# DESIGNING DRAINS AND SEWERS FOR BROWNFIELD SITES

Guidance Notes

BRITISH PLASTICS FEDERATION PIPES GROUP

# Introduction

A variety of legislation is relevant to the management of land affected by historic contamination (i.e. brownfield sites). Contamination is a material planning consideration – regional or local planning authorities can require assessment of the land and set conditions for the site to be made suitable for intended use. In addition, the Environment Agency and the devolved administrations in Wales, Scotland and Northern Ireland can require risk assessment and mitigation to protect water quality and discharge to rivers.

In preparing to develop a 'brownfield' site, a developer will consider the risks to humans living or working on the site posed by its former use as well as the risks of ingress to the water or wastewater systems.

Guidance is provided by UK Government on the management of risks from brownfield sites, including using risk assessments to consider dangers posed by contamination and potential solutions for managing contamination. It recommends that the assessment of risks is carried out by experts or specialist consultants who are suitably qualified and competent. (Example of guidance provided: https://www.gov.uk/guidance/land-contamination-risk-management).

In preparing this guidance note, it is assumed that a preliminary, and if required a more detailed quantitative, risk assessment has been completed and that an options appraisal has been carried out to identify solutions which meet regulatory and planning requirements. The site assessment report and options appraisal might conclude that there is no contamination on site; that nothing needs to be done about contamination found as it does not pose an ongoing risk to health or environment; or that the contamination needs to be managed, sometimes involving preventing or cleaning up contamination on part or all of the site, known as remediation.

Prior to finalising the remediation plan, the developer should consider the impact of the plan on the wastewater carried away from the site from infiltration into the drain or sewer, together with any impact of residual contaminants on the fabric of the pipe, joints and ancillaries. All materials commonly used in the UK for drains and sewers have some limitations in this respect and selecting the most suitable is key to ensuring longevity of the pipeline.

Plastic pipes and inspection chambers for the construction of gravity drains and sewers have been widely used for many years in the UK and are, in most cases, suitable for use on both brownfield and greenfield sites.

This guidance note provides additional information to pipeline designers and developers selecting and installing plastic pipes for drains and sewers.

### *Greenfield*

is an area of land which has not previously been built on. This includes the greenbelt land around cities.

### *Brownfield*

is an area of land or premises that has been previously used, but has subsequently become vacant, derelict or contaminated. The fact that a site has been formerly developed does not however mean that it is contaminated.

# Designing and selecting a pipeline

When preparing to lay a drain or sewer through a brownfield site, there are two factors to consider:

- Could any remaining contaminants in the soil find their way into the pipework and impact unacceptably on a water course (surface water drain / sewer) or the treatment works (foul water drain / sewer)?
- Could any remaining contaminants in the soil compromise the long-term performance of the pipework?

## Ingress to pipework

The risk of contamination is usefully described by the SOURCE - PATHWAY - RECEPTOR model.
**If any one of these elements is missing, then there is no risk of contamination entering the pipework.** Further consideration does not need to be given to potential ingress into the pipeline.

### *The Source:*

this is the location of the contamination. With respect to underground pipework, the source would be the soil above or below the pipeline which contains contaminants. The type of site and / or the remediation option proposed may remove the source entirely.

### *No source*

- Greenfield site - no contaminants have been introduced to the site.
- Brownfield site with complete removal of contaminants proposed by remediation plan.

### *The Pathway:*

this is the route taken by the contamination to the receptor. With respect to underground pipework, the pathway might be the trench backfill surrounding the pipe or rainwater bringing the contaminant down through the soil or rising ground water bringing the contaminant up through the soil. The pipework layout and / or the remediation option proposed may remove the pathway.

### *No pathway*

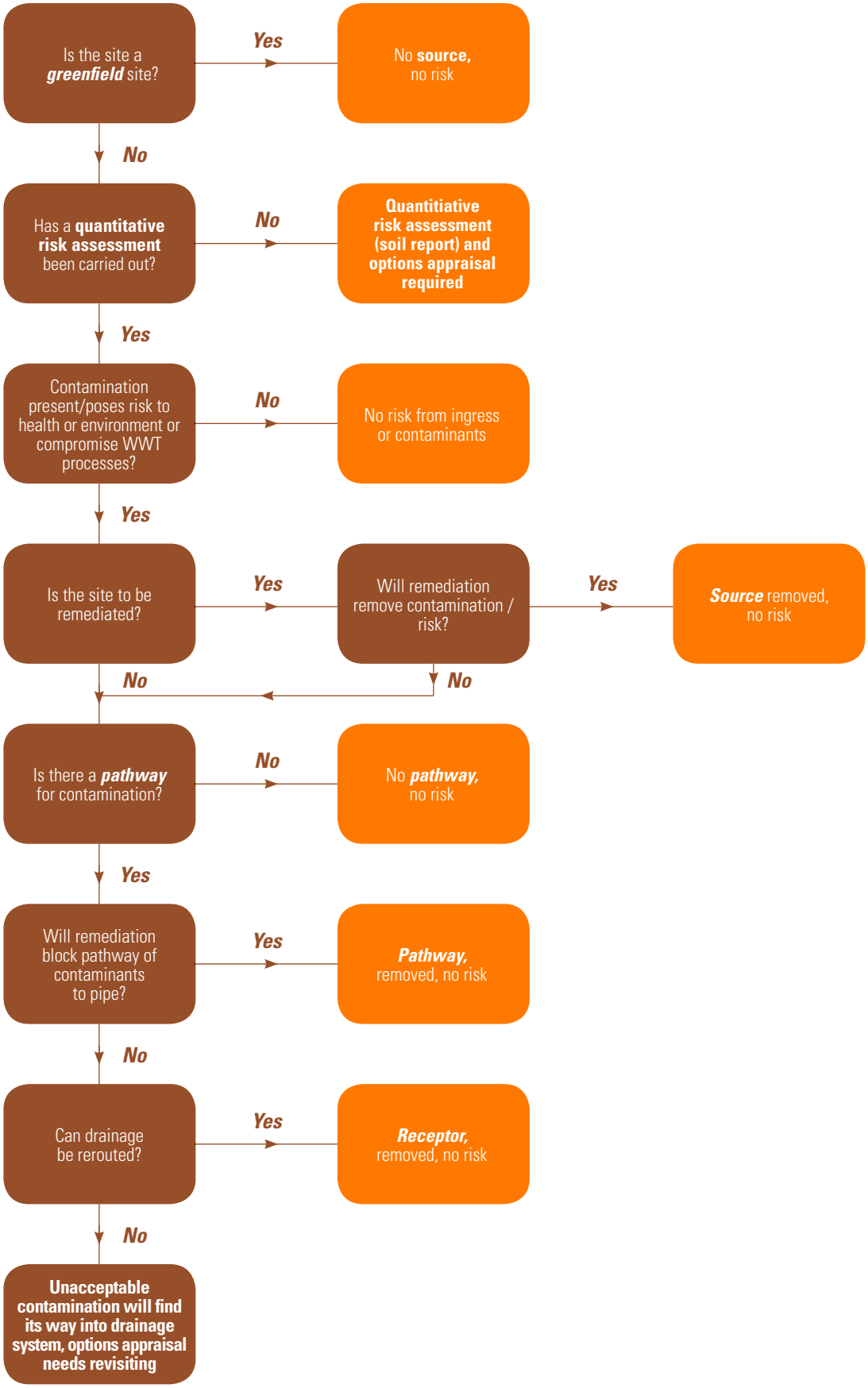
- A barrier layer proposed by remediation plan between the source of the contamination and the pipework.
- The location of the pipework is such that the contamination (for example on another part of the site) would not reach it.

### *The Receptor:*

this is the pipework running through the site.

The following flow diagram can be used to consider whether any remaining contaminants in the soil could find their way into the pipework and impact unacceptably on a water course (surface water drain / sewer) or the treatment works (foul water drain / sewer).

# Effect of contaminants on ingress



## Suitability of materials for drains and sewers

The assessment of brownfield sites typically identifies chemicals which remain because of the former use of the site. For example, chemical, pharmaceutical, and pesticide manufacture; foundries, engineering and printing works; gas works, filling stations and food processing.

With knowledge of the former use, soil surveys will be made to measure the presence of chemicals such as:

### *Inorganics*

- Metals (e.g. arsenic, cadmium, copper, lead, mercury etc.)
- pH (acids and alkalis)
- Asbestos

### *Organics*

- PAH (polycyclic aromatic hydrocarbons, e.g. Anthracene, Pyrene, complex hydrocarbons formed as a result of burning of organic material)
- TPH (total petroleum hydrocarbons, e.g. hexane, jet fuels, mineral oils, hydrocarbons that are found in crude oil)
- BTEX (i.e. Benzene, Toluene, Ethylbenzene and Xylene, released from vehicle emissions and a variety of industrial processes).
- Phenols

**NOTES:**

**1:** Survey reports may include all chemicals for which the soil was tested - they may show values below the limit of detection of the lab equipment (often seen as <0.1) meaning that their presence cannot be confirmed. The inclusion of a chemical in a list should not be taken as evidence of its presence.

**2:** At extremes of pH (i.e. 4>pH>10), it is recommended that the underlying reason be investigated.

**3:** The values for PAH, TPH and BTEX given in the flow chart on page 6 represent a safe level with respect to materials durability.

**4:** Where hydrocarbons (TPH, PAH) might come in contact with the seal, EPDM should be replaced by nitrile rubber or other suitable alternative. Where BTEX chemicals may come in contact with the seal, EPDM and nitrile rubber seals should be replaced by a suitable alternative. This applies to any pipe materials jointed by elastomeric seals. The pipe manufacturer or seal supplier can assist with this selection.

## Chemical resistance of plastic pipes

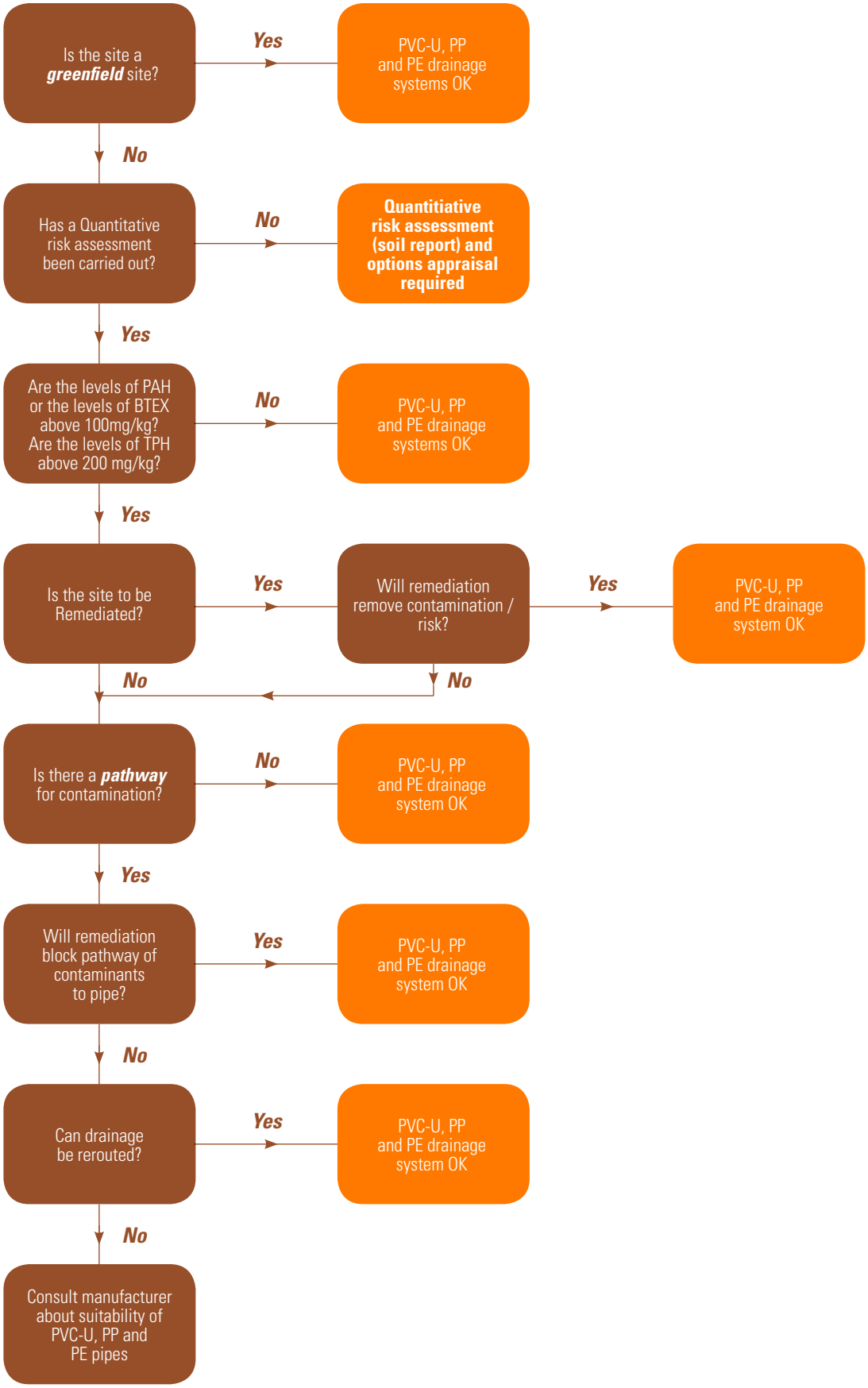
Plastic pipes for drains and sewers are manufactured from unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) or polyethylene (PE).

These materials are naturally resistant to inorganic compounds such as acids and alkalis, sulphides, chlorides, sulphates or cyanide. Their properties will not be affected by the presence of metals in the soil.

[Further information on specifications applicable to plastic pipes, inspection chambers, manholes and covers for drainage and sewerage applications in both private and public applications, can be found in the BPF Pipes Group guidance in that topic - www.bpfpipesgroup.com/support-downloads/.]

Where organic compounds are shown to be present in the soil, the following flow diagram can be used to consider whether they would affect the use of plastic pipes for drains and sewers. In cases where there could be an impact, amendment of the remediation plan before work commences to remove the source of the contaminant or the pathway to the pipework may often allow plastics pipes to continue as the material of choice.

## Effect of contaminants on pipe



A list of members who manufacture and supply plastic pipes for brownfield sites is provided on the BPF Pipes Group website,
https://bpfpipesgroup.com/members