

# Development Services Design Manual

*A guide for water mains and service connections*

Version 1.0

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## 1. General

### 1.1 Purpose

The purpose of this document is to provide standards and guidance to Bristol Water Development Engineers and External Designers to ensure consistency of approach and to encourage the use of best engineering practice for new mains and service connections.

The standards and guidance in this document will also ensure that the required levels of service are maintained consistent with the legal, regulatory and statutory requirements.

### 1.2 Scope

All Mains and Non-Standard Service Connections up to and including 300 mm internal diameter.

### 1.3 Legislation

The primary legislation for the Water Companies licence (appointment) and for conducting their business is the 1991 Water Industry Act.

Under powers given in this Act, the Secretary of State has made the:

- Water Supply (Water Fittings) Regulations 1999, Covering Waste, Misuse, Contamination, Undue Consumption, or Erroneous measurement of the water supplied;
- Water Supply (Water Quality ) Regulations 2000 ( amended 2001) Setting standards etc. for Water Quality at the customers tap.

Also from powers in the 1991 Water Industry Act, OFWAT has introduced various reporting requirements; Unplanned Customer Minutes Lost (UCML), Low Pressure Register (part of Asset Reliability – Infrastructure) etc., and Guaranteed Standards.

The Water Act 2003 adds provisions to:

- improve water resources management, with amendments to the Water Resources Act 1991 and the Water Industry Act 1991;
- strengthen the regulatory framework, and give customers a Consumer Council for Water to replace the Director General;
- impose duties for sustainable development;
- increase opportunities for competition, strengthen legislation for DWI, particularly fluoridation, plus drought & flood plans. Also provision and maintenance of fire hydrants.

These are almost all incorporated in the 1991 Acts by reference.





## 1.4 Competition

The framework for Competition is set out in the Water Industry Act 1991, and is extended by:

- Competition & Services (Utilities) Act 1992;
- Competition Act 1998 (applicable from 1 Mar 2000);
- Water Act 2003;
- New Appointees and Variants (NAV's) – where the appointed water or sewerage company can be replaced by another for a specific geographic area;
- Water Supply Licensing – new companies can obtain a licence to supply water, competing in one of two ways:
  - by developing their own source;
  - by retail selling to all Non-Household suppliers.

For more information, see [www.ofwat.gov.uk](http://www.ofwat.gov.uk)

## 1.5 Bristol Water Developer Service Standards (under Water UK)

Water companies have delivered on their promise to compile and deliver a key set of developer services standards that can be used to compare performance across the industry. This will underpin their commitment to support and help accelerate the Government's house building programme by providing greater transparency to help drive improvements in service levels and performance.

The new service standards measure water company performance in dealing with a broad range of activities which are essential for housing development against levels of service that customers, developers and self lay providers (SLP's) can expect in relation to the provision of water services infrastructure.

The full set of figures covers water supply and sewerage performance targets for a range of services including enquiries, quotations, connections, design, construction and adoption of developer laid assets across England and Wales.

The performance figures are available for each company and will be updated quarterly on the Water UK website.

[www.water.org.uk/developer-services](http://www.water.org.uk/developer-services)

## 1.6 Water Industry Act 1991 – Key sections

### Section 41:

- Provides the developer with the right to requisition a new water main for domestic purposes to connect their site to the public water network.



### **Section 45:**

- Provides the developer with the right to have a connection for domestic purposes from a building or part of a building to the public water main.

### **Section 51A-E:**

- Provides the developer with the right to provide the water main or service connection themselves and for Bristol Water to vest them in their company.

### **Section 55:**

- Imposes a duty to provide water for non-domestic purposes. An undertaker may refuse this request if it is likely to cause unreasonable expenditure or is likely to put at risk the undertaker's ability to provide water for domestic purposes to meet existing and future obligations.

### **Section 158:**

- Provides undertakers with the right to lay pipes in streets.

### **Section 174:**

- States that it is an offence to interfere with a water main and affect its use or operation either intentionally or negligently. This includes the construction of structures and whether the effect is temporary or permanent.

### **Section 185:**

- Provides the developer with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at the developers' expense.

## **2. Design principles for new mains**

This section is intended to provide Engineers with guiding principles which will cover the great majority of situations encountered on new developments. Nothing contained in this manual shall relieve the Engineer from using their skills and experience to produce a cost-effective and sensible proposal.

This document provides examples of designs for new mains that can be used to assess how mains, services and metering should be arranged.

### **2.1 Health & Safety design criteria**

The following is a list of risks which usually have an impact on a Distribution mains system. (This list may not be comprehensive, but acts as a guide to the Engineer responsible for design.)



The Design Engineer of any mains system should take due account of these risks within his design process and document the Design Engineer's Risk Assessment decisions for inclusion in the Pre-Construction Information:

- Deep excavations;
- Other utilities;
- Ground water;
- Contaminated ground in redevelopment areas;
- Storage and handling of materials e.g. large quantity of materials;
- Connecting to existing mains;
- Restricted working area;
- Traffic and pedestrian flow, proximity of the public to the works being carried out;
- Future operation and maintenance of the system;
- Pressure testing of the mains system;
- Chlorination of the new mains and services;
- Works on asbestos cement water mains.

Other risks may be encountered on specific projects which require full consideration on a project by project basis.

## 2.2 Point of connection

The start of any new water main design is the point or points at which the planned main will be connected to the existing network. This point(s) will be determined using the anticipated flows and demands as indicated on the application form to Bristol Water, together with any known future demands that are intended to be supplied through the new main. The point(s) of connection may also include a requirement for off-site reinforcement.

The point of connection is established by Bristol Water and once determined is valid for up to 6 months, after this time a new application will be needed. As the network is a dynamic system, it is not usually possible to extend the validity of a point of connection beyond 6 months.

## 2.3 Routing, positioning and location of new assets

All possible routes should be considered to identify the most suitable route for new mains taking account of whole life costs arising from construction, operation, maintenance, & eventual de-commissioning.

Consideration should also be given to ensuring that all existing assets are fully utilised.

In selecting a route, the following should be investigated, as appropriate:

- adverse ground conditions e.g. rock, groundwater;
- contamination;



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- existing & future land use;
- land ownership as it affects the company's powers to install and operate apparatus;
- allow for lead-time where it is necessary to serve notices;
- traffic management;
- environmental impact of the works;
- ease of access for safe construction and future operation/maintenance of the assets;
- proximity of other utilities;
- risk of disturbance from second-comers;
- probability of failure of the pipeline and its consequences;
- operability assessment e.g. automation, remote monitoring, balanced against manual operation;
- operating pressures at key points;
- requirement for air valves, sluice valves, pressure controlling valves etc;
- requirement for washouts – including means to dispose of water released;
- security of supply/cross connections to adjacent areas;
- potential betterment, statutory contributions, or compensation claims;
- available pressures – the new development must not cause pressures anywhere to fall below the reference level of service Low Pressure Register (part of Asset Reliability – Infrastructure).

Undertakers have the power (section 158 WIA 91) to lay mains in a street,

Note: The Water Industry Act 1991 section 219 (as amended by the Water Act 2003), provides that the meaning of "street" shall be as in Part III of the New Roads and Street Works Act 1991.

*"Extract: New Roads and Streetworks Act 1991 section 48, Streets, street works and undertakers.*

*(1) In this Part a "street" means the whole or any part of any of the following, irrespective of whether it is a thoroughfare;*

- a) any highway, road, lane, footway, alley or passage;*
- b) any square or court;*
- c) any land laid out as a way whether it is for the time being formed as a way or not.*

*Where a street passes over a bridge or through a tunnel, references in this Part to the street include that bridge or tunnel."*



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### 2.4 Cover for mains and services

Water mains should be installed at a minimum 900 mm cover. Any increase 900mm needs to be discussed with the Network Department. Service pipes should be installed at a minimum of 750 mm cover. Although private services can be laid between 750 mm and 1350 mm cover, the pipe should be between 750 mm and 850 mm cover for a distance of 1000 mm on each side of a boundary box.

### 2.5 Pipe materials, sizes, SDR and pressure rating

It is Bristol Water's policy to use plastic pipes for all new pipes up to and including 355 mm diameter and pressures up to 16 bar. New pipe systems should be designed for a maximum of 10 bar and coiled pipes should be used for pipes sizes up to and including 180 mm.

A summary of Bristol Water's preferred PE pipe materials, sizes, SDR and pressure rating for use in land that is not contaminated is provided below.

| External Diameter (mm) | Internal Diameter (mm) | Material | SDR     | Pressure Rating (bar) |
|------------------------|------------------------|----------|---------|-----------------------|
| 25                     | 20.2                   | PE80     | 11      | 12.5                  |
| 32                     | 25.8                   | PE80     | 11      | 12.5                  |
| 63                     | 50.9                   | PE80     | 11      | 12.5                  |
| 90                     | 78.8 / 72.9            | PE100    | 17 / 11 | 10 / 16               |
| 125                    | 109.7 / 101.3          | PE100    | 17 / 11 | 10 / 16               |
| 180                    | 158 / 146              | PE100    | 17 / 11 | 10 / 16               |
| 250                    | 219.6 / 203            | PE100    | 17 / 11 | 10 / 16               |
| 315                    | 276.6 / 255.8          | PE100    | 17 / 11 | 10 / 16               |
| 355                    | 311.6 / 288.3          | PE100    | 17 / 11 | 10 / 16               |

Confirmation of the network working pressure will be by the Network Section.

Where new pipes are required in contaminated land Bristol Water's preferred material is Type A Barrier Pipe. Other barrier pipe materials are available for use by third party organisations for private pipework only. A summary of Bristol Water's preferred barrier pipe materials, sizes, SDR and pressure rating is provided below.

| External Diameter (mm) | Internal Diameter (mm) | Material                  | SDR     | Pressure Rating (bar) |
|------------------------|------------------------|---------------------------|---------|-----------------------|
| 25                     | 20.2                   | PE80 Type A Barrier Pipe  | 11      | 12.5                  |
| 32                     | 25.8                   | PE80 Type A Barrier Pipe  | 11      | 12.5                  |
| 63                     | 50.9                   | PE80 Type A Barrier Pipe  | 11      | 12.5                  |
| 90                     | 78.8 / 72.9            | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |
| 125                    | 109.7 / 101.3          | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |
| 180                    | 158 / 146              | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |
| 250                    | 219.6 / 203            | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |
| 315                    | 276.6 / 255.8          | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |
| 355                    | 311.6 / 288.3          | PE100 Type A Barrier Pipe | 17 / 11 | 10 / 16               |



## 2.6 Standard dimensional ratio (SDR)

The ratio between wall thickness and outside diameter remains constant for a given pressure rating of the pipe. This relationship, called the standard dimensional ratio or SDR, can be expressed as an equation:

$$SDR = \frac{\text{nominal (minimum) outside diameter}}{\text{minimum wall thickness}}$$

## 2.7 Design criteria for mains within new development areas

The design layout for water mains in a new development, i.e. in new streets, should be such that the installation is economic to install, operate and maintain during its designed lifetime. Mains should be provided in a street as far as the point at which it is practicable to connect the service pipes, at reasonable cost and consistent with hydraulic efficiency.

A main should be laid in any street where 2 or more premises are being served and the communication pipe would be longer than 10 metres. End washouts will be required on all mains and must be located to suit hydraulic and operational convenience, including consideration as to how any wash out water will be drained.

Whilst the general laying of mains in private land on residential estates is discouraged, it may be unavoidable in types of development which afford shared private drives. In these situations, Bristol Water will use its powers under the Water Industry Act for future access and maintenance.

A water main laid on premises within a private driveway is preferable to multiple separate supply pipes being laid in parallel for more than 30 metres of their run, but for clearer guidance:

- 2 properties on a private drive – Bristol Water supply water to the boundary, developer lays services to the boundary;
- 3 properties on a private drive less than 30 metres – Bristol Water supply water to the boundary, developer lays services to the boundary;
- 4 properties on a private drive less than 30 metres – Bristol Water only consider installing a main within the driveway;
- 4 properties on a private drive greater than 30 metres – Bristol Water lay main on premises within driveway (installation in private footpath prohibited);
- 5 properties or more irrespective of length – Bristol Water lay main on premises within driveway (installation in private footpath prohibited).

Notes for adoption thereof:

- All apparatus to be readily accessible;
- No gated access restriction;
- No mains or stop tap boxes to be installed in parking bays;
- No mains to be installed in driveways that will have specialist finishes, e.g. Printed concrete, coloured tarmac;

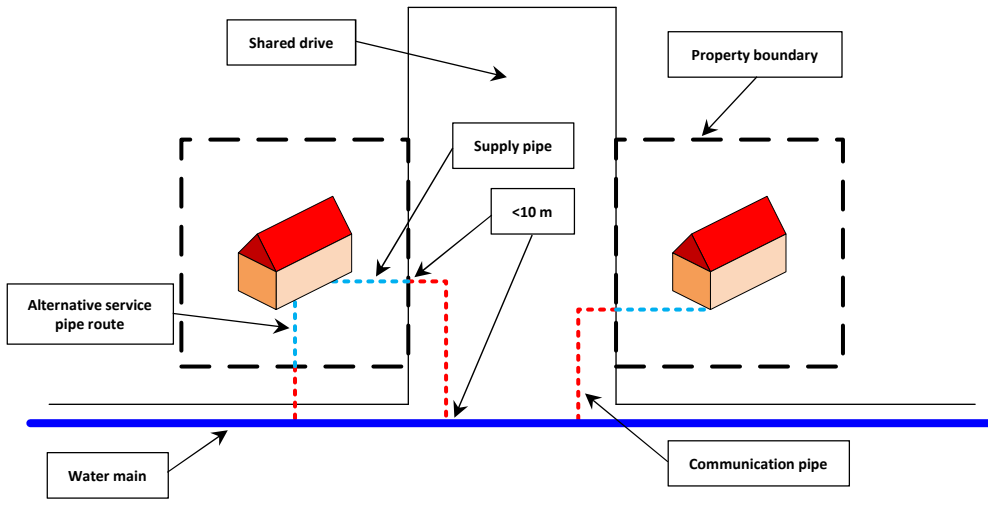


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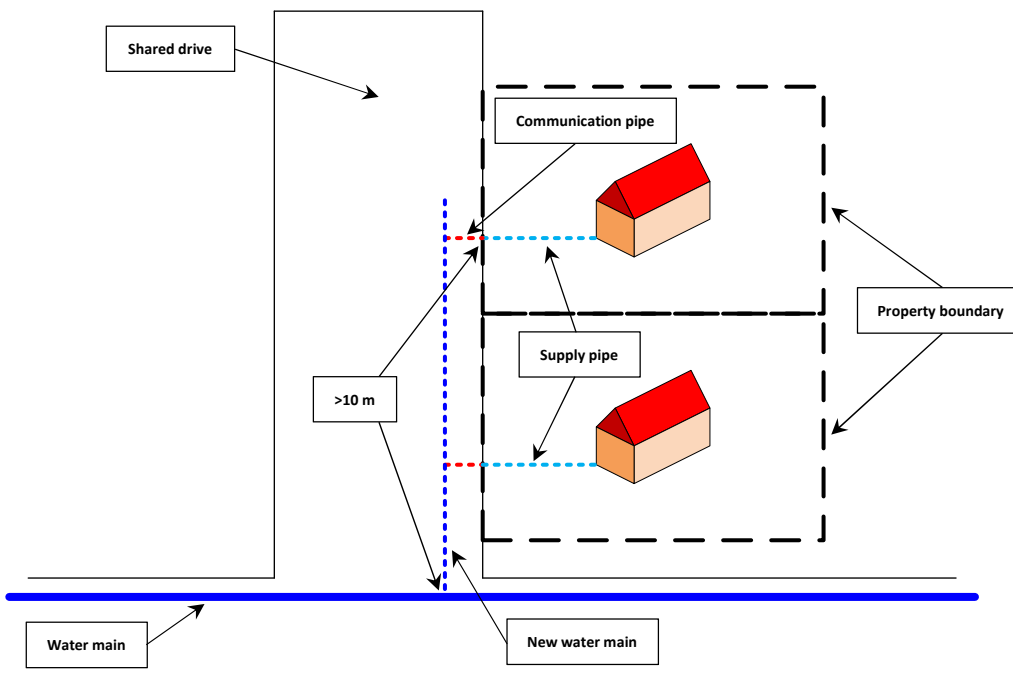
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- Adoption is at the discretion of Bristol Water;
- Mains laid within adopted highway are always preferred;
- Mains laid in private are in shared drives and not individual ones.



Service pipe layout where supply pipe exist is less than 10 metres from a water main



Mains and service pipe layout where supply pipe exist is more than 10 metres from a water main



Where mains are being laid on new developments, the main should be located on that side of the street with the highest number of service connections; installation of new mains on both sides of a street should only be made where for example, the street is exceptionally wider perhaps incorporate very wide verges and/or planted areas.

Mains should normally be installed in an area laid out as a street. If other utilities are being laid e.g. gas and electricity, in addition to water, then a footpath or service strip should be provided and utilities are laid in accordance with the current NJUG requirements.

More guidance can be found in the NJUG Publication Volume 1, *"Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus"*.

The overriding principle is to design for the most economic layout, with equal consideration being given to both initial installation cost and whole life operation and maintenance requirements. Where mains are of such a size or there are additional services such that NJUG spacing in the footpath cannot be achieved then consideration should be given to placing the main in a separately designated area or in the carriageway but not in private gardens (see also section 2.13).

## 2.8 Design criteria for mains in existing streets

Where a new main is required in an existing street to serve premises e.g. infill type developments then new mains should be located such that the number of road crossings made for both mains and planned service connections is minimised. On rare occasions consideration may be given to installing a new main on both sides of a street, thereby reducing the total number of road crossings. If water is required for domestic purposes only, and there is an existing main available, the developer can select to have connection from that main, even if it doesn't have available capacity. In this case no mains requisition is required.

Where a new main has not been requisitioned and the development scheme is such that an unacceptable number of long side service road crossings to an existing main will be made, then consideration should be given to installing a main in front of the premises and using short side service connections.

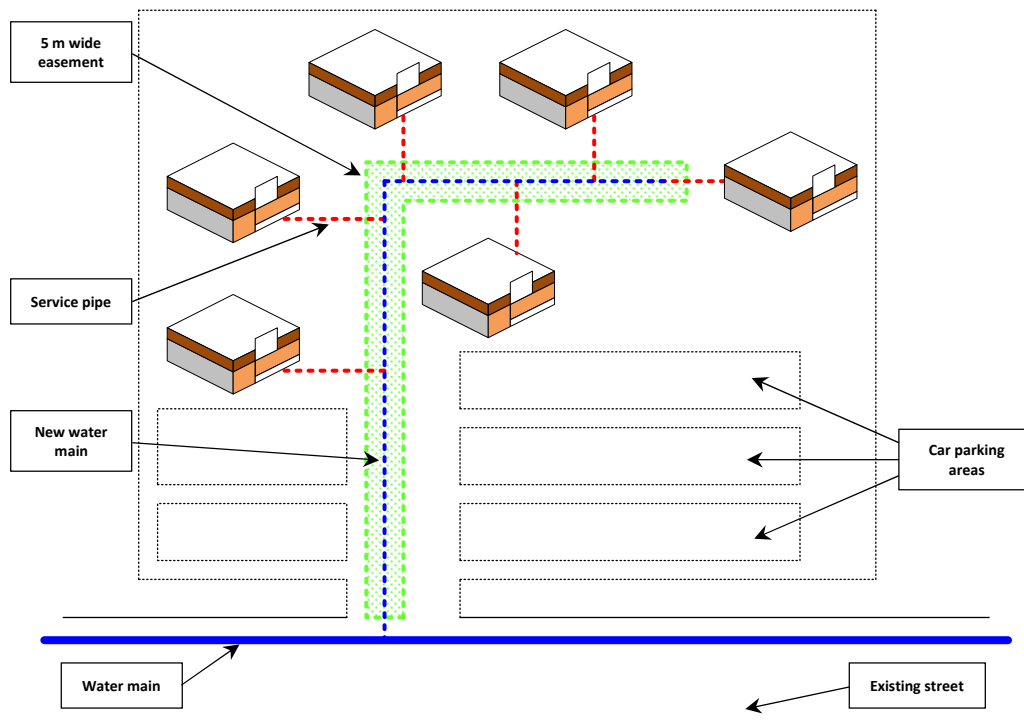
Bristol Water bears the cost of any mains augmentation works required to provide capacity where needed.

## 2.9 Design criteria for mains in retail parks, commercial and industrial areas

Wherever possible new mains should be located in an area designated as a street. In retail parks, commercial and industrial areas it may not always be clear which areas are streets and there is a particular risk that layouts of buildings, car parks and access roads may be changed without consultation with Bristol Water. In such areas it is even more important that the appropriate statutory notice has been served. New water mains should be coordinated with other services such as gas, electricity and telecoms and laid in accordance with NJUG guidelines.







An example showing an easement would be needed for a new commercial development

## 2.10 Unadopted roads

It cannot be assumed that all roads on new estates will be adopted. However, since they will almost certainly be classed as a street, the adoption of a road should not be a factor when determining the optimum design route for a new main.

## 2.11 Gated developments

The presumption should always be against installing mains within gated areas. In very rare circumstances we may, but only if we are given key-code access, other types of lock would not be allowed. Where a main is installed within the gated area, consideration should be given to installing an isolating valve just outside the development such that any main within the gated area can be isolated without delay if needed.

## 2.12 Service strips

There is no legal definition or land category for a service strip. It is a common term to mean “a strip of land intended to be used for the permanent installation of utilities apparatus, and intended always to be kept clear”. They are generally a 1 or 2 m wide strip of private land beside the road. However, many such service strips are intended to form part of the curtilage of the property abutting the road and are therefore owned and maintained by the house owner. It is BW’s policy not to lay mains in such service strips and an alternative route for a main must be found in these situations. If a service strip is unadopted by the highway authority, but remains in the ownership of an overall site owner, such as a



management company responsible for, perhaps, roads, verges, open spaces, etc and is open to the public, then we would lay a main in the service strip. Utility services will be installed in accordance with the current NJUG guidance.

### 2.13 Mains located in areas with restricted access

In most circumstances the main will be in a footpath or service strip adjacent to a highway which will provide adequate maintenance or operational working space for the main. Where the main is in a street, and the street is immediately adjacent to a building, the main may be laid no less than 1500 – 2000 mm (depending on diameter) away from the building or foundation, provided there is still a total of at least 5 m working width for access, (this would typically be the width of the pavement, plus part of the carriageway, as required). Where there is no other option, a reduced working width of no less than 3 m is acceptable, provided that:

- the main is no larger than 160 mm outside diameter;
- any joints, fittings or service connections are kept to a minimum within the restricted width area.

In extreme circumstances, consideration should be given to ducting the main through a pinch point. As with any other location where a main may be ducted, there must be sufficient clearance in line with the duct at one or both ends to be able to withdraw and replace the main, based on future build proposals. The ducting used shall be to the normal specification.

Some developments incorporate courtyards with a number of properties fronting onto them, and which provide the only access to those properties. Sometimes these courtyards are accessed via an archway beneath a building, such as a flat, similar to (or an extension of) a *“Flat over garage”* or *“FOG”*. If only two or three properties are accessed in this way, then it is reasonable to expect separate service pipes to be brought out under the archway to connect to BW main (provided a safe location can be found for the boundary boxes). However, this may become impractical for larger numbers. In these situations, we will consider laying a main under the arch and into the courtyard. We will only do this if the access is large enough to allow normal (small) construction traffic into the courtyard. This can be interpreted as stating a minimum size of opening of 3.5 m wide by 3 m high. The width is required to ensure clearance each side of the main to the foundations of the structures either side.

### 2.14 Land entry requirements

Before any water mains are laid by requisition it is necessary to establish if any land rights will be required. Any main installed in third party land, whether or not it is laid out as a street, will require a statutory notice to be served under section 158 or section 159 of the WIA 91. This requirement should be assessed at design stage and indicated on the approved layout drawings prior to any acceptance of the scheme by the developer. It is of particular importance that any *“as-laid”* record is fully in accordance with the planned position of the main that was shown in any notice before the main is connected to Bristol Water’s existing network.

It is particularly important if the land is, or could be, owned by the Crown (e.g. MoD land), Network Rail or the Duchy of Cornwall, as normal noticing rules do not apply and there are additional requirements. These could take longer than the serving of a conventional statutory notice.

For mains laid by a self lay provider (SLP) our future rights need to be protected by means of a deed of grant of easement, to be arranged by the SLP (an example template is included with the draft self lay agreement which is sent to the SLP).



### 2.14.1 Laying mains near trees

Where possible, we should avoid laying mains near existing or proposed trees, this may mean laying a main in a footpath on the opposite side of the road from that intended, if that is not possible (either through lack of room, lack of a footpath, or trees on both sides of the road), we may have to lay the main pipe in the carriageway. Sometimes it may be possible for a developer to reposition certain trees. If these options are not possible, proposed trees should be specified to have root restrictors installed. These should extend at least 1.5 m below finished surface level, in which case the minimum clearance between the wall of our pipeline/apparatus and the root restrictor can be reduced to 0.5 metres.

However, should the pipeline have to pass between two trees/large shrubs, even with root restrictors, a minimum clearance of at least 3 metres must be maintained between their boles to facilitate vehicular access.

In general, it is advisable not to lay mains under the canopy of trees, as this generally indicates the extent of the root system. Hand excavation only is normally expected in this area (unless vacuum excavation is employed).

Occasionally, provided there is room at one or both ends for installation and/or extraction, mains may be ducted beneath trees, in order to avoid disturbing roots during future maintenance. Connections should be avoided in these locations.

Damaging trees, as well as being environmentally unsound, can also be expensive.

More guidance can be found in the NJUG Publication Volume 4, *“Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees”*.

## 2.15 Water mains that are to be laid in a street

Bristol Water is able to lay mains or adopt mains that have been laid in a street, this may be:

- an adopted street on land which is owned by a Local Authority;
- a street on land which is owned by the developer and which may or may not be adopted in the future;
- a street on land which is in third party ownership.

There is no need for Bristol Water to obtain any permission for any of the above, over and above the serving of the appropriate notice(s), if mains are requisitioned and then laid by us or our contractor, unless the nature of the development is such that the area defined as a street is likely to be changed such that the main is no longer in a street.

### 2.15.1 Use of backfill

The excavation, backfilling and reinstatement within adopted streets, is governed by the Specification for the Reinstatement of Openings in Highways (SROH). This, strictly speaking, also applies to other, unadopted streets, but other arrangement may be made with third party street owners, such as only reinstating *“like for like”*, and not upgrading where the existing construction doesn't currently meet the specification.

Engineers should allow for the provision of granular fill (*“Type 1 backfill”*). In adopted highways, this must be used in the carriageway and also in footpaths and verges where the excavation is within 1m of the carriageway. The volume of



Type 1 is calculated using the standard width of the trench for the diameter of pipe and the depth is taken from the top of the pipe surround to the underside of the base course (*"black top"*).

On development sites Bristol Water do not allow for Type 1 in footpaths, only in prospectively adoptable carriageways. This was agreed with developers many years ago on the basis that any Type 1 we put in would be re-excavated during the laying of all the subsequent utility apparatus.

An exception to the above is when a developer has taken possession of an area of adopted highway and is carrying out other construction work within a fenced-off area. In these circumstances we should ask them whether or not they want Type 1 to be used as backfill. It will be the developer's responsibility to ensure that the highway authority's specification and satisfaction before the highway authority will take back possession.

The above notes only apply to mains installed by our contractor on an *"excavate and lay"* basis. They do not apply where mains are installed on a *"lay only"* basis as, in these cases, the developer will excavate, backfill and reinstate.

## 2.16 Water mains that are to be laid in land which is not a street

Bristol Water is able to lay and operate water mains serving a statutory notice to the land owner(s) and occupier(s), this right is set out in section 159 of the Water Industry Act 1991.

Any access to private land should be preceded by an appropriate notice to the land owner and occupier, a summary of notices requirements is provided below:

- 3 months for installing a new pipe;
- 21 days for installing a requisitioned main;
- 42 days for altering an existing pipe;
- 7 days for site investigation or surveys.

These notice periods are considered to be the minimum reasonable under the Water Industry Act, but where new mains are required to satisfy a requisition then a reasonable alternative period can be agreed.

## 2.17 Self laying of water mains in land which is not a street

Where mains are to be self laid and are intended to be subsequently adopted by Bristol Water, the rights provided to us by the Water Industry Act do not apply to the self lay provider.

The developer/self lay provider will need to obtain permissions from the land owner to install the pipes and then arrange for a deed of grant of easement if the developer is laying in third party land in favour of BW to be in place before the new mains can be adopted by us and connected to the existing water network.

Any costs that are incurred in arranging the permissions and subsequent transfer to Bristol Water are to be paid by the developer/self lay provider.



### 3. Pressure and flow principles for new mains

The successful hydraulic design of new mains and changes to the network should take into account demand, velocity, head loss and pressure.

#### 3.1 The reference level of service

Undertakers are required to record the number of domestic properties identified as receiving less than the Reference Level of Service. These are to be reported annually under the performance indicator Low Pressure Register (part of Asset Reliability – Infrastructure).

The Reference Level of Service is set at 10 metres head at the boundary stop tap, at a flow of 9 litres/min for a single property measured at the customer side of any boundary fitting.

Checking compliance against this standard would require excavation and is clearly impractical. The “*Surrogate Pressure Reference*” is agreed as a static pressure of 15 metres head at the nearest hydrant.

##### Reference level of service:

- for a single property the company aims to provide a flow of 9 litres/min at a pressure of 10 m head (1 bar), measured at the boundary.

##### Surrogate to Reference level of service:

- 15 m head (1.5 bar) static pressure at nearest hydrant. However when more than one property is fed from a shared supply pipe, a higher static pressure in the adjacent mains is required. OFWAT’s reference levels in such cases are as follow.

| Number of Properties | Static Pressure in Adjacent Main (m head) |
|----------------------|---|
| 2                    | 11  |
| 3                    | 14  |
| 4                    | 18  |
| 5                    | 23  |
| 6                    | 29  |

#### 3.2 Design guidance – Pressure

The Network should be designed for a minimum pressure of 2 bar (approx. 20 metres head) at any hydrant or node. Any new development which would cause the pressure at any point to fall below 2 bar will require appropriate system reinforcement. The only exception to this would be if the topography is such that new mains pass through an area of



high ground where there are no service connections, and are never likely to have service connections (e.g. remote moor land), then the design minimum operating pressure can be lower, in this circumstance the pressure must not drop below 5 metres available head.

Maximum mains pressure should not normally exceed 6 bar (approx. 60 m head), and mains pressure reduction schemes should be considered for all areas where the pressure can be reduced by 1bar at night.

Most domestic water-using fittings and appliances are designed for a maximum working pressure of 10 bar. Minimum working pressures are generally in the region of 0.5 bar, but some appliances will not perform well below say 1.5 bar.

### 3.3 Design guidance – Velocity of flow

The optimum design velocity of flow in mains is 1.0 m/s, with minimum and maximum design parameters of 0.2 m/s to 1.5 m/s.

### 3.4 Design guidance – Head loss per 1000 m (Hydraulic Gradient)

Any new pipe or network change should be designed so that the hydraulic gradient is typically in the range of 2 m to 4 m per 1000 m in the proposed main, and in any existing mains that may be influenced by the proposal. However, if downstream pressure is available in sufficient quantity and its reduction is not a concern, then a hydraulic gradient not exceeding 10 m in 1000 m can be used.

### 3.5 Universal pressure statement

The mains water pressure in the Water Company network varies due to elevation, and diurnal and seasonal fluctuations, but is generally between approx. 15 m (1.5 bar) and 60 m (6 bar) head but pressures in excess of 10 bar exist so confirmation will be required from the appropriate Network Manager.

This is static pressure and will be reduced inside the building depending on the length and size of the service pipe and the rate of flow. A standard 25 mm (o.d.) service pipe will normally provide 15 – 20 litres/min.

Mains pressure is adequate for all normal domestic situations but developers should satisfy themselves that it is sufficient for their purposes, particularly in buildings above 2 storeys, or those including fire sprinkler systems. The Water Companies have separate guidance notes for such situations.

Most domestic water using appliances will have manufacturers design and operating instructions. Installers must consider the minimum and maximum pressure requirements, and additional protection to avoid possible damage to fittings and appliances. Some appliances, notably combination boilers, may not perform well at pressures below 1.5 bar.

### 3.6 General requirements

All new mains must be designed to ensure that the pressure and flow for water provided for domestic and fire-fighting purposes is in accordance with sections 65 and 66 of the Water Industry Act 1991. There is no requirement for new mains to be upsized to provide water specifically for fire-fighting purposes.

Section 65 requires an undertaker to provide a constant pressure such that water can reach the top most storey of every building within the undertaker's area. However, an undertaker is not required to provide a supply of water at a



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height greater than that which it will flow by gravitation from the service tank or reservoir from which that supply is taken; additionally an undertaker is entitled to choose the reservoir or tank from which the supply will be taken.

Section 66 allows an undertaker to require a float operated cistern which will provide at least 24 hours supply to any premise where water is delivered at a height greater than 10.5 m below the draw off level of the service reservoir or tank from which the supply is taken. This means that the maximum pressure that is required to be provided is 1.5 bar.

The definition of water for domestic purposes is provided in section 218 of the Water Industry Act 1991 and refers to water used for drinking, washing, cooking, central heating and sanitary purposes. It also includes water used for business purposes within premises where the greater part of the premises is occupied as a house, provided that:

- no water is used for the business of a laundry or;
- for a business preparing food or drink for consumption off the premises; or
- for the use of a bath with a capacity exceeding 230 litres.

If an undertaker provides water for purposes other than domestic use, as defined above, in accordance with section 55 of the Water Industry Act 1991, then the cost of providing such mains and additional capacity shall be borne fully by the person(s) requisitioning the new main. Where water to a new development is required for both domestic and non-domestic capacity, then this shall normally be provided through a single main, unless the non-domestic demand is such that the water quality of any water provided for domestic purposes will not meet that required by the Water Industry Act 1991.

### 3.7 Sizing new mains for domestic premises

As a guide the typical size of pipe for a given number of properties is shown in the table below. The values given should not be a substitute for conducting an adequate hydraulic assessment taking into account all pertinent factors.

| Pipe Size              | Development Services look up tables max no. of houses that can be supplied | Number of houses than can be supplied for a given pipe size (*) |            | Result if no. of Properties that can be supplied for a given pipe size (**) |                      |
|------------------------|--|---|------------|---|----------------------|
| External Diameter (mm) | -  | Number of houses with head loss kept under 5m/km                | Flow (l/s) | Resulting head loss (m/km)  | Resulting flow (l/s) |
| 63                     | 17   | 9   | 0.8        | 9.4   | 1.2                  |
| 90                     | 60   | 85  | 2.6        | 3.4   | 2.2                  |
| 125                    | 150  | 485   | 6.3        | 1.7   | 3.6                  |
| 180                    | 775  | 1435  | 16.7       | 1.8   | 9.9                  |

\*According to modelling using New Development profile.

\*\*According to Development Services table, is modelled using New Development profile, multiplied by a specified peaking factor.





Peaking factors used are those taken from “*Pipe Sizing Basic Principles*” on Copper Board website, derived from BS6700).

### 3.8 Sizing mains for non-domestic and mixed demands

When a main intended purely for non-domestic demand is being sized, the estimated process demand and flow should be used.

In practice, most non-domestic water is provided through mains that also provide domestic water; the combined demands should be used when sizing the main. An exception to this is water used for fire-fighting purposes. Our water mains should not be upsized to include this demand. Unless the Fire & Rescue Service requesting fire hydrants is prepared to pay for the upsizing (which is extremely unlikely). We are permitted to allow a reduction in pressure and flow to domestic customers during a period when water is being drawn for fire-fighting purposes.

Developers are often unable to provide us (or provide wrong information) with either fittings or estimated demands, especially for commercial developments which may be of mixed use and/or speculative. They should be pushed hard to provide this information but, in cases where clearly they are not going to...

### 3.9 Managing water quality in new mains

Management of water quality in network mains is Bristol Waters responsibility. Mains that have been correctly sized and designed will maintain water quality under normal operational circumstances i.e. when the designed demand is connected. There may be circumstances, such as during the construction phase, when the actual demand is too low to ensure adequate turnover of water within the connected main. When a new main is connected to our existing network, service connections should be planned to be made within 7 days of the new main being connected.

Water demand on a new main should be sufficient to ensure refresh within 10 days, if this is unlikely then a flushing and sampling regime will need to be implemented by the Water Company. It should be noted that a flushing regime is an undesirable option due to the inherent waste of water, and should only be implemented where no other option, such as cross connection to an existing network, is available.

The cost of any cross connection or flushing and sampling regime would normally be attributable to the developer. An exception to this would be where the need to flush is due to a main being upsized by Bristol Water to provide supplies for another unrelated development.

## 4. Valves

Valves be handed “CC” shall be installed to control the flow within the network and enable all components to be isolated, drained and recharged for maintenance purposes. The number, size and position of valves at the point of connection to the existing main will be determined by the Design Engineer.

A valve should be located at all branch locations and the maximum spacing of isolation valves on distribution mains shall be 1000 m or to shut off a maximum of 50 properties.

Spindles must be installed on all valves which should end 200 mm below the cover to facilitate ease of future operation.





## 5. Air valves

Air valves shall be installed at the highest point on a section of main and at points of changing gradient. If the main is relatively flat with no discernible high points they should be positioned at intervals of, say, 800 m, however they are not required where customer connections will release air from the system. They should be capable of isolation for maintenance purposes without shutting off the main to which they are connected.

## 6. Washout hydrants

Washout hydrants should be installed on the end of every main and at any low point on the network that may be required to drain the main for maintenance purposes. Where washout hydrants are required on mains 200 mm or greater they shall be installed with a valve controlled branch. Washout hydrants shall be installed ensuring the outlet is no more than 300 mm from the surface upon completion.

- which have not been Requisitioned or adopted following Self lay.)

Any water design should reflect the most economical method of constructing a safe maintainable and extensible network. The following factors should be considered:

- validation for the type of pipe being installed e.g. barrier pipe, PE pipe, ductile iron etc;
- the possibility of future demand from the planned network.

## 7. Requirements for service pipes

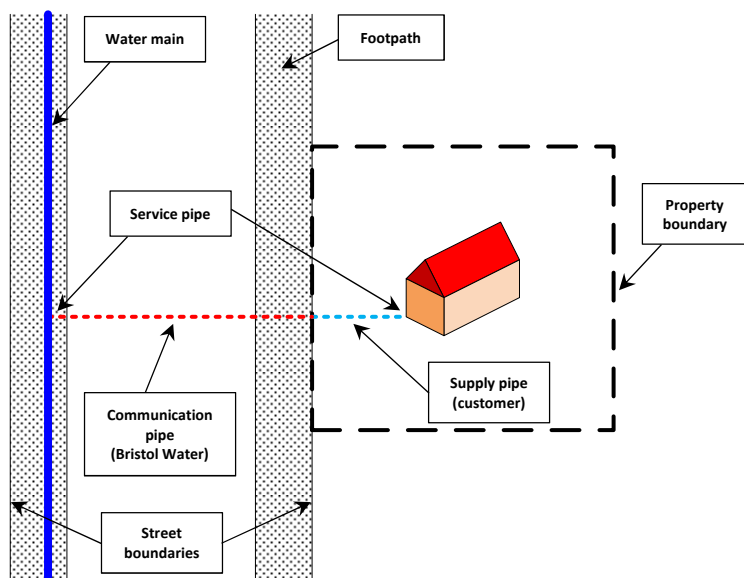
### 7.1 Definitions

**Service pipe:** the length of pipe that connects a water main to any premises being served.

**Supply pipe:** that part of a service pipe which is laid within the boundary of the premises being served.

**Communication pipe:** that part of a service pipe which is laid from the water main to the point of delivery.





Service pipe, communication pipe and supply pipe.

## 7.2 Conditions for connecting a service pipe to a water main

When a connection notice is served on a water company by the owner or occupier of premises, section 47 of the Water Industry Act 1991, permits a water undertaker to require that any of the following conditions are complied with before a service pipe is connected to a water main.

These conditions must be notified to the customer no later than 14 days after a connection notice has been provided.

- A requirement that a reasonable security has been provided in respect of any work that will be carried out by the undertaker;
- A requirement that a meter has been installed either by the undertaker or another party fully in accordance with the specifications approved by the undertaker;
- That any part of the service pipe not laid by the undertaker and the plumbing of the premises comply fully with the specifications approved by the undertaker;
- That a separate service pipe has been provided to each house or building on the premises, or to those different parts of a building on the premises which are separately occupied. Where a building is in multiple occupancy other arrangements are not prohibited, provided that the undertaker remains able to perform all its functions efficiently in relation to the supply of water to those premises or any part of those premises;
- Where the building e.g. a high rise building, is not capable of being supplied at a pressure in accordance with the requirements of the WIA 91, a requirement that a cistern with a float operated valve and capable of providing 24 hours water supply is provided within the building;
- A requirement that any water fittings used in connection with the supply of water to the premises, and that all the plumbing in the premises have been installed fully in accordance with the Water Supply (Water Fittings) Regulations 1999.

Where separate service pipes are required we may impose any other conditions, always provided that they are reasonable for us to perform our function, and notified within the 14 days above.

### 7.3 General requirements for service pipes

Modern developments are arranged in many different ways and it is difficult to be specific about the location and provision of service pipes. Mains, service pipes, stop taps and meters for any new development should be configured for optimum hydraulics, construction, and maintenance. Specifically the arrangement should not cause unreasonable cost or difficulty to either BW or the customer, either to construct or to undertake any future maintenance.

- 1) The normal rule is each set of premises – one service pipe – one meter;
- 2) Supply pipes i.e. that part of the service pipe laid generally within the boundary of the premises served, should be laid such that the communication pipe will be generally perpendicular to the main to which it will be connected, and preferably such that no part of the supply pipe is laid in any land that is not within the boundary of the premises being served;
- 3) A shared service pipe can serve any number of properties (typically in a multi-occupied building). It will not normally be in a street or in land protected by an easement, but should be installed such that it remains accessible for repair;
- 4) For low-rise buildings with multiple-occupancy the developers should be encouraged to lay separate service pipes for each occupancy unit. If this is completely impractical or impossible, a shared service pipe can be provided to a manifold arrangement in a ground floor services room or cupboard, where individual stop taps, meters and supply pipes will be provided;
- 5) For high-rise buildings, characterised by the requirement for pumping to upper floors, a shared service pipe from the tank/pump to each floor is often installed. A single common tank and pump is usually acceptable where a building has more than one tower, whether or not the buildings are linked at the ground floor. For small numbers of dwellings, where practical, the individual meters should be located in an accessible plant room or meter room in a basement or at ground level. Alternatively, meters may be installed in service cupboards where individual stop taps and supply pipes are fitted to a common manifold arrangement on each floor, where the pipework branches from the located riser;
- 6) For high or low rise multi-occupancy premises, a common billing agreement is available as a non-preferred option, but may be allowed after consultation with BW. Irrespective of the agreed billing arrangement, the water service pipe work within the building must be arranged such that individual metering to each dwelling or to any shared water provision can be installed without the need to carry out any modification;
- 7) There is a general presumption against making service pipe connections to trunk mains due to fluctuations of water pressure and availability of water. Applications to make connections should be made on the relevant form and only if no distribution main local to the property or properties are available.

#### 7.3.1 Sizing service pipes

The sizing of service pipes to new developments is governed by the requirement that there should be an adequate supply to meet customer demands, at the point of delivery, at all times while ensuring that water quality is not compromised through the use of oversized pipes.



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As a guide the typical size of pipe for a given number of properties is shown in the table below. The values given should not be a substitute for conducting an adequate hydraulic assessment taking into account all pertinent factors.

| Number of individual dwellings | Typical pipe outside diameter (PE pipes) (mm) |
|--------------------------------|---|
| 1                              | 25  |
| 2                              | 32  |
| 3 - 5                          | 50  |
| 5 - 20                         | 63  |

\*Not available in PE Barrier pipe.

### 7.4 Service connection arrangements

When a new development is being planned service connections should be designed in conjunction with both new and existing mains such that services are:

- laid in a position agreed with BristolWater;
- generally perpendicular to the main;
- preferably not crossing others' land;
- a minimum of 25 mm diameter blue PE (or barrier pipe as required), minimum depth 750 mm, maximum depth 1350 mm, (but the maximum depth should not exceed 850 mm for a distance of 1 metre each side of a boundary box);
- spaced (service tapping into the main) in accordance with the table below.

| Main material                               | Minimum spacing for tappings (mm)                  |
|---|--|
| PE (PE80 / PE100 including PE barrier pipe) | 300  |
| Iron (cast / spun / ductile)                | 300  |
| PVC-U                                       | 500 x 5 x main diameter (whichever is the greater) |

#### 7.4.1 Service connections in new streets or a street where a main is not installed

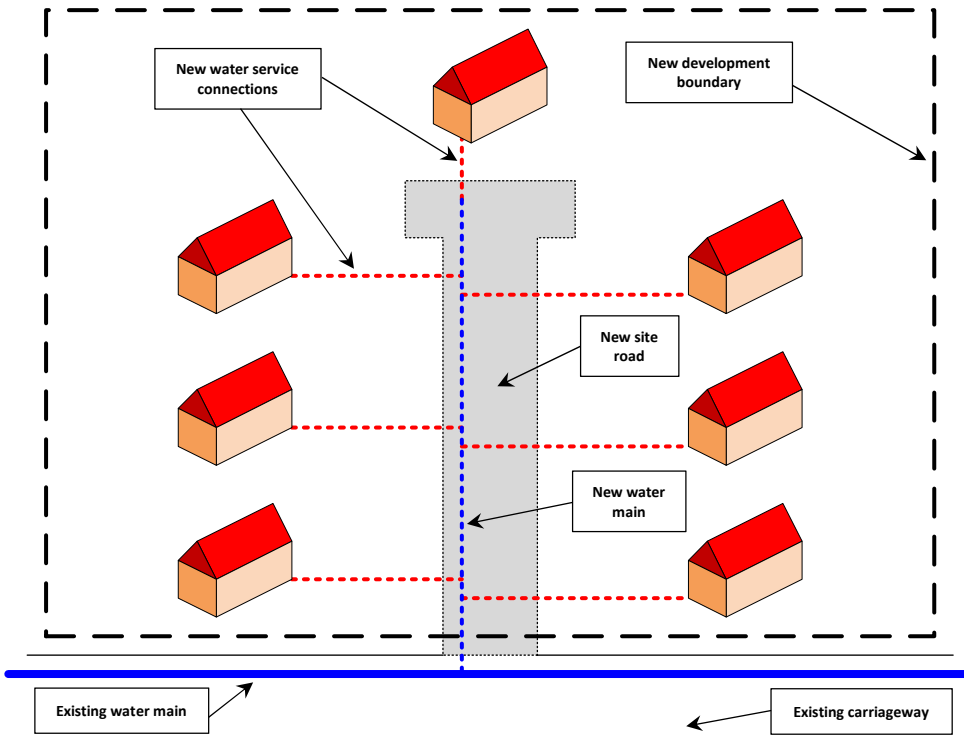
Developers requiring new water supplies are able to choose to requisition a main, or to request service connections. Where no main currently exists in a street, or where a new development and associated streets are being created it is likely that a new main will be requisitioned, although that may not always be the case.



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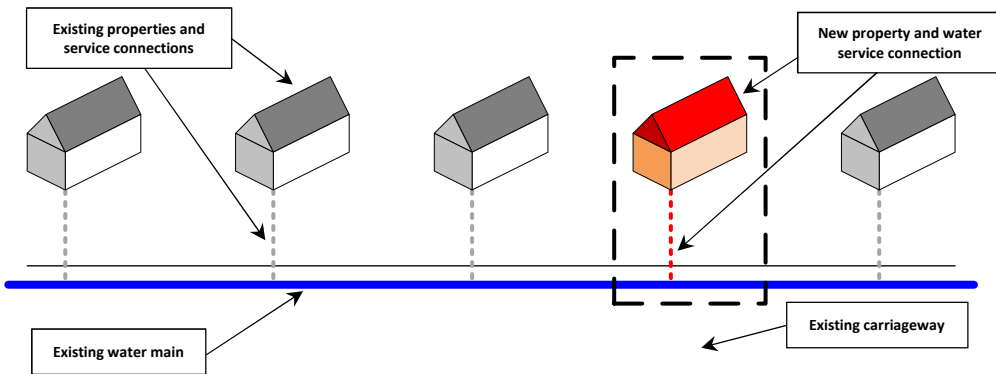


Example showing where new service connections would require installation of a new main.

## 7.4.2 Service connections to existing mains

### Example 1: New development is on the same side as an existing main

Where a new development is on an existing road and new services are being connected to an existing main which is located on the same side as the new properties, then the service would usually be connected to that main.



Showing where a new service would be connected to an existing main

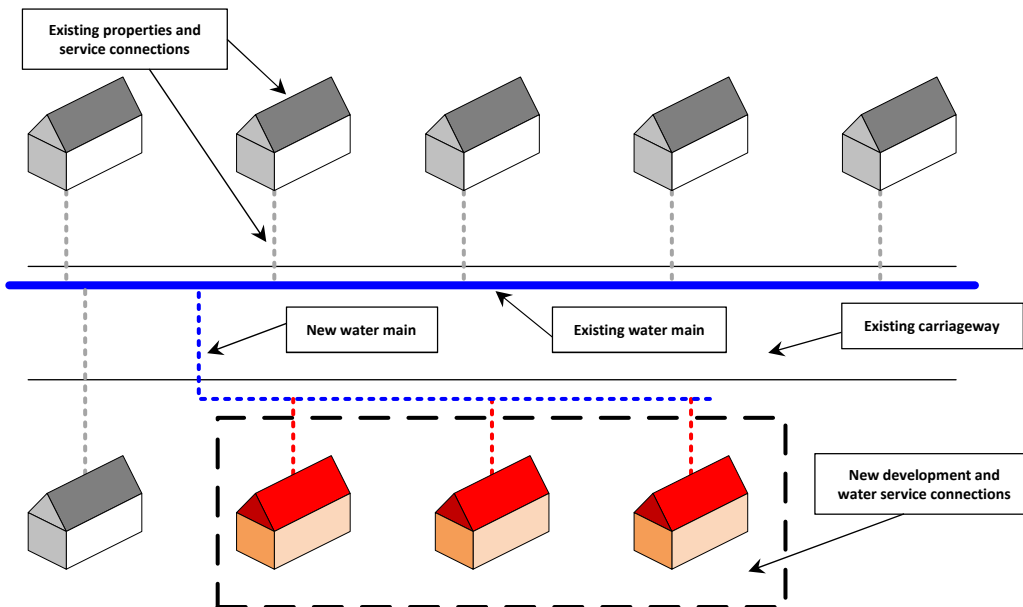


### Example 2: New development is on the opposite side to an existing main

Where an existing main is located on the opposite side of the road to the new premises, it is often preferable to install a new main on the side adjacent to the new premises using a single road crossing, rather than use a separate road crossing for each property.

The following considerations should be made when deciding how to plan this type of connection:

- (1) Is the street traffic sensitive,
- (2) Is the footpath in front of the new development being renewed,
- (3) Is it likely that further connections to properties will be needed?



Showing where a new main would be installed to avoid multiple road crossings

## 7.5 Standard service connection details

Bristol Water do not require boundary stop taps on new household connections where the meter arrangement on the property is in an in-wall or wall-mounted meter box. (These have an integral quarter-turn control valve, which can be operated from outside the property). In a difficult situation it is possible to squeeze-off the PE service pipe. Where meters are located within the premises, a stop tap located in an approved boundary box positioned in a hard standing area outside the premises, should be provided at the point where the service pipe enters the building.

The following pages indicate the arrangements available for standard service connections to new household premises, and for a temporary supply.



- A developer may choose to use any of the following service arrangement options, and is also able to choose which building elevation to use for any external, in wall or wall mounted equipment;
- Where an internal meter option is chosen then the boundary box in which the stop tap is located should be in a hard standing area adjacent to the premises being served;
- Supply pipes should leave the land associated with the connected premises so that the communication pipe is laid perpendicular to the connected main.

## 7.6 Services to multi occupancy premises

Premises that consist of a number of separate occupancy units, which may be domestic, commercial or industrial, can be metered using a common billing arrangement or individually with meters being provided for each occupancy unit. Additionally, there may be a need to fit separate meters to record water consumption for communal facilities such as communal hot water or laundry facilities. Where meters are installed in a communal area, each meter should be clearly identified using a tag with permanent lettering, so that customers may easily identify which meter serves their property. Where meters are located in a secure area, customers should be provided with access both for meter reading and to enable the water to their premises to be individually controlled. Meters should not be located in any area such as a plant room or similar that could present access difficulties or other safety related issues.

It is usually acceptable for domestic and commercial units to be served via a single shared supply within a multi occupancy premise.

Designs using other distribution options are not precluded, however, any alternative arrangements must be subject to a risk assessment as part of BW obligation under the Water Supply (Water Fittings) Regulations 1999, to ensure that water quality and leakage control will be maintained under all possible operating circumstances.

A bulk metering arrangement will not be made available where occupancy units within the premises are being offered for sale at the time that the first connection is made.

## 8. Metering

### 8.1 Metering standard service connections

Some Water Companies (UUOS) policy is to install a remote reading facility, known as Automated Meter Reading (AMR) to all new 15 mm or 20 mm meters fitted to standard service connections. The various locations and individual requirements for standard service arrangements are set out in section 9 (Requirements for service pipes) of this document.

#### 8.1.1 Meter carrier arrangements

It is the customer's responsibility to install a meter carrier fully in accordance with the Water Companies specification for all new standard service connections. During the design process, the location and accessibility of the meter must be clearly defined such that the meter remains accessible for operational and maintenance purposes.



### 8.1.2 Internally located meters

Where a meter is to be installed inside the premises the meter carrier should be located immediately after the controlling stop tap and immediately before the drain valve. The meter may be oriented in any direction, but should be positioned such that the recording dial can be read directly and with sufficient space to permit a meter change. Consideration should also be given to how possible changes to the immediate surroundings of the meter will impact on future maintainability. A stop tap located within an underground meter chamber should be positioned externally close to where the service pipe enters the building.

### 8.1.3 Externally located meters for standard connections

Meters may be located within an “in wall box” or a “wall mounted box”, as set out in section 9 of this document. When either of these options is chosen, a risk assessment should be carried out with regard to any external influences that may impact on the meter enclosure. Frost protection is an integral feature of any externally located meter box, and where there is any possibility of the enclosure being damaged by external influences then relocation or additional mechanical protection should be considered.

It is essential that the meter box is installed fully in accordance with the manufacturer’s requirements and that the installation is fully re-validated at the time the service connection is made. This re validation is particularly important as there can often be a considerable period of time between installation of the meter box and its connection to the water supply during which the integrity of the box and insulation may have been affected. Under no circumstances should any box, wall-mounted or in-wall be connected to the water network unless it has been installed fully in accordance with the manufacturer’s requirements.

## 8.2 Metering non-standard connections

Service connections greater than 25 mm are classed as non-standard connections, these connections may be used to provide supply to a number of individually metered premises or may be used to supply single premises and fitted with a bulk meter. The arrangements for metering and their locations are likely to be design specific and dependant on the construction of the building, the layout of the pipe work and the availability of sufficient space to facilitate the meter installation.

## 9. Fire-fighting

Section 57 of the Water Industry Act 1991 provides that undertakers have a duty to provide water free of charge for fire-fighting, including water used for testing and training purposes.

BW has no duty to provide infrastructure specific to fire-fighting, i.e. hydrants or additional mains capacity, which would be rechargeable to the requisitioner. Hydrants are ordinarily requisitioned by the Fire & Rescue Service, but not mains capacity.

The mains network is designed by Bristol Water to meet the normal (non-fire) requirements of their customers.





## 9.1 Fire hydrants

For more information see “*National Guidance Document on the Provision of Water for Fire-fighting*” - Water UK, January 2007. This third edition of the National document has been produced jointly by representatives of the Water Industry, and the Fire & Rescue Service with the encouragement of the Department for Environment, Food and Rural Affairs, The Welsh Assembly Government and the Department for Communities and Local Government.

It demonstrates commitment by all Water Companies and the Fire & Rescue Service to improve working relationships and secure co-operation in meeting the challenges facing both parties.

## 9.2 Statutory duty

The ideal flows, which the Fire & Rescue Service would like from hydrants, are given in the “*National Guidance Document on the Provision of Water for Fire-fighting*” - Water UK, January 2007. The actual flow available from hydrants will be less than this in many cases.

The Water Industry Act does not provide for Fire & Rescue Service to requisition hydrants on Trunk Mains, but the Water Company will normally have a policy to cover such requests.

Typically the Fire & Rescue Service will identify a particular fire risk adjacent to a trunk main and a valve-controlled hydrant will be agreed where possible.

Water Undertakers are required to allow any person to take water for fire-fighting, from any pipe to which a hydrant is fixed.

Hydrants are fitted to water mains at the request of the Fire & Rescue Service. They are installed, maintained, and replaced at the Fire & Rescue Service expense.

Legislation does not specify the pressure and flow which must be made available at a hydrant, but the following extract taken from Appendix 5 of the guidance sets out:

*“The following flows represent the ideal requirements (see Section 5.1 and Appendix 4 for guidance on how these flows should be considered) on new developments and during permanent system changes. In some locations the existing distribution system will not allow the delivery of such flows”.* Therefore we do not guarantee any specific flows from hydrants and the following figures are reprinted here for information.

## 9.3 Requirements for fire-fighting water

### 9.3.1 Housing

Housing developments with units of detached or semi-detached houses of not more than two floors should have a water supply capable of delivering a minimum of 8 litres per second through any single hydrant.

Multi occupied housing developments with units of more than two floors should have a water supply capable of delivering a minimum of 20 to 35 litres per second through any single hydrant on the development.



### 9.3.2 Transportation

Lorry/coach parks – multi-storey car parks – service stations, all of these amenities should have a water supply capable of delivering a minimum of 25 litres per second through any single hydrant on the development or within a vehicular distance of 90 m from the complex.

### 9.3.3 Industry

In order that an adequate supply of water is available for use by the Fire & Rescue Service in case of fire it is recommended that the water supply infrastructure to any industrial estate is as follows with the mains network on site being normally at least 150 mm nominal diameter:

- up to one hectare 20 litres per second;
- one to two hectares 35 litres per second;
- two to three hectares 50 litres per second;
- over three hectares 75 litres per second.

### 9.3.4 Shopping, offices, recreation and tourism

Commercial developments of this type should have a water supply capable of delivering a minimum flow of 20 to 75 litres per second to the development site.

### 9.3.5 Education, health and community facilities

Village halls should have a water supply capable of delivering a minimum flow of 15 litres per second through any single hydrant on the development or within a vehicular distance of 100 m from the complex.

### 9.3.6 Primary schools and single storey health centres

Should have a water supply capable of delivering a minimum flow of 20 litres per second through any single hydrant on the development or within a vehicular distance of 70 m from the complex.

### 9.3.7 Secondary schools, colleges, large health and community facilities

Should have a water supply capable of delivering a minimum flow of 35 litres per second through any single hydrant on the development or within a vehicular distance of 70 m from the complex.

## 9.4 Hydrants on large diameter mains

Section 58-2B of the Water Industry Act 1991 says that we need not fix fire hydrants on trunk mains. This proviso to our legal responsibilities is long-standing. However, we have been asked by the Fire & Rescue Service to allow, in certain circumstances, hydrants to be fixed to large diameter mains.



There are advantages to both parties in allowing this, providing certain criteria are met. The Fire & Rescue Service may enjoy a better supply to fight certain fires – e.g. in industrial estates, and we may suffer fewer discolouration problems if a large volume of fire-fighting water is drawn from a trunk main rather than from the local distribution network.

The following criteria should form part of any decision relating to the installation of a fire hydrant on a trunk main.

1. Any request to install a fire hydrant on a large diameter main will be treated on its own merits.
2. Fire hydrants will not normally be allowed on strategic supply mains which are, or can be, used to transfer bulk water supplies between areas.
3. Fire hydrants will not be allowed on large diameter mains where it is anticipated that loss of supply and/or pressure or discolouration will occur if used. As a guide, assuming a flow rate of 1250 litres per minute, the operation of the hydrant should not cause the flow in the main to exceed 1 metre per second, or drop the pressure by greater than 10 m.
4. Fire hydrants may be allowed on large diameter mains, which are deemed to be a normal distribution main within a district meter area. The Water Company local operations staff will determine whether or not a main can be used for fire-fighting purposes, in liaison with the Asset Performance Manager, as required.

Operations staff will consider the practicality of installing a hydrant on such a main i.e. whether or not the installation can take place under pressure or without a shut off affecting large numbers of properties.

5. The hydrant will be installed with a controlling gate valve on the hydrant tee in every case.
6. Where a request is granted then the installation will be re-charged at actual cost.
7. BW reserves the right to remove a fire hydrant from a trunk main after installation if problems are subsequently caused on the network.

## 9.5 Requests for water for fire-fighting

Any requirement for a fire hydrant is a Fire & Rescue Service decision; all new developments should be notified to the relevant Fire & Rescue Service during the design stage, such that any fire hydrants can be in place prior to new mains being connected and premises being occupied. The Fire & Rescue Service should respond to any enquiry from a water company or other water infrastructure Development Engineer within 42 calendar days of the enquiry being made.

Where new mains are being installed as part of a requisition, the general process for applications will be as follows:

- the finalised water mains design should be forwarded to the FRS office within the area that the new development is sited;
- the Fire & Rescue Service has 42 calendar days in which to respond and to provide details of any hydrants that may be required;
- the Fire & Rescue Service will raise an order to Bristol Water for any fire hydrant(s) requested.

Where new mains on a new development site are being self laid, the Fire & Rescue Service will deal directly with the self lay provider (SLP). The process is the same as that which applies to a requisitioned main:

- the SLP will provide a copy of the approved design to the Fire & Rescue Service;



- the Fire & Rescue Service will then have 42 days to respond directly to the SLP, who will then amend the approved design accordingly, and provide a copy to us;
- all financial transactions relating to the provision and installation of the hydrant will be between the SLP and the Fire & Rescue Service.

## 9.6 Fire sprinkler systems

This policy is based on information taken from BSI BS9251 Rev2, for which the Fire Sprinkler Association (FSA) have issued a guidance document:

- FSA Guidance on BS9251:2005 - REVISION 2 - dated 21<sup>st</sup> June 2006.

If developers supply their domestic sprinklers from a storage tank and pump. This is a higher capital cost, but has the advantages:

- there will always be water available for fighting a fire;
- the same standard service pipe can supply the property;
- no difficulties with metering;
- less risk of contamination from dead-legs;
- there is no service impact on the local network.

If a developer insists on installing a mains-fed sprinkler, the connection and service pipe will need to be adequately sized for the flow. It will be the developer's responsibility to requisition a suitably sized service pipe, using information on local pressure. A 32 mm service is unlikely to be adequate, so a 63mm will often be necessary.

### 9.6.1 Commercial sprinklers

Although water for fire-fighting is provided free of charge, in many circumstances the capital cost of the installation will be less if the fire and domestic supplies are provided from the same mains connection. It should be so arranged that the normal supply can be isolated from outside the premises, whilst leaving the fire-fighting supply intact.

Depending on the size of supply pipe, and the number of sprinklers, it may be acceptable to supply the sprinklers (or hose reels) directly i.e. without a tank. The developer should satisfy himself of the adequacy of the pipe work, and consider not least the hydraulic restriction of the incoming water meter.

### 9.6.2 Fire mains

In the event that the developer requires underground hydrants within the site, these will normally require:

- a dedicated "*fire main*" (an additional service pipe exclusively for fire-fighting) from a separate mains connection, with backflow protection. This is also the case for commercial sites where multiple customers are fed through a bulk-metered private network.



The flows required from hydrants will usually be very restricted by any meter, and the meter would be liable to damage, possibly causing further blockage. Fire Valves on meter by-passes are not acceptable.

### 9.6.3 High rise residential

For high rise buildings BW may not have a specific requirement for a separate fire main riser. Water meters will normally tolerate flows through sprinklers in individual flats, and this arrangement is acceptable.

Development Engineers should satisfy themselves that there is sufficient water available at the Point of Delivery (usually the highway boundary) and that the pipe work is hydraulically adequate for the required flow.

Where residential premises are fitted with sprinklers supplied from a [usually] dedicated tank, it is acceptable for that tank to be replenished from the domestic supply. There are particular Fittings Regulations applicable where fire-fighting water is drawn from the domestic supply.

Pipe work sized for an exceptional fire flow is likely to be oversized for normal use, leading to stagnation.

Development Engineers should bear in mind that Bristol Water will not normally know if premises are fitted with fire protection systems, and, except where there is dedicated storage, any interruption to the supply could leave the premises unprotected. This could be due to the Water Company undertaking planned or unplanned work, or if the supply to the premises is shut-off longer term for any reason e.g. when vacant. In the case of flats, whether high or low rise, regulations require that an external stop tap is available so that the individual unit can be isolated from a common access area in an emergency, typically for frost damage when occupancy units are empty.

## 10. Abandonment and diversion of existing mains

The section 185 of the Water Industry Act 1991 provides for a water company to alter or remove any pipe or other apparatus if requested to do so, by any person who has an interest in land that is being improved, on the basis that the land cannot be improved without the required alteration or removal. This requirement does not apply to any pipe or equipment that is located in a street.

The following provision and examples can be used to ascertain how the various combinations of new requisitioned mains, diverted mains and abandoned mains would be treated.

Bristol Water will require advance payment of the estimated reasonable cost of diverting or abandoning any existing mains or other associated equipment. This applies to both self lay and requisition schemes, but note that diversions can be self laid in many instances (but certain parts, such as the connections may be non-contestable).

### **Important note:**

If a new development is to take place on land where existing equipment is to be altered, it is important that this information is passed to Bristol Water as early as possible. This will assist in avoiding the possibility of equipment being altered during a site clearance exercise and then being replaced in the same location when the site is subsequently redeveloped.



We will be pleased to assist in forward planning when a site is being redeveloped. This is particularly relevant in city centre re-developments where the capacity of existing mains may be reduced due to encrustation or by activities such as slip lining.

## 11. Example layouts for mains and services

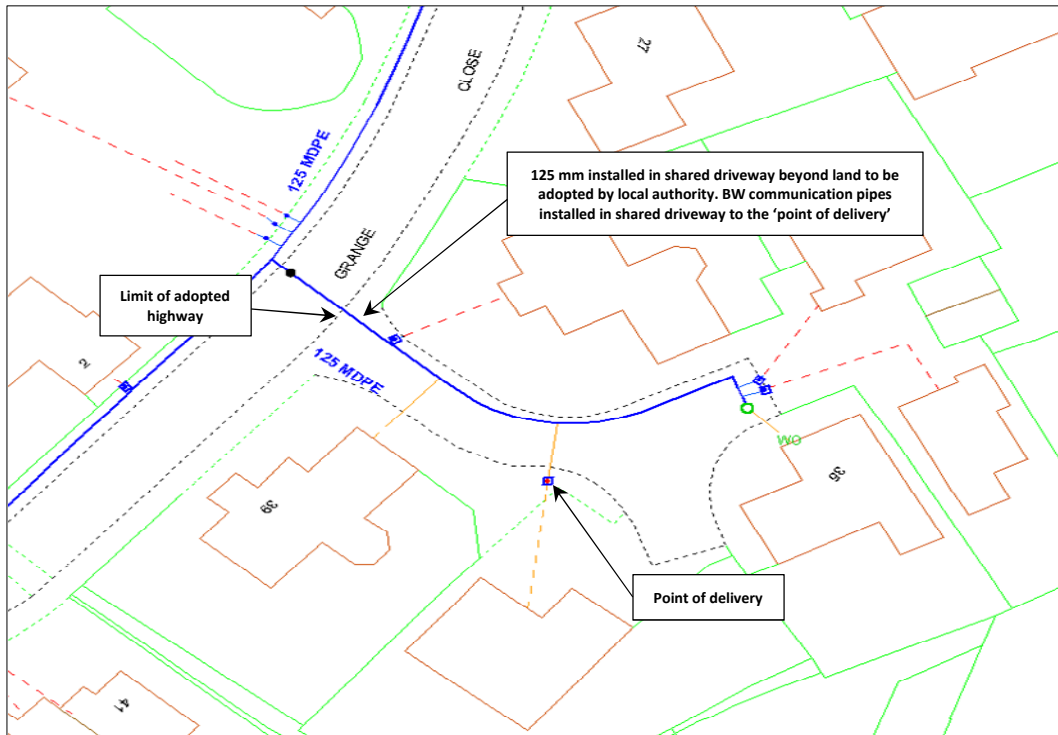
This section provides examples that demonstrate how this guidance would be applied to a design for a new development.

The general principles are:

- new mains should be laid in a street;
- new mains should be on the side of the street with the greatest number of service connections;
- routes for new mains should be planned in conjunction with other utilities and laid in accordance with NJUG guidance;
- service connections should be arranged so that they run perpendicular to the main that they are connected to;
- the total length of pipe installed (both mains and services) is minimised, this is particularly relevant in areas such as shared drives and courtyards;
- all equipment such as valves and stop taps should be installed so that access is generally available without any requirement for special arrangements such as traffic management notices etc. These examples are provided to assist in planning new developments; it should not be assumed that any final design will always be fully in accordance with these examples.



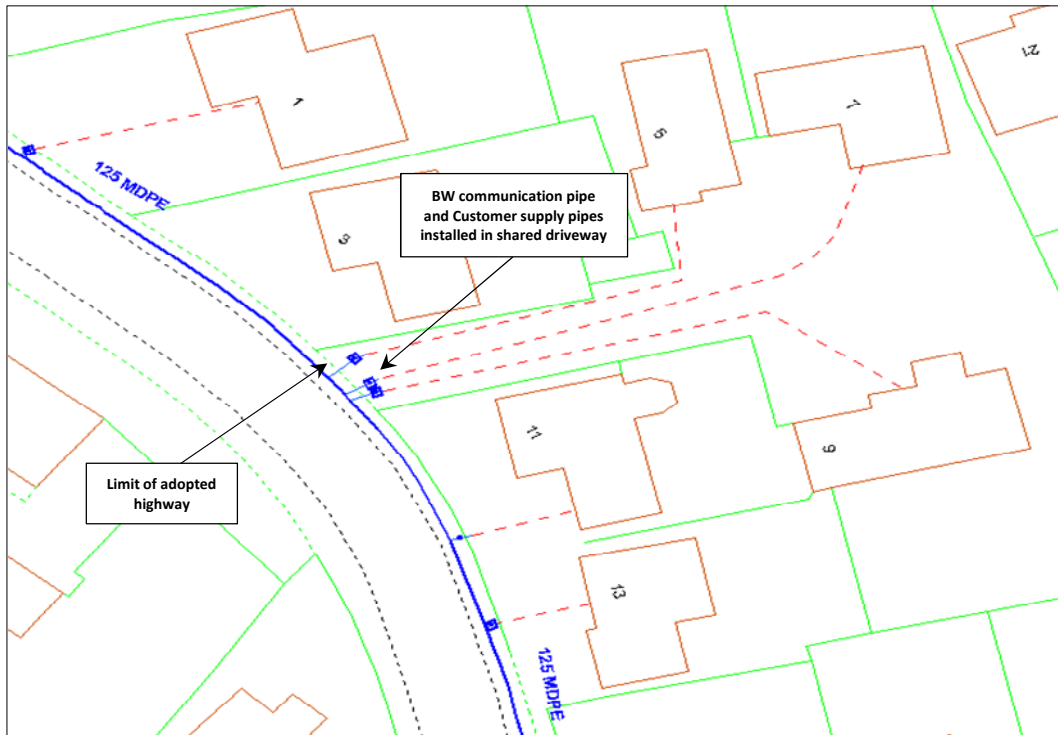
### 11.1 Example of mains in a shared driveway



In the above example the mains and communication pipes were installed within the shared driveway. There is no requirement for an easement as the new main were installed in a street.



### 11.2 Example of services in a shared driveway



In the above example the services were installed within the shared driveway to serve the plots 5, 7 and 9.





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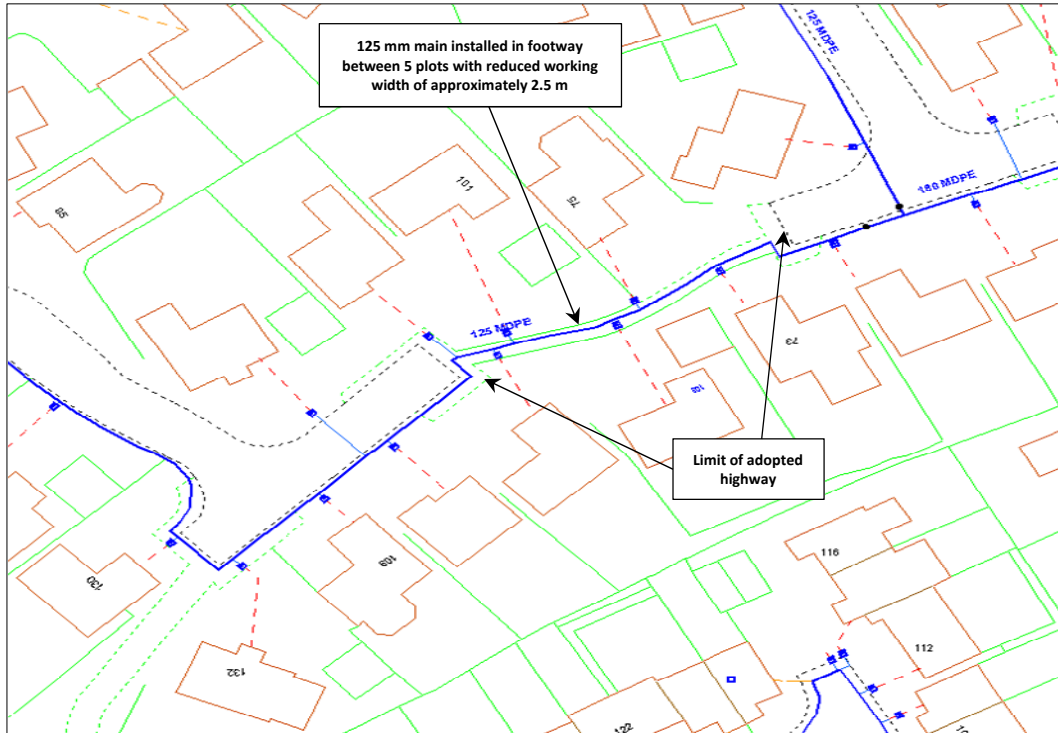
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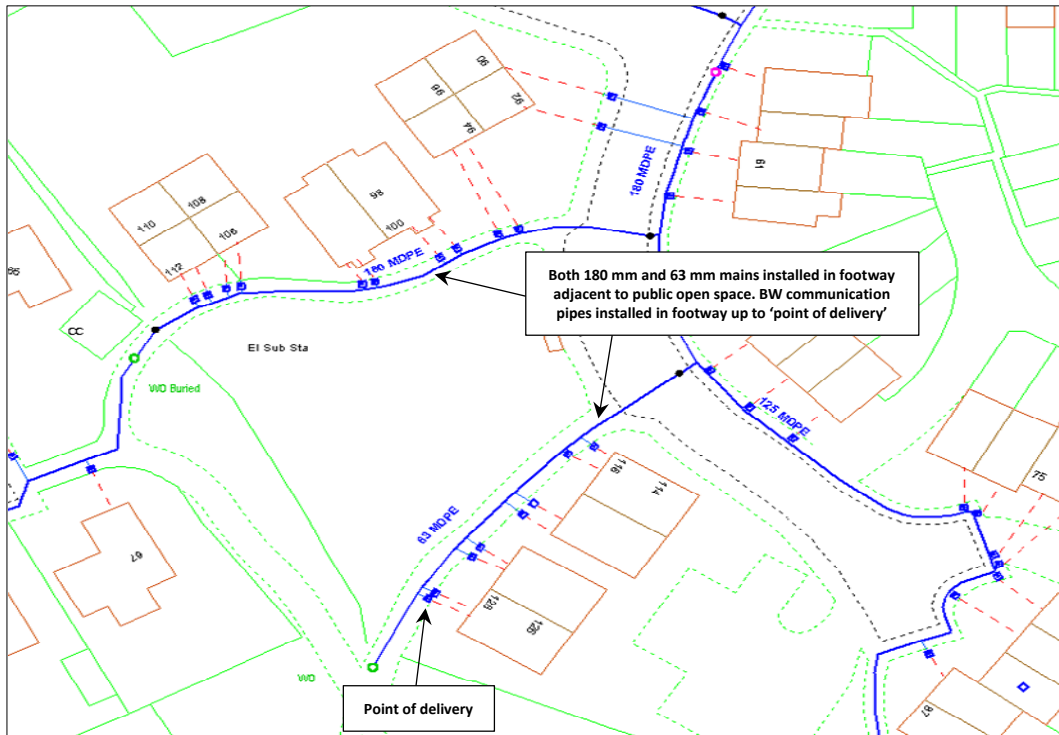
## 11.3 Example of mains with reduced working area



In the above example the mains were installed in footway with a reduced work width of approximately 2.5 m to serve the plots 73, 75, 101, 103 and 105. This solution is not ideal, but there was no other alternative to supply these 5 plots.



### 11.4 Example of mains in a footway adjacent to public open space



In the above example the mains and communication pipes were installed within the footway adjacent to the public open space. It does not matter whether the footway is adopted or a shared footway as the main is installed in a street and there is no requirement for an easement.



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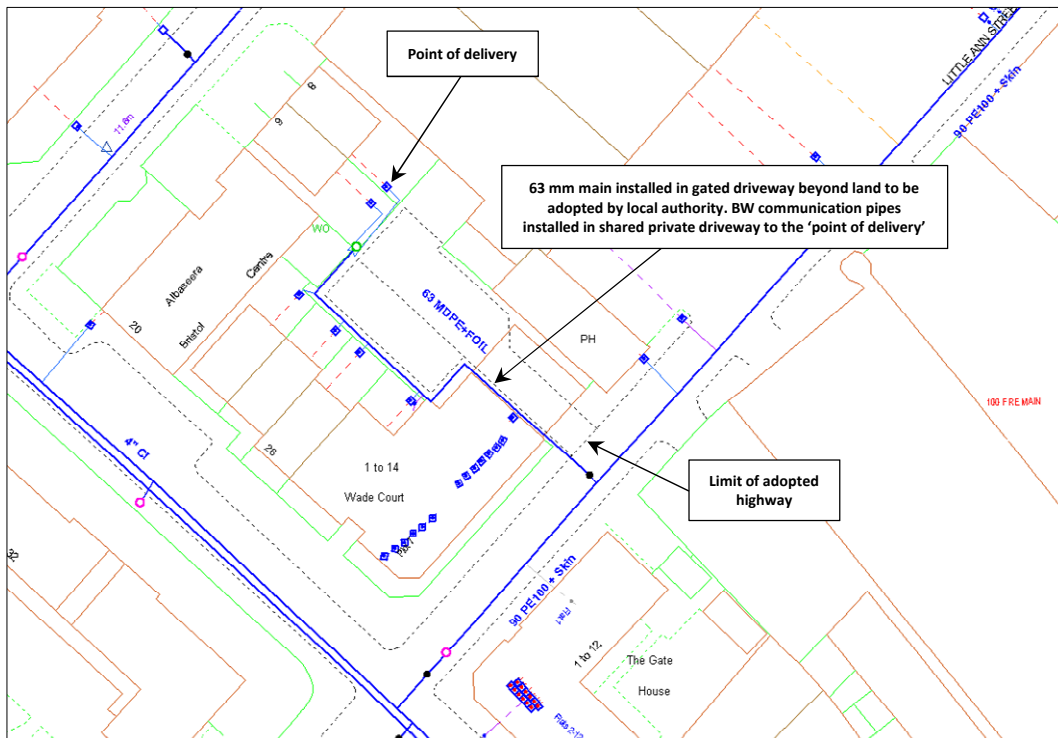
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## 11.5 Example of mains in shared private driveway within a gated development



In the above example the mains and communication pipes were installed within the private driveway of a gated development. There is no requirement for an easement as the main is installed in a street. A controlling valve is sited outside the gated area so the main/services can be isolated without delay if needed.



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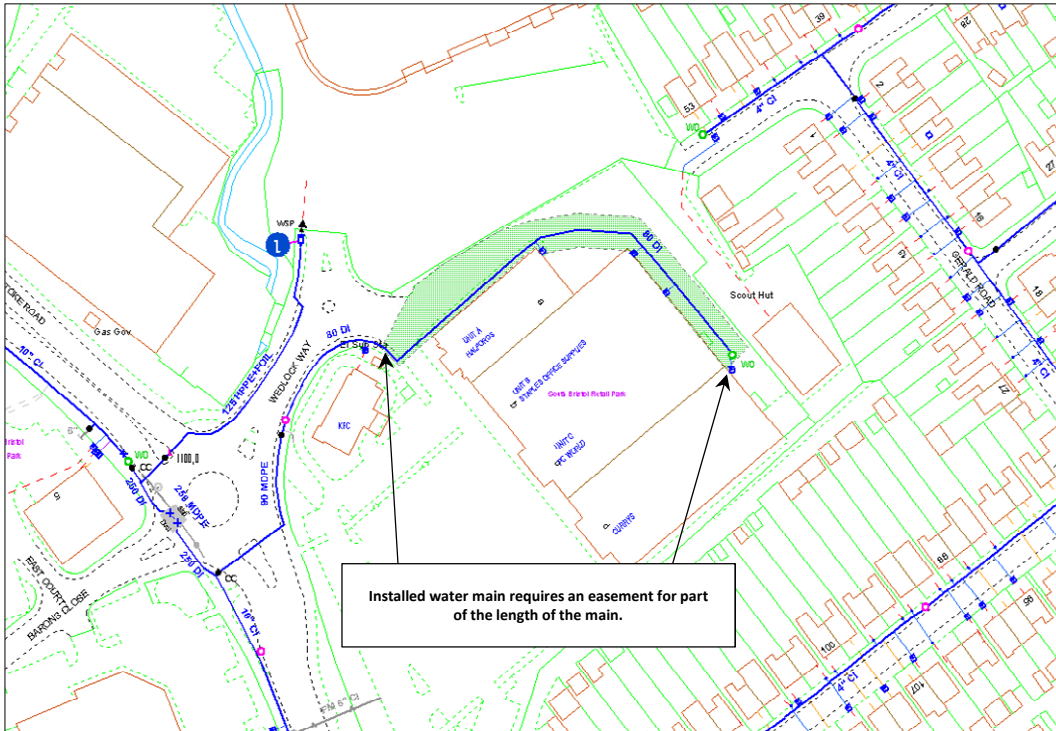
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## 11.6 Example of mains on a commercial development requiring an easement



In the above example the installed main require an easement to protect Bristol Water asset from any future changes to the site layout. The communication pipes would be installed up to the edge of the defined easement area to the point of delivery.



## 12. Diversions of water mains

Diversions are generally required as a result of a request from an external customer (e.g. developer or Highway Authority) as a result of their proposals to carry out work in the vicinity of our apparatus. To enable their construction to proceed, it is often the case that a diversion of a main is necessary. The primary considerations in such cases should be to guarantee both the short term supplies and longevity of Company apparatus.

### 12.1 Legislation

The section 174 of the Water Industry Act 1991 states that it is an offence to interfere with a water main and affect its use or operation either intentionally or negligently. This includes the construction of structures and whether the effect is temporary or permanent.

The section 185 of the Water Industry Act 1991 provides the developer with the right to make a reasonable request to have a public water main removed or altered, at the developer's expense.

### 12.2 Design considerations

The following risks should be considered:

- the continued integrity of the apparatus both during the customer's proposed work and the diversion work for instance a reduction in ground level (and therefore cover) during construction of a road, or from movement of heavy machinery;
- possible interruptions to supply and potential damage by the contractor;
- health and safety of operators, maintainers and general public both during and after the proposals have been complete.

### 12.3 Location and position of mains

Final consideration should include a full awareness the following:

- details of both horizontal and vertical alignment, excavation depths and proximity of any other apparatus;
- the reason for the diversion and permanent works being proposed by the third party;
- possible diversion routes and any options for consideration;
- future maintenance and operation of the diverted main and other apparatus;
- the possible construction methods.



## 12.4 Evaluation of proposals

### A. Horizontal Alignment

The third party proposals may render an existing main vulnerable due its new relative position. For example if the existing main is under the footway and will be under carriageway as a result of a road being widened, then diversion should be considered. It may, however, be possible to leave the water main in the proposed carriageway subject to risks being considered e.g. the operation of valves and other apparatus.

### B. Vertical Alignment

Considerable changes in the cover to the apparatus may result in the need for diversion. As a guide an increase of >300 mm or a decrease of >150 mm should be properly investigated.

Increases in cover result in:

- possible extra cost to Bristol Water for future excavation;
- health and safety issues for deep excavations;
- increased loading on the main;

Decreases in cover result in:

- lack of protection to the apparatus;
- possible damage from third parties or vibration;
- possible Unplanned Customer Minutes Lost incidents;
- possible freezing in winter.

## 12.5 Construction activities

The apparatus is at its most vulnerable to damage or failure while the development construction is taking place. This is because of vehicle movements over the apparatus, excavations and vibration of compacted materials. The full extent of any construction activity should be properly understood (including heavy traffic movements around the extremities of the site) to ensure that any proposed diversion takes proper account of this risk. Protection to existing assets should be considered on a risk-based, case by case basis.

## 12.6 Protection

If the diversion of the main is considered necessary but impractical, protection should be considered as an alternative. Protection to existing assets should be considered on a risk-based, case by case basis.



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## 12.7 Enhancement

Any diversion work that is required to accommodate the customer's proposals should be considered on a *"like for like"* basis. Such situations should not be used as an opportunity to enhance the network.

## 12.8 Fire & Rescue Service

When possible, consultation with the Fire & Rescue Service should take place if any fire hydrant is affected and in particular Fire hydrants should not be left in the carriageway.

