

# FloodSmart



## Floodplain Storage Assessment

### Site Address

Twinbrooks Barn  
Upbrooks  
Clitheroe  
BB7 1PL

### Date

2023-07-05

### Report Status

FINAL

### Grid Reference

375382, 442286

### Site Area

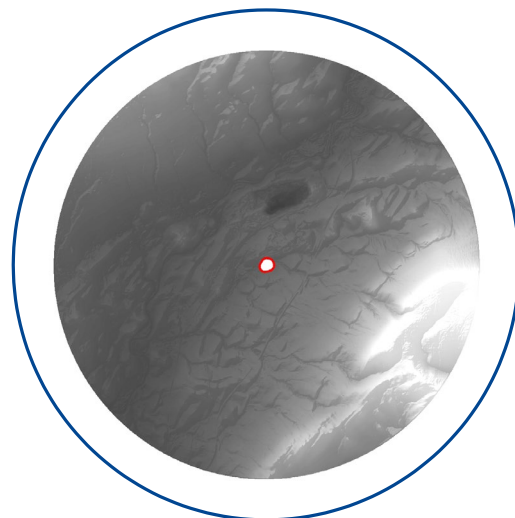
0.225 ha

### Report Prepared for

Mr A Thornburn  
Twinbrooks Barn  
Upbrooks  
Clitheroe  
BB7 1PL

### Report Reference

74970.02R2



## Summary

Development proposals comprise the construction of a new residential building and replacement outbuilding located within an area modelled to be affected by fluvial flooding, at a Medium to Low risk of surface water flooding and a Low risk of groundwater flooding.

The proposed development would result in an increase in the building footprint within the Flood Zone and which would reduce the volume of available floodplain water storage in a 1% AEP (1 in 100 year) plus 36% climate change allowance flood event, where the flood level is 83.08 mAOD.

Ground reprofiling is proposed on the areas of soil mounds highlighted within the topographic survey to achieve level for level, volume for volume floodplain compensation.

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# 1. Introduction



## Objective

GeoSmart Information Limited has been commissioned by Mr A Thornburn to undertake an assessment of the floodplain compensation requirements for the proposed development at the Twinbrooks Barn, Upbrooks, Clitheroe, BB7 1PL. A technical note has been produced summarising the requirements, which could be used separately within the detailed design of compensatory storage and/or voids design.

## Report Limitations

The findings presented in this report are based on information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and have taken the data presented at face value. No Site visit has been undertaken, and Site-specific modelling has not been undertaken.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

## Summary of findings

The Site is located within Flood Zones 1, 2 and 3, with the Site affected by the 1 in 100- year plus 36% climate change event.

The Flood Risk Assessment prepared by GeoSmart (ref: 74970.00.01) (2023) confirms the modelled flood levels on the Site during the 1% AEP (1 in 100 year) plus 36% plus Climate change (CC) event and the 0.1% AEP (1 in 1000 year) are 83.08 mAOD and 83.24 mAOD, respectively.

An increase in the built footprint is proposed on the Site of 148 m<sup>2</sup>. The proposed building is affected by the 100 year plus 36% CC event and therefore, it could potentially displace flood water.

In order to prevent the displacement of flood water during all events up to the 1 in 100 year plus 36% allowance for climate change flood events though, compensatory floodplain storage is required.

The preferred method of providing floodplain compensation and which has been assessed within this report is to:

**A:** remove existing 'non-floodable' building structures to free up floodplain storage;

**B:** lower ground levels on a level for level and volume for volume basis.

Only where A and B do not free up a suitable volume of floodplain storage, should C be used. This is likely to be acceptable on existing brownfield Sites, where the EA agree.

**C:** the use of voids beneath buildings and ground through the use of a podium/platform type structural arrangement.

Calculations undertaken within this report confirm level for level floodplain storage can be provided through lowering of ground levels on the Site through the removal of the existing spoil heaps, as confirmed by the Client.

## 2. Site Context



### Site information

The Site is located in Clitheroe in a setting of commercial and residential land use at National Grid Reference SD 75384 42288. Site plans and drawings are provided in Appendix A.

Figure 1. Aerial imagery of the Site (Bluesky, 2023)

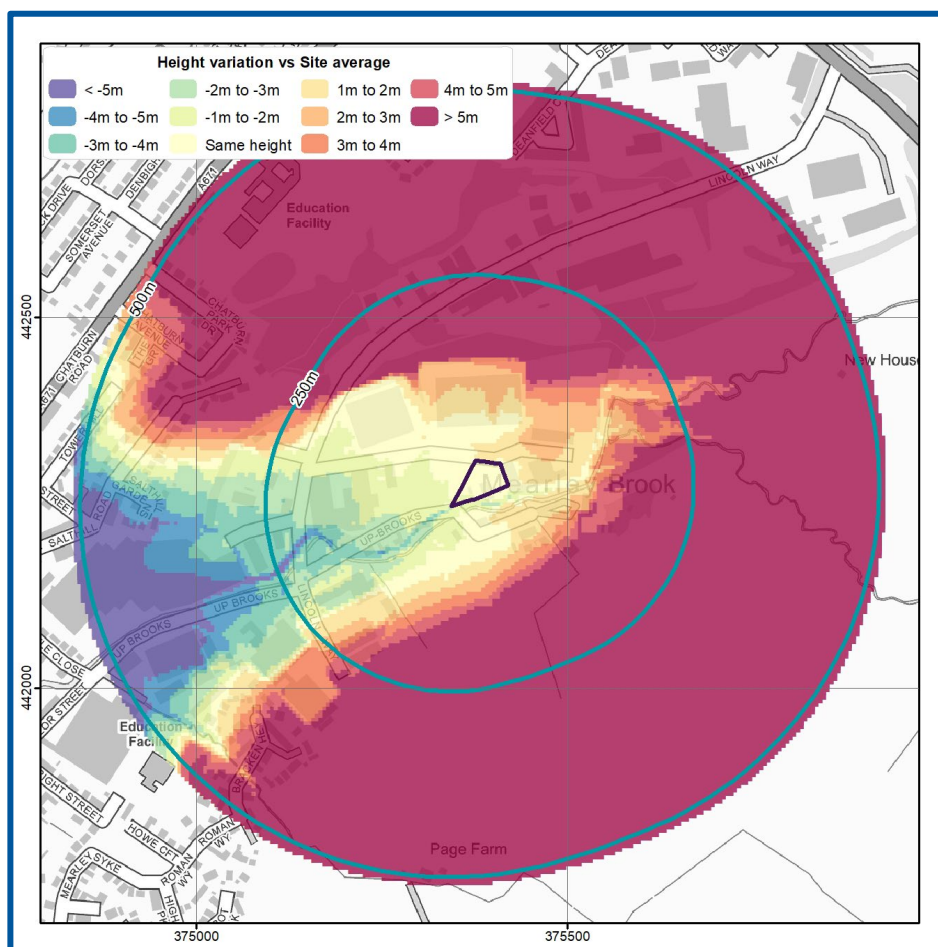


BlueSky copyright and database rights 2023

Figure 2 (overleaf) indicates ground levels within 500m of the Site fall in a south easterly direction

A topographic survey has been undertaken for the Site by Sunderland Peacock Architects (2018) identifying ground levels fall gradually to the southwest from 84.67 mAOD to 82.29 mAOD (Appendix A).

Figure 2. Site Location and Relative Elevations (GeoSmart, 2023)

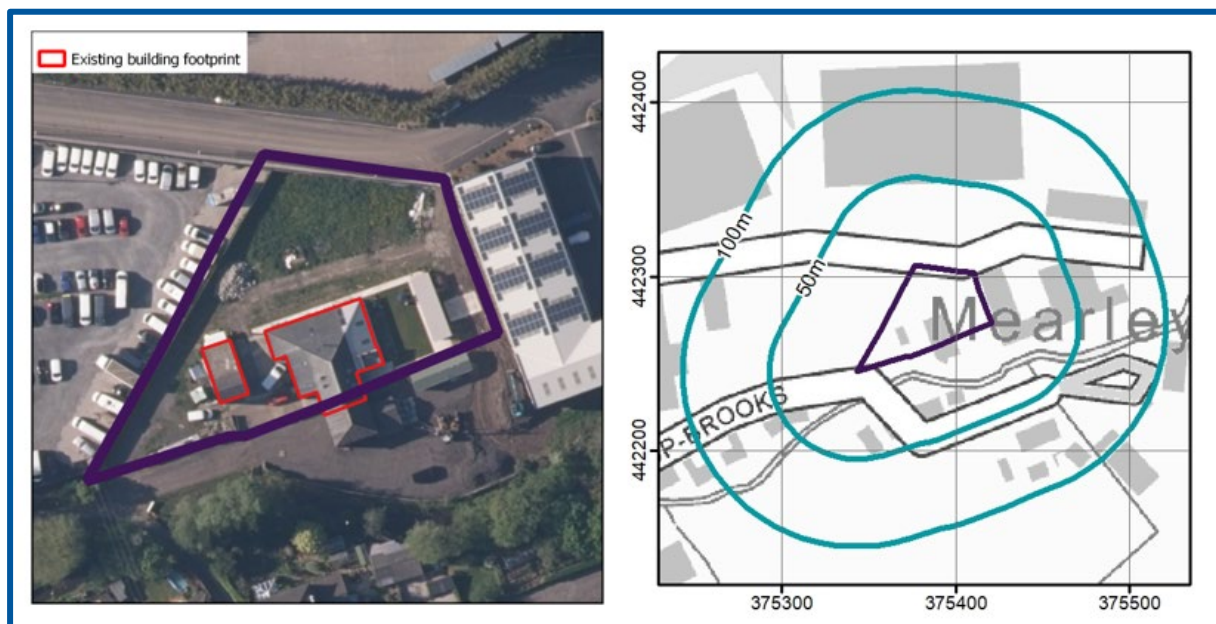


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## Existing Site Arrangement

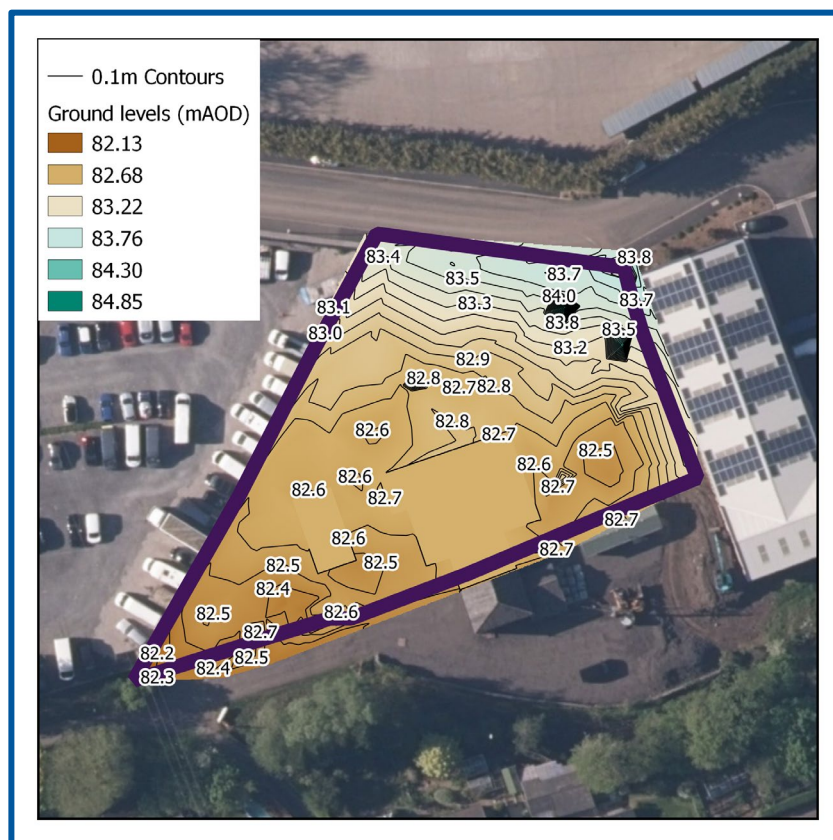
The Site is currently used within a residential capacity. At present there are two buildings at the south of the Site with the north of the Site comprising of grassed areas as well as a series of isolated mounds and areas of concrete/ stone.

Figure 3. Existing Site Arrangement and Layout



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Figure 4. Existing ground elevation map\*



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Sunderland Peacock Architects Topographic survey (2018)

\*Assumed FFL of the existing buildings on Site of 82.70 mAOD.

## Proposed Development

Development proposals comprise the demolition of one of the buildings and the construction of a replacement outbuilding and a single two storey dwelling as well as an associated access road, car parking spaces and landscaped areas. According to data from the Client the finished floor levels of the proposed replacement outbuilding are to be set at 82.70 mAOD and the new dwelling at 83.38 mAOD.

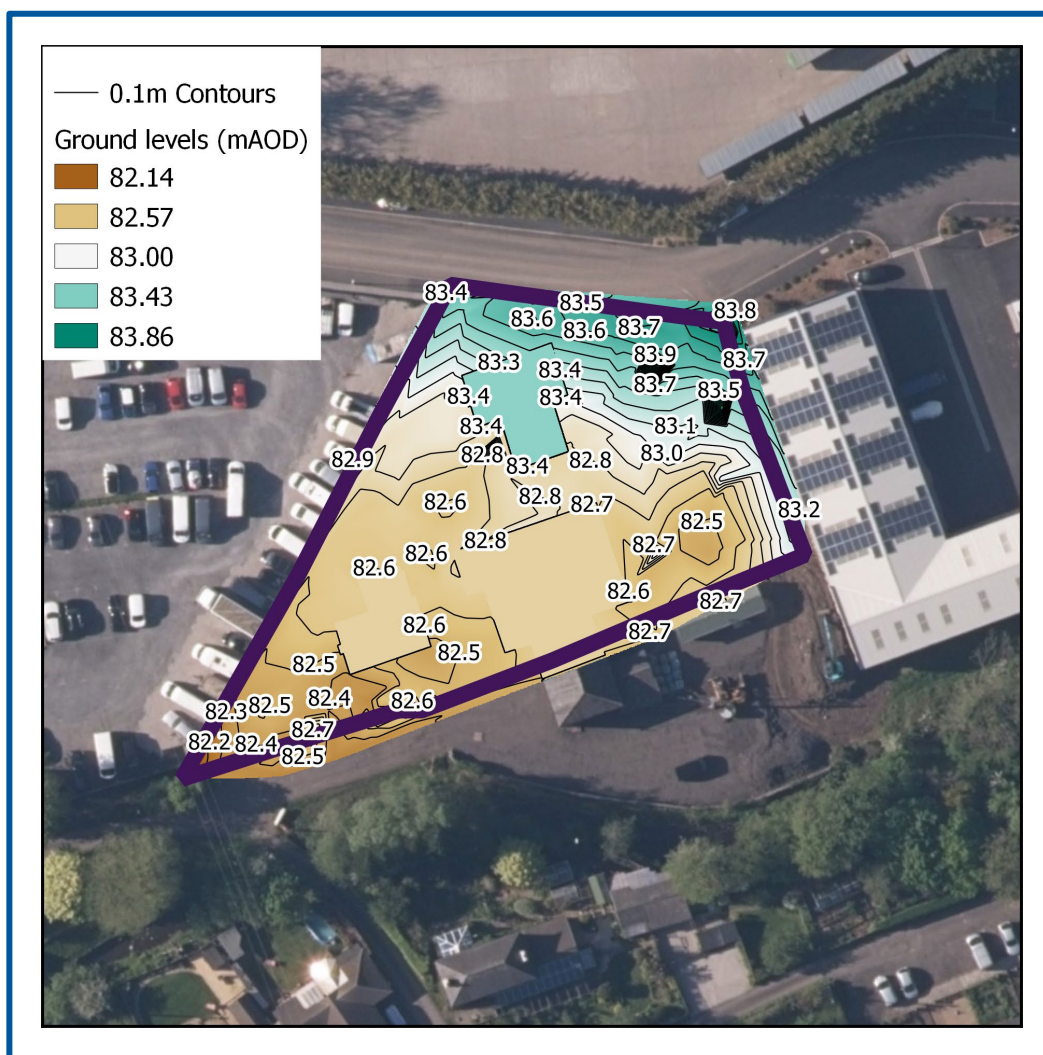
The main existing building of Twinbrook Barn is not proposed to undergo any changes. Site plans are included within Appendix A

**Figure 5. Proposed Development Plan**



Sunderland Peacock Architects development plan (2022)

Figure 6. Ground levels including the proposed FFLs

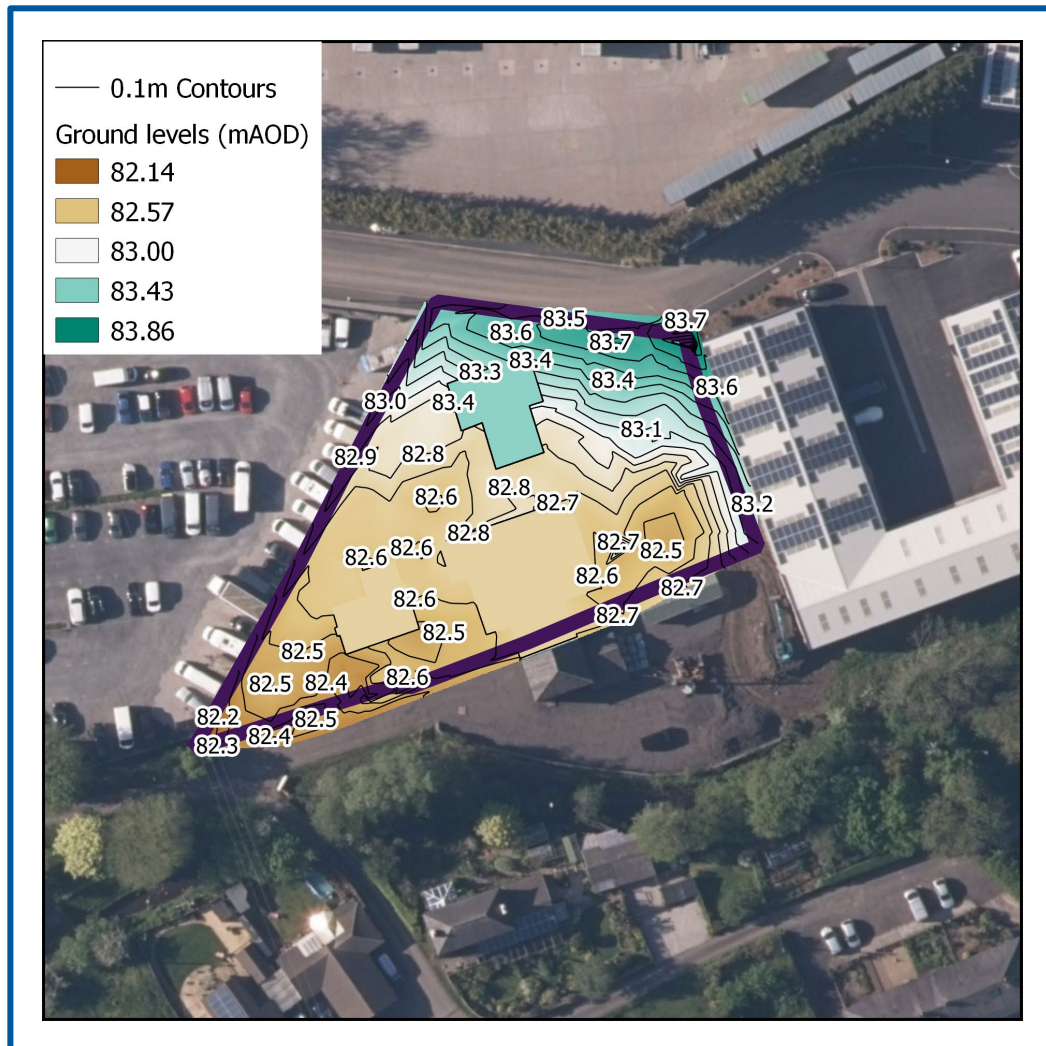


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Sunderland Peacock Architects Topographic survey (2018) and development plans (2023)

Table 1. Existing and proposed building footprints on the Site.

Existing	Proposed	Increase
Existing outbuilding (65 m <sup>2</sup> )	Replacement Outbuilding (88 m <sup>2</sup> )	Total increase in non-floodable building footprint: <b>148 m<sup>2</sup></b>
	New Dwelling (125 m <sup>2</sup> )	
Twinbrooks Barn (330 m <sup>2</sup> )	Twinbrooks Barn (330 m <sup>2</sup> )	
Total: 395 m <sup>2</sup>	Total: 543 m <sup>2</sup>	

Figure 7. Ground levels including the proposed FFLs and soil mounds removed



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A Detailed Terrain Model (DTM) map has been produced on the basis of the proposed finished floor level of the building, interpolated topographic survey by Sunderland Peacock Architects Topographic survey (2018) (Appendix A) using standard Triangular Interpolation Network (TIN) with assumed FFLs. An additional scenario has been produced with areas of mounds, ascertained from the topographic survey, proposed to be removed/reprofiled having the level assumed based on the surrounding elevations.

The DTM data will be used to calculate the losses and gains in floodplain storage volume on the Site using the SAGA Raster volume calculator tool within QGIS v3.16.10. This will enable the calculation of the available volume of floodplain storage beneath each flood level increment from the maximum flood level of 83.08 mAOD.

## 3. FRA review & Policy



### FRA review and summary

In accordance with the National Planning Policy Framework (NPPF) 2021 and National Planning Policy Guidance (NPPG) 2022, a site-specific Flood Risk Assessment (FRA) was produced by GeoSmart Information Ltd in October 2021 and updated in March 2023 to support a planning application for the proposed development (ref: 74970.00.01).

#### Sea (Coastal/Tidal) Flooding Risk

The Site is located in an inland location and the risks of flooding from coastal and estuarine environments are considered to be Very Low.

#### River (Fluvial) Flooding Risk

The Site is located 10 m north of the Mearley Brook watercourse. According to the EA's Flood Map for Planning Purposes, approximately 73% of the Site (1,775m<sup>2</sup>) is located within fluvial Flood Zone 3 (High probability) from the River Mearley, a further 16% (390 m<sup>2</sup>) is located within fluvial Flood Zone 2 at Medium probability. The remainder of the Site, 11% (265 m<sup>2</sup>) and land to the north is located within Flood Zone 1 at Low probability.

The EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, indicates the Site has a Medium to Very Low risk of flooding from Rivers and the Sea.

- The EA's modelled data has been analysed in line with the most up to date guidance on climate change (EA, 2022), to confirm a maximum "design" flood level at the Site.
- During a 1 in 100 year plus 36% climate change allowance event the flood level at the Site would be 83.08 mAOD.
- During this event, flood depths in the area proposed for buildings could be up to 0.54 m. Flood mitigation measures are included in the next section.

Emergency evacuation routes are available to the north of the proposed development and Site.

#### Surface Water (Pluvial) Flooding Risk

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site is at a variable risk of pluvial flooding ranging from Low to High.

- It should be noted that the area proposed for development is classed as at Medium to Low risk with only the access road affected to depths less than 0.3 m.
- During a High risk event the area proposed for development is not likely to be affected with flooding restricted to areas outside of the development footprint.

## Groundwater Flooding Risk

Groundwater Flood Risk screening data indicates a Low risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.

- Based on a review of (limited) site specific data groundwater levels may rise in the bedrock and superficial aquifer in response to high river events and prolonged rainfall recharge events.

## Risk of Flooding from Artificial Sources

The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:

- The EA's Risk of Flooding from Reservoir map confirms the Site is not at risk of reservoir flooding.
- Ordnance Survey (OS) data confirms there are no canals near to the Site.
- A sewer flooding history search was undertaken using the Strategic Flood Risk Assessment (Ribble Valley Borough Council, 2017). This confirms no recorded incidences of sewer flooding at or within the vicinity of the Site.

The FRA report confirms that as there would be an increase in the proposed building footprint at the Site, floodplain storage analysis would be required to confirm the most appropriate method to prevent displacement of flood waters at the Site.

## 4. Floodplain Storage



### Floodplain Storage

#### *Floodable Area*

An area of land that has the capacity to flood during a flood event, with minimal damage and disruption is considered to be 'floodable'. This typically comprises areas where no buildings are proposed such as driveways, patio and soft landscaping areas. In some cases, it may also include non-habitual buildings such as open sided barns, garages and outhouses.

#### *Non-floodable area*

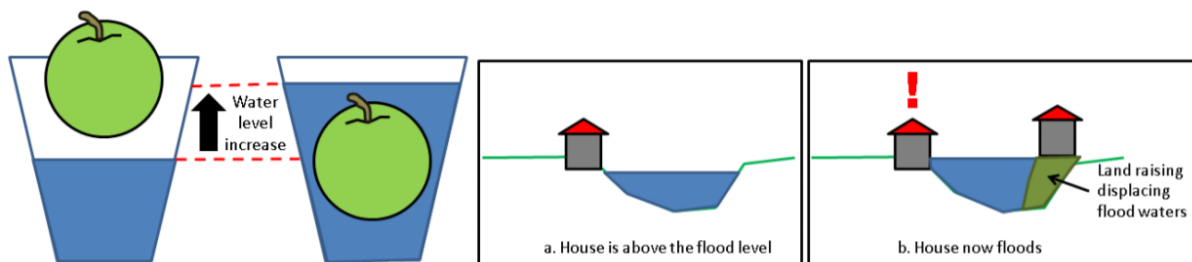
Non-floodable areas of development sites usually consist of buildings that are designed to keep flood waters out, or areas of raised ground and landscaping to achieve non-floodable access into a Site, which do not allow flood water to flow freely and take up a volume.

#### Floodplain displacement

An increase in non-floodable areas, through an increase in building footprint or raising of ground levels, will reduce the area and available storage volume, which is available to store flood water on-Site during an event.

This could potentially increase the extent, depth and alter the direction of flood flows, which could increase the risk of flooding off-Site. The following figure provides a simplified schematic to confirm the theory behind this.

**Figure 8. Schematic to explain the theory behind the displacement of flood water<sup>21</sup>**



<sup>1</sup> Excerpt image from Hart Technical Note 1:

[https://www.hart.gov.uk/sites/default/files/4 The Council/Polices and published documents/Planning policy/Technical%20Note%201-Level%20for%20Level%20Flood%20Compensation.pdf](https://www.hart.gov.uk/sites/default/files/4%20The%20Council/Polices%20and%20published%20documents/Planning%20policy/Technical%20Note%201-Level%20for%20Level%20Flood%20Compensation.pdf) access on 24/05/2021

## Floodplain Compensation

### *Level for Level Storage Analysis*

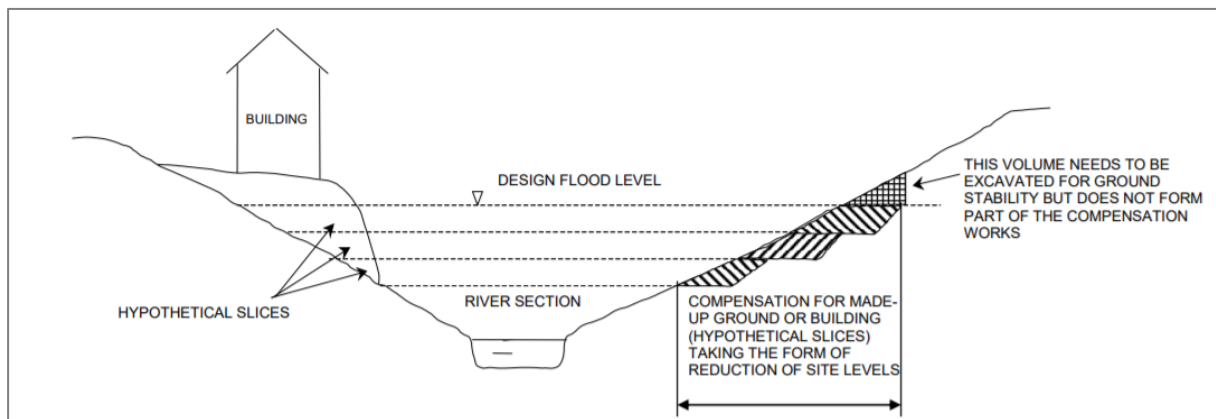
#### **a. Removal of existing buildings**

The removal of non-floodable building structures is normally the primary method in increasing the available volume of floodplain storage to offset the displacement of flood waters as a result of any development proposals.

#### **b. Lowering of ground levels**

The preferred method for providing floodplain compensation is to lower ground levels on-site to ensure the same volume of flood storage is provided on a level for level basis.

**Figure 9. Schematic of theory behind level for level floodplain storage**



#### **c. Voids beneath the proposed building and access**

Where ground levels and the removal of existing buildings do not provide sufficient floodplain storage to prevent the displacement of flood water, then voids can potentially be used beneath buildings and if required, access roads.

There are many construction methods to include a void, but where these features are used they will require protection to avoid blockages and not increase security risks and have to be designed to ensure flooding can flow into and out of the area so as not to alter flood flow routes or available storage volumes.

Figure 10. Schematic of theory behind the use of voids for floodplain storage



## Calculations and Analysis

The following calculations have been undertaken at a high level and displayed in table 2 to summarise the volumes of floodplain storage and then refined within tables 3 and 4 to confirm whether floodplain storage can be provided on the Site.

### High level analysis

Table 2 confirms the lowest flood level at which each development area would be impacted, and the maximum flood depth experienced within each area, this has initially been calculated on an approximate basis in Table 2 but is refined in Table 3.

**Table 2. Lowest level to flood and depth of flooding associated with each development footprint area.**

Development area (m <sup>2</sup> )	Lowest level to flood (mAOD)	Maximum flood depth (m)	Approximate Volume displaced (m <sup>3</sup> )
Existing: 395 m <sup>2</sup>	82.68	0.40	158.00
Proposed: 455 m <sup>2</sup> *	82.54	0.54	245.70
(Proposed) Total water displaced (m <sup>2</sup> )			87.70

\*Building footprint within the areas affected by the 1 in 100 plus climate change allowance event

### Refined level for level analysis

The preferred methods for providing floodplain compensation are to remove existing non-floodable structures and to lower ground levels on-Site to ensure the same volume of flood storage is provided on a level for level and volume for volume basis.

The floodplain losses and gains have been calculated at 0.2m increments.

The total volume of water displaced by the development in tables 2 and 3 are different, because table 3 provides a more accurate analysis using detailed topographic ground elevations in the areas of the proposed building footprints on the Site, whereas table 2 only provides the lowest ground level and confirms the 'worst-case' scenario.

The volumes calculated in Table 3 are the available floodplain storage volume in the existing and proposed scenarios. These are then subtracted from one another to confirm the volume of floodplain storage available at the Site. Where the number is (-) negative this means the proposed development would result in a loss in floodplain storage volume.

The volumes have been calculated using a 0.1m raster grid.

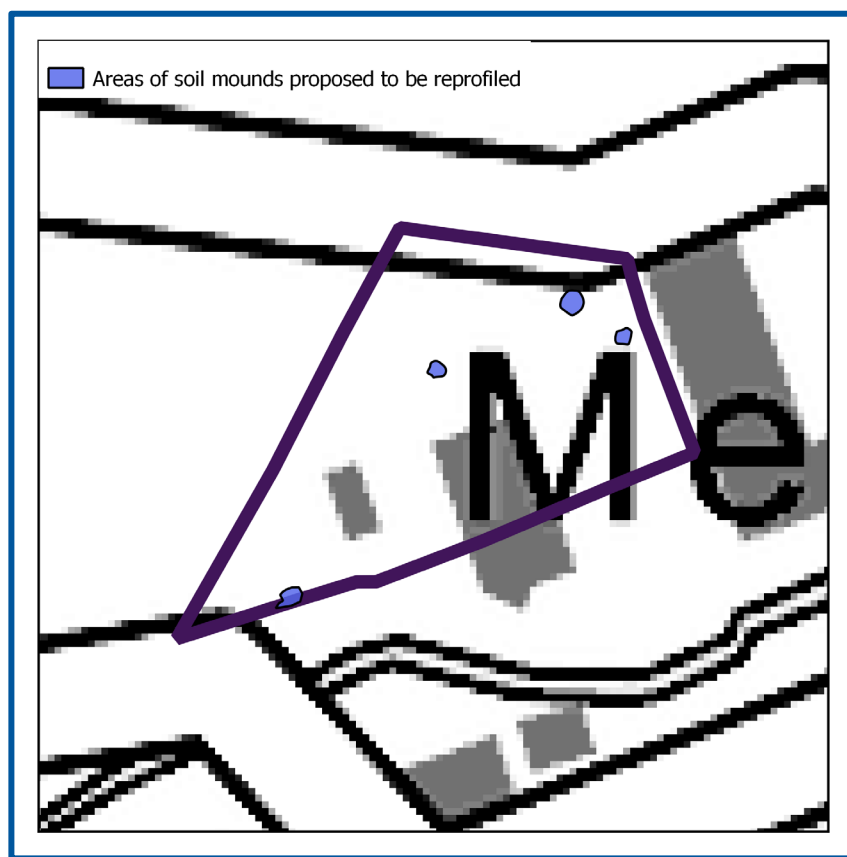
**Table 3. Level increments of floodplain storage loss without ground lowering**

Flood level at 0.2m increments (mAOD)	a. Available volume of floodplain storage in the existing Site (m <sup>3</sup> )	b. Available volume of floodplain storage on the proposed Site (m <sup>3</sup> )	c. Volume of floodplain storage available (m <sup>3</sup> ) (=a-b)
82.88 to 83.08	388.67	388.58	-0.09
82.68 to 82.88	312.42	318.20	5.78
82.48 to 82.68	128.43	122.62	-5.81
82.28 to 82.48	21.44	20.90	-0.54
82.08 to 82.28	0.00	0.64	0.64
81.88 to 82.08	0.00	0.00	0.00
Totals	850.96	850.94	-0.02

Table 3 indicates that the development will result in a net decrease in 0.02 m<sup>3</sup> storage below 83.08 mAOD, demonstrating losses in floodplain storage at the depth bands between 82.28 to 82.68 mAOD. Table 4 (overleaf) indicates the scenario where during the development the areas of soil mounds identified in the topographic survey are removed and subsequently reprofiled to the surrounding ground elevations as shown in Figure 7. The areas to be reprofiled are highlighted in Figure 11.

Based on the aerial imagery there is also a large pile of stone at the eastern boundary however as the levels of this were omitted from the topographic survey, reprofiling of ground in this area has not been assessed.

Figure 11. Areas of the Site proposed to be reprofiled



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Table 4. Level increments of floodplain storage loss with soil mounds removed

Flood level at 0.2m increments (mAOD)	c. Available volume of floodplain storage in the existing Site (m <sup>3</sup> )	d. Available volume of floodplain storage on the proposed Site (m <sup>3</sup> )	c. Volume of floodplain storage available (m <sup>3</sup> ) (=a-b)
82.88 to 83.08	388.67	389.23	0.56
82.68 to 82.88	312.42	313.82	1.40
82.48 to 82.68	128.43	128.65	0.22
82.28 to 82.48	21.44	21.46	0.02

Flood level at 0.2m increments (mAOD)	c. Available volume of floodplain storage in the existing Site (m <sup>3</sup> )	d. Available volume of floodplain storage on the proposed Site (m <sup>3</sup> )	c. Volume of floodplain storage available (m <sup>3</sup> ) (=a-b)
82.08 to 82.28	0.00	0.62	0.62
81.88 to 82.08	0.00	0.00	0.00
Totals	850.96	853.78	2.82

Table 3 indicates that as a result of the proposed development through the removal of soil mounds and heaps and the subsequent re-profiling of land to those indicated in Figure 7 there will be no losses in floodplain storage at each depth band. This therefore identified a net improvement from the existing pre-development scenario with the use of voids beneath the building considered unnecessary.

This is based on an assumed lowest level of the existing soil mounds being reprofiled to an elevation interpolated from the topographic data assuming relatively level surfacing post development.

## 5. Conclusions



The Site is located within Flood Zones 1, 2 and 3, with the Site affected by the 1 in 100- year plus 36% climate change event.

The Flood Risk Assessment prepared by GeoSmart (ref: 74970.00.01) (2023) confirms the modelled flood levels on the Site during the 1% AEP (1 in 100 year) plus 36% event and the 0.1% AEP (1 in 1000 year) are 83.08 mAOD and 83.24 mAOD, respectively.

The proposed development results in an increase in the building footprint of 60 m<sup>2</sup> within areas affected by flooding through the construction of a new dwelling and a larger outbuilding footprint.. In order to provide floodplain compensation for the proposed development, the volume which is displaced will be provided on a level for level, volume for volume basis. There would be an increase in the volume of available floodplain storage of 2.82 m<sup>3</sup>.

This is based on ground levels in the areas of existing soil mounds re-profiled, as confirmed by the Client. The supporting calculations are provided in Appendix B.

Management and maintenance of the areas proposed for floodplain storage should be undertaken in perpetuity over the lifetime of the development, to ensure the capacity of the floodplain is protected and maintained.

## 6. References and Glossary



### References

**Defra/Environment Agency (2005).** Flood Risk Assessment Guidance for New Development. *Phase 2 Framework and Guidance for Assessing and Managing Flood Risk for New Development – Fill Documentation and Tools*. R & D Teport FD232-TR2.

**Environment Agency [EA] (2022).** Flood risk assessments: climate change allowances. Accessed from: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> on 21/06/2023.

**Environment Agency [EA] (2023).** MagicMap. Accessed from: <http://magic.defra.gov.uk/MagicMap.aspx> on 21/06/2023.

**Environment Agency [EA] (2023).** Flood map for planning. Accessed from <https://flood-map-for-planning.service.gov.uk/> on 21/06/2023.

**Environment Agency [EA] (2023).** Long term flood risk assessment for locations in England. Accessed from <https://www.gov.uk/check-long-term-flood-risk> on 21/06/2023.

**GeoSmart (2023).** FloodSmart Plus. Ref: 74970.00.01

**Ministry of Housing, Communities & Local Government (2021).** National Planning Policy Framework (NPPF). Accessed from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1005759/NPPF\\_July\\_2021.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf) on 21/06/2023.

**Ministry of Housing, Communities & Local Government (2022).** Planning Practice Guidance (NPPG). Flood Risk and Coastal Change. Accessed from <https://www.gov.uk/guidance/flood-risk-and-coastal-change> on 21/06/2023.

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**LiDAR Survey Open Data (2023).** Accessed from: <https://environment.data.gov.uk/DefraDataDownload/?Mode=survey> on 21/06/2023.

# Glossary

## General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is $\pm 0.25\text{m}$ for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council

## SuDS

A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

## Aquifer Types

### Principal aquifer

These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

### Secondary A aquifer

Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

### Secondary B aquifer

Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

### Secondary undifferentiated

Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.

### Unproductive Strata

These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

## NPPF (2021) terms

### Exception test

Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

### Sequential test

Aims to steer new development to areas with the lowest probability of flooding.

### Essential infrastructure

Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.

Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

## Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2023 BlueSky copyright and database rights 2023
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2023 Environment Agency copyright and database rights 2023

## 7. Appendices



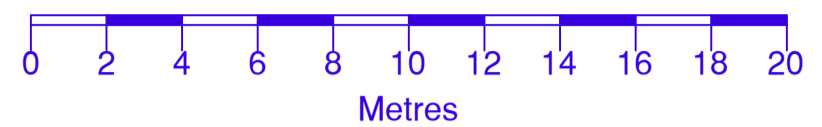
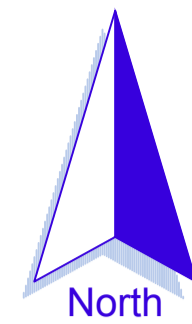
## Appendix A



### Site plans

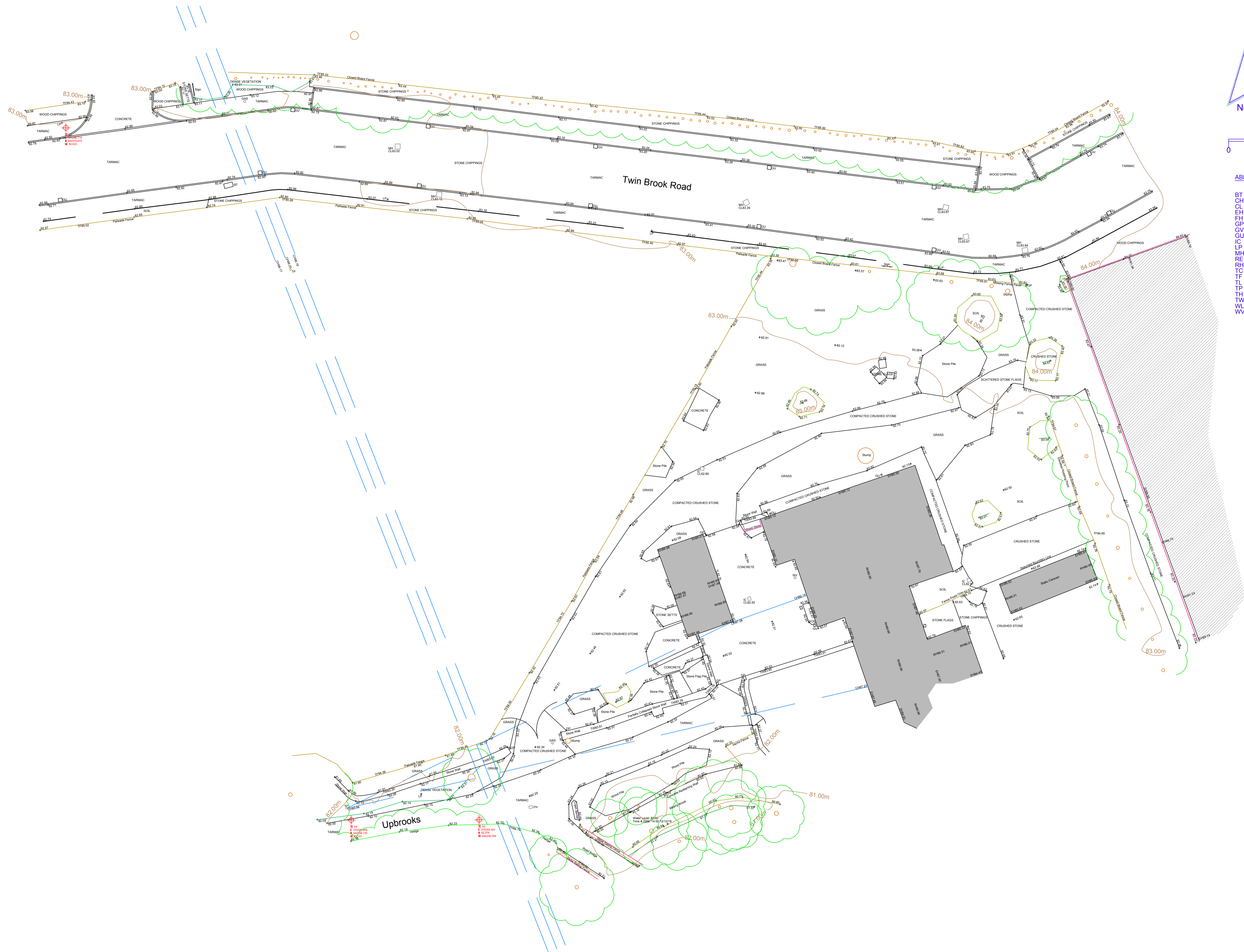


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#### ABBREVIATIONS

BT	BT Cover
CH	Cable Height
CL	Cover Level
EH	Eaves Height
FH	Fire Hydrant
GP	Gate Post
GV	Gas Valve
GU	Gully
IC	Inspection Cover
LP	Lamp Post
MH	Man Hole
RE	Rodding Eye
RH	Ridge/Roof Height
TC	TricAD Control
TF	Top of Fence
TL	Threshold Level
TP	Telegraph Pole
TH	Top of Hedge
TW	Top of Wall
WL	Water Level
WV	Water Valve



Client  
Mr and Mrs Thornburn

Job Title  
Proposed Residential Development  
on land at:  
Twinbrooks Farm  
Upbrooks  
Clitheroe  
BB7 1PL

Drawing Title  
Existing Site Survey Plan

Scale  
1:200 @ A1

Date  
Dec 2018

Drawn  
TricAD

spa

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## Appendix B



# Floodplain Storage Calculations

Project ref: 74970  
Development Twinbrooks  
Date 05/07/2023

Baseline scenario						
Flood Level (mAOD)	Depth bands (mAOD)	Volume in existing scenario	Volume available at 200mm incriments	Volume in proposed scenario	Volume available at 200mm incriments	Change in available volume
83.08	82.88 to 83.08	851.58	388.67	850.94	388.58	-0.09
82.88	82.68 to 82.88	462.91	312.42	462.36	318.20	5.78
82.68	82.48 to 82.68	150.49	128.43	144.16	122.62	-5.81
82.48	82.28 to 82.48	22.06	21.44	21.54	20.90	-0.54
82.28	82.08 to 82.28	0.62	0.00	0.64	0.64	0.64
82.08	81.88 to 82.08	0.00	0.00	0.00	0.00	0.00
			850.96		850.94	-0.02

Based on the removal of existing soil mounds

Volume in proposed scenario	Volume available at 200mm incriments	Change in available volume
853.78	389.23	0.56
464.55	313.82	1.40
150.73	128.65	0.22
22.08	21.46	0.02
0.62	0.62	0.62
0.00	0.00	0.00
	853.78	2.82

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- handle complaints speedily and fairly.
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The Property Ombudsman scheme  
Milford House  
43-55 Milford Street  
Salisbury  
Wiltshire SP1 2BP  
Tel: 01722 333306  
Fax: 01722 332296  
Email: [admin@tpos.co.uk](mailto:admin@tpos.co.uk)

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- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
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- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

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We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

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Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

[martinlucass@geosmartinfo.co.uk](mailto:martinlucass@geosmartinfo.co.uk)

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