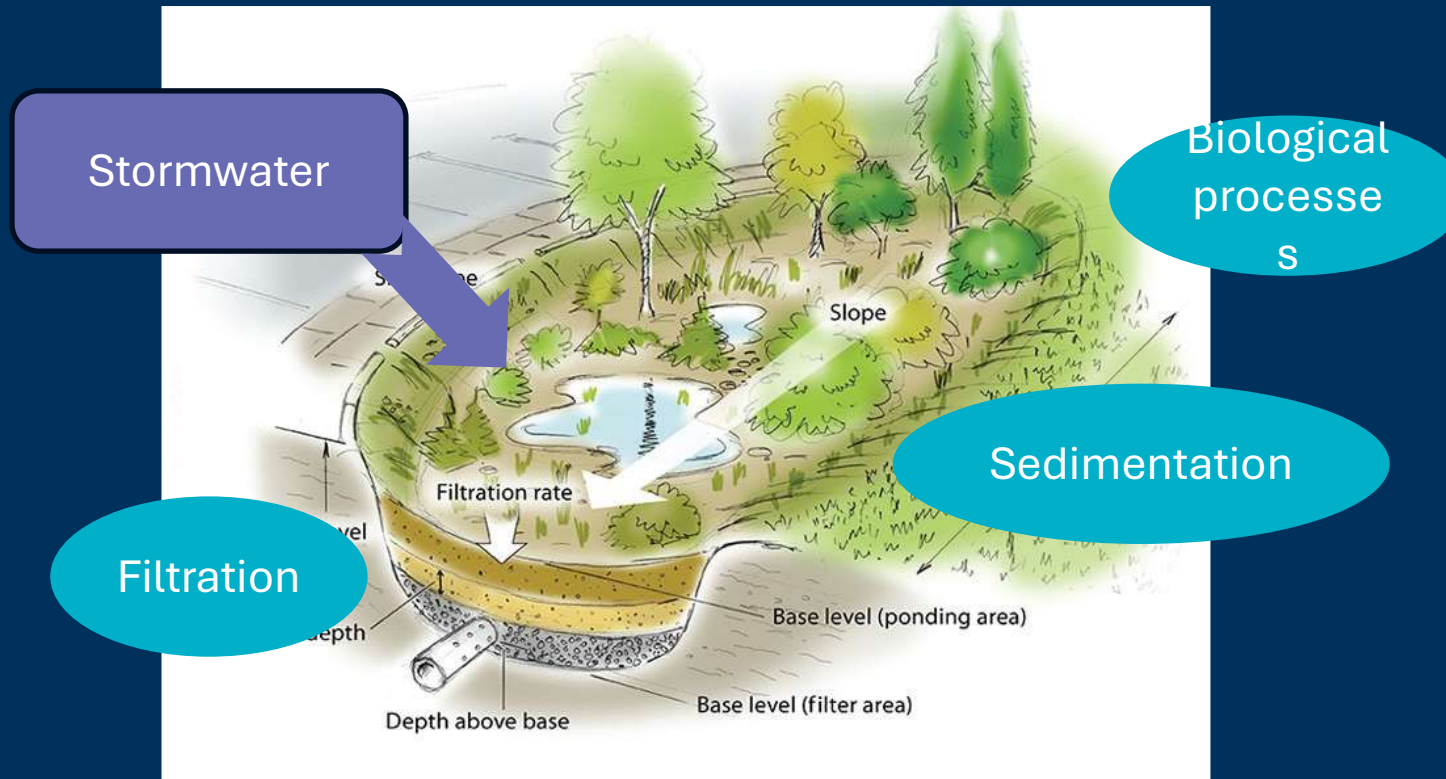


Biofilter Contamination

When does a pollution control device have too much pollution?

Introduction



End of filtration media life cycle



Refresh is required



Previous study - Monash University

Heavy Metals in Stormwater Biofilter Media: Will They Become a Management Issue?

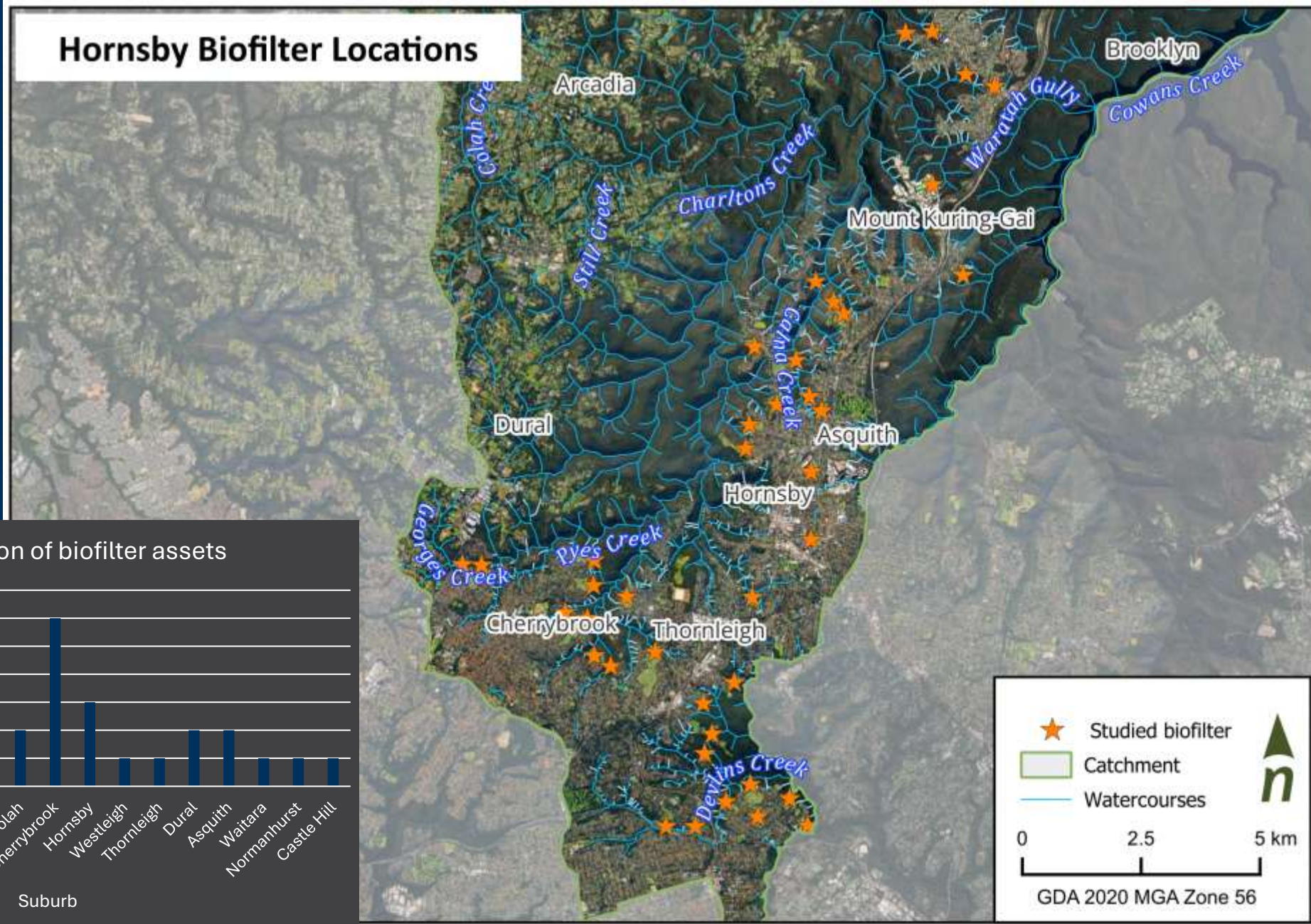
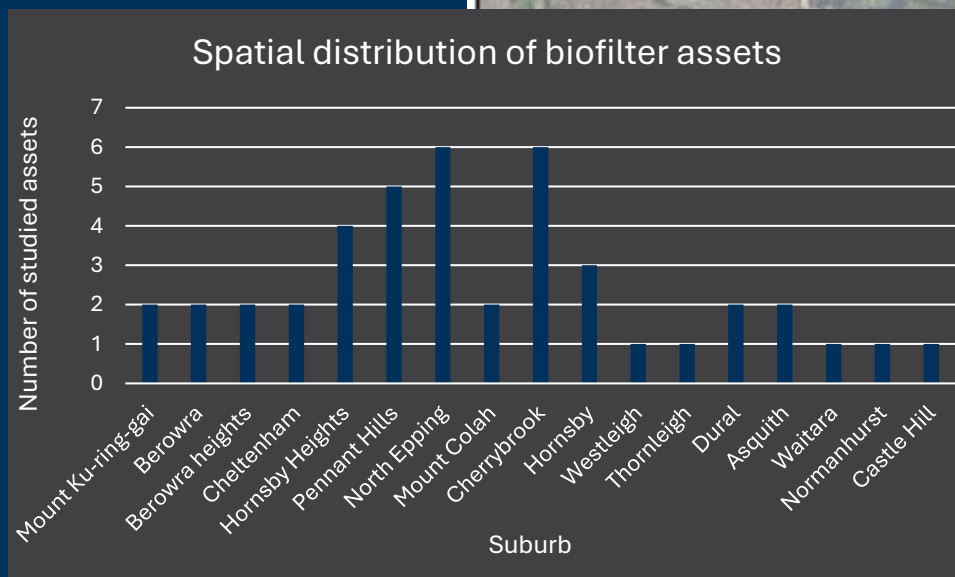
- Heavy Metals accumulate in the surface
- Heavy metals decrease with distance from inlet
- Metal concentration decreased with time
- Zinc triggered special waste disposal considerations

Project Objectives

- Which assets are contaminated?
- What factors influence contamination?
 - Catchment characteristics,
 - Biofilter characteristics
 - Pre-treatment characteristics
- What are the Asset Management implications?
 - \$\$ to tip when a refresh is required
 - Potential upgrades/ performance based issues

Methods

- 43 study sites



Methodology

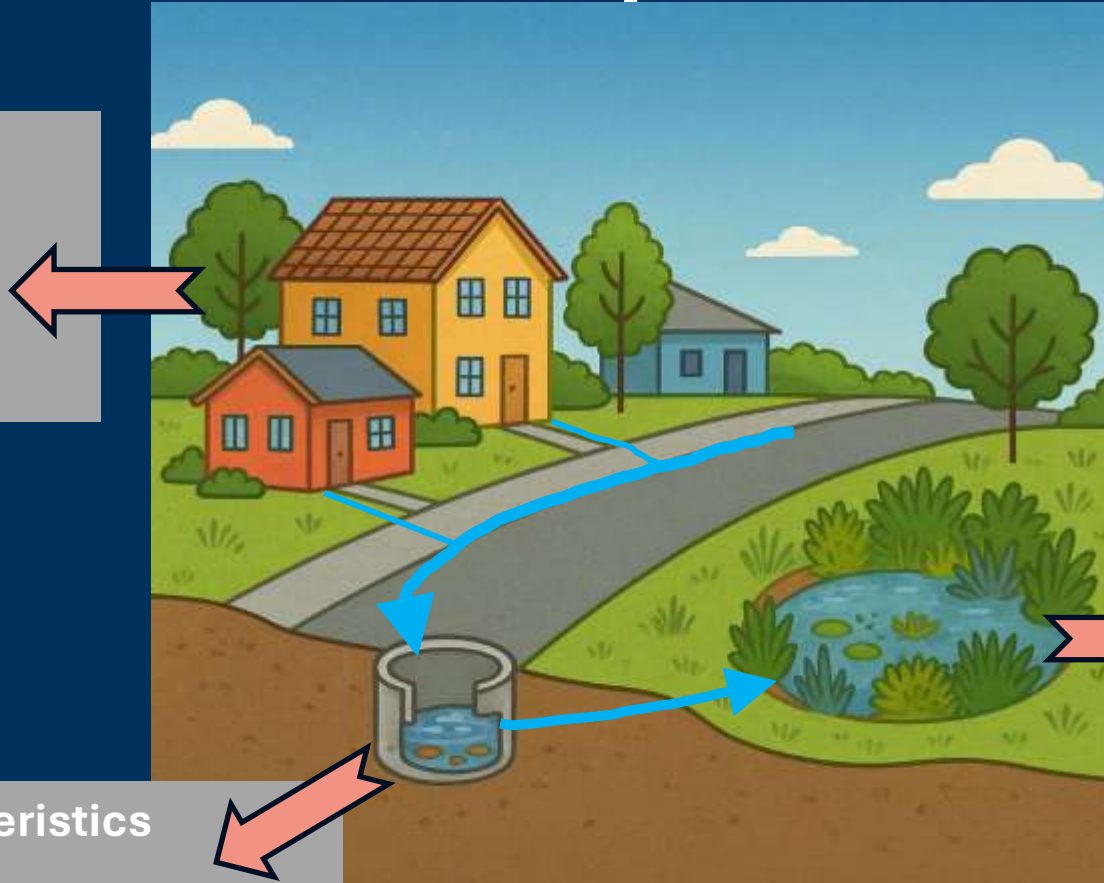
- Audit information done by myself
- Catchment characteristics provided by Civille
- PACE university students engaged to sample
 - One sample per inlet
 - Sample with 2m of the inlet
 - Sample the top 300mm of material



Methods – Potential impacts

Catchment characteristics

- Location
- Catchment size
- Land use
- Impervious fraction



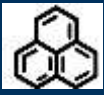
Biofilter characteristics

- Age
- Size (area)
- Biofilter area to catchment area ratio
- Biofilter area to catchment impervious area ratio
- Vegetation (coverage, strata, species, condition, shading)
- Biofilter condition (siltation, ponding, wet zone, moisture, saturated conductivity, filter media material and thickness)

Pre-treatment characteristics

- GPT presence
- GPT duration
- GPT category,
- GPT model
- Performance (low, moderate, high)

Methods – Contamination levels

	Contaminant group	Contaminants
	BTEX	BTEX Xylenes Total
	Heavy metals and metalloids	Arsenic, Chromium, Hexavalent Chromium, Copper, Lead, Nickel, Zinc
	Organochlorine Pesticides and Organophosphate Pesticides (OCP/OPP)	OCP Endosulfan Total, OCP Extended Suite Total, OPP MHP
	Polycyclic aromatic hydrocarbons (PAH)	Benzo[a]pyrene, PAH Total
	Polychlorinated Biphenyls (PCB)	PCB Total
	Semi-volatile organic compounds (SVOC)	SVOC Chlorpyrifos
	Total Petroleum Hydrocarbons	TPH C10-C14, TPH C15-C28, TPH C29-C36, TPH C10-C36

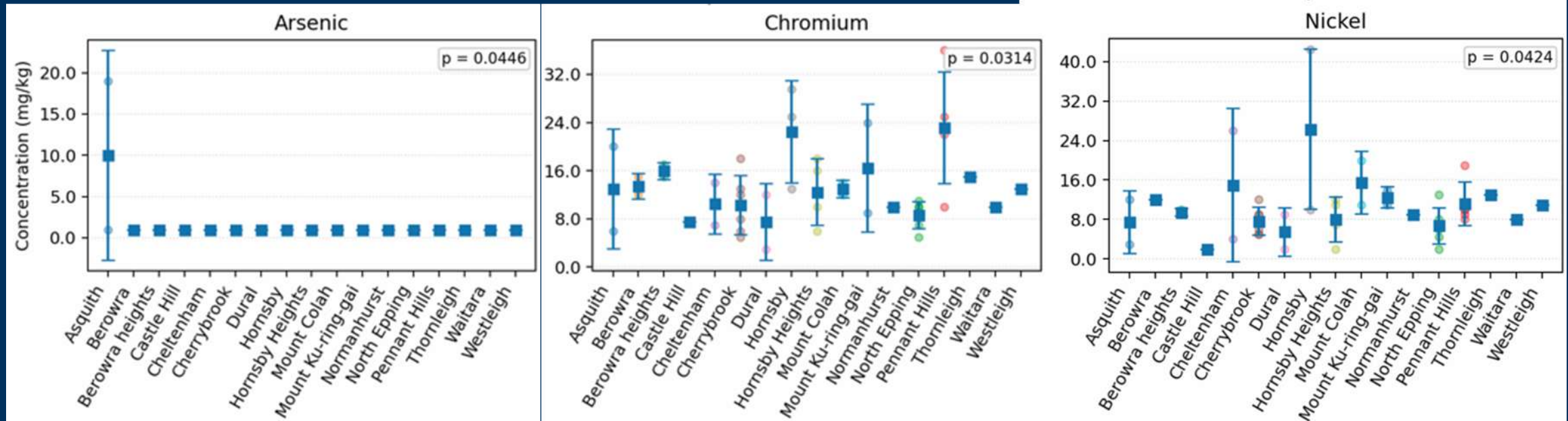
Methods – Statistical analysis

- Null hypothesis:
 - Contamination levels remain constant across different categories or value ranges of a parameter.
- Null hypothesis reject when $p < 0.05$ (probability value in ANOVA)



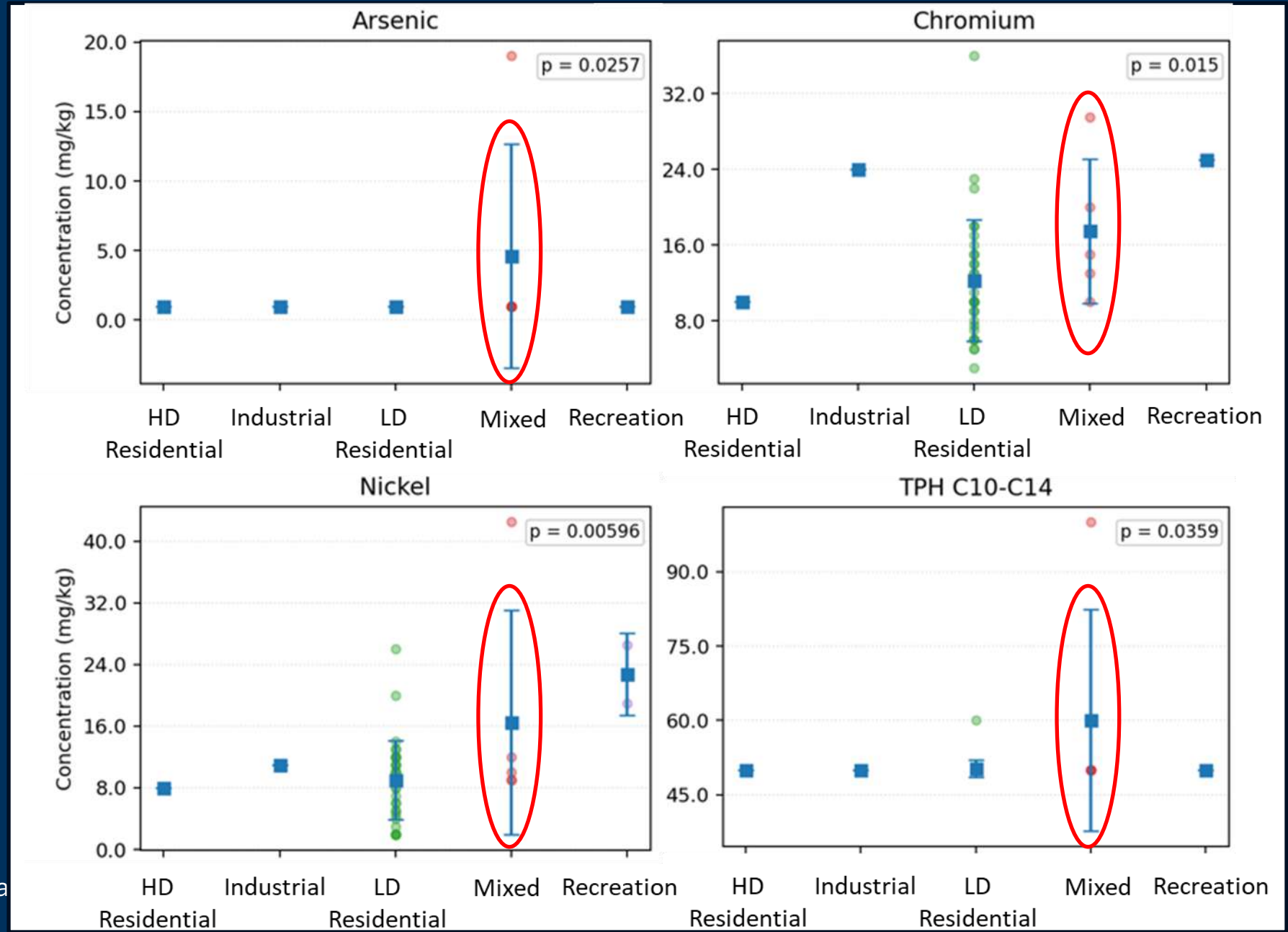
Results - Catchment characteristics

Suburbs



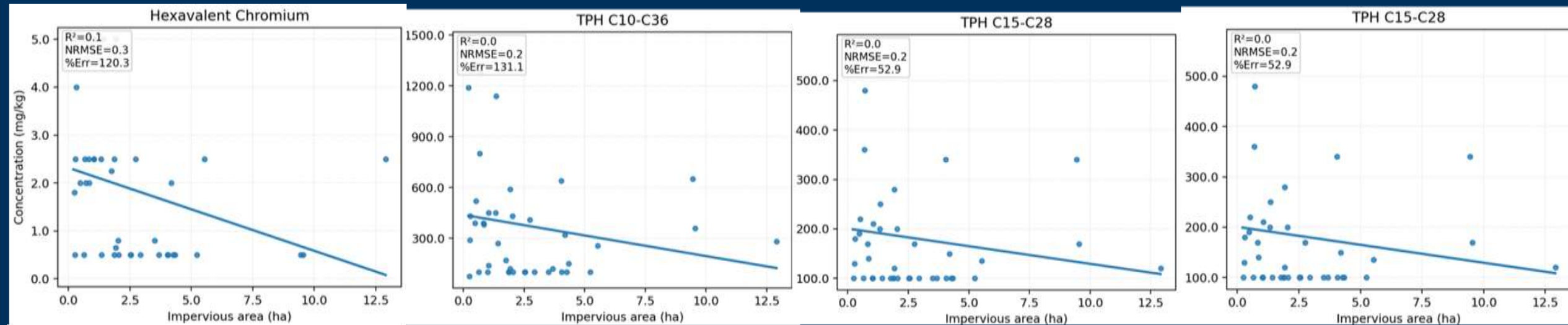
Results - Catchment characteristics

Dominant
Land use



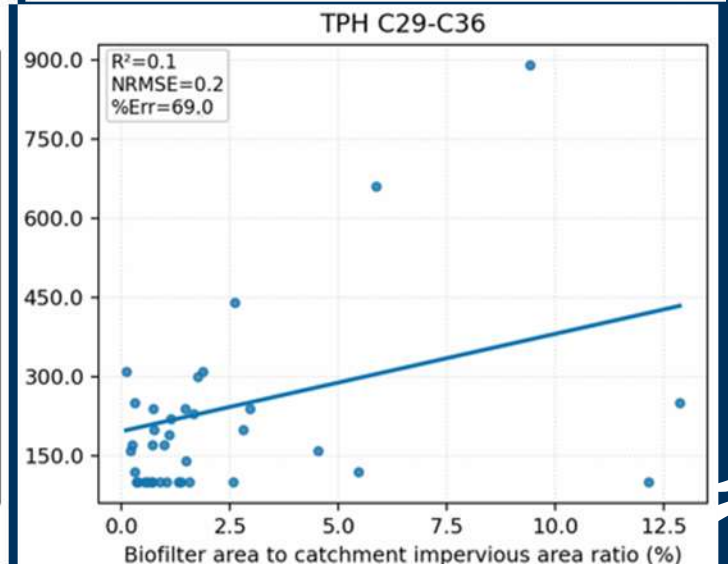
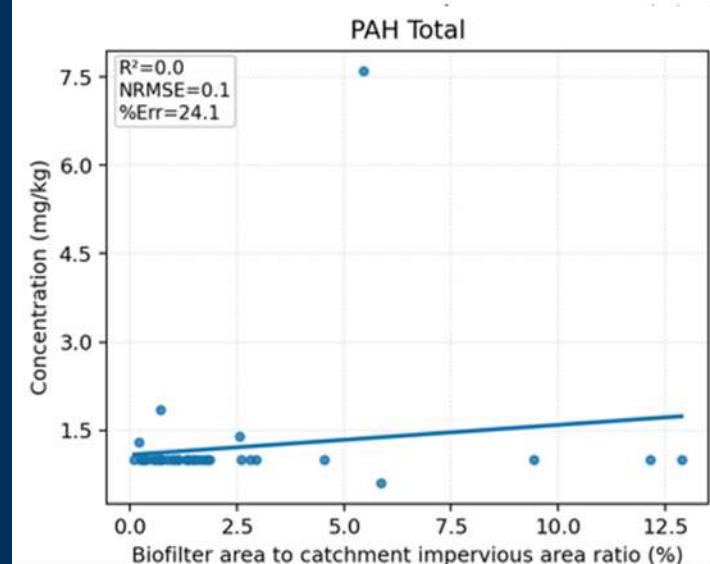
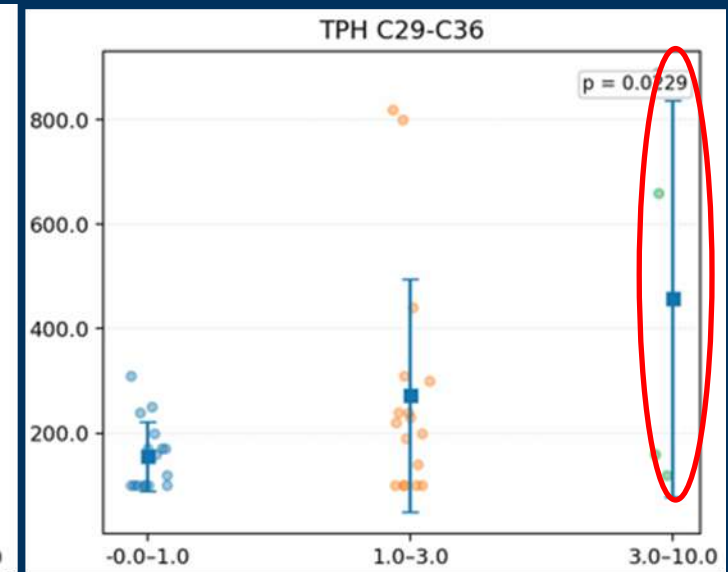
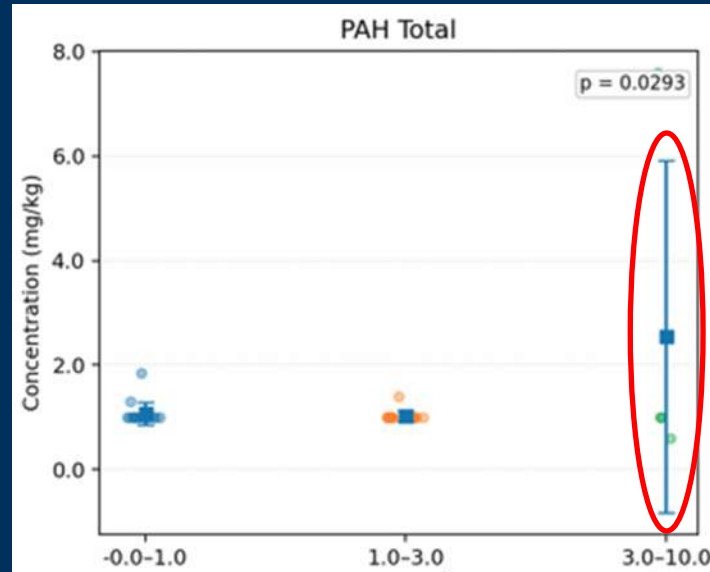
Results - Catchment characteristics

Catchment impervious area



Results - Biofilter characteristics

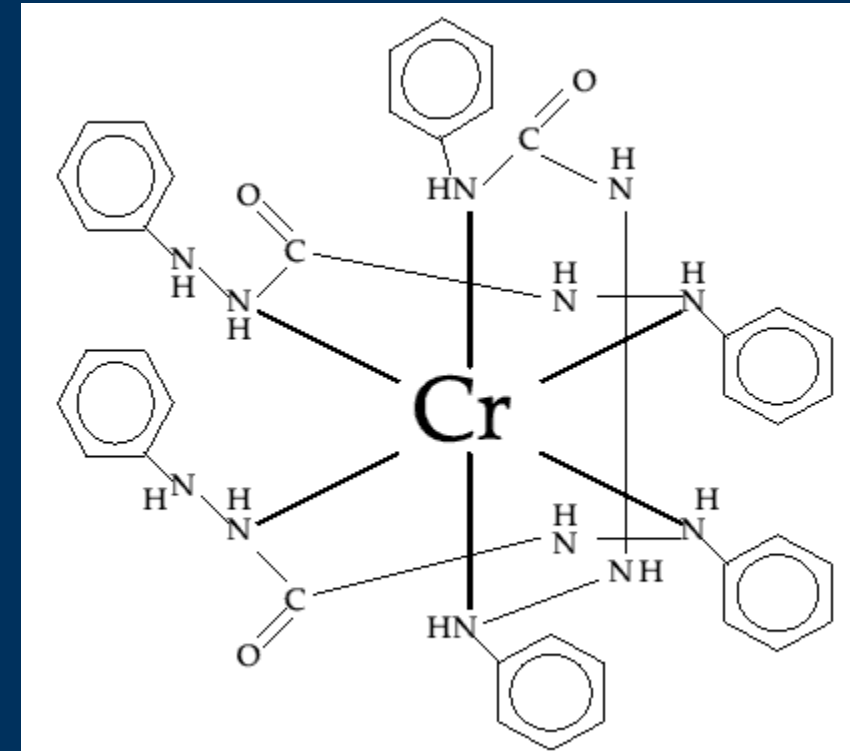
Biofilter area to
catchment
impervious area
ratio



Results - Biofilter characteristics

Siltation

- Low siltation = greater uptake of
 - TPH C10–C14,
 - BTEX Xylenes,
 - OCPs (Endosulfan, OPP MHP, SVOC Chlorpyrifos, Extended Suite),
 - and PCBs
- More siltation = greater uptake of
 - Hexavalent Chromium



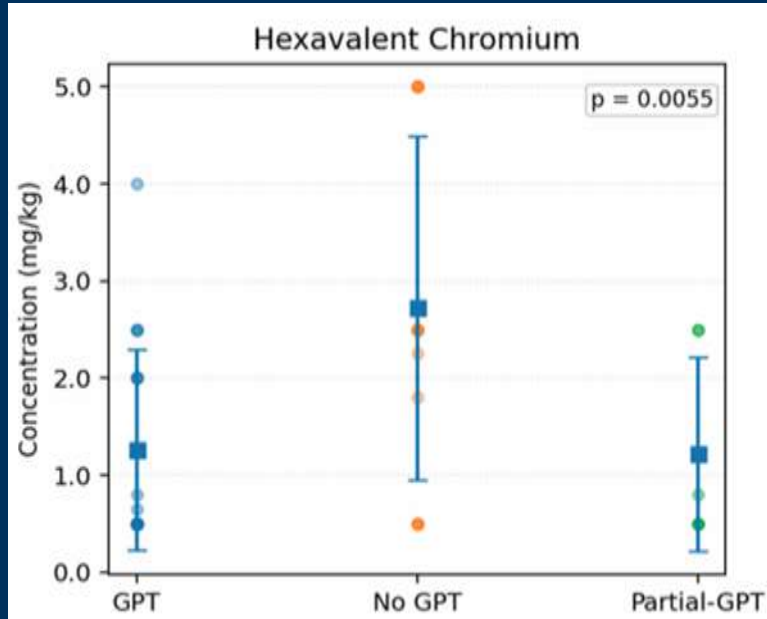
Results – Vegetation

- Healthy vegetation
 - PAH's are fixed from the system
- Unhealthy/ young
 - PAH still present and in the media

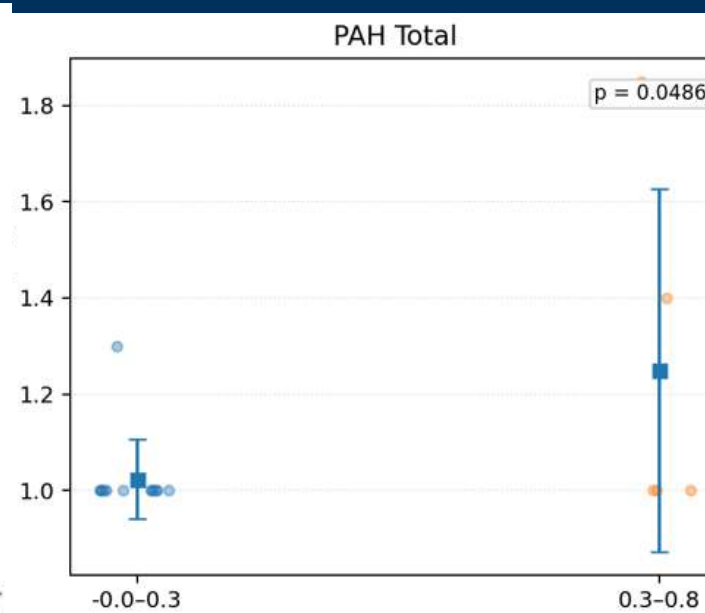


Results – Pre treatment

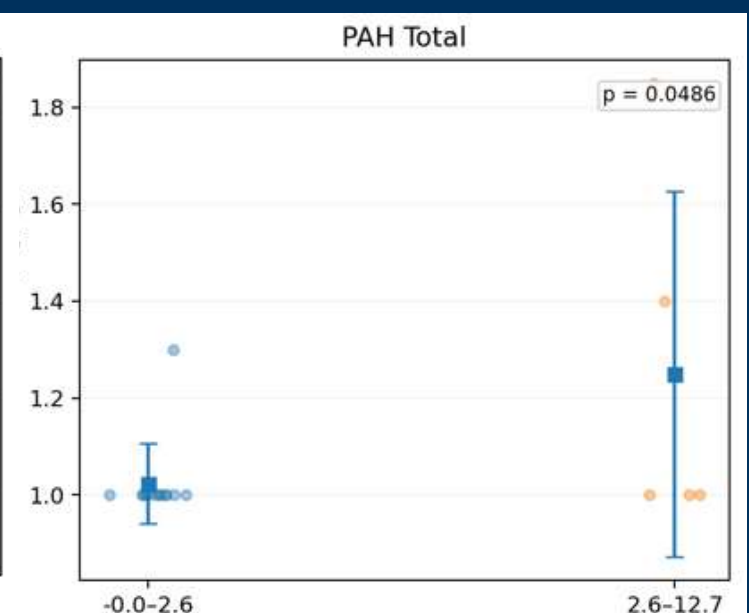
Pre-treatment type



Lifetime fraction without GPT



Duration without GPT (years)



Results – Pre treatment

GPT categories, models, and performance: some observed trends (without statistically significance)

- **Sediment Basins:** lower concentrations of hydrocarbons (e.g., TPHs)
- **Vortex style GPTs:** lower and more consistent contaminant levels, particularly for metals.



Results – 2 Contaminated sites

- Cawthorne Bio-basin
 - 5 years old
 - 3.45 ha catchment
 - Residential catchment
 - Moderately effective GPT
 - Contaminated with Nickel



Results

- Stewart St Bio-basin
 - 13 years old
 - 2.3 ha catchment
 - Mixed use catchment (residential and gun range)
 - No GPT
 - Contaminated with Nickel



Asset Management Implications

- Age doesn't impact whether a biofilter is contaminated.
 - Freedom to refresh relative to performance and not contamination.
- GPT's reduce contamination and improve function in the bio-basin.
- HSC needs to upgrade its bio-basins where possible to improve pollution capture



Further questions

- Does an offline bio-basin work better for pollution absorption?
- Are devices in industrial centres more likely to be contaminated?
 - Sample size
- What is the Nickel derived from?
 - Appropriate roof typologies

