

**Flood Risk Assessment**  
**And**  
**Surface Water Drainage Strategy**

**Project:** Proposed redevelopment of 4No dwellings

**Site:** Great Jones St  
Manchester  
M12 5NX

**Client:** Oslady Homes Ltd  
**Architect:** Paul Carr Architect

**Date:** 20<sup>th</sup> December 2022

**Job Ref:** 22-5583

**Prepared by:** JH

**Checked by:** JH

**Revisions:**

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## Proposals

The proposal is to redevelop an existing site with four new dwelling houses.

The site was previously used for housing incorporating several terraced properties that have previously been demolished.

## Flood Risk Assessment



### Flood map for planning

Your reference  
22-5583

Location (easting/northing)  
387395/396596

Created  
21 Dec 2022 11:14

**Your selected location is in flood zone 1, an area with a low probability of flooding.**

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

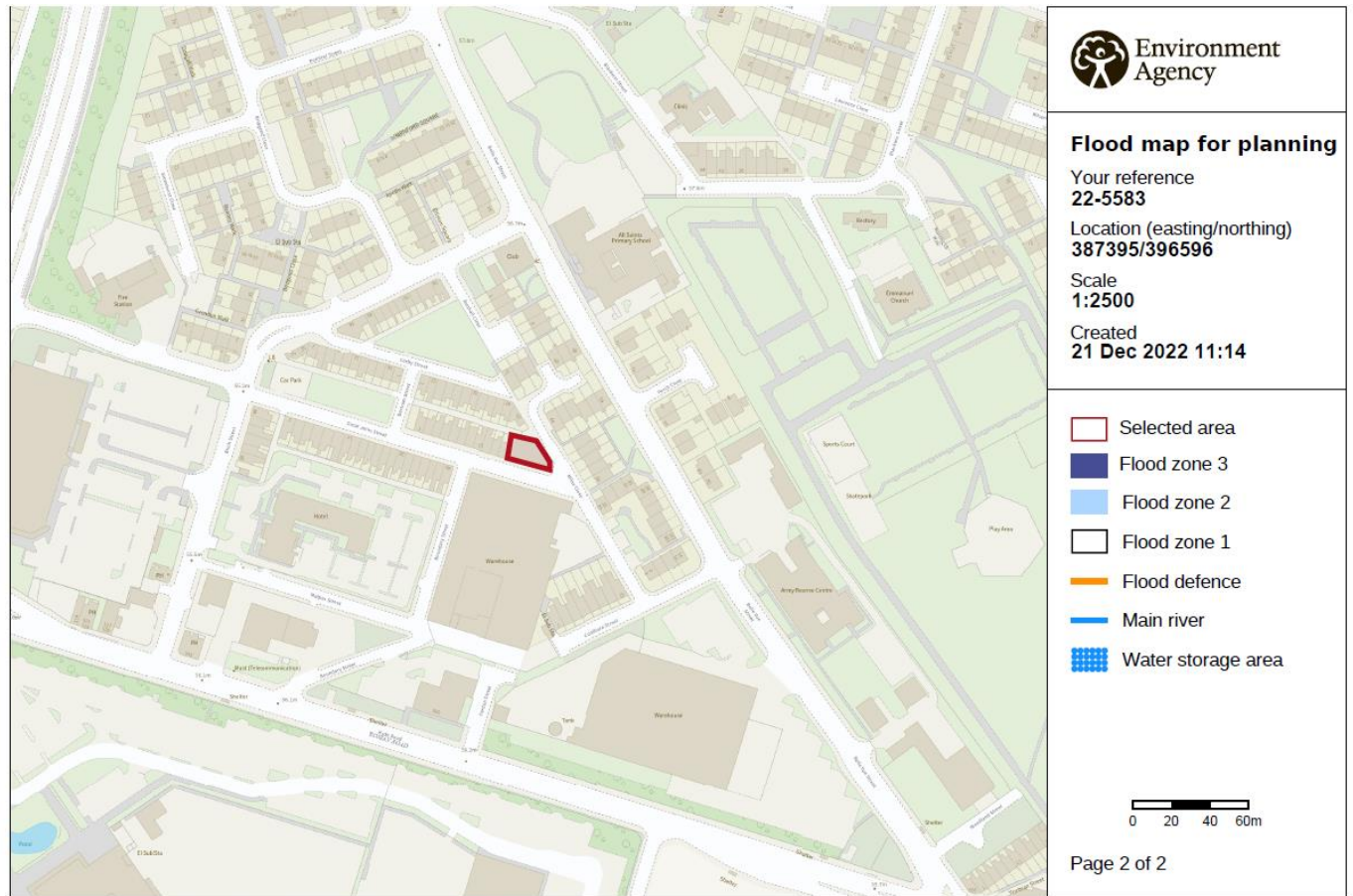
#### Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

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From above, the site is located in an area of low risk of flooding from rivers or seas, reservoirs or surface water accumulation.

From more detailed maps, we see that the potential risk to surface water flooding would be less than 300mm above the road level to the front of the property with velocity of over 0.25l/s heading westwards - away from the site.

We are therefore satisfied that the site is in a low risk area of flooding but recommend the finished ground floor level is 300mm above the road level to the front of the property.

As the site is less than 1ha then no additional assessment is necessary

## Surface Water Drainage Design and Strategy

The proposal is to construct four new attached dwelling houses on the site of the previous dwellings – adjacent to the pre-war terrace housing.

The site has been derelict for some years and is covered with brick rubble now grassed over.

The new development consists of a further row of houses constructed using traditional masonry construction with tiled sloping roofs similar to the adjacent terrace. Small rear yards will be provided to each property that will be part paved and part grassed over.

The properties are accessed directly off the front pavement, thus no front gardens are incorporated into the scheme.

### Catchment areas.

Existing site. = approx. 250m<sup>2</sup>

Proposed houses,

Roof area = 166m<sup>2</sup> of which we consider 95% to discharge to drainage with 50% to the front and 50% to the rear.

Rear Gardens = 79m<sup>2</sup> of which we would conservatively say 50% would discharge to below ground drainage

### Drainage Hierarchy.

The LLFA Level 2 Hybrid SFRA requirements are to discharge the surface water to the following receptors:

- primarily into the ground via infiltration, otherwise
- to a suitable nearby surface water body,
- to a surface water sewer, or
- to a combined sewer.

From the desk top study of the site, we consider that the underlying soil conditions are of a cohesive nature and unsuitable for discharging water via infiltration. Therefore, we would need to consider alternative solutions.

No nearby water sources are available to discharge the surface water to and from the available sewer maps, no surface water is readily available, only combined sewers are shown – a 450mm dia combined sewer in Great Jones St running east to west, a 225mm combined sewer in the rear alleyway running east to west and a further 225mm dia combined sewer in Milne St running north to south and connecting with the 450mm sewer in Great Jones St.

Unfortunately, the site is very small with only rear yards available for any form of attenuation.

We therefore suggest that the surface water from the front of the property is discharge to the combined sewer in Great Jones St whilst the surface water from the rear is connected into the combined sewer in the rear alleyway.

## Surface water runoff flow rates

### Front

From roof with 40% climate change:

#### DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

#### Design rainfall intensity

|                                                       |                                                                             |
|-------------------------------------------------------|-----------------------------------------------------------------------------|
| Location of catchment area;                           | Manchester                                                                  |
| Storm duration;                                       | D = 1 hr                                                                    |
| Return period;                                        | Period = 100 yr                                                             |
| Ratio 60 min to 2 day rainfall of 5 yr return period; | r = 0.360                                                                   |
| 5-year return period rainfall of 60 minutes duration; | M5_60min = 18.0 mm                                                          |
| Increase of rainfall intensity due to global warming; | p <sub>climate</sub> = 40 %                                                 |
| Factor Z1 (Wallingford procedure);                    | Z1 = 1.00                                                                   |
| Rainfall for 1hr storm with 5 year return period;     | M5_1hr <sub>i</sub> = Z1 × M5_60min × (1 + p <sub>climate</sub> ) = 25.2 mm |
| Factor Z2 (Wallingford procedure);                    | Z2 = 2.01                                                                   |
| Rainfall for 1hr storm with 100 year return period;   | M100_1hr = Z2 × M5_1hr <sub>i</sub> = 50.6 mm                               |
| Design rainfall intensity;                            | I <sub>max</sub> = M100_1hr / D = 50.6 mm/hr                                |

#### Maximum surface water runoff

|                                         |                                                                        |
|-----------------------------------------|------------------------------------------------------------------------|
| Catchment area;                         | A <sub>catch</sub> = 83 m <sup>2</sup>                                 |
| Percentage of area that is impermeable; | p = 90 %                                                               |
| Maximum surface water runoff;           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = 1.1 l/s |

**SW Runoff – Front = 1.1l/s**

### Rear

From roof and gardens with 40% climate change:

#### DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

#### Design rainfall intensity

|                                                       |                                                                             |
|-------------------------------------------------------|-----------------------------------------------------------------------------|
| Location of catchment area;                           | Manchester                                                                  |
| Storm duration;                                       | D = 1 hr                                                                    |
| Return period;                                        | Period = 100 yr                                                             |
| Ratio 60 min to 2 day rainfall of 5 yr return period; | r = 0.360                                                                   |
| 5-year return period rainfall of 60 minutes duration; | M5_60min = 18.0 mm                                                          |
| Increase of rainfall intensity due to global warming; | p <sub>climate</sub> = 40 %                                                 |
| Factor Z1 (Wallingford procedure);                    | Z1 = 1.00                                                                   |
| Rainfall for 1hr storm with 5 year return period;     | M5_1hr <sub>i</sub> = Z1 × M5_60min × (1 + p <sub>climate</sub> ) = 25.2 mm |
| Factor Z2 (Wallingford procedure);                    | Z2 = 2.01                                                                   |
| Rainfall for 1hr storm with 100 year return period;   | M100_1hr = Z2 × M5_1hr <sub>i</sub> = 50.6 mm                               |
| Design rainfall intensity;                            | I <sub>max</sub> = M100_1hr / D = 50.6 mm/hr                                |

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## Maximum surface water runoff

Catchment area;  $A_{catch} = 162 \text{ m}^2$   
 Percentage of area that is impermeable;  $p = 90 \%$   
 Maximum surface water runoff;  $Q_{max} = A_{catch} \cdot p \cdot I_{max} = 2.0 \text{ l/s}$

**SW Runoff – Rear = 2.0l/s**

Although both rates are minimal and fall within acceptable limits we would recommend that forms of attenuation are provided to restrict the immediate of flow into the adjacent sewers.

## Front

At the front of the property a small area is provided that can contain some below ground attenuation to slow down the discharge from site.

## ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.03

### EA Defra method

#### Site characteristics

Location; Manchester  
 Hydrological region; 10  
 Soil type (Wallingford Procedure W.R.A.P map); 4  
 Standard percentage runoff;  $SPR = 0.47$   
 Average annual rainfall;  $SAAR = 880 \text{ mm}$   
 5 year return period rainfall of 60 minute duration;  $M5_{60min} = 18.0 \text{ mm}$   
 Ratio 60-minute to 2 day rainfalls of 5 year return;  $r = 0.36$   
 Rainfall intensity increase due to global warming;  $p_{climate} = 40\%$   
 Impervious area req. attenuation storage;  $\alpha = 100.0 \%$

#### Catchment details

| Subcatchment | Name  | Area (ha) | PIMP (%); | Impermeable. area (ha) |
|--------------|-------|-----------|-----------|------------------------|
| 1;           | roof; | 0.00;     | 95.0;     | 0.00;                  |
| <b>Total</b> |       | 0.00;     | 95.0;     | 0.00;                  |

#### Greenfield runoff rates

Catchment area;  $AREA = 50.00 \text{ hectare}$   
 Greenfield runoff rate (50 hectare site);  $\bar{Q}_{rural} = 0.00108 \text{ m}^3/\text{s} \times (AREA/1\text{km}^2)^{0.89} \times (SAAR/1\text{mm})^{1.17} \times SPR^{2.17} = 315.5 \text{ l/s}$   
 Greenfield runoff rate;  $\bar{Q} = \bar{Q}_{rural} / AREA \times A = 0.0 \text{ l/s}$   
 Greenfield runoff rate per unit area;  $\bar{Q}_A = \bar{Q} / A = 6.3 \text{ l/s/hectare}$

#### Estimated site discharges

FSR growth rate (1 year);  $FSR_{1yr} = 0.87$   
 Discharge (1 year);  $Q_{1yr} = \bar{Q} \times FSR_{1yr} = 0.0 \text{ l/s}$   
 FSR growth rate (30 year);  $FSR_{30yr} = 1.70$

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Discharge (30 year);  
FSR growth rate (100 year);  
Discharge (100 year);

$$Q_{30yr} = \bar{Q} \times FSR_{30yr} = 0.0 \text{ l/s}$$

$$FSR_{100yr} = 2.08$$

$$Q_{100yr} = \bar{Q} \times FSR_{100yr} = 0.0 \text{ l/s}$$

### Estimated attenuation volume - 1 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{1yr} = 114.9 \text{ m}^3 / \text{hectare}$$

$$BSV_{1yr} = Uvol_{1yr} \times \alpha \times A = 0.10 \text{ m}^3$$

$$FF_{1yr} = 1.00$$

$$SVR_{1yr} = 1.58$$

$$ASV_{1yr} = SVR_{1yr} \times BSV_{1yr} = 0.15 \text{ m}^3$$

$$HR_{1yr} = 1.00$$

$$Vol_{1yr} = HR_{1yr} \times ASV_{1yr} = 0.15 \text{ m}^3$$

Library item: Estimated attenuation output

### Estimated attenuation volume - 30 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{30yr} = 265.7 \text{ m}^3 / \text{hectare}$$

$$BSV_{30yr} = Uvol_{30yr} \times \alpha \times A = 0.22 \text{ m}^3$$

$$FF_{30yr} = 0.95$$

$$SVR_{30yr} = 1.70$$

$$ASV_{30yr} = SVR_{30yr} \times BSV_{30yr} = 0.37 \text{ m}^3$$

$$HR_{30yr} = 1.08$$

$$Vol_{30yr} = HR_{30yr} \times ASV_{30yr} = 0.40 \text{ m}^3$$

Library item: Estimated attenuation output

### Estimated attenuation volume - 100 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{100yr} = 341.0 \text{ m}^3 / \text{hectare}$$

$$BSV_{100yr} = Uvol_{100yr} \times \alpha \times A = 0.28 \text{ m}^3$$

$$FF_{100yr} = 0.90$$

$$SVR_{100yr} = 1.74$$

$$ASV_{100yr} = SVR_{100yr} \times BSV_{100yr} = 0.49 \text{ m}^3$$

$$HR_{100yr} = 1.13$$

$$Vol_{100yr} = HR_{100yr} \times ASV_{100yr} = 0.55 \text{ m}^3$$

Library item: Estimated attenuation output

### Attenuation storage required

Vol. increase due to head-discharge relationship;

$$p_{hydro} = 1.25$$

Maximum attenuation storage required;

$$V_{req\_max} = Vol_{30yr} \times p_{hydro} = 0.5 \text{ m}^3$$

### Interception storage

Interception rainfall depth;

$$d_{int} = 5 \text{ mm}$$

Volume of interception storage required;

$$V_{int\_req} = 0.8 \times A_{imp} \times d_{int} = 0.03 \text{ m}^3$$

### Long term storage

Proportion of paved area draining in to network;

$$\alpha = 1.0$$

Proportion of pervious area draining in to network;

$$\beta = 0.5$$

Rainfall depth for 100years, 6 hour event;

$$RD = M100\_360 = 78.8 \text{ mm}$$

Extra runoff vol of dev.runoff over greenfield runoff;

$$Vol_{xs} = \max(RD \times A \times (PIMP \times \alpha \times 0.8 + ((1 - PIMP) \times \beta \times SPR) - SPR), 0 \text{ m}^3) = 0.20 \text{ m}^3$$

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## Treatment volume

Treatment volume (assume 80% runoff);

$$T_{vol} = 0.8 \times A \times 15\text{mm} \times \text{PIMP} = \mathbf{0.09 \text{ m}^3}$$

## FRONT ATTENUATION:

### USE 4No 0.69x0.41x0.45m DEEP ESS ECOCELL MODULAR STORAGE UNITS

## Rear

To assist with preventing flooding, we intend to use additional attenuation in the form of small water butts at the base of each RWP but no other SUDs elements are possible other than localised areas of permeable paving to the rear yards, thus calculate reduction in the necessary attenuation using 4No 250l butts,

## Rear

### ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.03

### EA\_Defra method

#### Site characteristics

|                                                      |                                   |
|------------------------------------------------------|-----------------------------------|
| Location;                                            | Manchester                        |
| Hydrological region;                                 | 10                                |
| Soil type (Wallingford Procedure W.R.A.P map);       | 4                                 |
| Standard percentage runoff;                          | SPR = <b>0.47</b>                 |
| Average annual rainfall;                             | SAAR = <b>880</b> mm              |
| 5 year return period rainfall of 60 minute duration; | M5_60min = <b>18.0</b> mm         |
| Ratio 60-minute to 2 day rainfalls of 5 year return; | r = <b>0.36</b>                   |
| Rainfall intensity increase due to global warming;   | p <sub>climate</sub> = <b>40%</b> |
| Impervious area req. attenuation storage;            | $\alpha$ = <b>100.0</b> %         |

#### Catchment details

| Subcatchment | Name     | Area (ha) | PIMP (%); | Impermeable.<br>area (ha) |
|--------------|----------|-----------|-----------|---------------------------|
| 1;           | roof;    | 0.00;     | 95.0;     | 0.00;                     |
| 2;           | gardens; | 0.00;     | 50.0;     | 0.00;                     |
| <b>Total</b> |          | 0.00;     | 73.1;     | 0.00;                     |

#### Greenfield runoff rates

|                                           |                                                                                                                                                                                             |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Catchment area;                           | AREA = <b>50.00</b> hectare                                                                                                                                                                 |
| Greenfield runoff rate (50 hectare site); | $\bar{Q}_{\text{rural}} = 0.00108\text{m}^3/\text{s} \times (\text{AREA}/1\text{km}^2)^{0.89} \times (\text{SAAR}/1\text{mm})^{1.17} \times \text{SPR}^{2.17} = \mathbf{315.5 \text{ l/s}}$ |
| Greenfield runoff rate;                   | $\bar{Q} = \bar{Q}_{\text{rural}} / \text{AREA} \times A = \mathbf{0.0 \text{ l/s}}$                                                                                                        |
| Greenfield runoff rate per unit area;     | $\bar{Q}_A = \bar{Q} / A = \mathbf{6.3 \text{ l/s/hectare}}$                                                                                                                                |

#### Estimated site discharges

|                            |                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------|
| FSR growth rate (1 year);  | FSR <sub>1yr</sub> = <b>0.87</b>                                                       |
| Discharge (1 year);        | Q <sub>1yr</sub> = $\bar{Q} \times \text{FSR}_{1\text{yr}} = \mathbf{0.0 \text{ l/s}}$ |
| FSR growth rate (30 year); | FSR <sub>30yr</sub> = <b>1.70</b>                                                      |

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Discharge (30 year);  
FSR growth rate (100 year);  
Discharge (100 year);

$$Q_{30yr} = \bar{Q} \times FSR_{30yr} = 0.0 \text{ l/s}$$

$$FSR_{100yr} = 2.08$$

$$Q_{100yr} = \bar{Q} \times FSR_{100yr} = 0.0 \text{ l/s}$$

### Estimated attenuation volume - 1 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{1yr} = 74.3 \text{ m}^3 / \text{hectare}$$

$$BSV_{1yr} = Uvol_{1yr} \times \alpha \times A = 0.12 \text{ m}^3$$

$$FF_{1yr} = 1.00$$

$$SVR_{1yr} = 1.59$$

$$ASV_{1yr} = SVR_{1yr} \times BSV_{1yr} = 0.19 \text{ m}^3$$

$$HR_{1yr} = 1.00$$

$$Vol_{1yr} = HR_{1yr} \times ASV_{1yr} = 0.19 \text{ m}^3$$

Library item: Estimated attenuation output

### Estimated attenuation volume - 30 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{30yr} = 183.3 \text{ m}^3 / \text{hectare}$$

$$BSV_{30yr} = Uvol_{30yr} \times \alpha \times A = 0.30 \text{ m}^3$$

$$FF_{30yr} = 0.95$$

$$SVR_{30yr} = 1.71$$

$$ASV_{30yr} = SVR_{30yr} \times BSV_{30yr} = 0.51 \text{ m}^3$$

$$HR_{30yr} = 1.10$$

$$Vol_{30yr} = HR_{30yr} \times ASV_{30yr} = 0.56 \text{ m}^3$$

Library item: Estimated attenuation output

### Estimated attenuation volume - 100 year

Attenuation storage vol (fig A7.1 - A7.8);  
Basic storage volume ;  
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);  
Storage volume ratio (fig A8.1 - A8.8);  
Adjusted storage volume;  
Hydrological regional volume ratio (fig A9.1);  
Final estimated attenuation storage;

$$Uvol_{100yr} = 238.3 \text{ m}^3 / \text{hectare}$$

$$BSV_{100yr} = Uvol_{100yr} \times \alpha \times A = 0.39 \text{ m}^3$$

$$FF_{100yr} = 0.90$$

$$SVR_{100yr} = 1.75$$

$$ASV_{100yr} = SVR_{100yr} \times BSV_{100yr} = 0.68 \text{ m}^3$$

$$HR_{100yr} = 1.15$$

$$Vol_{100yr} = HR_{100yr} \times ASV_{100yr} = 0.78 \text{ m}^3$$

Library item: Estimated attenuation output

### Attenuation storage required

Vol. increase due to head-discharge relationship;

$$p_{hydro} = 1.25$$

Maximum attenuation storage required;

$$V_{req\_max} = Vol_{30yr} \times p_{hydro} = 0.7 \text{ m}^3$$

### Interception storage

Interception rainfall depth;

$$d_{int} = 5 \text{ mm}$$

Volume of interception storage required;

$$V_{int\_req} = 0.8 \times A_{imp} \times d_{int} = 0.05 \text{ m}^3$$

### Long term storage

Proportion of paved area draining in to network;

$$\alpha = 1.0$$

Proportion of pervious area draining in to network;

$$\beta = 0.5$$

Rainfall depth for 100years, 6 hour event;

$$RD = M100\_360 = 78.8 \text{ mm}$$

Extra runoff vol of dev.runoff over greenfield runoff;

$$Vol_{xs} = \max(RD \times A \times (PIMP \times \alpha \times 0.8 + ((1 - PIMP) \times \beta \times SPR) - SPR), 0 \text{ m}^3) = 0.23 \text{ m}^3$$

## Treatment volume

Treatment volume (assume 80% runoff);

$$T_{vol} = 0.8 \times A \times 15\text{mm} \times \text{PIMP} = \mathbf{0.14 \text{ m}^3}$$

## REAR ATTENUATION:

**USE 4No 250 Litre RAINWATER STORAGE BUTT WITH OVERFLOWS TO BELOW GROUND DRAINAGE  
INCORPORATING 6No 0.69x0.41x0.45m DEEP ESS ECOCELL MODULAR STORAGE UNITS**

## Summary

The development consists of erecting four attached dwellings on the site of previous housing.

The properties are being constructed using traditional construction with pitched tiled roofs to match the existing adjacent terraced housing.

The site is very restricted, with the front opening directly onto the pavement and space to the rear for relatively small rear gardens.

The underlying soils are expected to be of a cohesive nature and thus unsuitable for infiltration.

The only receptor available for removing the surface water from the proposed development is the existing combined sewers to the front and rear of the site, into which we propose to discharge the attenuated surface water to. Unfortunately, no existing connections are available within the curtilage of the site.

However, to reduce the flow of water off site, we have recommended using attenuation systems in the form of above ground rain water butts to each rear rain water pipe and below ground attenuation tanks to the front and rear as per the attached layout.

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