REGENESIS®

Two UK airport projects demonstrate successful in situ PFAS remediation

CASE STUDY

PFAS plumes treated with colloidal activated carbon barriers unlock regulatory permission for full-scale remedial works

INTRODUCTION

REGENESIS was contacted by two separate consultants working at a private and an international Airport in the UK. The groundwater at both sites was contaminated with **PFAS**.

REGENESIS and the environmental consultancies worked closely with the airport managers and separate regulatory authorities to ensure that two successful pilot trials were delivered demonstrating the efficacy of **PlumeStop® Colloidal Activated Carbon (CAC)** in preventing the advection of PFAS contamination in groundwater.

PLUME STOP™
Liquid Activated Carbon

Additional investigation works were completed to further characterise the aquifer, providing a high-resolution characterisation of the PFAS flux allowing accurate targeting and emplacement of the **PlumeStop injectable Permeable Reactive Barrier (iPRB).**

In both cases, the source of the PFAS impacted groundwater was the use of **Aqueous Film Forming Foams (AFFF)** on firefighting training areas.

Case History - Private Airport

The first site where PlumeStop was used to target PFAS in the subsurface is a private airport in the UK. Here, a proportion of the airport's land is being divested to allow development to residential housing; with this change of land use needing to meet regulatory 'planning' conditions. As part of these requirements, the remediation of the PFAS needed to be proven in a pilot and a full-scale design considered acceptable in order to allow the divestment to take place.

Case History - International Airport

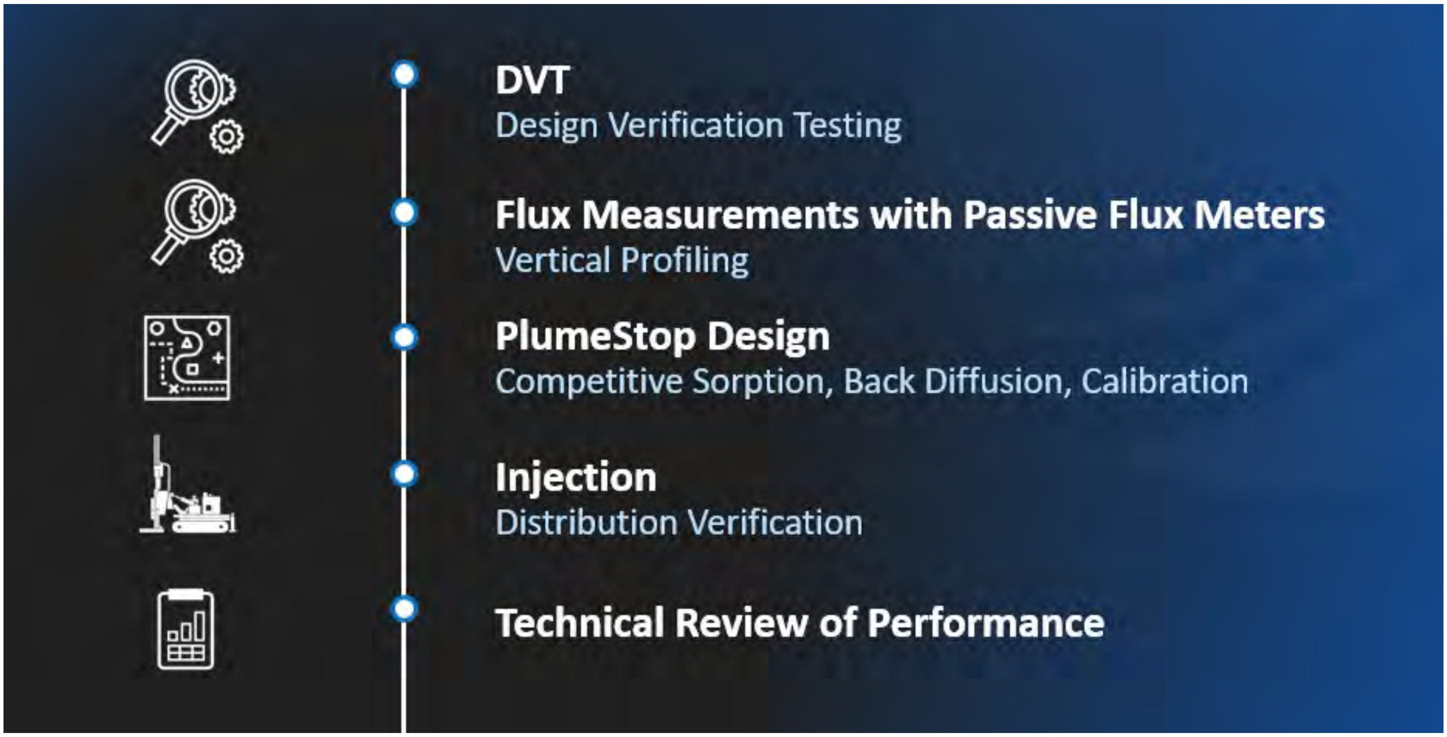
During routine groundwater sampling, an international airport in the UK identified PFAS contamination moving beyond the site boundary from their fire training area. Measurable concentrations of PFOS and PFOA were recorded in an ephemeral spring downgradient and it was determined that remediation works were required to remove the risk to the offsite environment including surface waters. Following a remediation options appraisal, REGENESIS were engaged to trial a PlumeStop PRB at the site boundary.

	Private Airport	International Airport
Geology	Weathered chalk	Made ground over alluvium
Contamination of Concern (COC)	PFOS / PFOA	PFOS / PFOA
COC range	3,500 ng/L PFOS	75,000 ng/L PFOS
Target depth	3 to 11m BGL	3 to 11m BGL
Pilot trial area	10m long barrier	10m long barrier
Former site use	Fire Training Area	Fire Training Area
Project driver	Real estate transaction	Removal of off-site liability
Remedial design details	Installation of an injectable permeable reactive barrier	Installation of an injectable permeable reactive barrier

DESIGN APPROACH AND PLANNING

For both sites, REGENESIS undertook **Design Verification Testing (DVT)** before installing 10m long pilot-scale barriers.

These DVT works aimed to confirm a series of design assumptions regarding the flux of PFAS, which the full-scale PlumeStop i-PRBs are required to intercept. The flux of PFAS is governed by the PFAS concentrations, groundwater seepage velocity and the geology of the target formation. These parameters can vary considerably vertically and laterally across the proposed barrier installation zone.



The DVT works comprised:

1. Installation of additional boreholes and detailed soil logging.
2. Permeability testing to confirm the seepage velocity of the aquifer.
3. Groundwater sampling; to identify compounds which may competitively absorb to the PlumeStop i-PRB.
4. Installation of passive samplers to confirm contaminant flux and its variability with depth.
5. Total Oxidizable Precursor Assay testing to ensure the total mass of PFAS entering the barrier.
6. Clean water injection testing confirming that the underlying geology will accept the proposed volume of PlumeStop.

DVT outcomes

At both airports, the DVT works demonstrated that PFAS flux had been under-estimated using conventional site investigation techniques and confirmed the need for passive sampling to attain high-resolution data on contaminant flux zones.

In both cases, minor changes to the PlumeStop dose compensated for this difference with no impact on the pilot program and a <5% change in project costs.

DESIGN METHODOLOGY AND APPLICATION

In both cases, a 10m barrier was installed perpendicular to groundwater flow downgradient of the fire training areas. A series of nested wells were installed to monitor “shallow” and “deep” groundwater to evaluate and ensure effective treatment laterally and vertical across the target aquifer zone.

Each PlumeStop iPRB was installed close to existing groundwater monitoring wells with historical data. Additional monitoring wells were installed upgradient, within the barrier and downgradient to it, so that the PlumeStop performance could be measured against PFAS influx throughout the validation periods.

The PlumeStop iPRB’s were installed through a series of low pressure Direct Push Technology (DPT) injections along the pilot-scale length. Injections targeted the contaminant flux zones to coat the aquifer in a thin layer of tiny particles of activated carbon. This converts the contaminant flux zones in the treatment area into subsurface filters, which adsorb incoming contamination and halt offsite migration. This prevents risk to downgradient receptors, removes offsite liability to the site owner and allows Enhanced Natural Attenuation (ENA) of the downgradient plume.

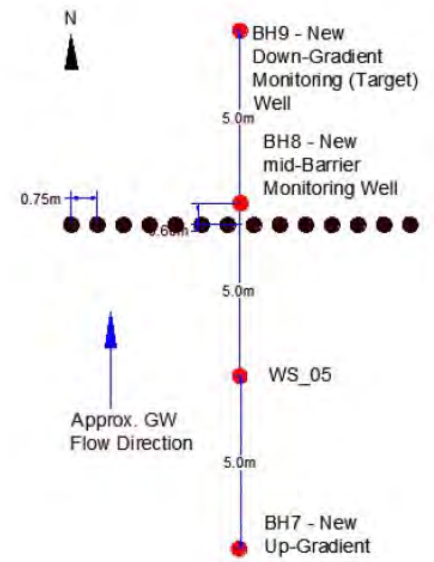


Figure 1. Pilot Configuration - Private Airport

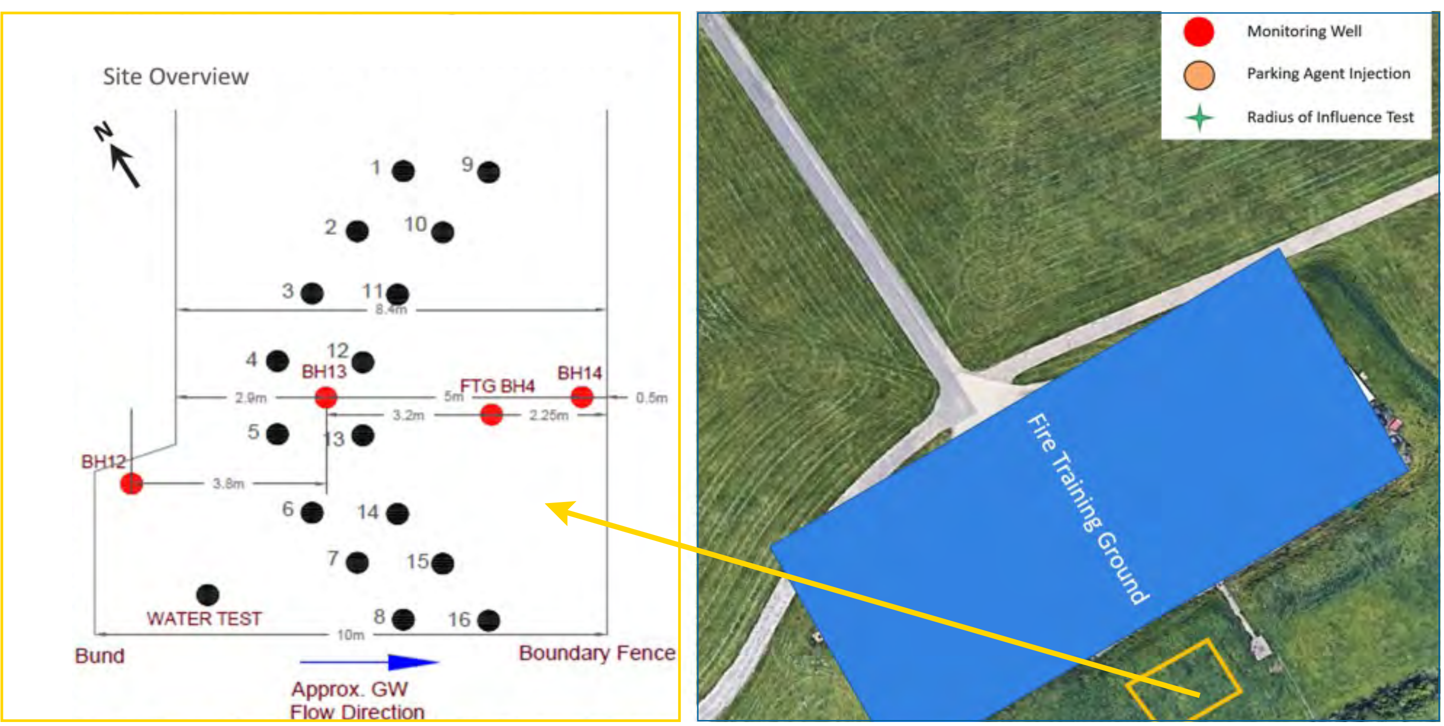


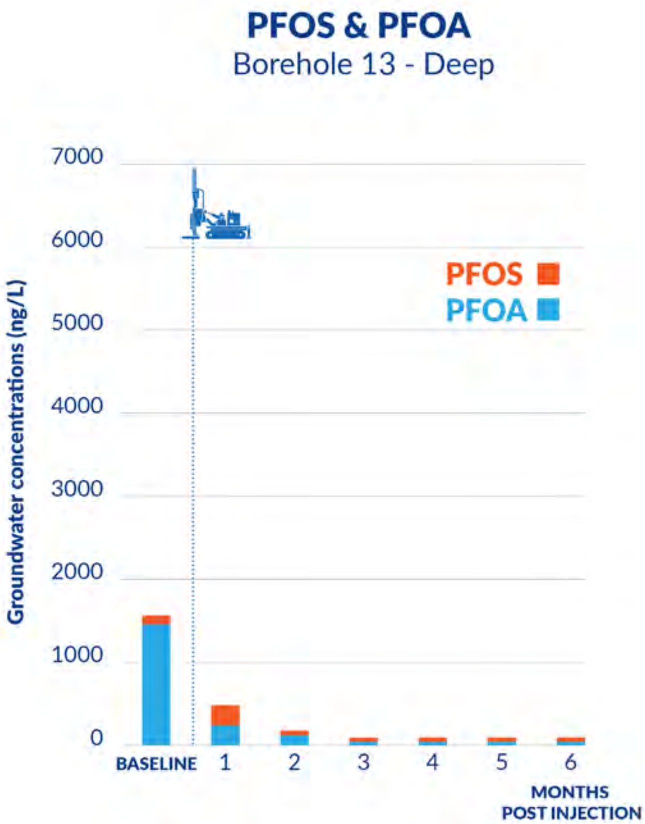
Figure 2. Pilot configuaration - International Airport

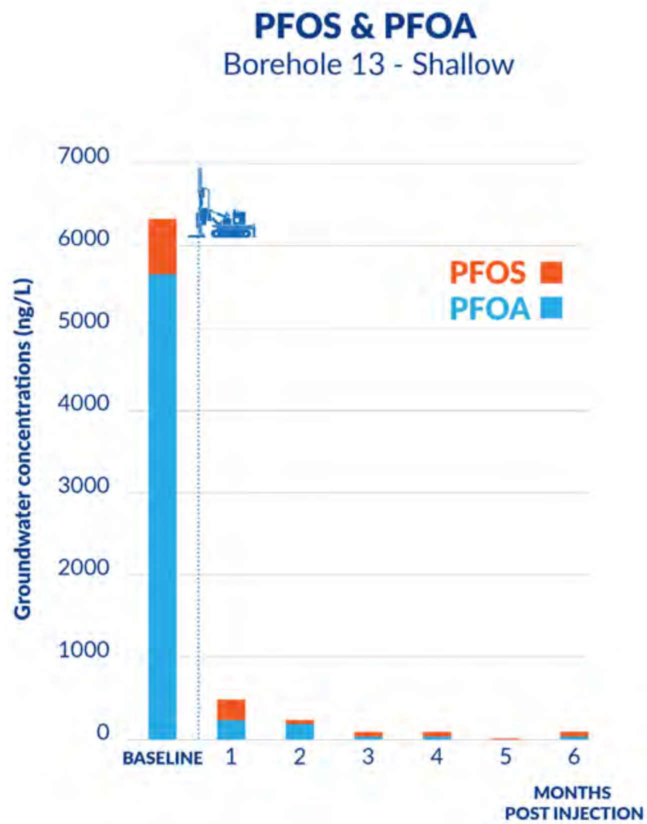
RESULTS

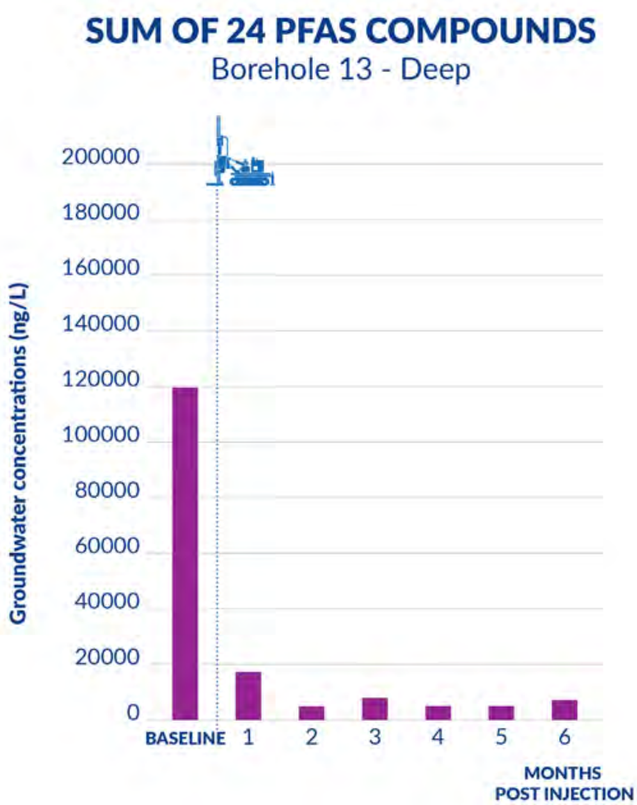
Groundwater monitoring at both sites showed that the target compounds PFOS and PFOA were reduced to at, or close to detection limits and that the total PFAS concentrations were also significantly reduced. All reductions were maintained throughout the validation period.

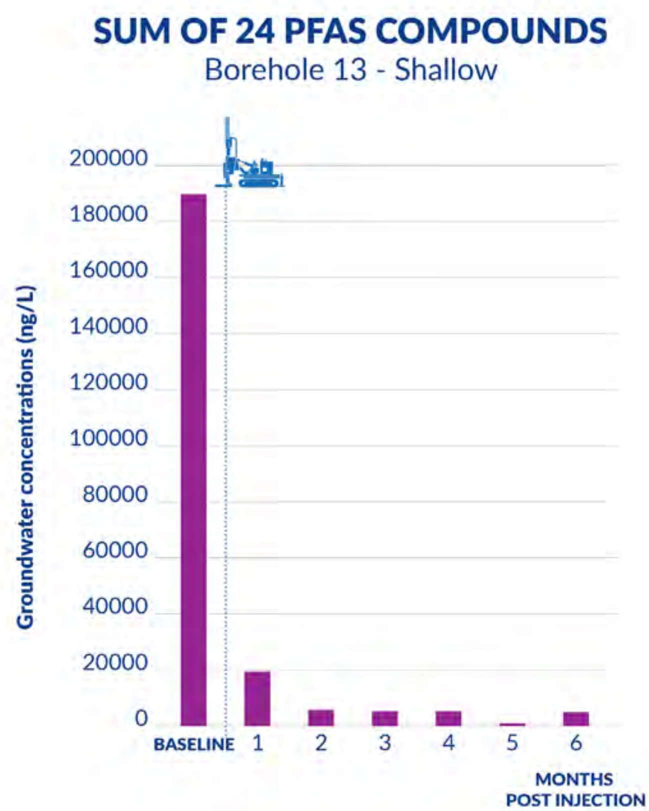
PRIVATE AIRPORT - MONITORING RESULTS

INTERNATIONAL AIRPORT - MONITORING RESULTS









CONCLUSIONS

The successful results from both pilot studies were used to complete accurate full-scale designs for each site.

The results of the DVTs, pilot studies and the full-scale plans were presented to all stakeholders including the local and national regulatory authorities.

This considered, phased approach, combined with successful pilot study results, allowed permission to be granted for the progression of full-scale works on both sites, which have been completed in 2022. Monitoring is ongoing.

CLIENT REFERENCE

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