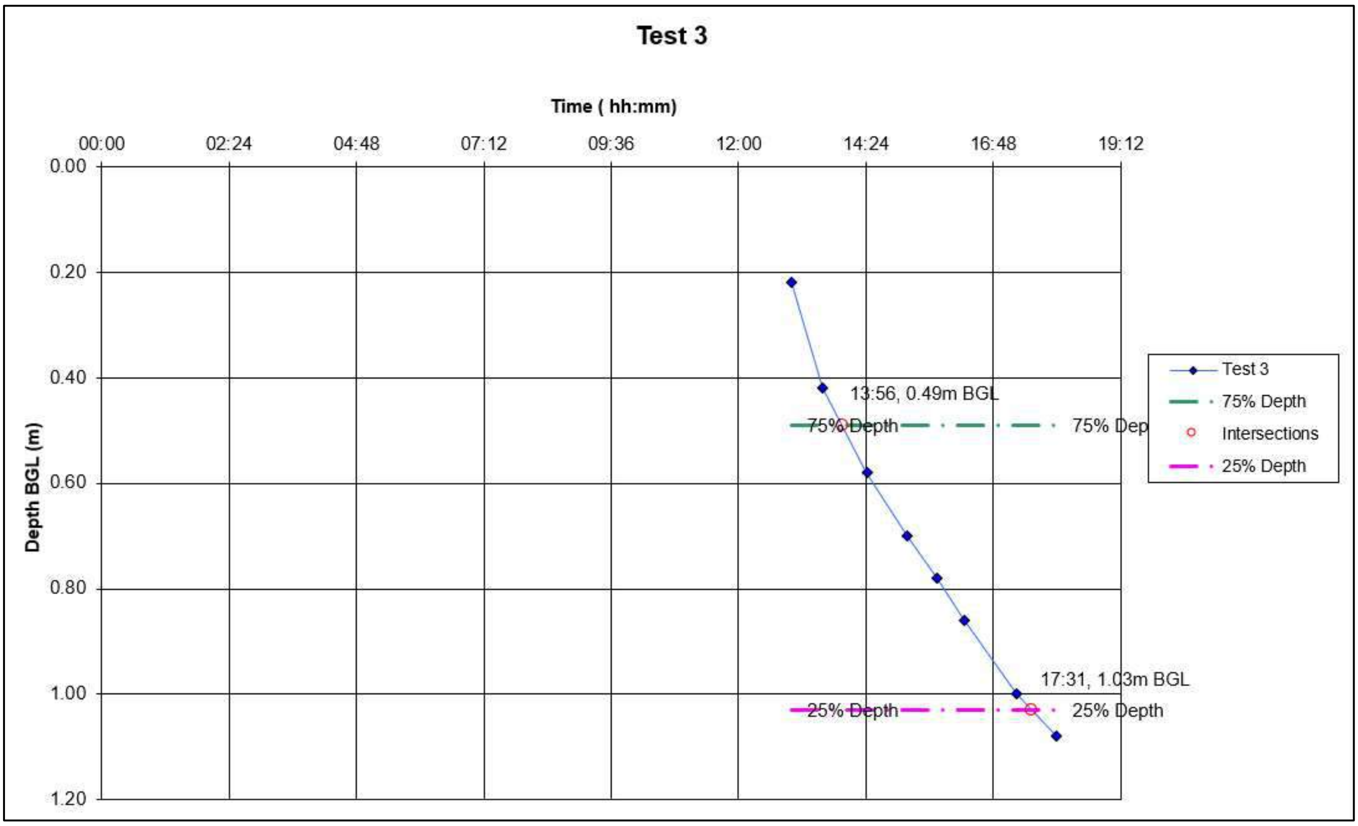
TIME	DEPTH (BGL)m
07:45	0.28
07:50	0.35
08:20	0.48
09:00	0.70
09:30	0.79
10:00	0.84
10:35	*0.90*
11:05	0.93
11:30	0.96
12:00	1.00
12:30	1.04
12:55	1.07
75% full	0.54 m BGL
25% full	1.05 m BGL
Tested past 25%=>OK	

TEST 3

TIME	DEPTH (BGL)m
13:00	0.22
13:35	0.42
14:25	0.58
15:10	0.70
15:45	0.78
16:15	0.86
17:15	1.00
18:00	*1.08*
75% full	0.49m BGL
25% full	1.03m BGL
Tested past 25% =>OK	


Test 1
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Depth BGL (m)
13:01, 0.51m BGL
75% Depth
75% D
15:20, 1.04m BGL
25% Depth
25% Depth
Test 1
75% Depth
Intersections
25% Depth


Test 2
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Depth BGL (m)
08:30, 0.54m BGL
75% Depth
75% Depth
12:38, 1.05m BGL
25% Depth
25% Depth
Test 2
75% Depth
Intersections
25% Depth


Test 3
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
19:12
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Depth BGL (m)
13:56, 0.49m BGL
75% Depth
75% Dep
17:31, 1.03m BGL
25% Depth
25% Depth
Test 3
75% Depth
Intersections
25% Depth

Project No:	0	Sheet	2 of 2
Project			
0			
0			
Engineer	Date	Checked	Date
D Kane	22/02/2022	0	0

Testing Carried Out in Accordance with BRE Digest 365

Test 1

Test hole dimensions : 1.40 m long
0.60 m wide
0.87 m depth of water
ap_{50} = 2.58 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.3654 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 139 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 1.698E-05 m/s or 0.061 m/h

Test 2

Test hole dimensions : 1.40 m long
0.60 m wide
0.79 m depth of water
ap_{50} = 2.42 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.3318 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 248 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 9.214E-06 m/s or 0.033 m/h

Test 3

Test hole dimensions : 1.40 m long
0.60 m wide
0.86 m depth of water
ap_{50} = 2.56 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.3612 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 215 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 1.094E-05 m/s or 0.039 m/h

=> Infiltration for Design is the lowest value = 9.214E-06 m/s or 0.033 m/h

	STORMWATER INFILTRATION TEST	Project No:		Sheet	3 of 3
	PIT NO TP3	Project	St Fillans		
		Engineer	Date	Checked	Date
		D Kane	22/02/2022		

TRIAL PIT LOG

DEPTH (BGL)	STRATA
0.4	Sandy gravelly topsoil
0.9	orange brown clayey gravelly sand
1.3	brown clayey gravelly sand

COMMENTS

	Test 1	Test 2	Test 3
Width (m)	0.90	0.90	0.90
Length (m)	1.30	1.30	1.30
Depth (m)	1.30	1.30	1.30

Note width and length taken at location 50% depth

DEPTH OF GROUND WATER 0m
(From TP excavated near this pit)

WEATHER: bright sun, high wind, odd shower
NOTES:
Sides : relatively stable, sand wash out
Water Ingress at.................................0m

Notes: recordings in italics added to artificially extend test to base to ensure accurate calculation

TEST 1

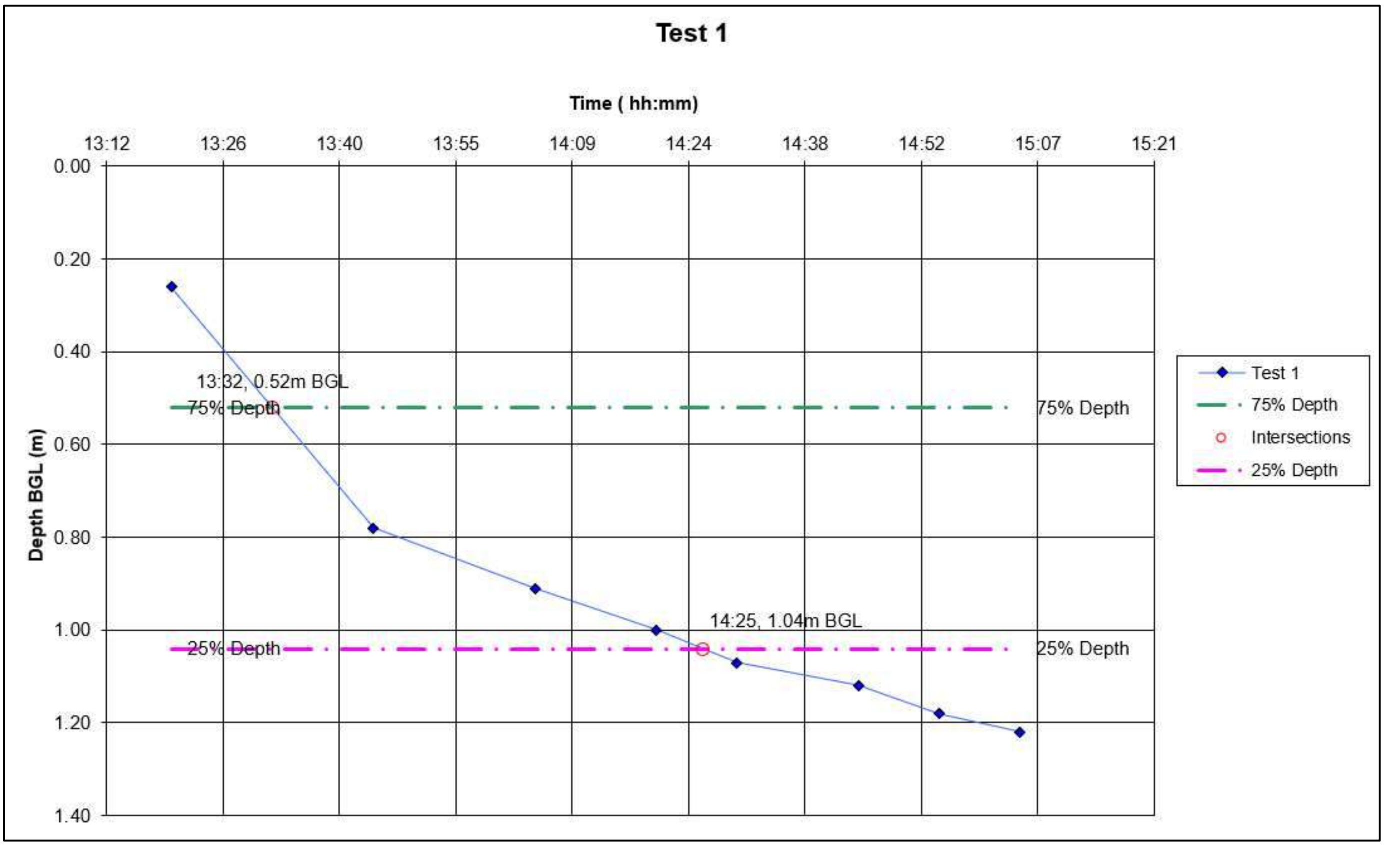
TIME	DEPTH (BGL)m
13:20	0.26
13:45	0.78
14:05	0.91
14:20	1.00
14:30	1.07
14:45	1.12
14:55	*1.18*
15:05	1.22
75% full	0.52m BGL
25% full	1.04m BGL
Tested past 25%=>OK	

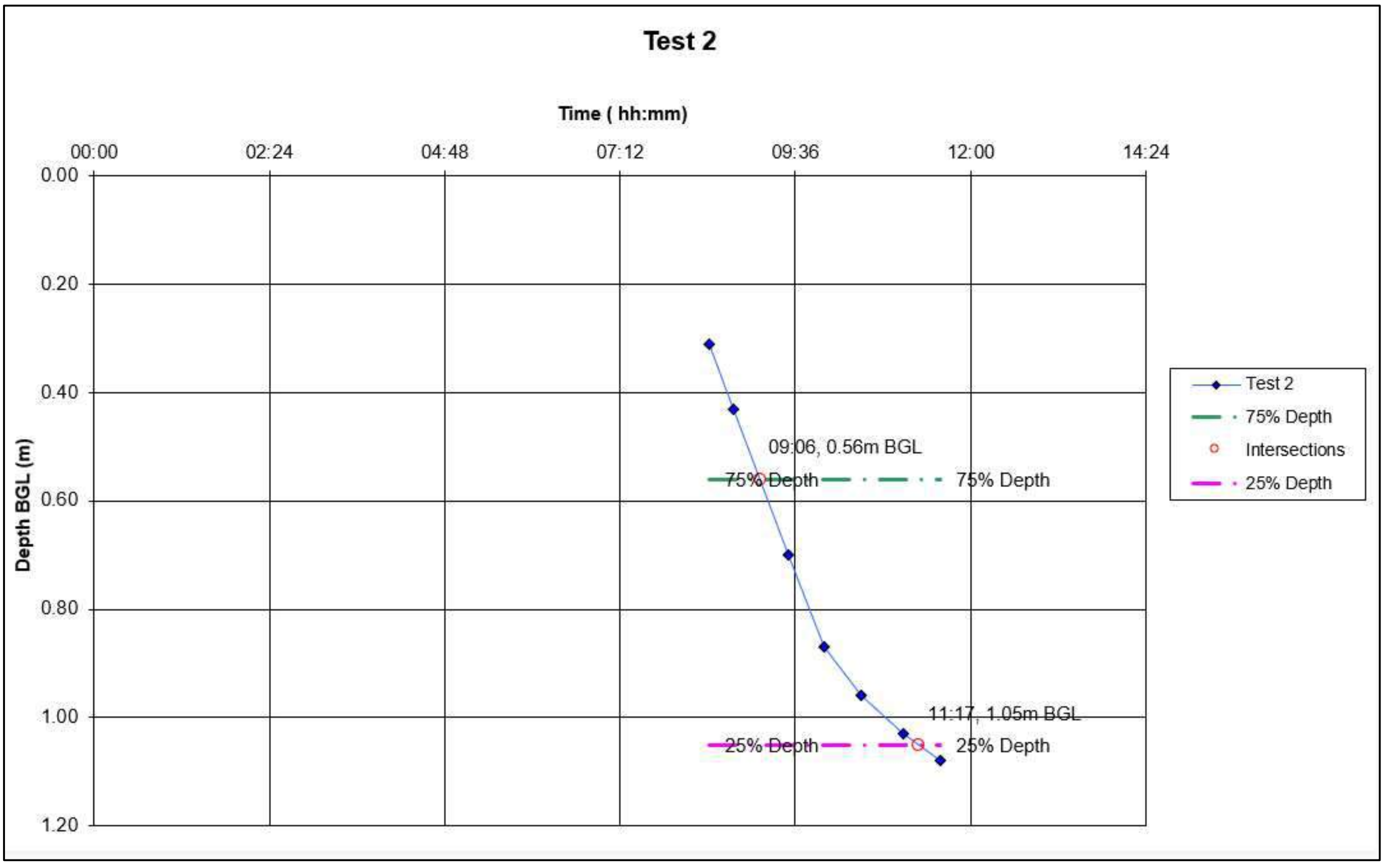
TEST 2

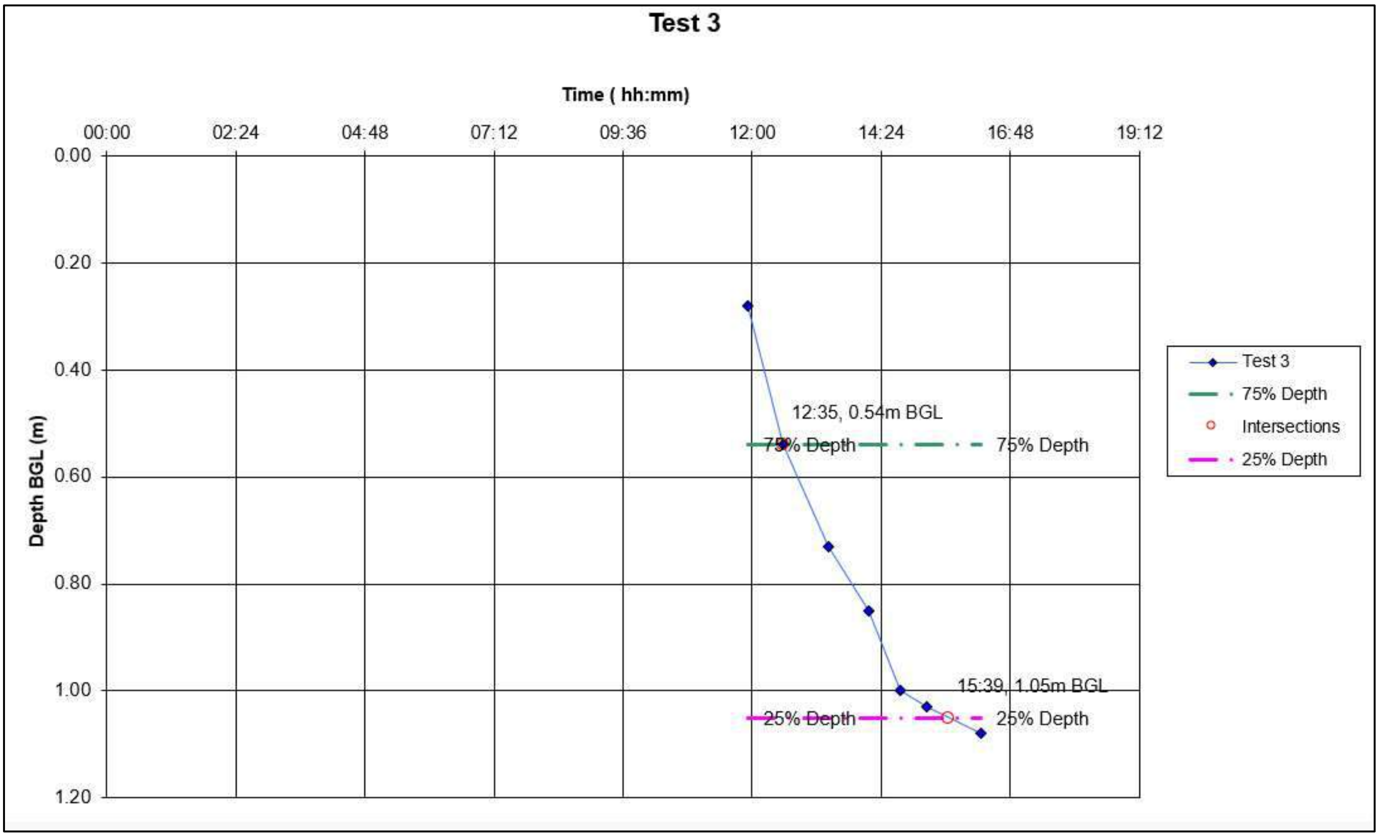
TIME	DEPTH (BGL)m
08:25	0.31
08:45	0.43
09:30	0.70
10:00	0.87
10:30	0.96
11:05	1.03
11:35	*1.08*
75% full	0.56m BGL
25% full	1.05m BGL
Tested past 25%=>OK	

TEST 3

TIME	DEPTH (BGL)m
11:55	0.28
12:35	0.54
13:25	0.73
14:10	0.85
14:45	1.00
15:15	1.03
16:15	1.08
75% full	0.54m BGL
25% full	1.05m BGL
Tested past 25%=>OK	


Test 1
Time (hh:mm)
13:12
13:26
13:40
13:55
14:09
14:24
14:38
14:52
15:07
15:21
Depth BGL (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
13:32, 0.52m BGL
75% Depth
75% Depth
14:25, 1.04m BGL
25% Depth
25% Depth
Test 1
75% Depth
Intersections
25% Depth


Test 2
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
Depth BGL (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
09:06, 0.56m BGL
75% Depth
75% Depth
11:17, 1.05m BGL
25% Depth
25% Depth
Test 2
75% Depth
Intersections
25% Depth


Test 3
Time (hh:mm)
00:00
02:24
04:48
07:12
09:36
12:00
14:24
16:48
19:12
Depth BGL (m)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
12:35, 0.54m BGL
75% Depth
75% Depth
15:39, 1.05m BGL
25% Depth
25% Depth
Test 3
75% Depth
Intersections
25% Depth

Project No:	0	Sheet	2 of 2
Project:			
0			
0			
Engineer	Date	Checked	Date
D Kane	22/02/2022	0	0

Testing Carried Out in Accordance with BRE Digest 365

Test 1

Test hole dimensions : 1.30 m long
0.90 m wide
0.96 m depth of water

ap_{50} = 3.282 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.5616 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 54 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 5.281E-05 m/s or 0.190 m/h

Test 2

Test hole dimensions : 1.30 m long
0.90 m wide
0.77 m depth of water

ap_{50} = 2.864 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.45045 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 131 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 2.001E-05 m/s or 0.072 m/h

Test 3

Test hole dimensions : 1.30 m long
0.90 m wide
0.80 m depth of water

ap_{50} = 2.93 m^2 (Surface area of test hole at 50% effective depth)
$vp_{75\text{-}25}$ = 0.468 m^3 (Volume at 50% effective depth of test hole)
$tp_{75\text{-}25}$ = 184 mins (Time taken for test to empty 75% volume to 25% volume)

soil infiltration rate, f = 1.447E-05 m/s or 0.052 m/h

=> Infiltration for Design is the lowest value = 1.447E-05 m/s or 0.052 m/h

Appendix B

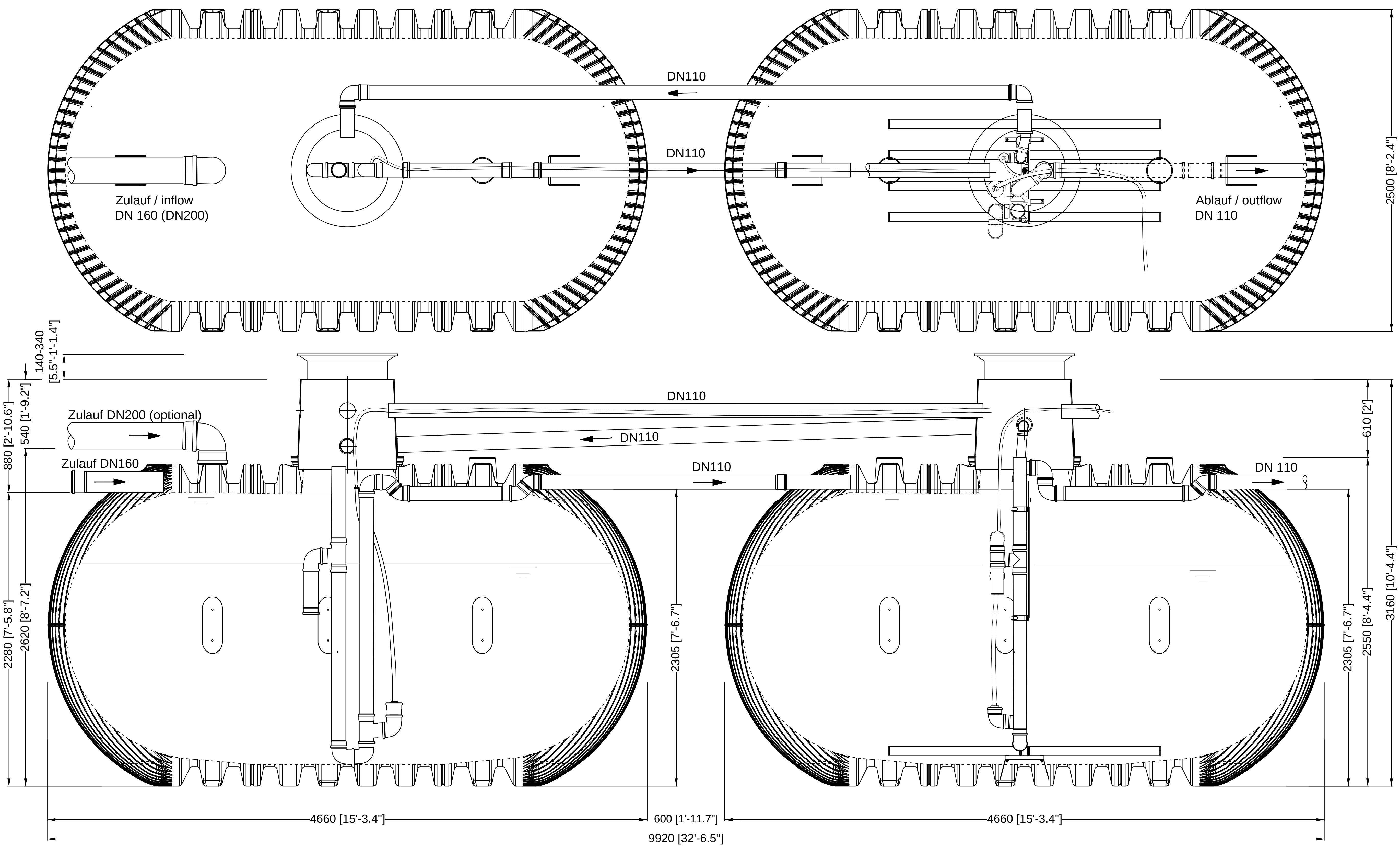
Wastewater treatment plant specification

WWT System Enquiry Sizing Sheet

Project: **WWT - St Fillans Village Hall**

		FLOW LITRE / DAY		BOD GRAMS / DAY		NH_3 GRAMS / DAY	
Source of Waste	**No**	**Per Person**	**Total**	**Per Person**	**Total**	**Per Person**	**Total**
Local community sports club, e.g. squash, rugby & football	130	40	5200	25	3250	6	780
	TOTAL		**5200**		**3250**		**780**
	PE		**35**		**55**		**98**

Size of System Required = 98PE



Vorklärung / Schlammspeicher pre-treatment / sludge storage

SBR Reaktor sbr-reactor

D Klaro E Professional XXL 100 EW - Tankdom Maxi 2 x Carat XXL 16000 L / 2 x 4226,7 gal.			Artikel-Nr. product no. article no. articulo no. 107757
GB Klaro E Professional XXL 100 inh. TD-Maxi 2x Carat XXL 16000 L / 4226,7 gal.	ES Klaro E Professional XXL 100 PE Cúpula Maxi 2x Carat XXL 16000 L / 4226,7 gal.	FR Klaro E Professional XXL 100 EH Maxi-dôme 2x Carat XXL 16000 L / 4226,7 gal.	revision
gezeichnet drawn ISC	Gewicht weight	Otto Graf GmbH Carl-Zeiss-Str. 2-6 DE-79331 Teningen mail@graf.info www.graf.info	GRAF
Datum date 2017.06.16	Toleranz tolerance +/- 3%		
Maßstab scale M 1:30	Einheiten units mm [inch] gal. = US gal.		

DIN A3

Technical data sheet for GRAF Professional wastewater treatment plant

Graf UK Ltd
Regen House, Beaumont Road, Ba
Oxfordshire OX16 1RH
Tel. (01608) 661500
Email: info@grafuk.co.uk

Plant size 100 PE

Maximum hydraulic load	Qd	15,00 m³/d
Maximum organic load	Bd	6,00 kg/d

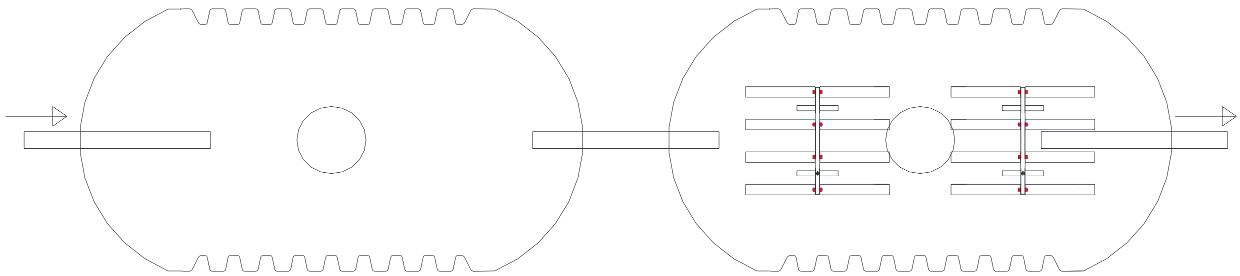
Design according to ATV-A122

effluent values:

	BOD5	**COD**	**SS**	**NH4N**	**Ntot**	**P**	**colif. germs**
<	20 mg/l		30 mg/l	20 mg/l			

Total tank capacity: 44,3 m³

air compressor	type: rotary vane		DTN 41
	installed motor power		1,50 kW
	power consumption at 0,3 bar		1,50 kW
	motor design	0,7 bar 50 Hz 3~	380 V
calculated maximum daily operating time			11,9 h/d



symbolic representation

stage	**number**	**container, material**	**diameter width** [m]	**length** [m]	**maximum water depth** [m]	**volume maximum** [m³]
ss + pt + b	1	Carat XXL 22.000L, PE	2,50	6,14	2,31	22,1
sbr	1	Carat XXL 22.000L, PE	2,50	6,14	2,31	22,1

calculation for GRAF Professional wastewater treatment plant according to ATV-A122

basic data / project data

customer	Graf UK Ltd	date	*17.01.2018*
project		editor	MUS
type of waste water	domestic		
specialties			

base of calculation

	BOD5	COD	SS	NH4N	Ntot	P	colif. germs
outlet	**< 20 mg/l**		**< 30 mg/l**	**< 20 mg/l**			

population equivalent			100	PE
wastewater	at Q_{PE}	150 l/(PE*d)	15,0	m³/d
infiltration water		0 %	0,0	m³/d
total daily inflow	Q_d		15,0	m³/d
daily peak factor			10	h/d
hourly volume of wastewater			1,5	m³/h
waste load BOD5	B_d	60 g/(PE x d)	6,00	kg/d
waste load BOD5 after primary treatment	B_d	40 g/(PE x d)	4,00	kg/d
cleaning cycles per day			4	

1. Stage: sludge storage, pre-treatment and buffer

type of container		Carat XXL 22.000L	
number of containers / proportion of chambers		100%	
width		2,50	m
length		6,14	m
water depth		2,31	m
total area		15,36	m²
sludge storage (ss)			
specific sludge storage volume		250	l/(PE*a)
removal interval		6,0	months
required volume	100PE x 250l/(PE*a) x 6/12months =	12,50	m³
required water depth		1,33	m
retention period	(22,13m³ - 12,5m³ - 5,05m³) / 1,5m³/h =	3,05	h
primary treatment (pt)			
required volume		2,40	m³
required water depth		0,19	m
overall (ss + pt)			
required water depth		1,52	m
selected water depth		1,70	m
buffer (b)			
percentage of daily load		33%	
required volume	33% x 15 m³/d =	5,00	m³
required water depth		0,61	m
selected water depth		0,61	m
selected volume	34% total daily inflow =	5,05	m³
overall (ss + pt + b)			
required water depth		2,13	m
required volume	12,5m³ + 2,4m³ + 5m³ =	19,90	m³
existing total volume	14,7m³ + 2,4m³ + 5,1m³ =	22,13	m³

calculation for GRAF Professional wastewater treatment plant according to ATV-A122

basic data / project data

customer	Graf UK Ltd	date	*17.01.2018*
project		editor	MUS
type of waste water	domestic		
specialties			

2. Stage: biological treatment (SBR)

type of container			Carat XXL 22.000L	
number of containers / proportion of chambers			100%	
width			2,50	m
length			6,14	m
water depth		Wd max =	2,31	m
total area			15,36	m²
required volume		4kg/d / 0,2kg/(d*m³) =	20,00	m³
required water depth			1,98	m
BOD5 volume load Br		4kg/d / 22,13m³ =	0,18	kg/(m³*d)
BOD5 sludge loading B	$_{TS}$	≤	0,05	kg/(kg*d)
sludge index	ISV		100,00	ml/g
total solids	TS_{BB}	≤	4,00	kg/m³
oxygen concentration	C_O	≥	2,00	mg/l
selected water depth before loading phase		Wd max - 33% x 15 m³/d =	1,70	m
water depth after loading phase		Wd min + 25% x 15 m³/d =	2,09	m
existing total volume			22,13	m³

V-DTN

V-DTN 16 | V-DTN 26 | V-DTN 41

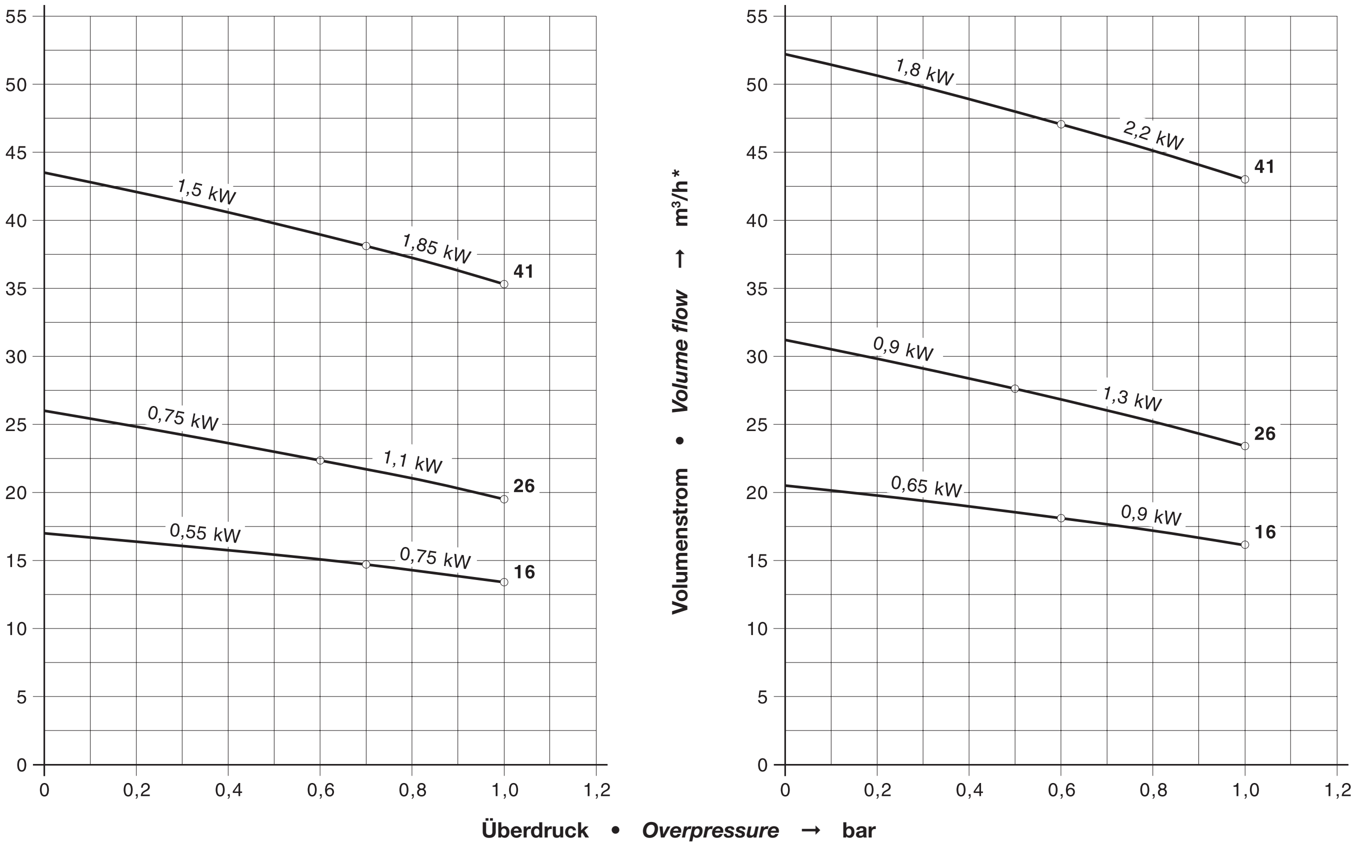
Elmo Rietschle
A Gardner Denver Product

Trocken laufende Drehschieber-Verdichter
Volumenstrom 17 bis 52,2 m^3/h, Überdrücke bis 1 bar.
Mit integriertem Saugluftfilter.
Leiser Lauf, Berührungsschutz gegen heiße Oberflächen und intensive Kühlung dank Schallhaube. Flexible Anschlussmöglichkeiten, vibrationsfrei, einbau-, bedienungs- und wartungsfreundlich.
Die Motoren entsprechen DIN EN 60034 und sind in Schutzart IP 55 und Isolationsklasse F ausgeführt.

Dry running rotary vane compressors

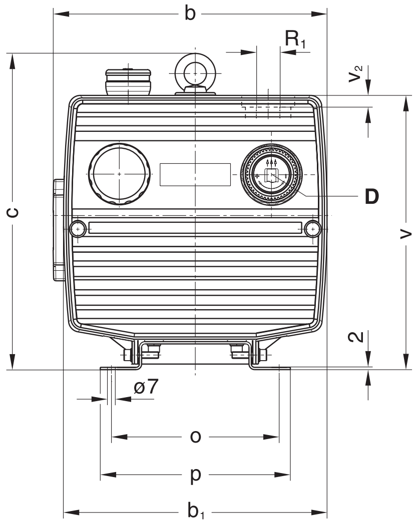
Volume flow from 17 to 52,2 m^3/hr, overpressure upto 1 bar.
With integral suction paper filter.
Sound cover produces low noise level and intensive cooling and protects from touching hot surfaces. Flexible connections possible, vibration free, easy to operate, maintain and build in.
Motors correspond to DIN EN 60034 and have IP 55 protection and insulation class F.

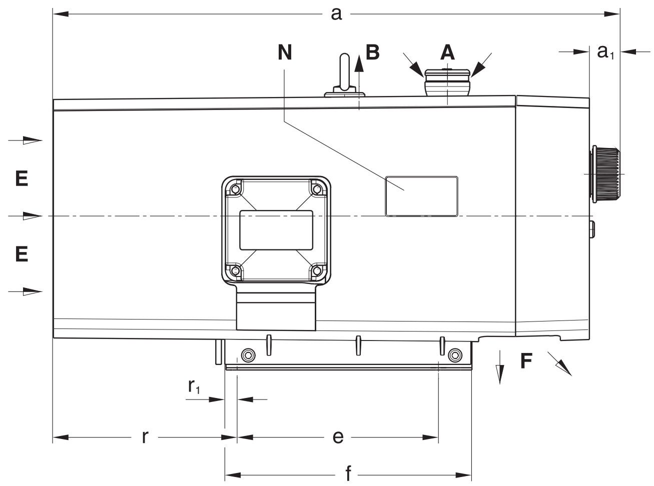
Auswahldiagramm • *Selection diagram* 50 Hz 60 Hz



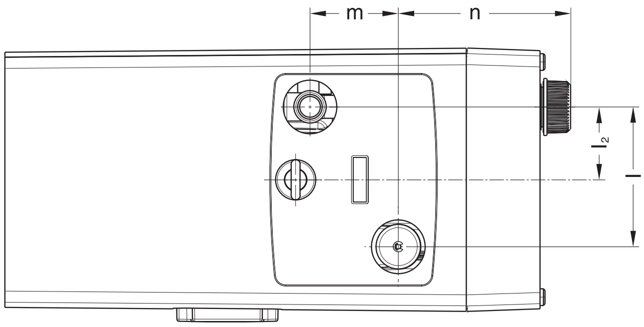
V-DTN			16		26		41	
Volumenstrom *Volume flow*	m^3/h	50 Hz	17,0		26,0		43,5	
		60 Hz	20,5		31,2		52,2	
Überdruck *Overpressure*	bar	50 Hz	0,7	1,0	0,6	1,0	0,7	1,0
		60 Hz	0,6	1,0	0,5	1,0	0,6	1,0
Motorausführung *Motor version*	3~	50 Hz	200-255/346-440V ± 5%					
		60 Hz	200-290/346-500V ± 5%					
	1~		230V ± 10% (50/60 Hz)					
Motorleistung *Motor rating*	kW (3~)	50 Hz	0,55	0,75	0,75	1,1	1,50	1,85
		60 Hz	0,65	0,90	0,90	1,3	1,80	2,20
	kW (1~)	50 Hz	-	0,75	0,75	1,1	-	1,85
		60 Hz	-	0,90	0,90	-	-	-
Stromaufnahme *Current drawn*	A (3~)	50 Hz	2,7 / 1,55	3,6 / 2,1	3,6 / 2,1	5,55 / 3,2	6,6 / 3,8	9,0 / 5,2
		60 Hz	2,9 / 1,7	3,8 / 2,2	4,2 / 2,4	5,7 / 3,3	6,9 / 4,0	9,0 / 5,2
	A (1~)	50 Hz	-	5,9	5,6	6,6	-	10,5
		60 Hz	-	5,9	6,5	-	-	-
Drehzahl *Speed*	min⁻¹	50 Hz	1450					
		60 Hz	1740					
Mittlerer Schalldruckpegel Average noise level	dB(A)** EN ISO 3744	50 Hz	61		62		67	
		60 Hz	63		64		69	
Gewicht *Weight*	kg	3~	28,0	28,2	30,7	33,9	47,0	48,4
		1~	-	28,7	34,4	34,4	-	49,0

Abmessungen • *Dimensions* [mm]





A	Ansaugung • *Suction*
B	Druck-Anschluss • *Pressure connection*
D	Druck-Regulierventil • *Pressure regulating valve*
E	Kühlluft-Eintritt • *Cooling air entry*
F	Kühlluft-Austritt • *Cooling air exit*
N	Datenschild • *Data plate*



V-DTN	16	26	41
a	478	513	592
a_1	30	33	42
b	245	245	275
b_1	236	236	270
c	283	283	319
e	180	180	200
f	220	220	242
l	125	125	147
l_2	65	65	72

V-DTN	16	26	41
m	79	79	90
n	126	161	175
o	150	150	190
p	170	170	210
r	164	164	201
r_1	11	11	10
v	246	246	282
v_2	14	14	8
R_1	Rp $^1/_2$	Rp $^1/_2$	Rp $^3/_4$

Zubehör • *Accessories*

V-DTN			16		26		41	
Rückschlagventil *Non-return valve*	**ZRK**		13		13		20	
Schlauchanschluss *Hose connection*	**ZSA**		13		13		20	
Motorschutzschalter *Motor starter*	**ZMS (3~)**	50 Hz	40 / 16	40 / 25	40 / 25	63 / 40	100 / 40	100 / 63
		60 Hz	40 / 25	40 / 25	63 / 25	63 / 40	100 / 63	100 / 63
	ZMS (1~)	50 Hz	-	63	63	100	-	160
		60 Hz	-	63	100	-	-	-

m³/h* Der Volumenstrom bezieht sich auf freie atmosphärische Luft von 1 bar (abs.) und 20°C. • *The capacity refers to free atmospheric air at 1 bar (abs.) and 20°C.*

dB(A)** bei mittlerer Belastung, ansaugen und ausblasen über Schlauchleitung • *at medium load, inlet and discharge connected to a pipeline*

Kennlinien, Tabellenangaben (Toleranz ±10%) beziehen sich auf betriebswarme Verdichter. • *Curves, tables content (tolerance ±10%) refer to compressor at normal operating temperature*.

Technische Änderungen vorbehalten! • *We reserve the right to alter technical information!*

Gardner Denver

Elmo Rietschle is a brand of Gardner Denver's Industrial Products Division and part of Blower Operations.

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Fax +49 7622 392300

er.de@gardnerdenver.com
www.gd-elmorietschle.com

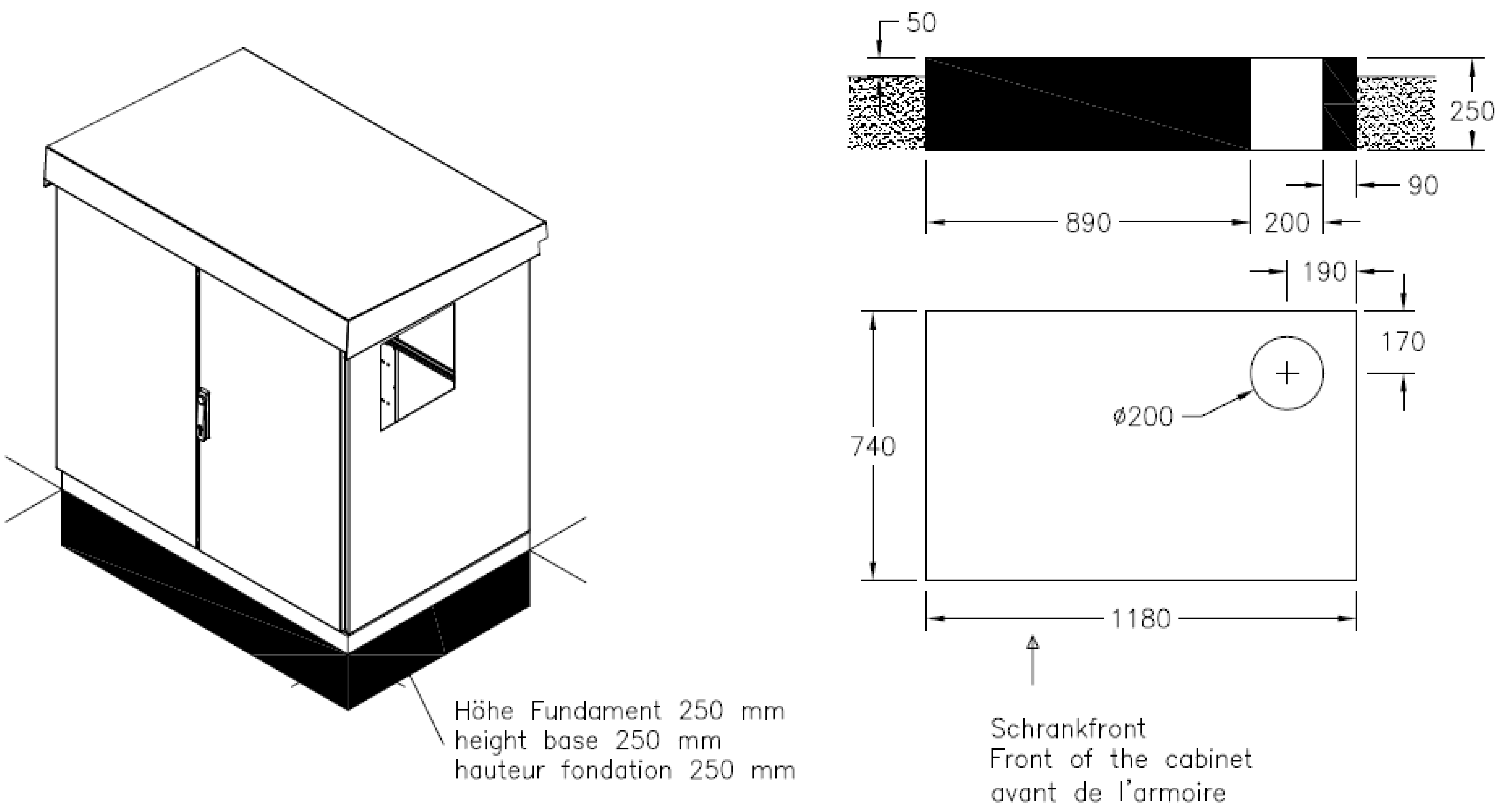
GRAF Professional

System components – External cabinets with control unit

External steel cabinet XL suitable for compressor DT4.25; DTN41; KDT3.60; KDT 3.80	
Material	Steel plate 1,5 mm, powder-coated
Lock	pivot lever inc. cylinder lock
Dimensions [WxHxD]	1200 x 1110 x 800 mm
Weight, net	140 kg
Space for 30 L precipitant canister	

GRAF Professional

System components – Plinth Dims. for External Cabinet XL



PLANS

NOTES

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HEALTH AND SAFETY NOTES

SIGNIFICANT RESIDUAL HAZARDS	PRESENT	DESCRIPTION
Asbestos	☐	
Health Hazards	☐	
Structural Instability	☐	
Ground Conditions	☐	
Contamination	☐	
Buried and Overhead Services	☐	
Underground Structures	☐	
Adjacent Activities	☐	
Site Restrictions	☐	
Other (specify)	☐	

ACTIONS / NOTES:

REVISIONS

REV	DATE	BY	DETAILS

CLIENT
St Fillans Community Council

PROJECT
Proposed New Village Hall
St Fillans

DRAWING TITLE
Location Plan
SITE A
As Proposed

SCALE	PAPER SIZE
1:2500	A3

PURPOSE	DRAWN BY	DATE	JOB NO.	DWG. NO.	REVISION
Pre App	RP	01.11.21	5342	Loc 1	

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St Fillans

DRAWING TITLE
Block Plan
SITE A
As Proposed

SCALE
1:500

PAPER SIZE
A3

PURPOSE	DRAWN BY	DATE	JOB NO.	DWG. NO.	REVISION
Pre App	RP	01.11.21	5342	SK03	

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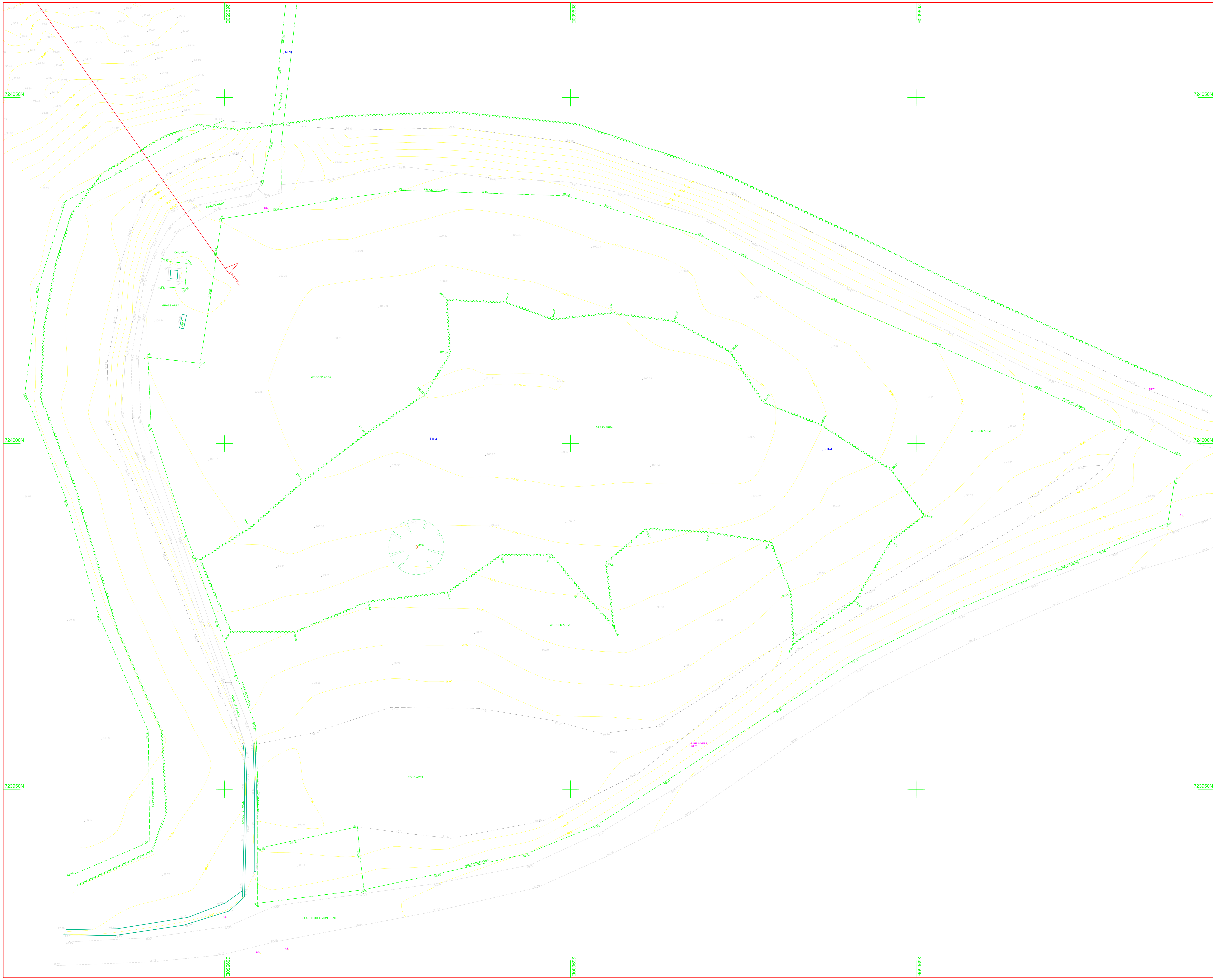

LEGEND

SYMBOLS

BOREHOLE
CONTROL STATION
GATE
SERVICE COVER
STUMP
TRIAL PIT
TREE

LINE STYLES

BOTTOM OF BANK
BUILDING FOOTPRINT
BUSH CANOPY
CHANGE OF SURFACE
CHANNEL LINE
FENCE
HEDGE
OVERHEAD WIRES
ELECTRIC
TELECOM
PATH EDGE
ROAD CENTRE LINE
STRIP GULLY
TOP OF BANK
TOP OF KERB
TREE CANOPY
WALL

ABBREVIATIONS

AV	=	AIR VALVE	LP	=	LAMPOST
BH	=	BOREHOLE	MH	=	MANHOLE
BOL	=	BOLLARD	MKR	=	MARKER
BOX	=	ELEC / BT BOX	PIT	=	TRIAL PIT
BT	=	BRITISH TELECOM	PEG	=	MARKER PEG
EA	=	EAVES LEVEL	RD	=	RIDGE LEVEL
EC	=	ELECTRICITY COVER	RS	=	ROAD SIGN
EP	=	ELECTRICITY POLE	SB	=	SIGN BOARD
FFL	=	FINISHED FLOOR LEVEL	SC	=	STOP COCK
FP	=	FLAG POLE	SV	=	STOP VALVE
G	=	GULLY	TCB	=	TELEPHONE CALL BOX
GAS	=	BRITISH GAS	TL	=	TRAFFIC LIGHT
HY	=	FIRE HYDRANT	TOW	=	TOP OF WALL
IC	=	INSPECTION COVER	TP	=	TELEGRAPH POLE
IL	=	INVERT LEVEL	TV	=	TELEVISION
SG	=	STRIP GULLY	WM	=	WATER METER

NOTES

1. GRID IS RELATED TO O.S. GRID
2. ALL LEVELS RELATE TO O.S.B.M. ASCERTAINED BY LOGGING G.P.S. DATA
3. CONTOURS ARE AT 0.50 (m) INTERVALS
4. CONTOURS AT VERTICAL FEATURES ARE INDICATIVE
5. LEVELS FOR ROAD ARE TAKEN ALONG CHANNEL LINE
6. WHILE EVERY EFFORT HAS BEEN MADE TO LOCATE THE POSITION OF ALL SERVICE COVERS (eg. manholes) IT SHOULD BE NOTED THAT THIS MAY NOT HAVE BEEN POSSIBLE AT THE TIME OF SURVEY DUE TO GROUND COVER OR LOCAL OBSTRUCTIONS.
7. ISOLATED MATURE TREES ARE DENOTED BY TRUNK AND ESTIMATED AVERAGE OUTER CANOPY.
8. ALL CONTROL STATION COORDINATES SHOULD BE CHECKED AND VERIFIED ON SITE PRIOR TO USE. DOUGLAS LAND SURVEYS SHOULD BE INFORMED OF ANY DISCREPANCIES FOUND.
9. OWNERSHIP OF SURVEY DATA REMAINS WITH DOUGLAS LAND SURVEYS, UNTIL INVOICE RELATING TO SUCH DATA HAS BEEN PAID IN FULL.

CONTROL STATIONS

SURVEY STATIONS

Name	Easting	Northing	Height	Remark
STN1	269558.490	724056.380	100.774	HILTI
STN2	269579.402	724000.439	100.928	W.PEG
STN3	269636.501	723998.968	100.168	W.PEG

18/01/2022

Douglas LAND SURVEYS Ltd.

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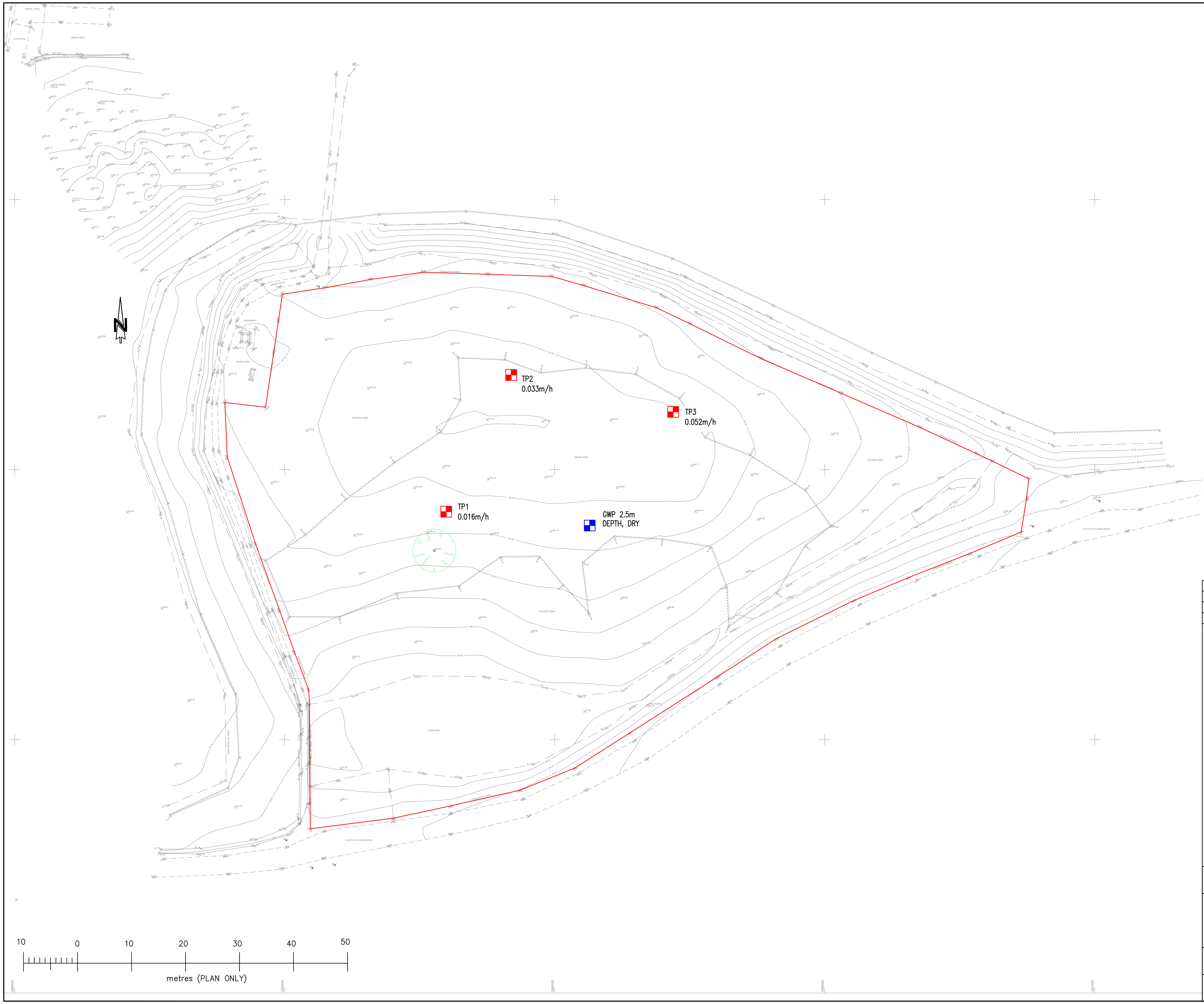
A1

Title:
WAR MEMPRIAL, ST. FILLANS.

Drawn By:	Scale:	Date:
S.WILSON	1/250	10/02/2022

Drawing Number: 0722

Revision: 01



REV	DESCRIPTION	DATE

Atholl Associates
Flood Risk and Drainage

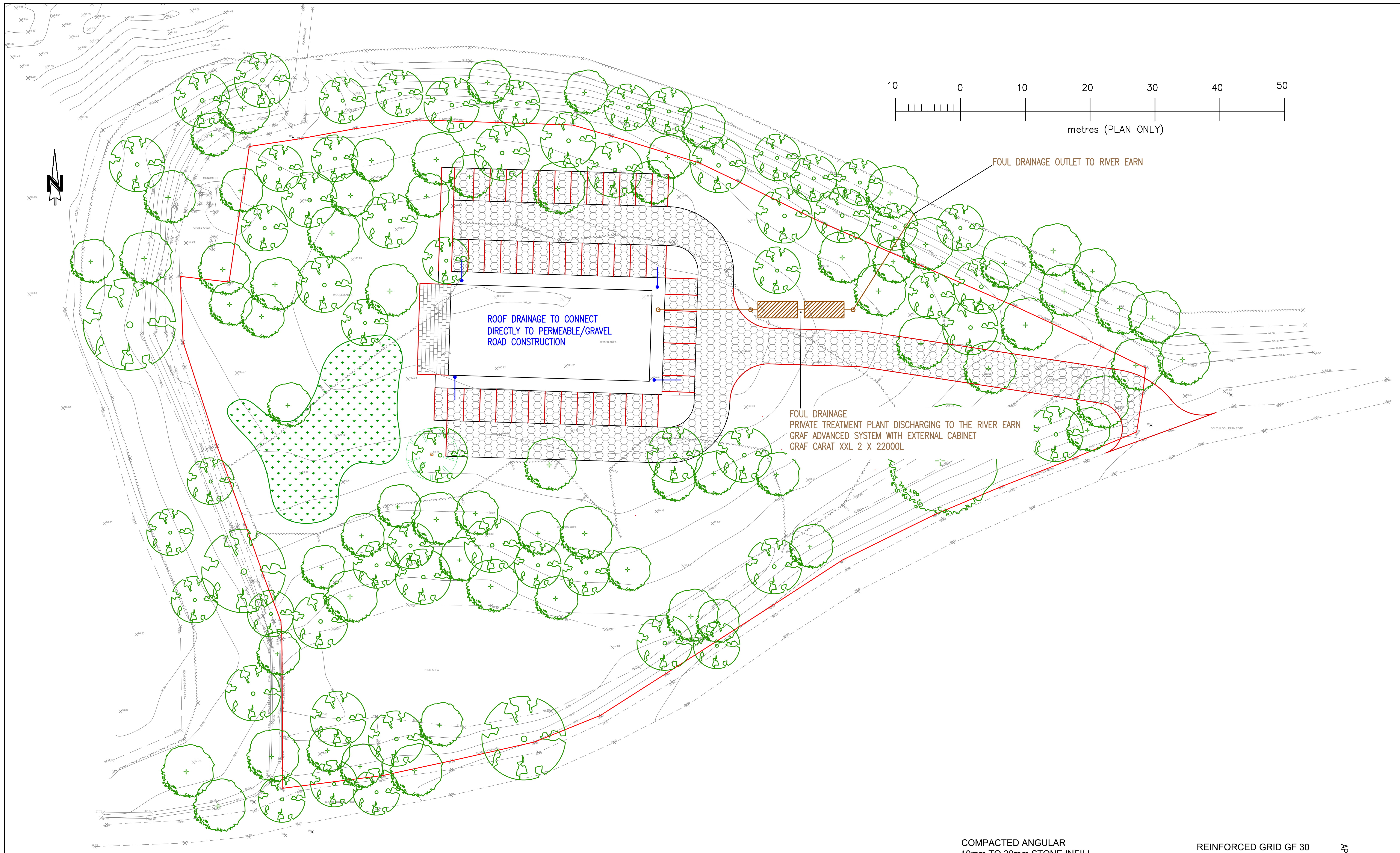
Algo Business Centre
Glenearn Road, Perth PH2 0NJ

T 07904451873 E brian@athollassociates.co.uk

Project: ST FILLANS VILLAGE HALL

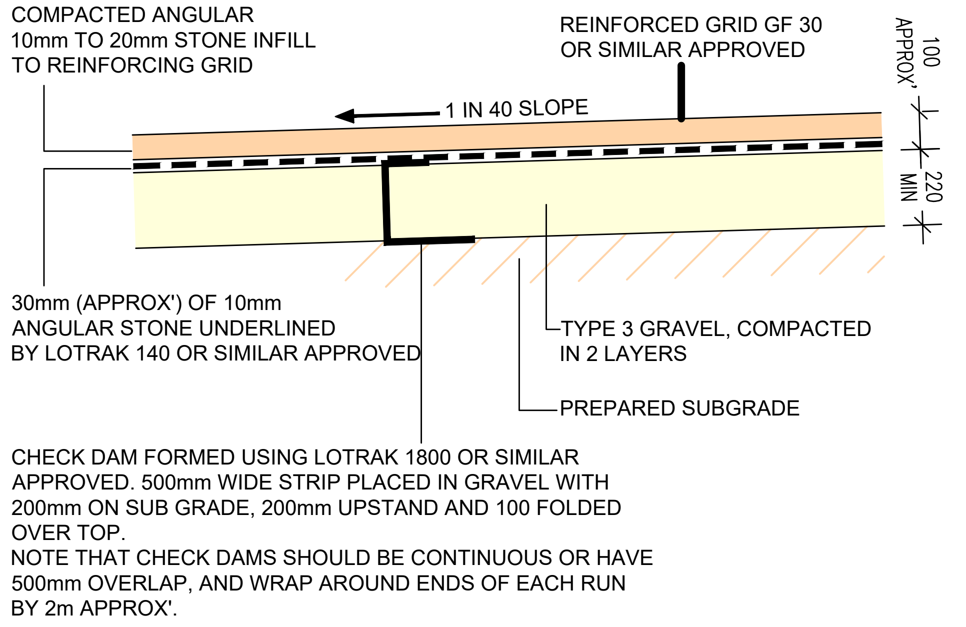
Title: TRIAL PIT LOCATION PLAN

Drawn By: DK	Scale: A2 1:500	Date: FEB 21
Drawing Number: AA/DD/196b/001		Revision:



NOTES:

1. TYPE 3 SUB-BASE (4 TO 40MM NO FINES, VOID RATIO 30%) TO BE USED OVER WHOLE AREA, WITH A UNIFORM DEPTH AT LEAST 220mm DEEP AND LAID ON A PREPARED SUBGRADE WITH A MAXIMUM SURFACE GRADIENT OF 1 IN 40.
2. CHECK DAMS TO BE FORMED TO FULL DEPTH OF TYPE 3 GRAVEL USING LOTRAK 1800 OR SIMILAR APPROVED, IN ACCORDANCE WITH LAYOUT SHOWN IN DETAIL C.
3. TYPE 3 TO BE LAID IN 2 LAYERS, EACH LAYER TO BE ROLLED TO ACHIEVE SUITABLE COMPACTION.
4. TYPE 3 LAYER TO BE OVERLAIN WITH PLASTIC (LDPE) CELLULAR REINFORCEMENT LAYER SUCH AS GROUNDFORCE GF30 OR SIMILAR, AND INFILLED WITH ANGULAR STONE, NOMINAL SIZE 10-20mm AND UNDERLAIN BY 10mm GRAVEL
PLUS GEOTEXTILE AS PER DETAIL A
5. ACTUAL DEPTH OF SUB-BASE TO COMPLY WITH REINFORCING GRID MANUFACTURER'S SPECIFICATION BASED ON LIGHT PARKING USE, AND CBR OF SUBGRADE
6. TYPE 3 GRAVEL LAYER TO BE LAID DIRECTLY ONTO SUBGRADE IF CBR GREATER THAN 5%. IF CBR < 5%, A SUITABLE GEOTEXTILE TO BE SPECIFIED, E.G. LOTRAK 140 OR SIMILAR APPROVED.



TYPICAL PERMEABLE GRAVEL ROAD CONSTRUCTION
NTS

REV	DESCRIPTION	DATE

Atholl Associates
Flood Risk and Drainage

Algo Business Centre
Glenearn Road, Perth PH2 0NJ
T 07904451873 E brian@athollassociates.co.uk

Project:	ST FILLANS VILLAGE HALL
Title:	DRAINAGE STRATEGY PLAN
Drawn By: DK	Scale: A2 1:500
Date:	FEB 22
Drawing Number:	AA/DD/196b/002
Revision:	

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Flood Risk and Drainage