Towards Equitable (2EQ) Trent Understanding the distributional equity associated with the Environment Agency's Operational Services

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Sayers and Partners in association with JBA

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Study context

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Context

What is a Regulated Service?

The Environment Agency's regulatory activity covers fisheries, flood risk, radioactive substances, agriculture and intensive farming, water resources, water quality, industrial products and processes, waste management, power generation, climate change, emissions trading, waterway navigation, control of major accident hazards, and much more.

What is covered in this project?

Here we focus on authorised and licenced sites and activities sites, and incidents reported that relate to the regulatory activities opposite.

- Radioactive and other waste sites and licensees
- Integrated Pollution Prevention and Control (IPPC) authorisations
- High Public Interest
- Environmental Pollution Incidents (CAT1,2,3, and 4)
- Hazardous waste and large scale illegal dumping incidents
- Illegal waste dumping (fly-tipping) incidents

- Authorised and licenced activities
- Reported Infractions and Complaints

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Context

Motivation

Delivering a Regulatory Service that is **equitable**, **efficient**, and delivers **fair** outcomes is central to the successful discharge of the Environment Agency's mandate.

Geographic scope

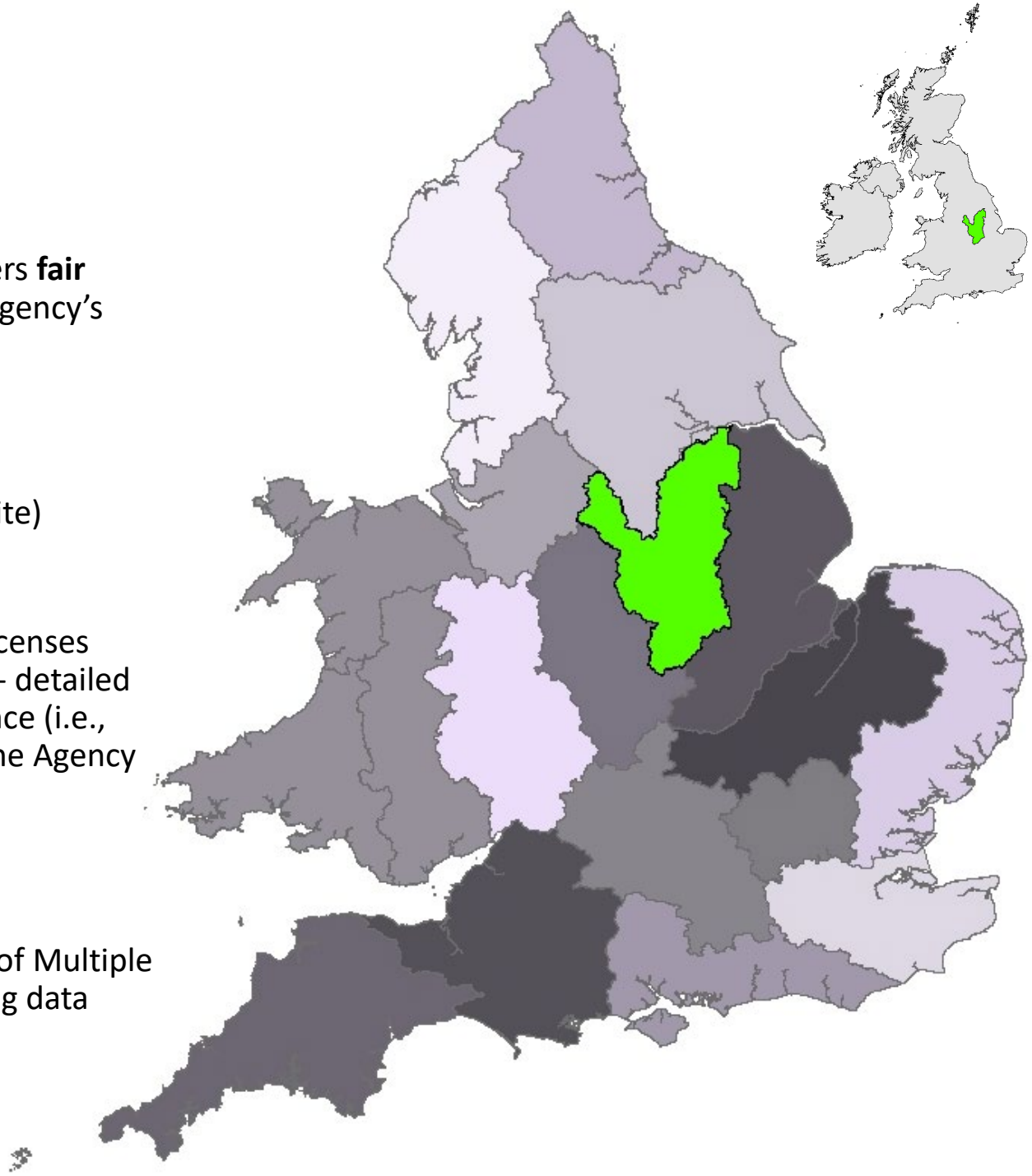
The **Trent Area** as defined by the Derbyshire, Nottinghamshire, and Leicestershire Environment Agency Water Management Area (opposite)

Scope of outcomes

The outcomes from these services are considered in the context of licenses provided and incidents reported (using data provided by the Agency - detailed later). *Note:* No attempt is made to gather additional primary evidence (i.e., through questionnaires or interviews) or to independently validate the Agency data.

Distributional outcomes

The social distribution of outcomes are explored by considering the intersection of the outcomes and social deprivation (using the Index of Multiple Deprivation) and the indicative resources spent on each activity (using data provided by the Agency).



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Equity and its relationship to fairness and justice

Part 2 - Equity and its relationship to fairness and justice

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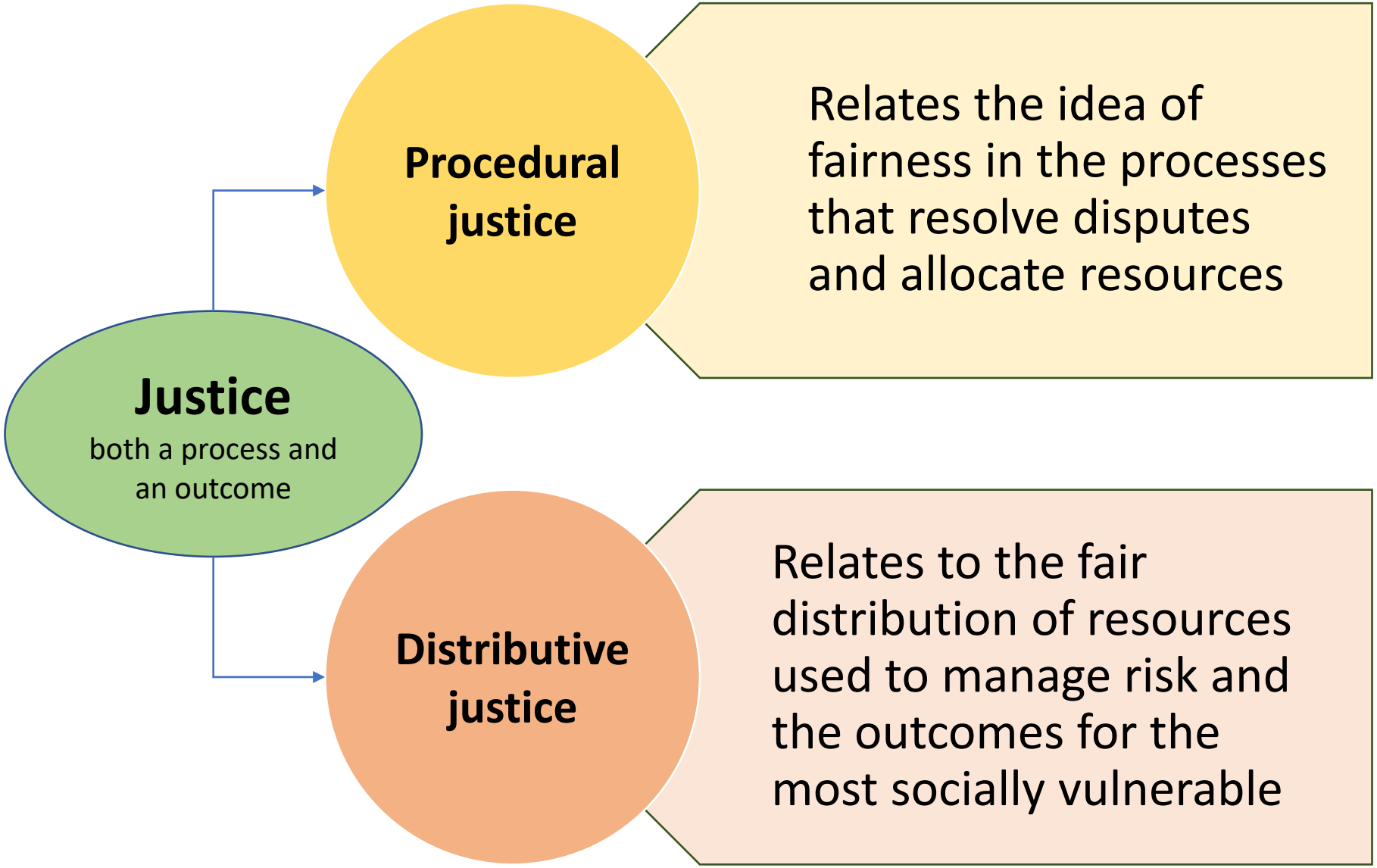
Equity is considered through the lens of fairness and justice requires consideration of ‘procedure’ and ‘distribution’ (see for example Sayers *et al.*, 2017)



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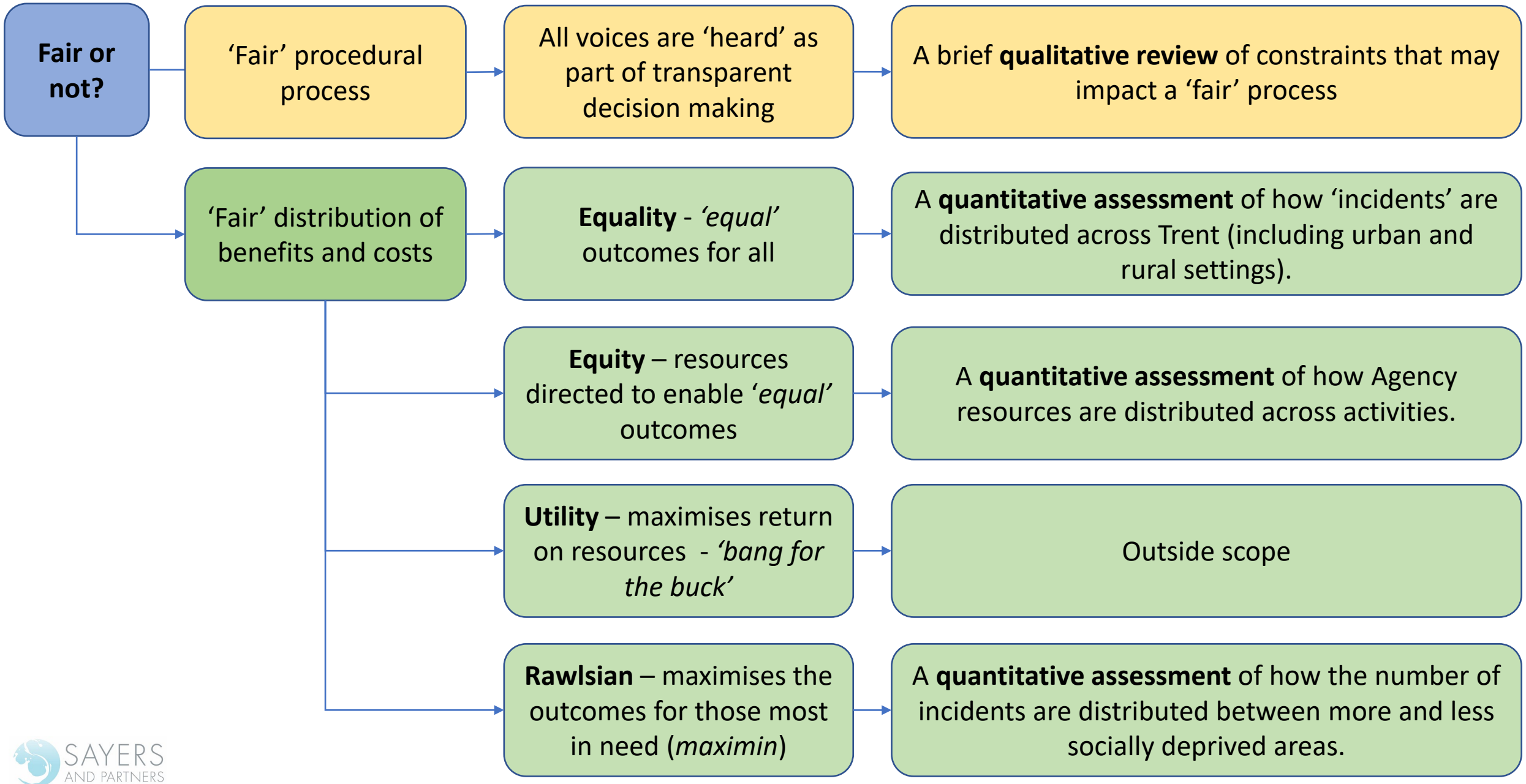
These aspects frame the investigation of equity within the project…



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A qualitative review of the influences that may impact a fair process

Part 3 – A qualitative review of constraints that may impact a ‘fair’ process

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Influences that may impact a fair process

History

The legacy distribution of sites (e.g., waste sites) influences current situation and present-day decision-making recognising that existing sites and licences may be difficult to alter (e.g., requiring complex new planning to develop new sites or significantly greater investment that simply maintaining the existing sites).

Geography

The geographical distribution of waste to be treated or the availability of resources (e.g., water for abstraction) will strongly influence where sites are located. For example, transport links, brownfield development opportunities and many other place-based factors may influence a decision to develop a factory (producing waste) at a particular location. Considerations of environmental equity may have (have had) limited influence.

Complaints

The distribution of complaints may reflect the propensity and/or capacity of certain demographics to become actively involved in such matters, thus biasing the data available.

Organisational bias

The possibility that a regulator consciously or unconsciously steers new development (such as waste sites or additional licences etc) away from those who might most strongly object.

A quantitative assessment of Regulatory Services

Sites, their performance, and incidents across Trent

Part 4 - A quantitative assessment of Regulatory Services: Sites, their performance, and incidents across Trent

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Overview of the framework

#1 Physical and social geography

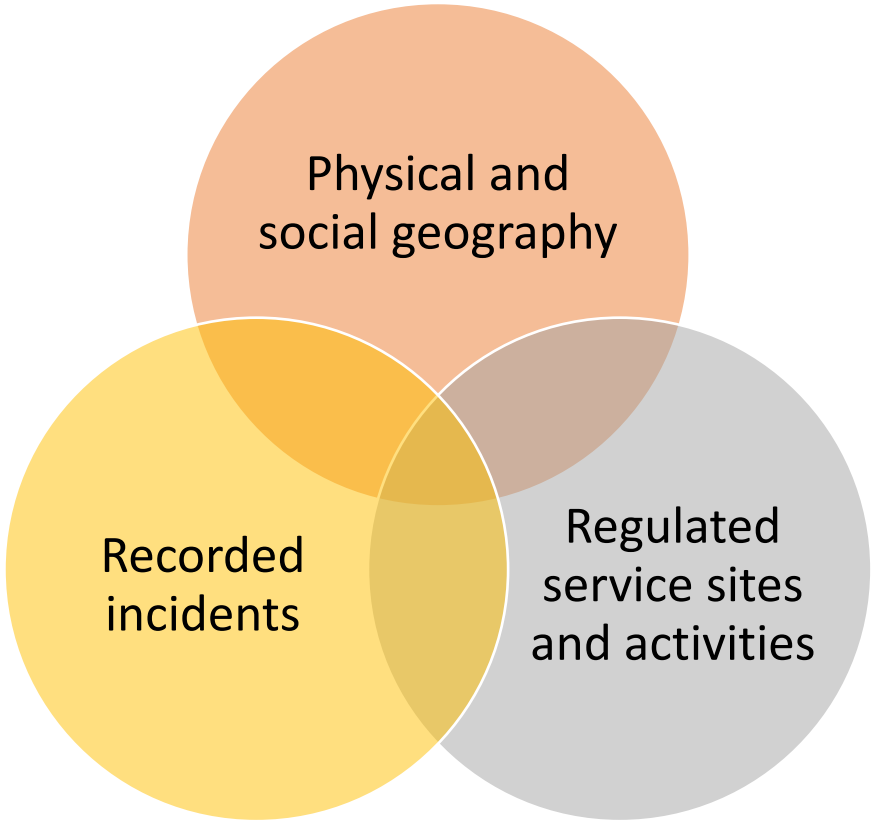
Not all places are the same. Two perspectives on 'place' are used here: urban and rural setting; greater or lesser social deprivation.

#2 Regulated service sites and activities

Regulated services include licencing sites and organisations to operate within the regulations and recording regulatory infractions and other incidents. Licensees typically approach the Environment Agency (rather than vice versa). The spatial distribution of many of the licenses' sites often reflects legacy infrastructure decisions (e.g., the location of a waste processing site). Existing sites and licences are considered to describe the Regulatory Service.

#3 Recorded Incidents

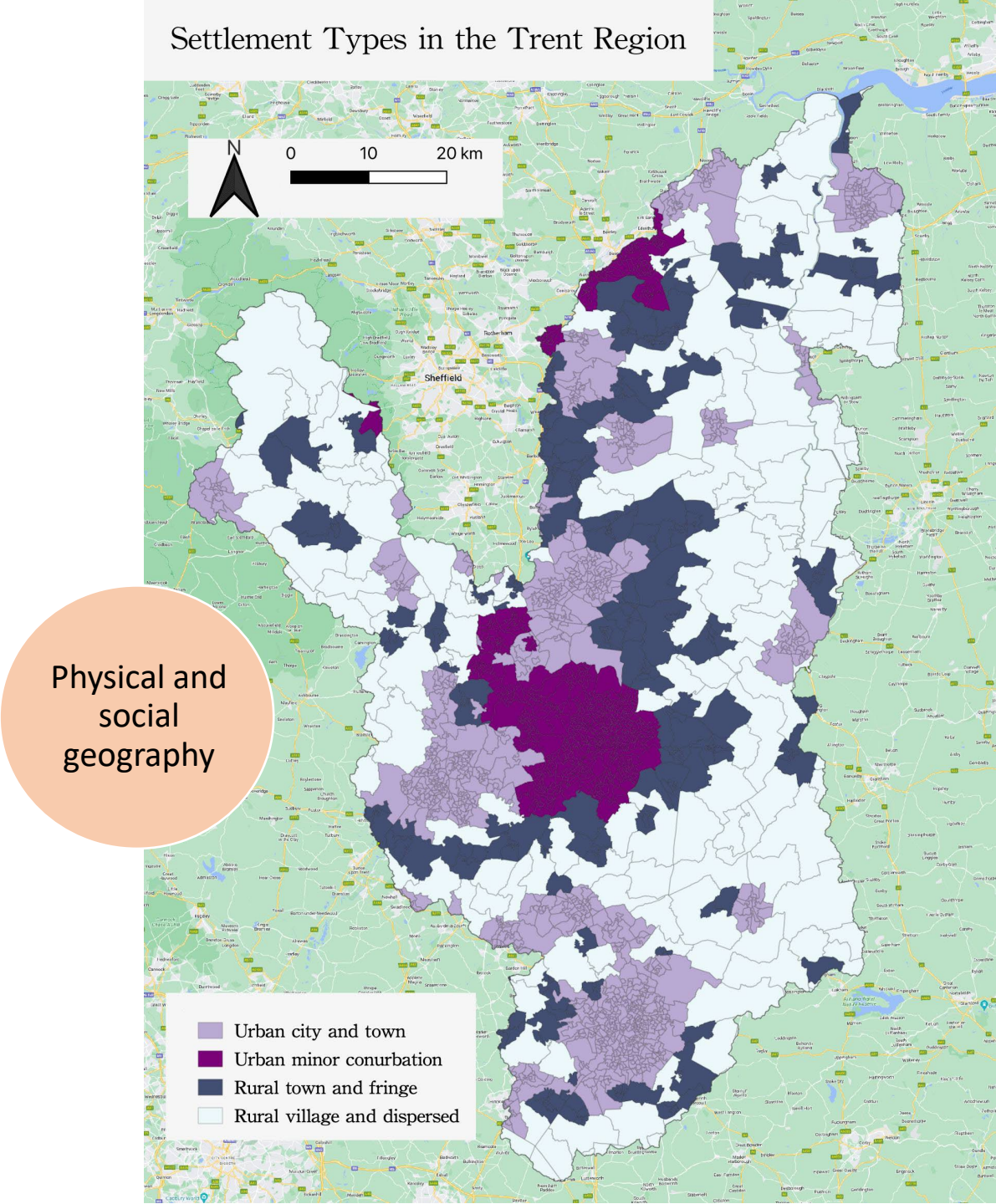
The Environment Agency records incidents that are reported to them. It is recognised that although an incident occurs at a given location that incident may be influenced by a broader social context. The relationship between social geography and incidents is explored through three different proximity lens: an incident within the Lower Super Output Area, within 1km, or within a 5km radius.



Physical and social geography - Spatial

Rural and Urban Settings – defined using multiple criteria and assigned to each Lower Super Output Areas (LSOA) defined by the Census 2011 (~1600 people in each LSOA).

Usage here - The settlement types are defined across England by the ONS using a combination of metrics (as set out by Bibby and Brindley, 2013). The settlement types cover eight categories of urban and rural settings, four of which are present in the Trent Region. This data is used to grouped the results presented later by rural and urban settings. Given each LSOA contains the same number of people (approximately) this means they vary in size; with rural LSOAs larger than their urban counterpart (*opposite*).



Physical and social geography

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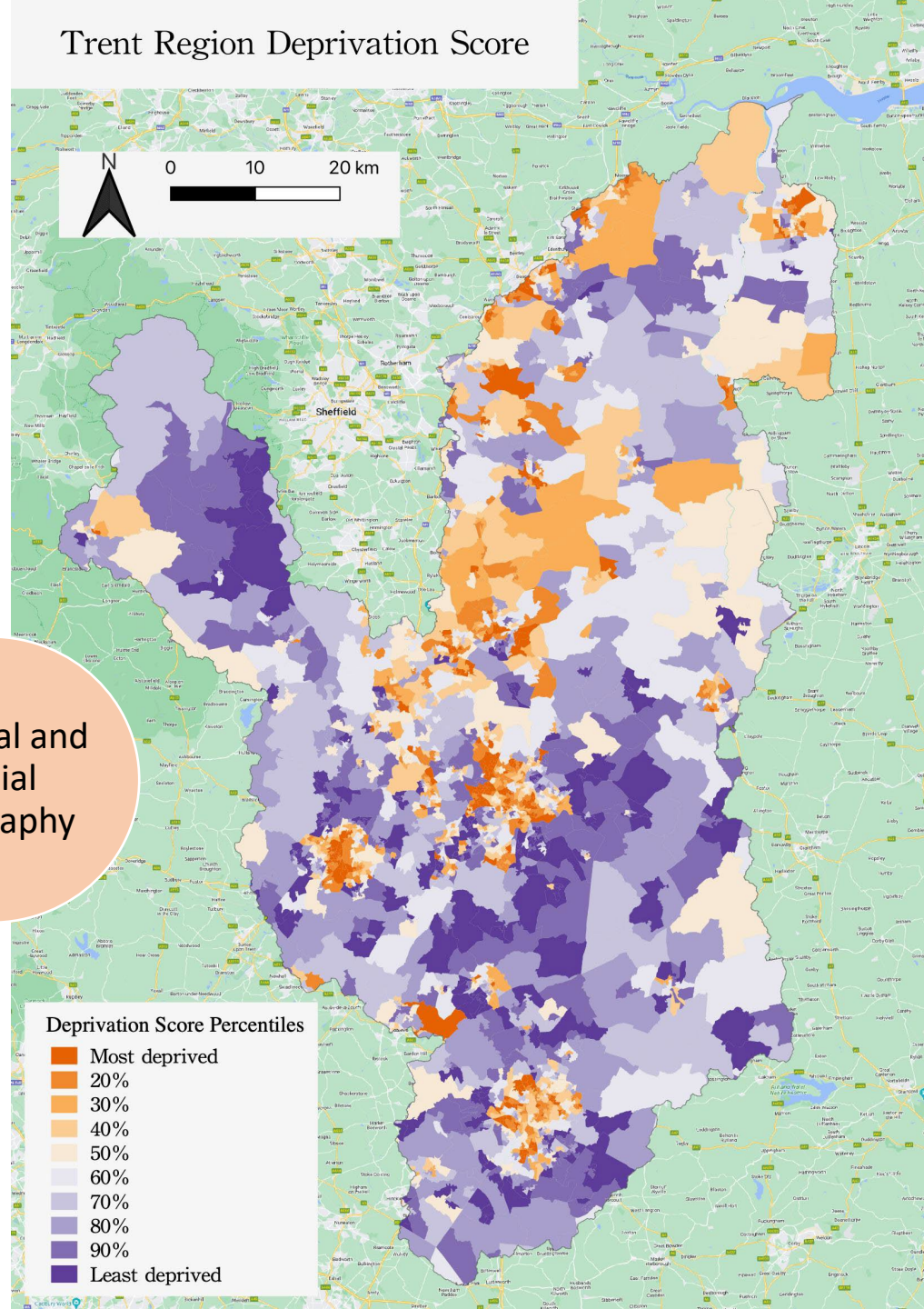
Physical and social geography - Spatial

Rural and Urban Settings

Index of Multiple Deprivation (IMD) – the IMD is a measure of relative deprivation at an LSOA scale. It is a combined measure of deprivation based on a total of 37 separate indicators that are grouped into seven domains, each of which reflects a different aspect of deprivation experienced by individuals living in an area (as detailed by the ONS here).

Usage here - For the analysis the distribution of the IMD is normalised using the distribution in Trent. This enables the LSOAs within the Trent Region to be ranked by deprivation, from the most to least deprived. This ranking is used in the distributional analysis presented in the following slide.

Physical and social geography



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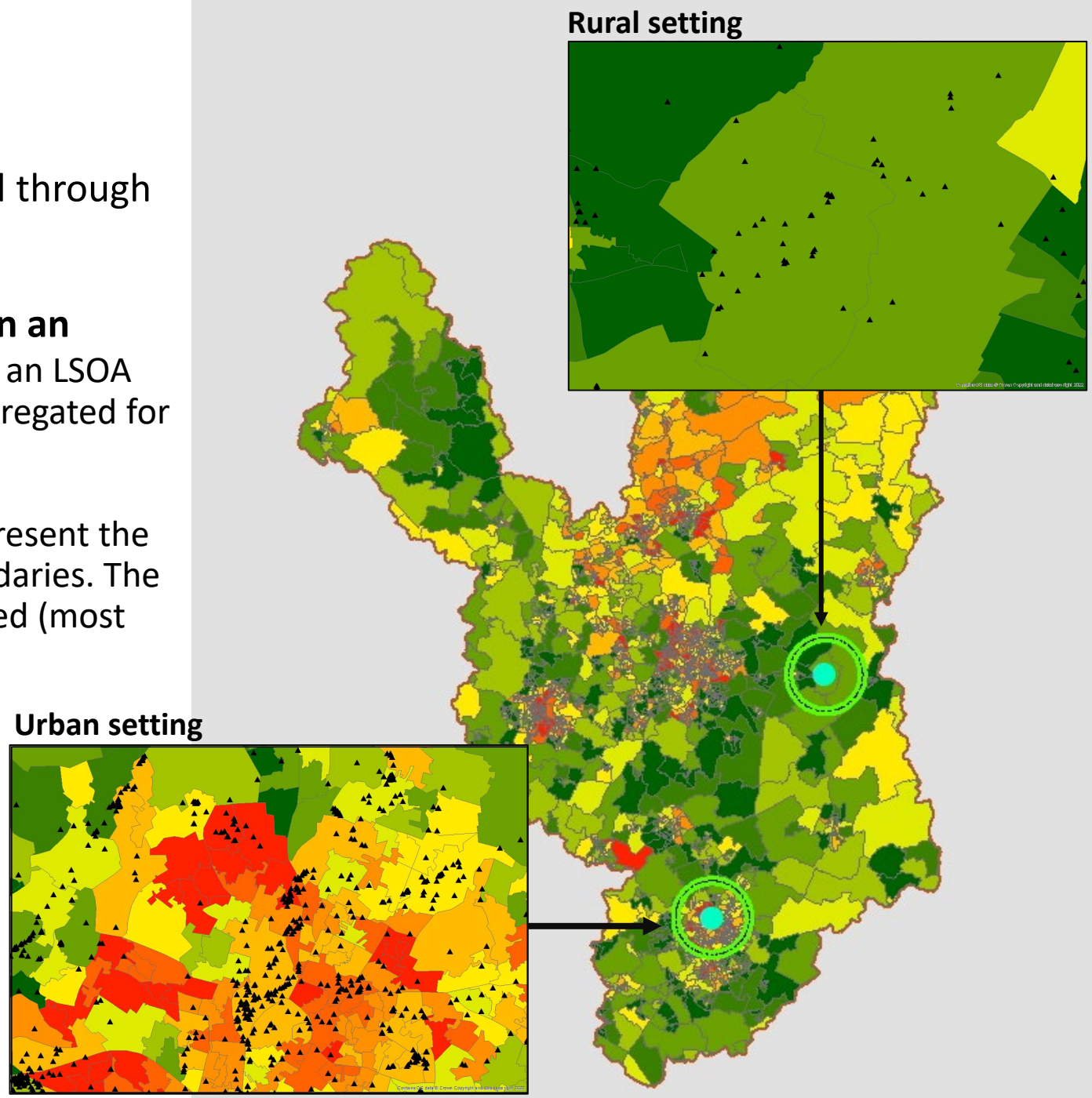
Method of spatial aggregation

The recorded sites and incidents are considered through three lenses:

#1 The number of records falling directly within an LSOA. In this case the records falling directly within an LSOA are simply summed and the number of incidents aggregated for rural and urban settings, or by IMD decile.

Opposite: By way of example, the black triangles represent the location of CAT3 incidents overlaying the LSOA boundaries. The LSOA are shaded green (least deprived) through to red (most deprived) by decile.



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Method of spatial aggregation

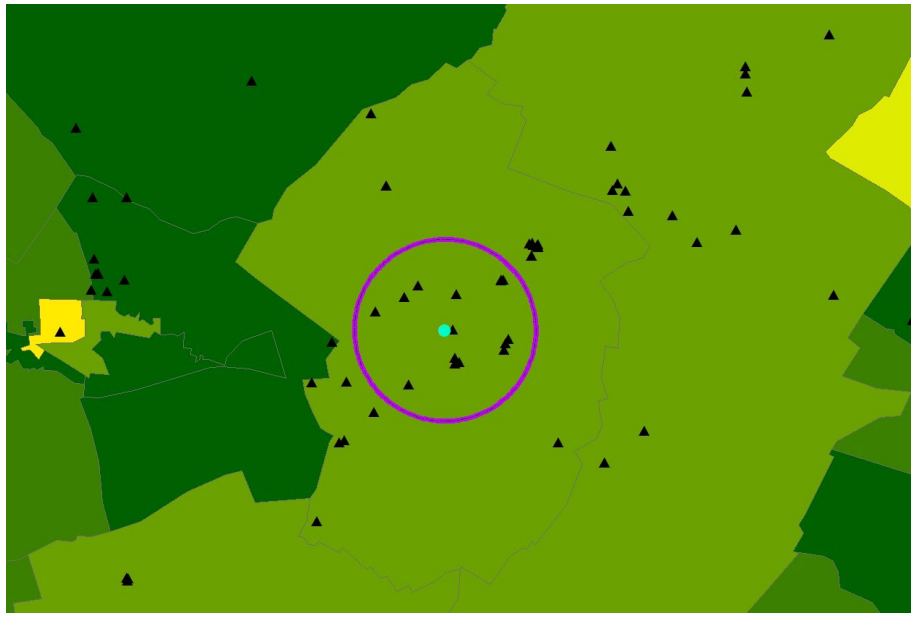
The recorded sites and incidents are considered through three lenses:

#1 **The number of records falling directly within an LSOA.**

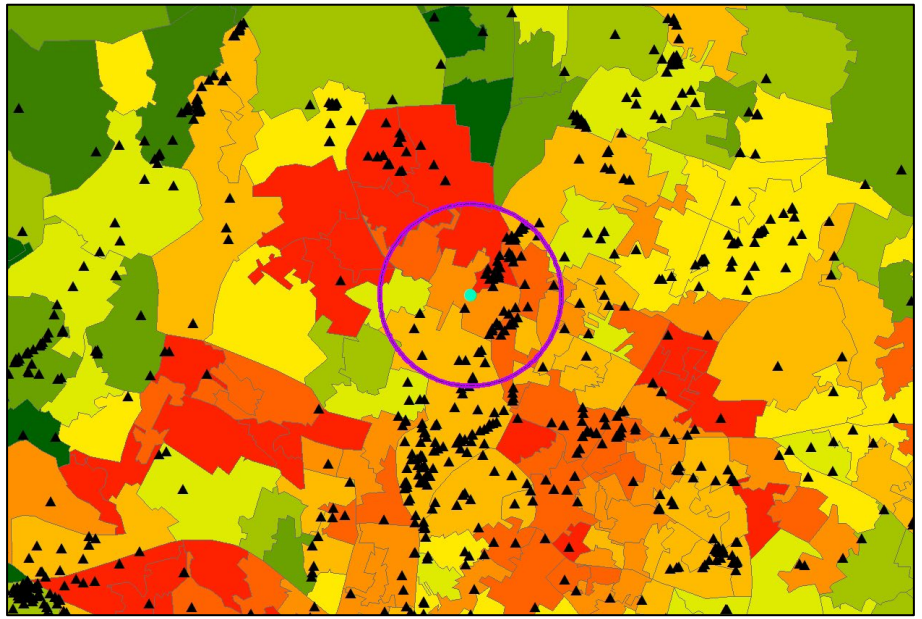
#2 The number of records falling within 1km of an LSOA. Not only those living 'within' the same LSOA as the recorded incident are impacted by that incident. Those in nearby neighbourhoods (LSOAs) are also likely to be impacted. To capture this anyone living within 1km of an LSOA with a recorded incident is counted as impacted by that incident.

Opposite: The 1km radius is taken from the LSOA centroid. In rural areas with larger LSOAs this may be contained within a single LSOA, but in urban areas with smaller LSOAs the 1km radius will cover many LSOAs. This tends to highlight the importance of incidents in urban areas, where population densities are higher and more people affected by an incident. The majority (99%) of the **most** deprived neighbourhoods (10% most deprived by IMD) are located in urban areas. Whereas the majority (75%) of the **least** deprived neighbourhoods (10% least deprived by IMD) are located in rural settings.

Rural setting: Fewer people live within 1km of an incident



Urban setting: More people live within 1km of an incident



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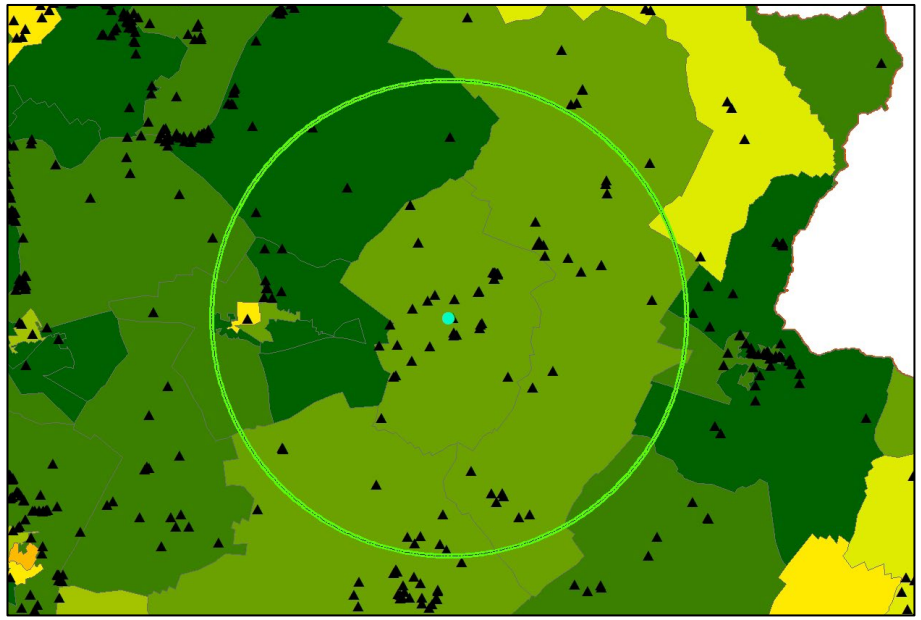
Method of spatial aggregation

The recorded sites and incidents are considered through three lenses:

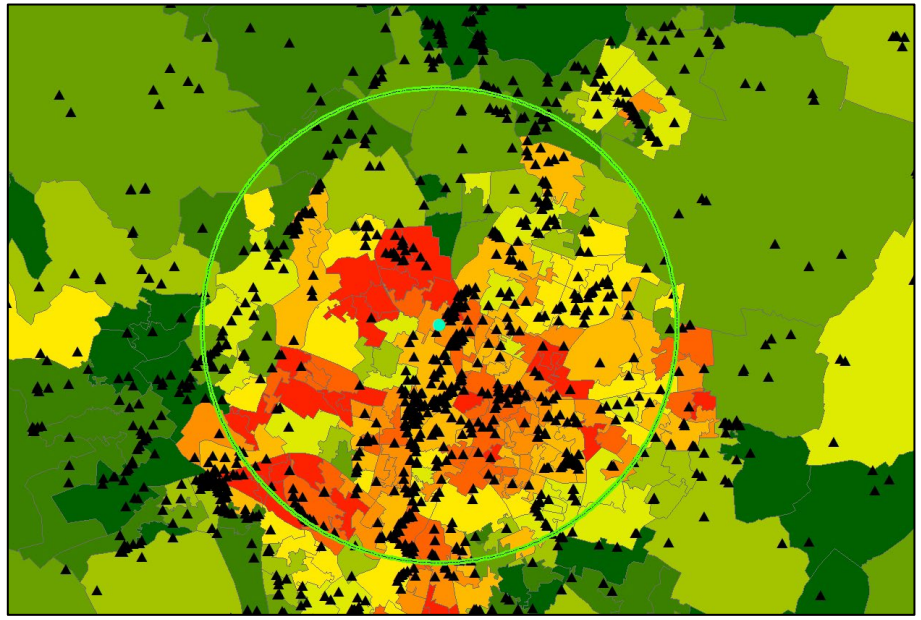
#1 **The number of records falling directly within an LSOA.**
#2 **The number of records falling within 1km of an LSOA.**
#3 The number of records falling within 5km of an LSOA

Opposite: The analysis is repeated assuming a larger radius of influence. Using a 5km radius tends to capture a small number rural LSOAs. In urban areas, many LSOAs are assumed to be impacted by a single incident.

Rural setting: Fewer people live within 1km of an incident



Urban setting: More people live within 1km of an incident



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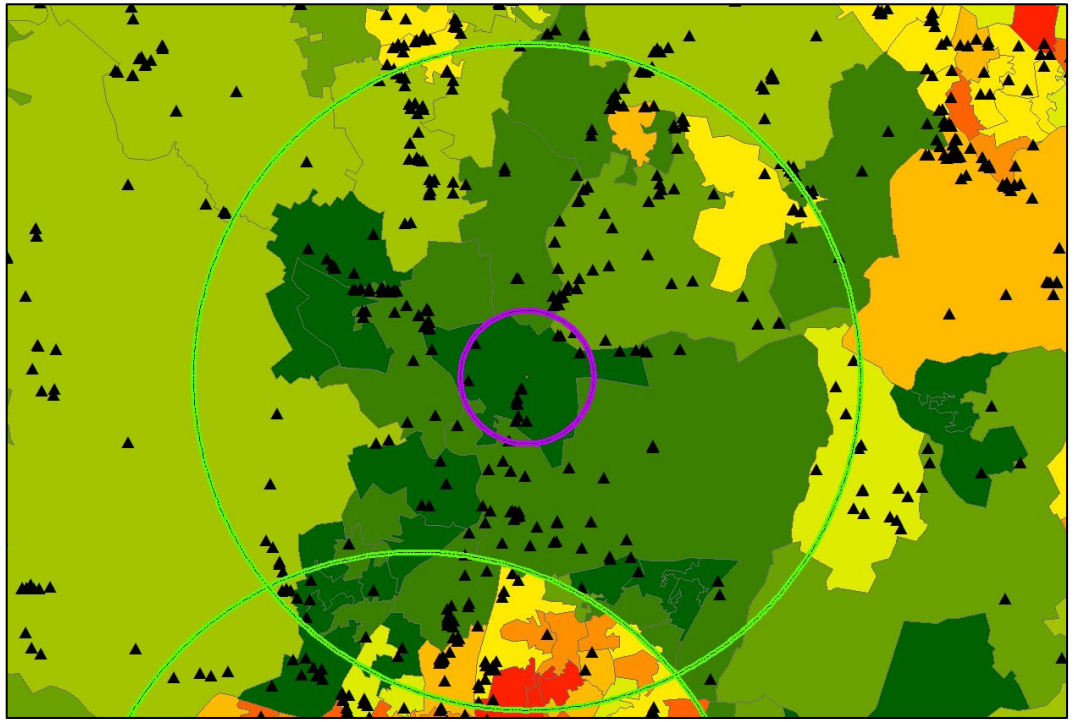
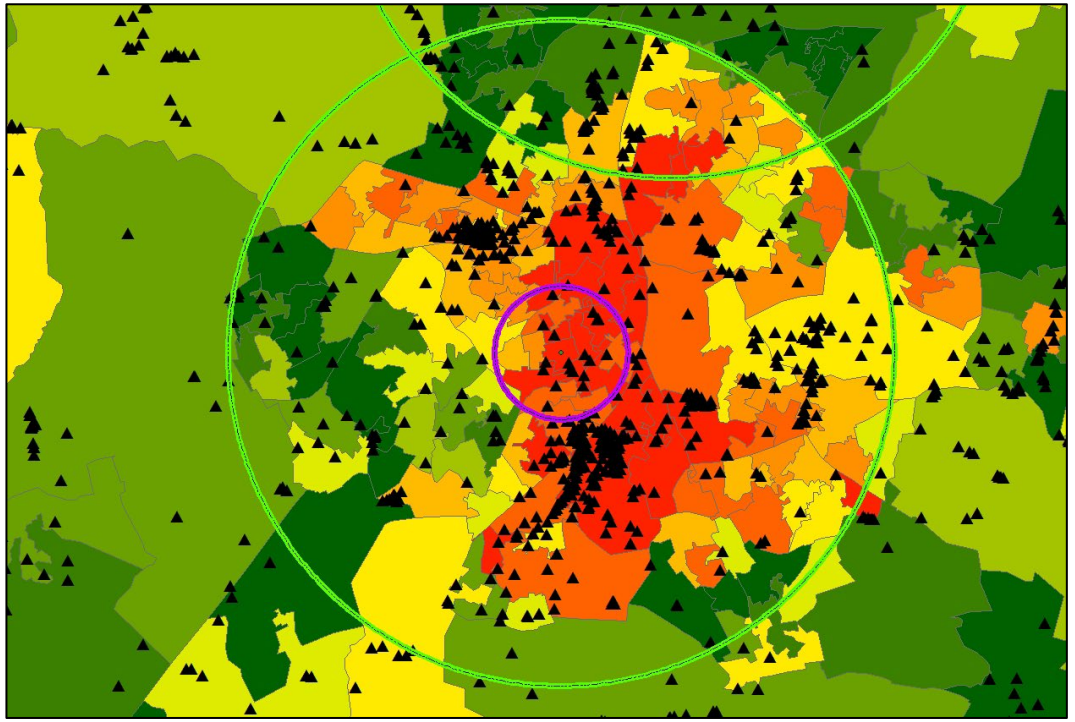
Method of spatial aggregation

A summary illustration: The difference in the number of LSOAs assumed impacted varies depending on the assumption of directly within, within the 1km, and within 5km buffers. The 1km buffer is primarily used as the indicative ‘zone of influence’ in the following slides (unless stated otherwise).



Rural setting

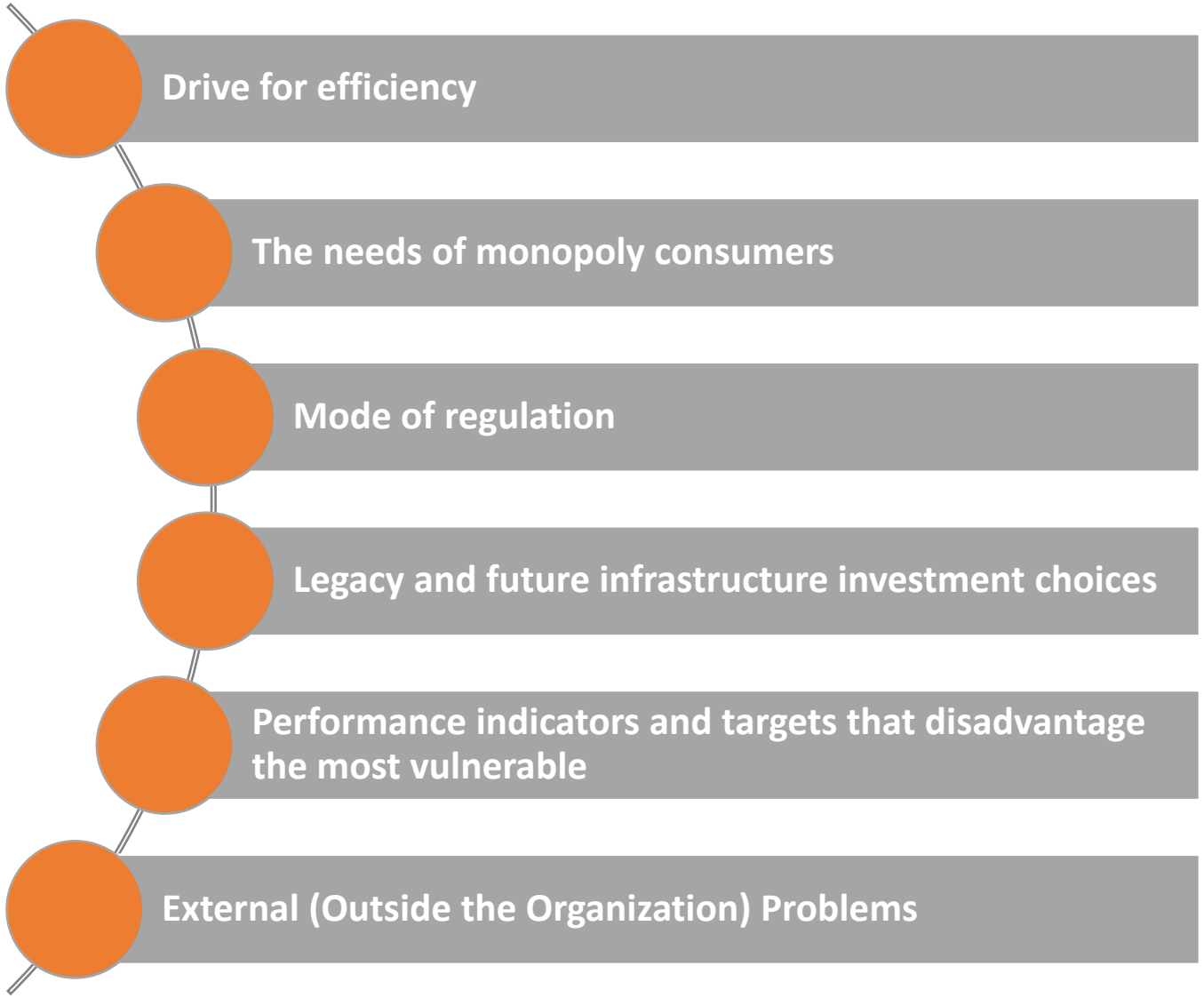


Urban setting

Regulated service sites and activities - Influences

Service delivery is influence by multiple pressures.

Some are difficult to modified through day-to-day activities (mode of regulation, existing infrastructure, *etc.*), and others respond to internal processes and priorities (drive for efficiency *etc.*).



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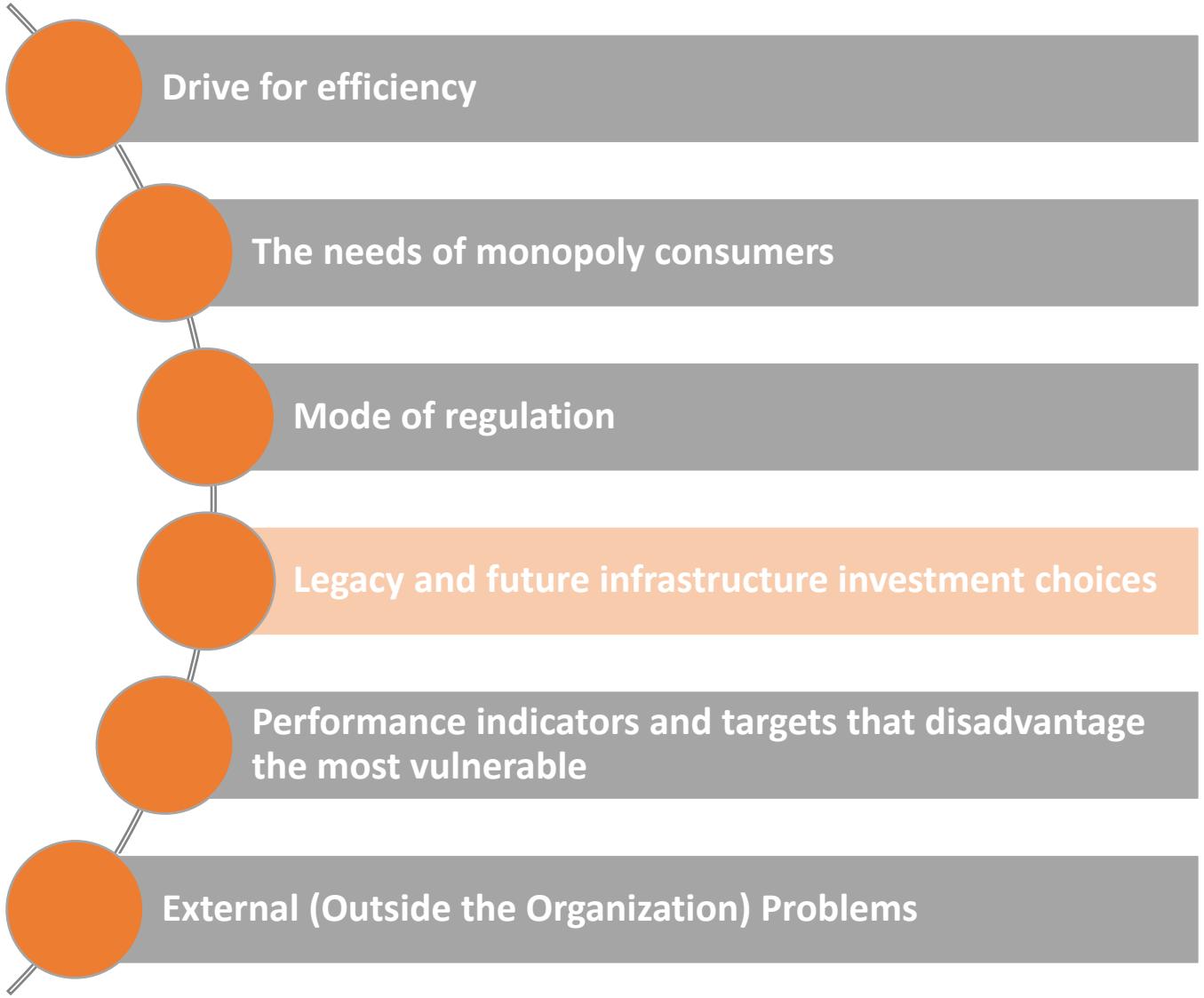
Regulated service sites and activities - Influences

Service delivery is influence by multiple pressures.

Some are difficult to modified through day-to-day activities (mode of regulation, existing infrastructure, *etc.*), and others respond to internal processes and priorities (drive for efficiency *etc.*).

The spatial analysis presented here implicitly reflects legacy decisions – the location of existing waste sites and the licences have been provided.



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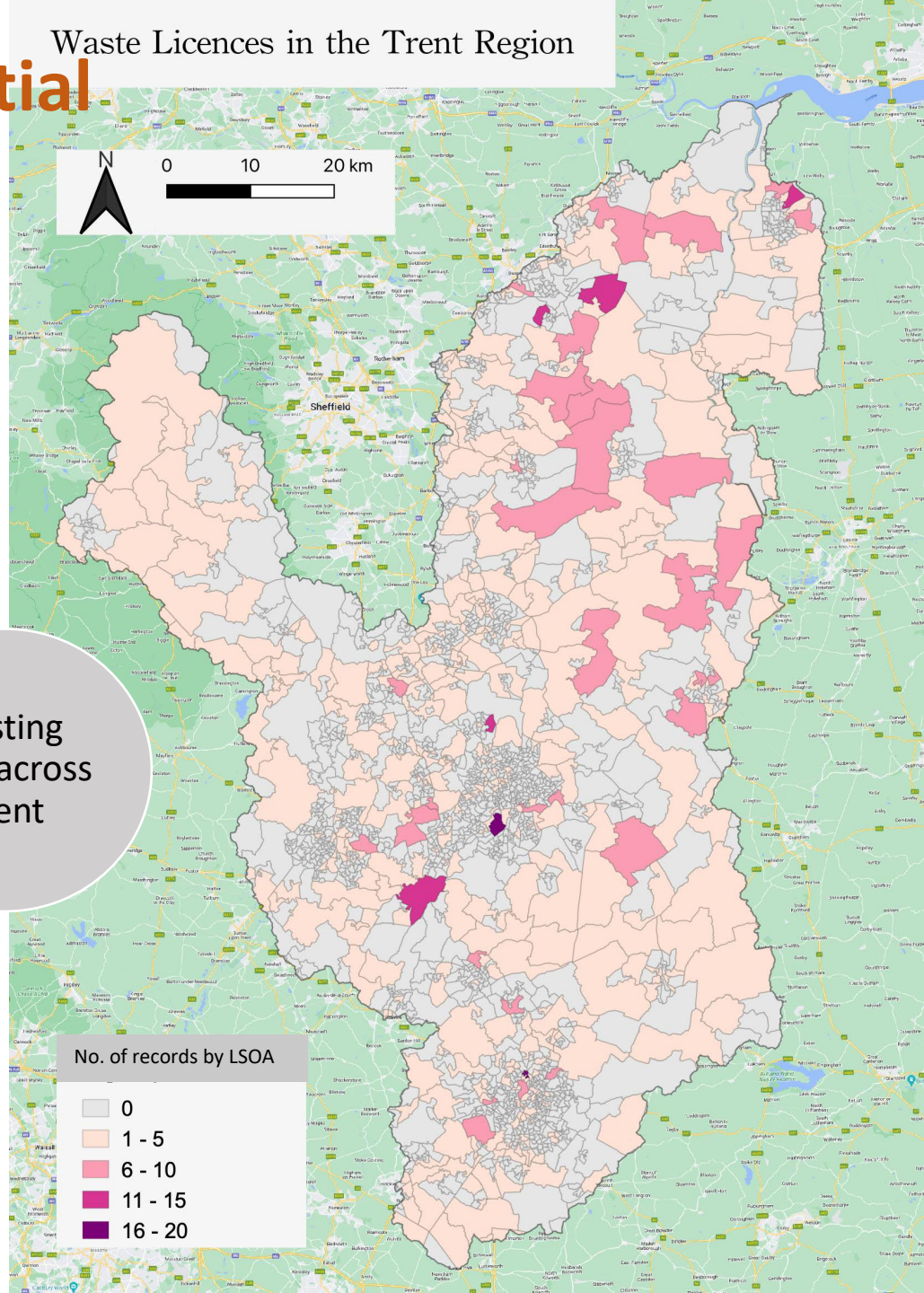
Regulated service sites and activities - Spatial

Sites with a waste licence (to process or discharge waste)

Data used: A spatial join of *Trent_LSOA.shp* with *Waste Licences Regis.shp* provided by Environment Agency (August 2022).



Existing sites across Trent

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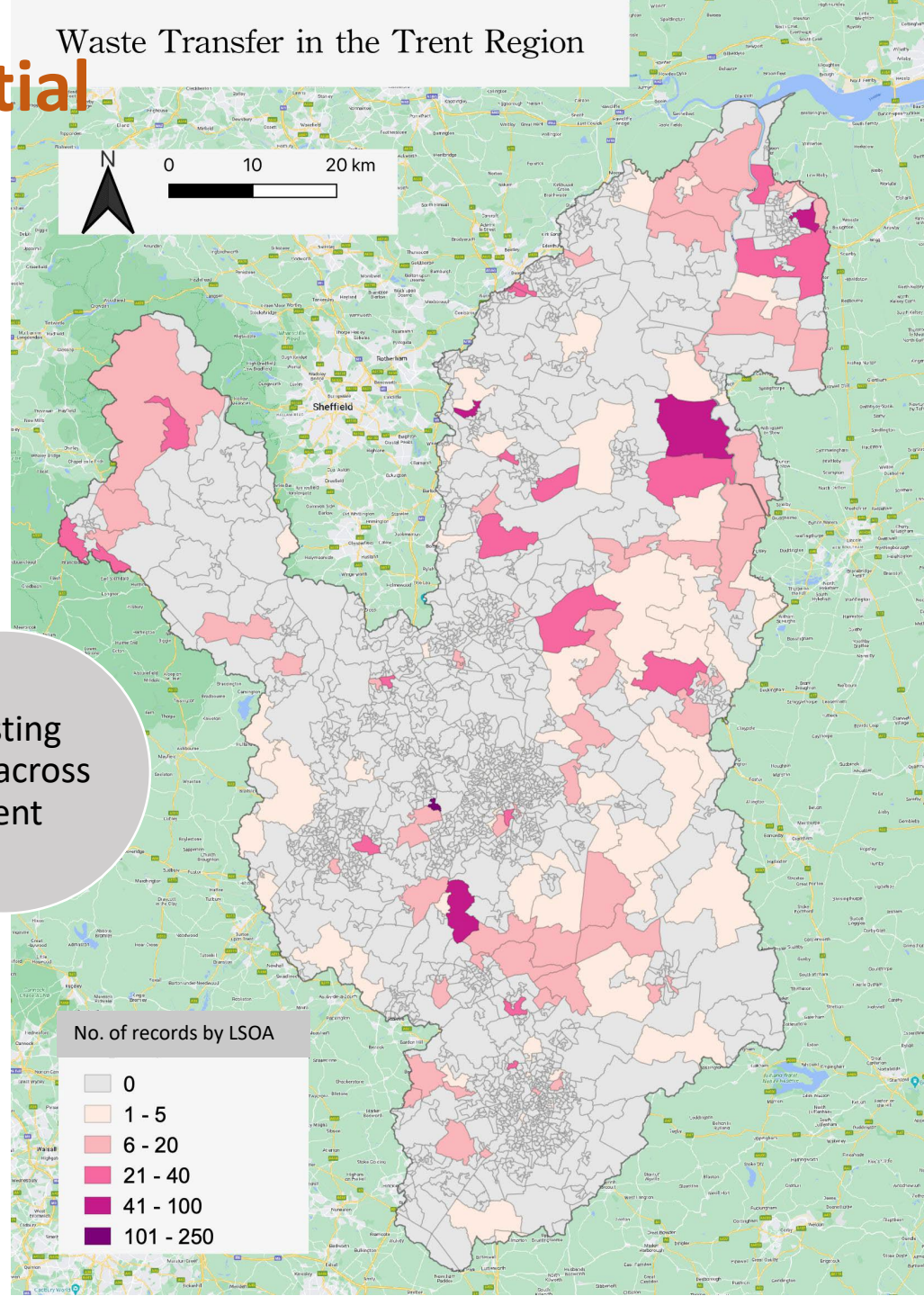
Regulated service sites and activities - Spatial

Sites with a waste licence (to process or discharge waste)
Sites with a waste transfer licence (to handle and/or transport waste)

Data used: A spatial join of *Trent_LSOA.shp* with *Waste Transfer.shp* provided by Environment Agency (August 2022).



Existing sites across Trent

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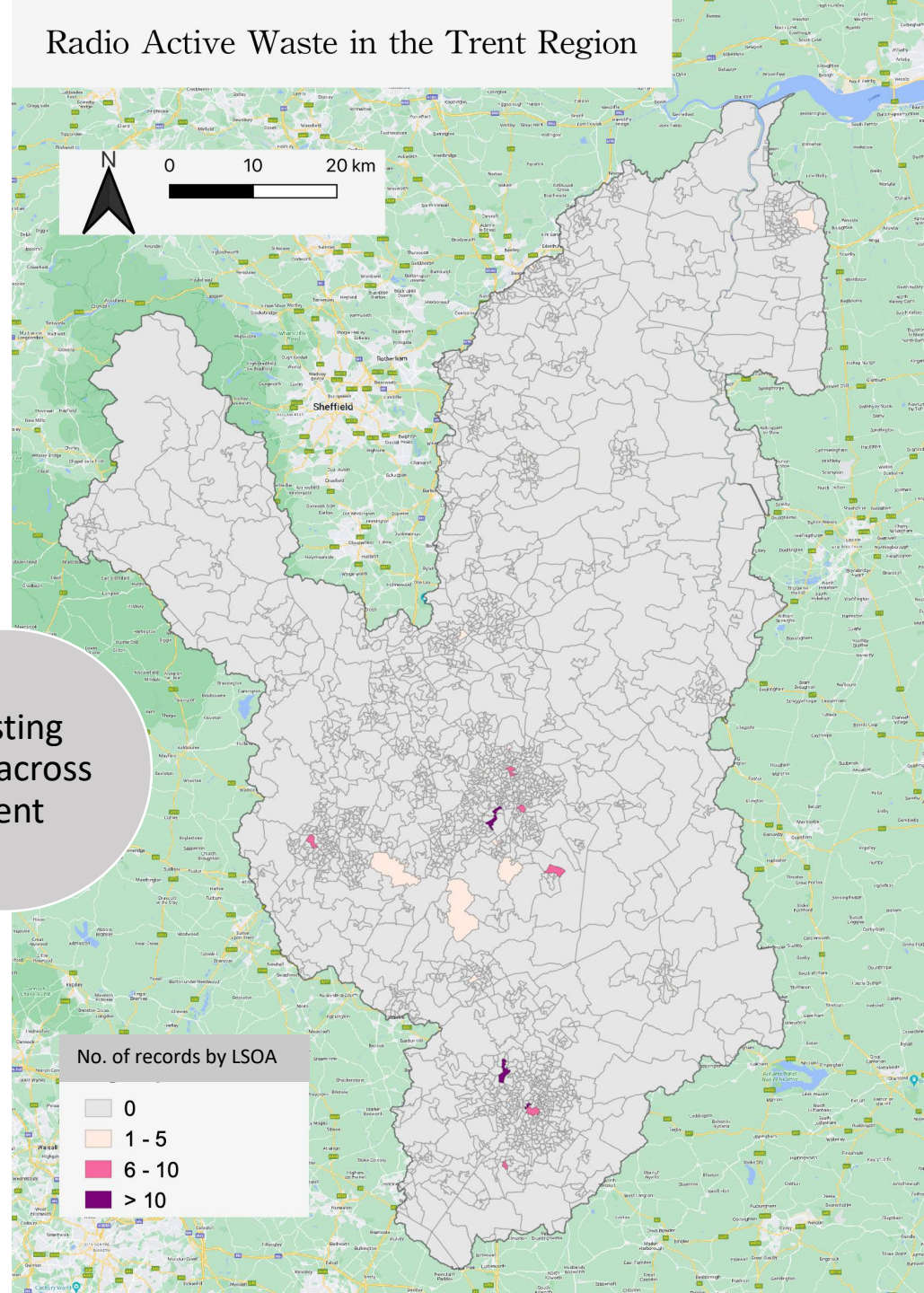
Quantified assessment

Regulated service sites and activities - Spatial

- Waste licences (sites able to process or discharge waste)
- Waste transfer licences (sites able to handle and/or transport waste)
- **Radioactive Waste** (sites able to handle to transport waste)

Data used: A spatial join of *Trent_LSOA.shp* with *Radio_Active_Wastes.shp* provided by Environment Agency (August 2022).



Existing sites across Trent

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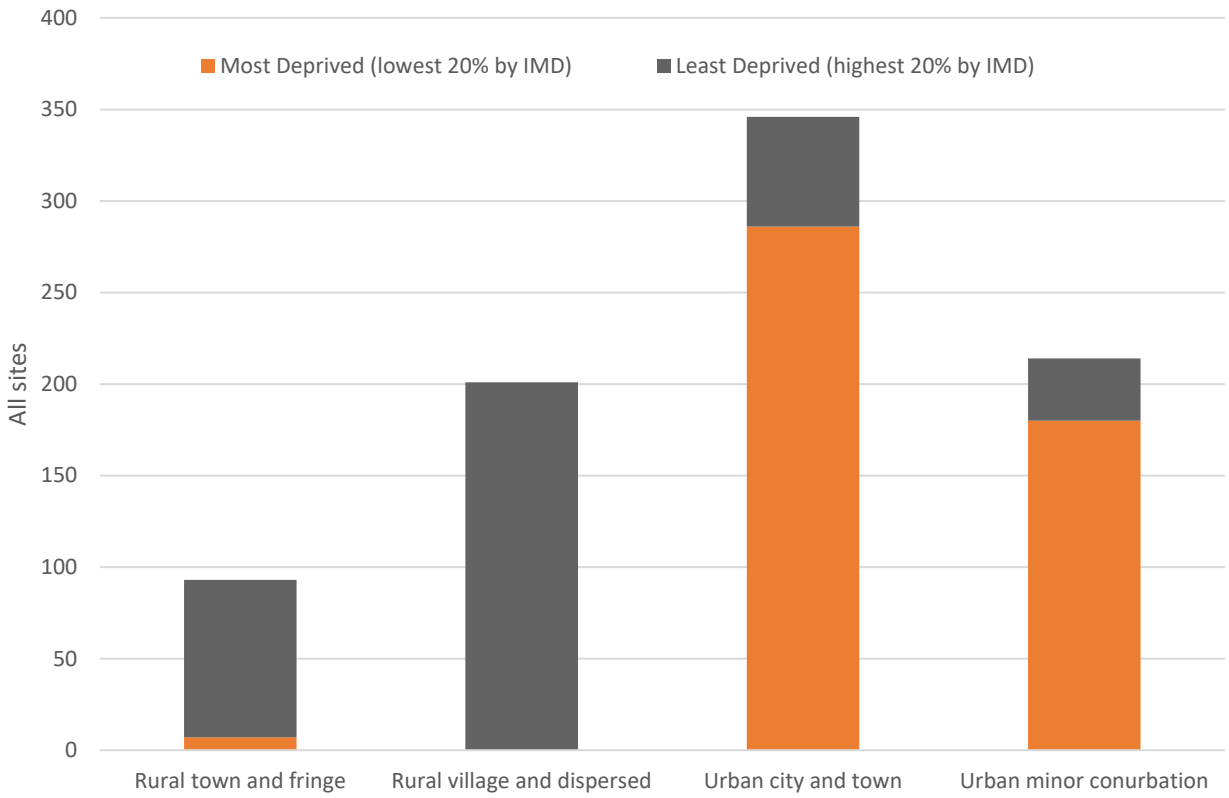
Regulated service sites and activities – Distributional insights

By Settlement Type: All sites and licences

The existing licenced sites and activities* are predominately located in urban deprived neighbourhoods.

The number of licenced sites and activities are biased towards urban areas (60% of all sites). Combined with the concentration of the most deprived neighbourhoods in urban areas across Trent, a person living in the most deprived neighbourhoods (lowest 20% by IMD rank) is 25% more likely to share that neighbourhood with a regulated activity (either a site or licensee) compared to those living in the least deprived neighbourhoods.



*A licenced site or activity refers to: Radioactive waste sites and licences, waste transfer sties and licences, and waste licences

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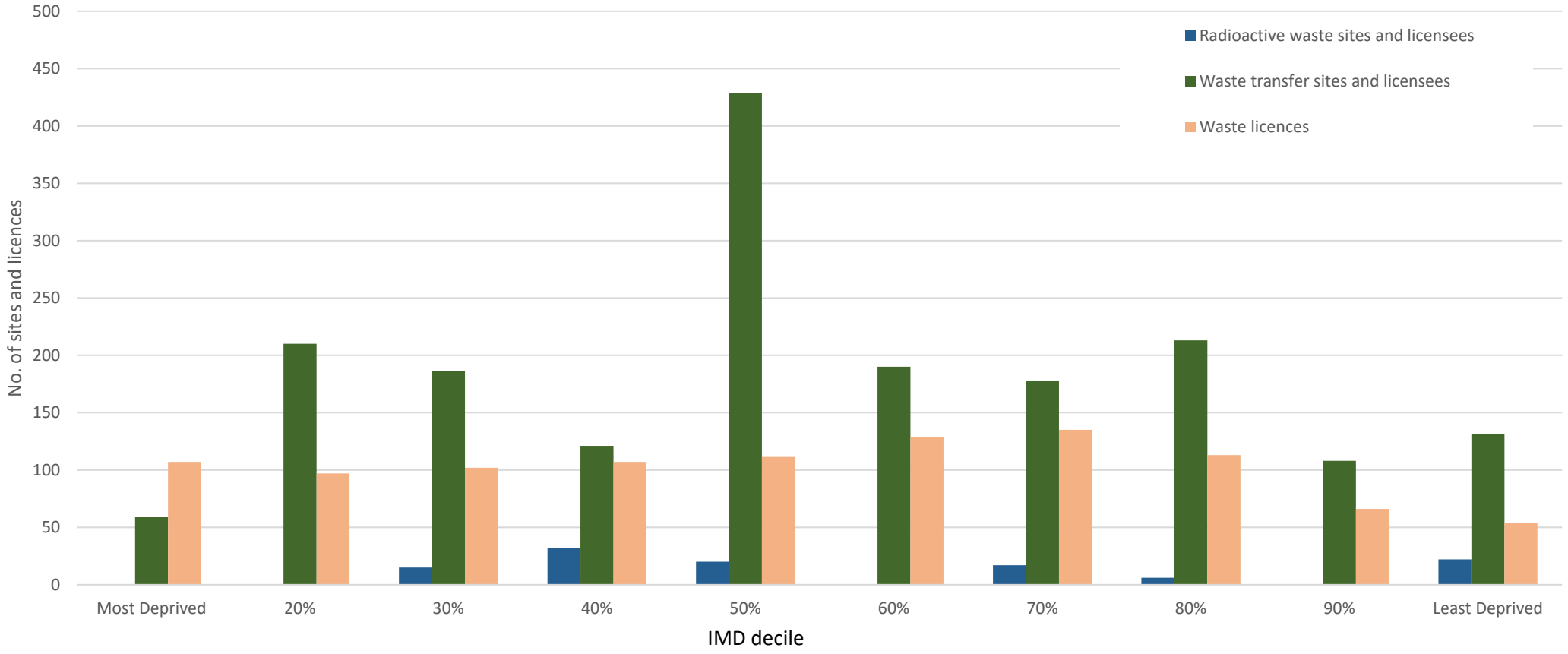
Regulated service sites and activities – Distributional insights

By social deprivation: All sites and licences

The number of existing licenced sites and activities* **directly within** neighbourhoods are shown below for each IMD deciles (rescaled for Trent). For example, those living within the 5th decile are the most likely to share their neighbourhood with a regulated site or licence.

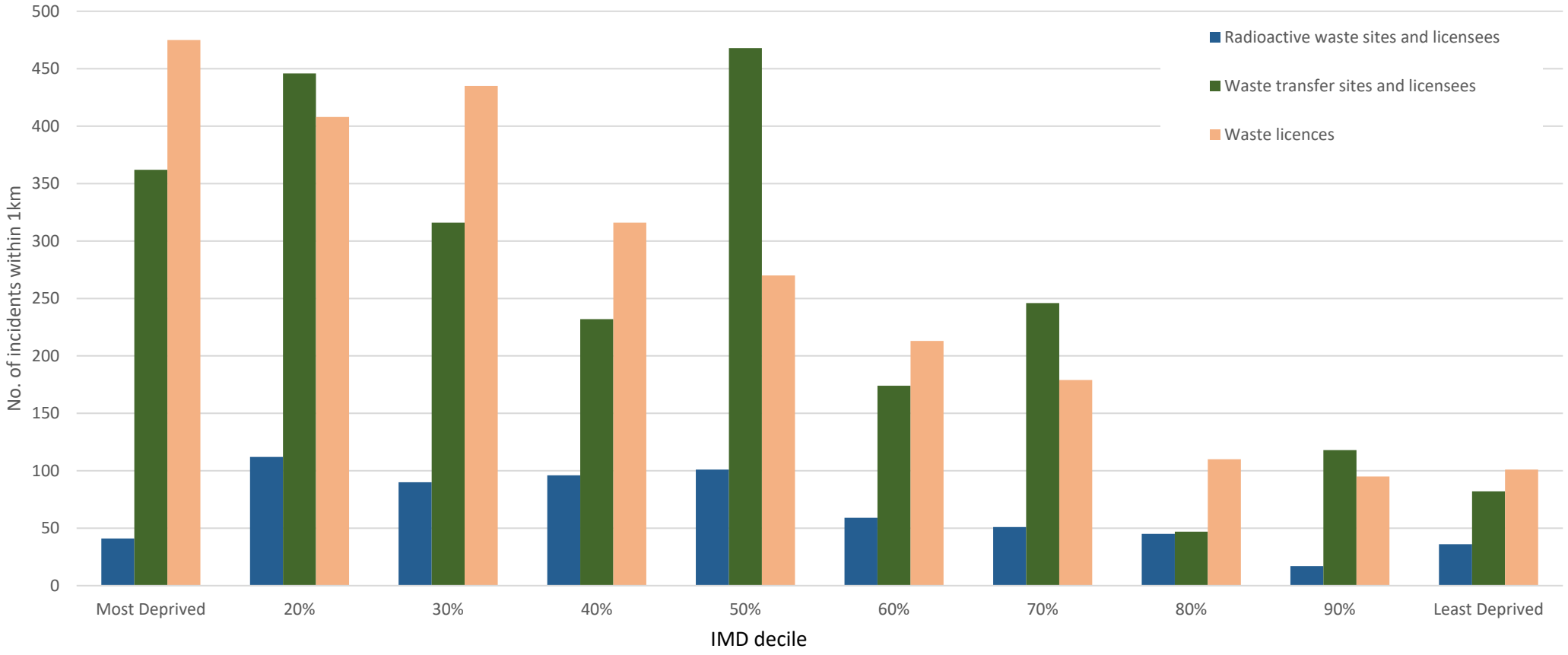


*A licenced site or activity refers to: Radioactive waste sites and licences, waste transfer sties and licences, and waste licences

Regulated service sites and activities – Distributional insights

By social deprivation: All sites and licences

When all licences sites and activities **within 1km** of a neighbourhood are considered, a bias towards the more deprived neighbourhoods emerges (as below)**



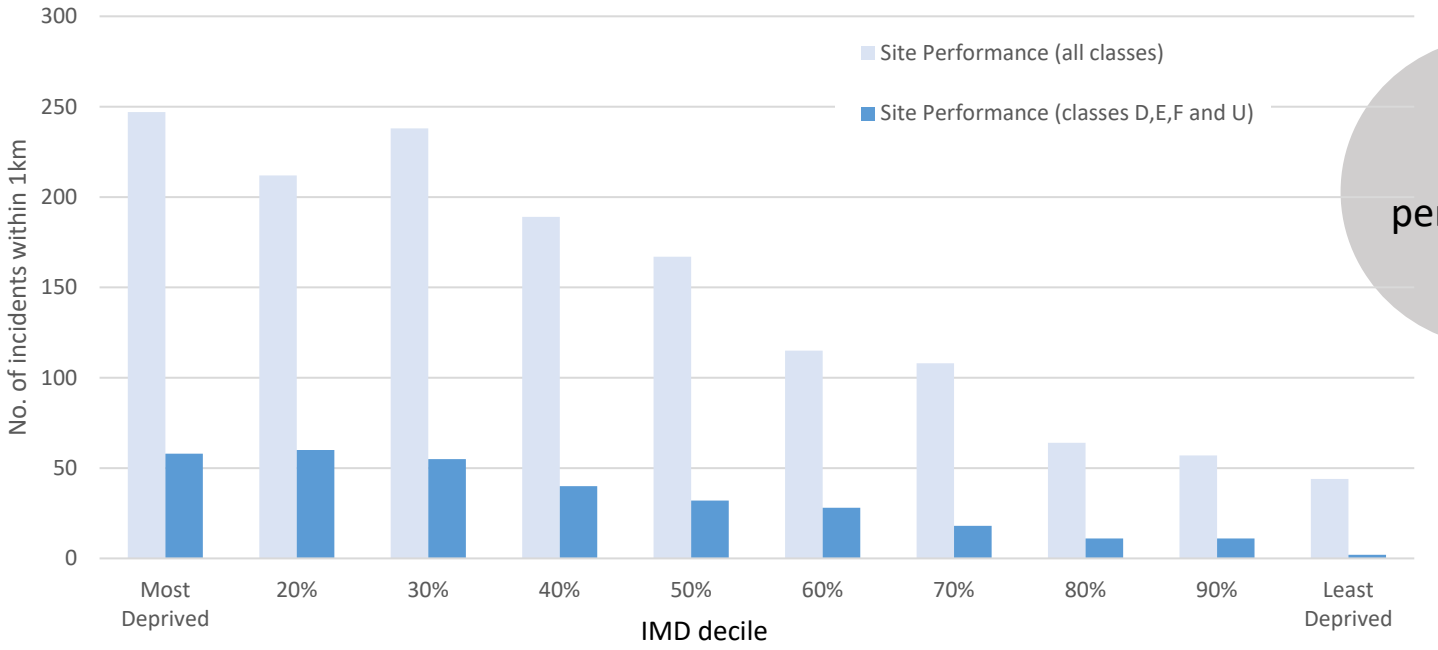
*A licenced site or activity refers to: Radioactive waste sites and licences, waste transfer sties and licences, and waste licences

** The number of sites increases as many are associated with multiple different neighbourhoods (although within 1km of each)

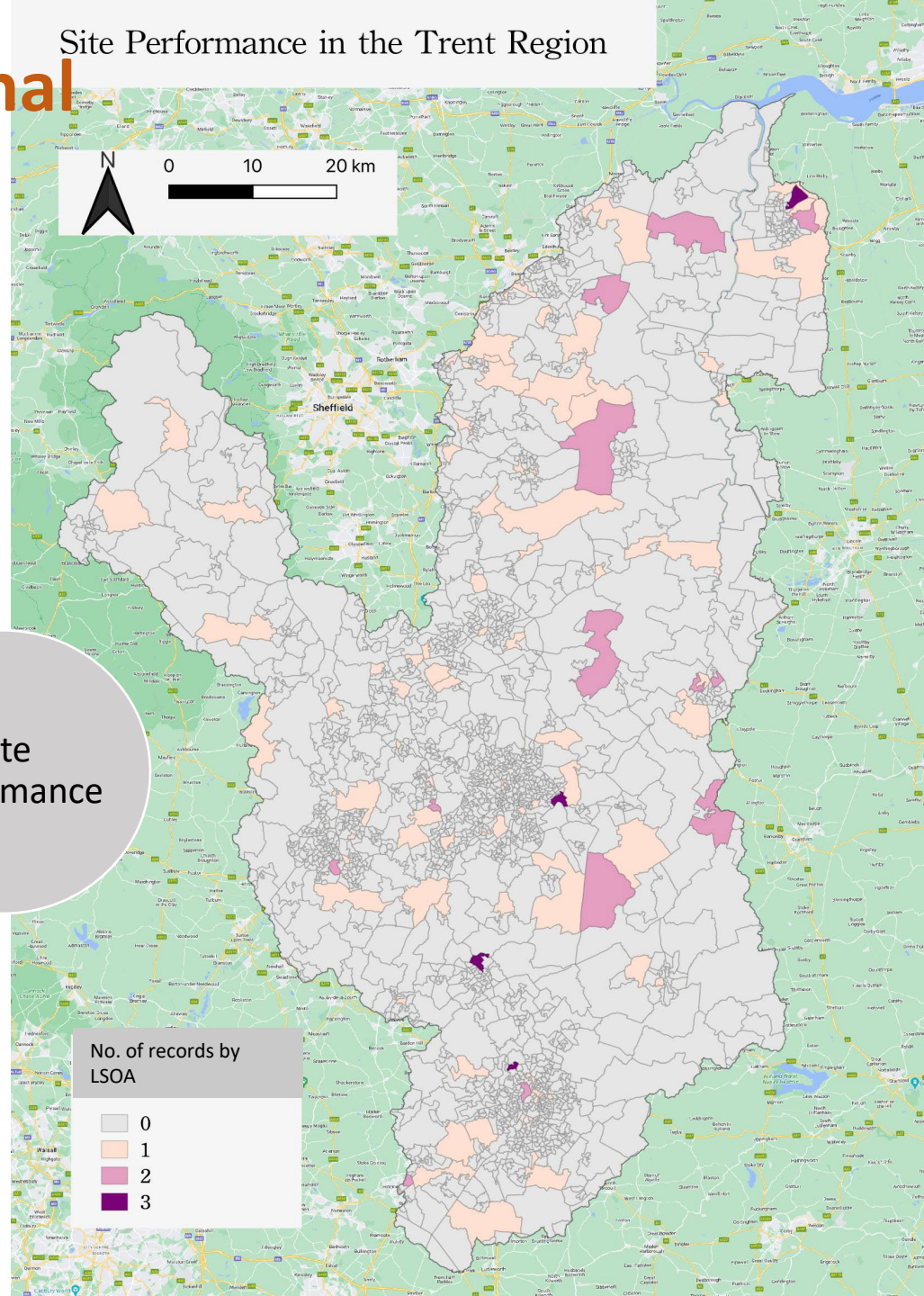
Site performance – Spatial and distributional

Site Performance

Sites performance is measured using multiple classes (from A to F). An **'infraction'** is defined here as a site performance of D,E,F – the three worst performing categories - or U (unclassified). Locations shown opposite. As shown below the most deprived neighbourhoods record more **infractions.**



Site performance

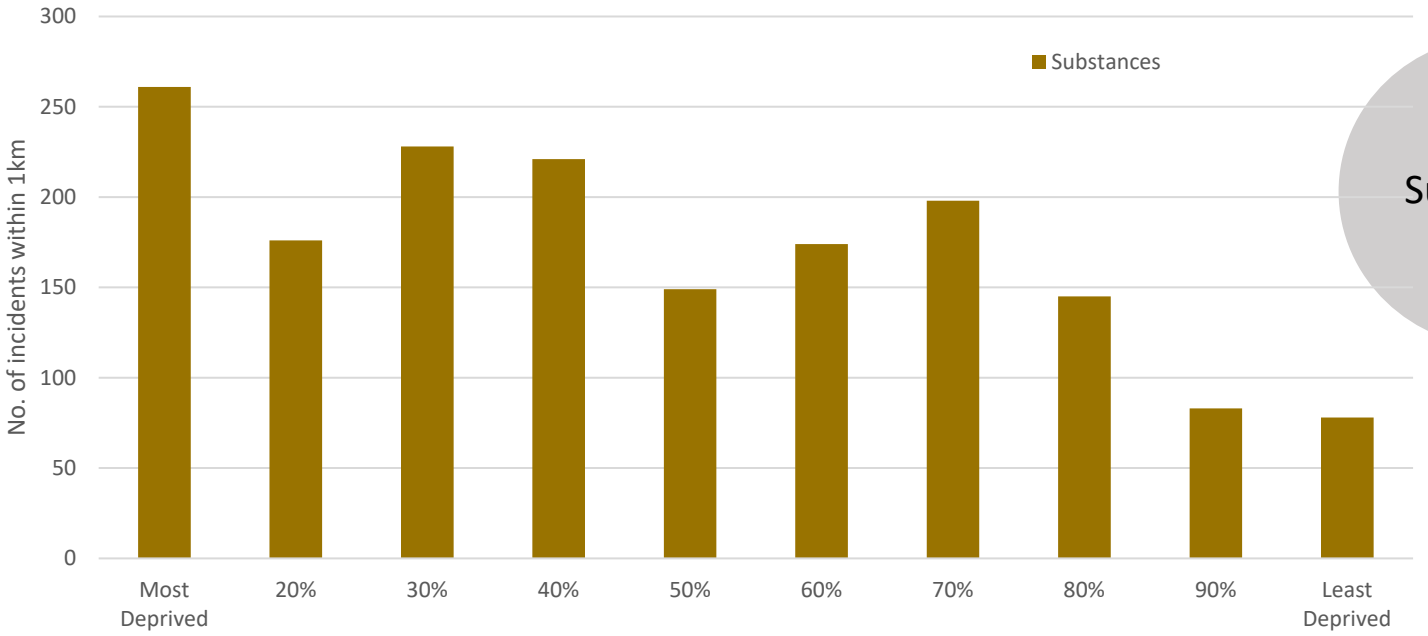


Data used: A spatial join of Trent_LSOA.shp with Site_Performance_2021.shp provided by Environment Agency (August 2022).

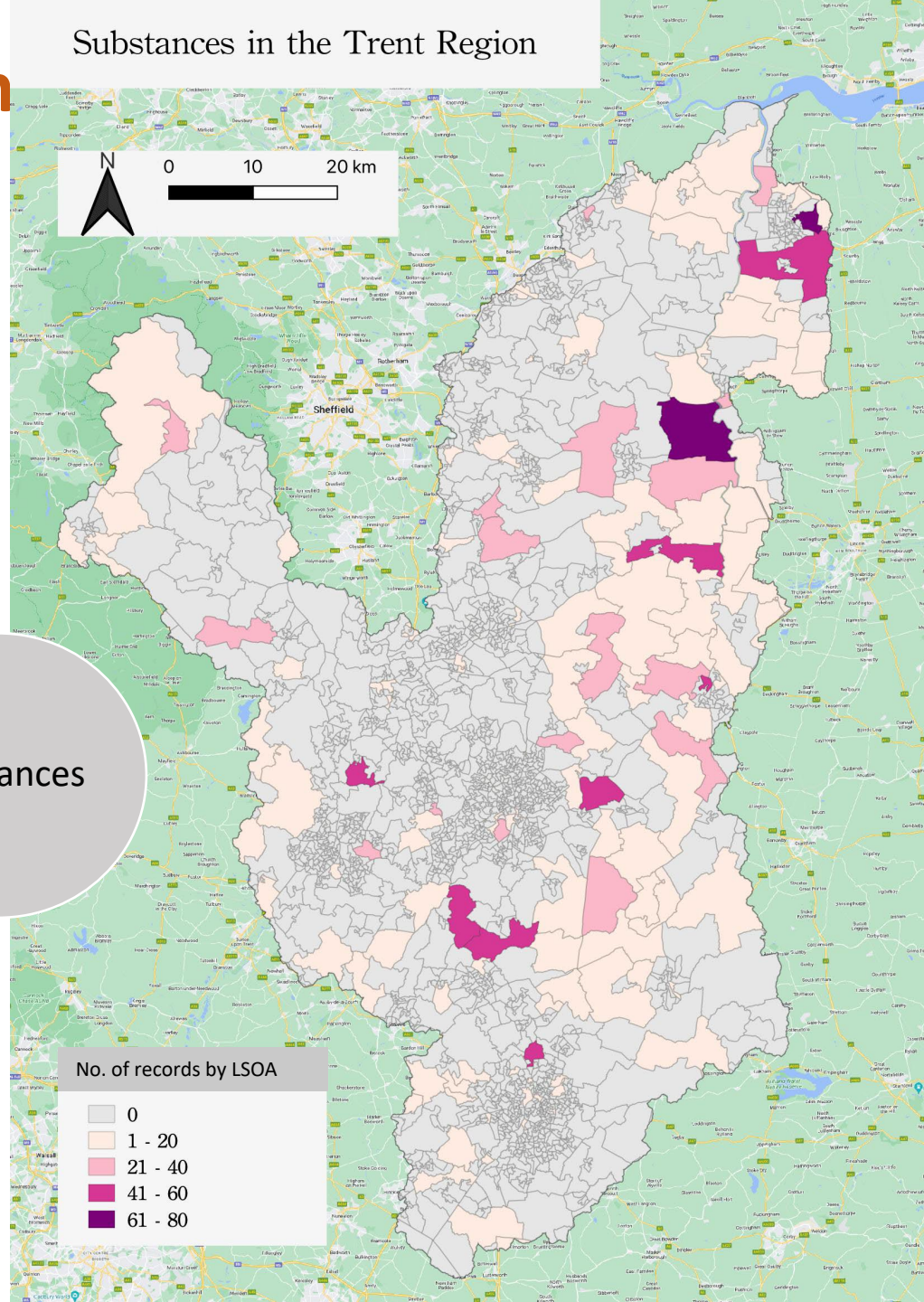
Site performance – Spatial and distribution

- **Substances**

Substances covers the regulation of a broad range substances released non-hazardous landfill, water industry, intensive farming, food and drink industries and other processing activities.



Substances



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Data used: A spatial join of Trent_LSOA.shp with Substance.shp provided by Environment Agency (August 2022).

Recorded Incidents - Spatial

What is an incidents?

The Environment Agency becomes aware of 'incidents' through one of three mechanisms:

- Self-reporting by the licensee
- Public compliant
- Agency monitoring

For the purposes here an 'incident' recorded by the Agency is assumed to be legitimate. No effort is made to identify the cause or severity of an incidents beyond that recorded in the data provided by the Agency (*table opposite*).

In most cases the data provided covers *'substantiated and unsubstantiated'* incidents, and these are used in the analysis presented. Only the data for CAT4 incidents has been provided as *'substantiated'* records.

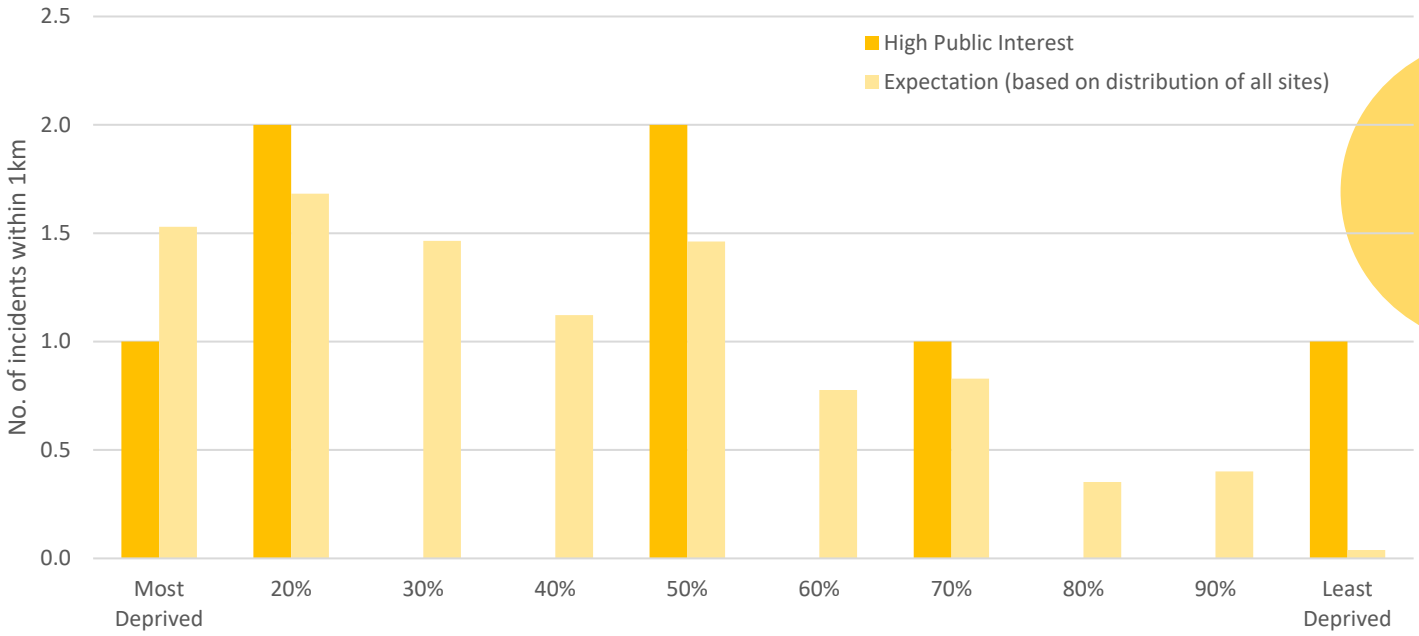
Where data is provided for multiple years this is highlighted and where necessary a simple annual average is determined. Where this is done this is highlighted.

Reference	Refers to:
Active IPPC authorisations	Any industrial and agricultural activities with a high pollution potential must have an Integrated Pollution Prevention and Control (IPPC) authorisation. The companies themselves bear responsibility for preventing and reducing any pollution they may cause
Water Management Area name	All areas within the Trent are part of the Trent (East Midlands - Water Management Area)
High Public Interest	Decided on a case-by-case and subjective basis by the Agency, but include gauging the level of engagement with individuals, interest groups, businesses, local councillors, media and whether there is ongoing engagement from the local MP.
Illegal waste dumping	Illegal dumping of liquid or solid waste on land or in water.
Hazardous waste and large-scale illegal dumping	Refers to the most significant illegal dumping activities,(such as lorries dumping rubbish and hazardous waste (including deliberately mislabelling waste, or running a waste site without a permit, or exporting waste.
Environmental Pollution Incidents - CAT1	This dataset only includes substantiated completed and closed Environment Management incidents (predominantly pollution), where the environment impact level is either Category 1 (major). There is an inherent lag time in investigating and recording the necessary incident details to complete a record and recent incidents may not appear
Environmental Pollution Incidents - CAT2	As above but where the incident is Category 2 (significant) to at least 1 media (i.e. water, land or air)
Environmental Pollution Incidents - CAT3	Refers to lower impact pollution events (such as farm pollution) considered to have a minor or minimal impact on the environment, people or property with only a limited or localised effect on water, land or air quality.
Environmental Pollution Incidents – CAT4	Refers to lowest impact pollution

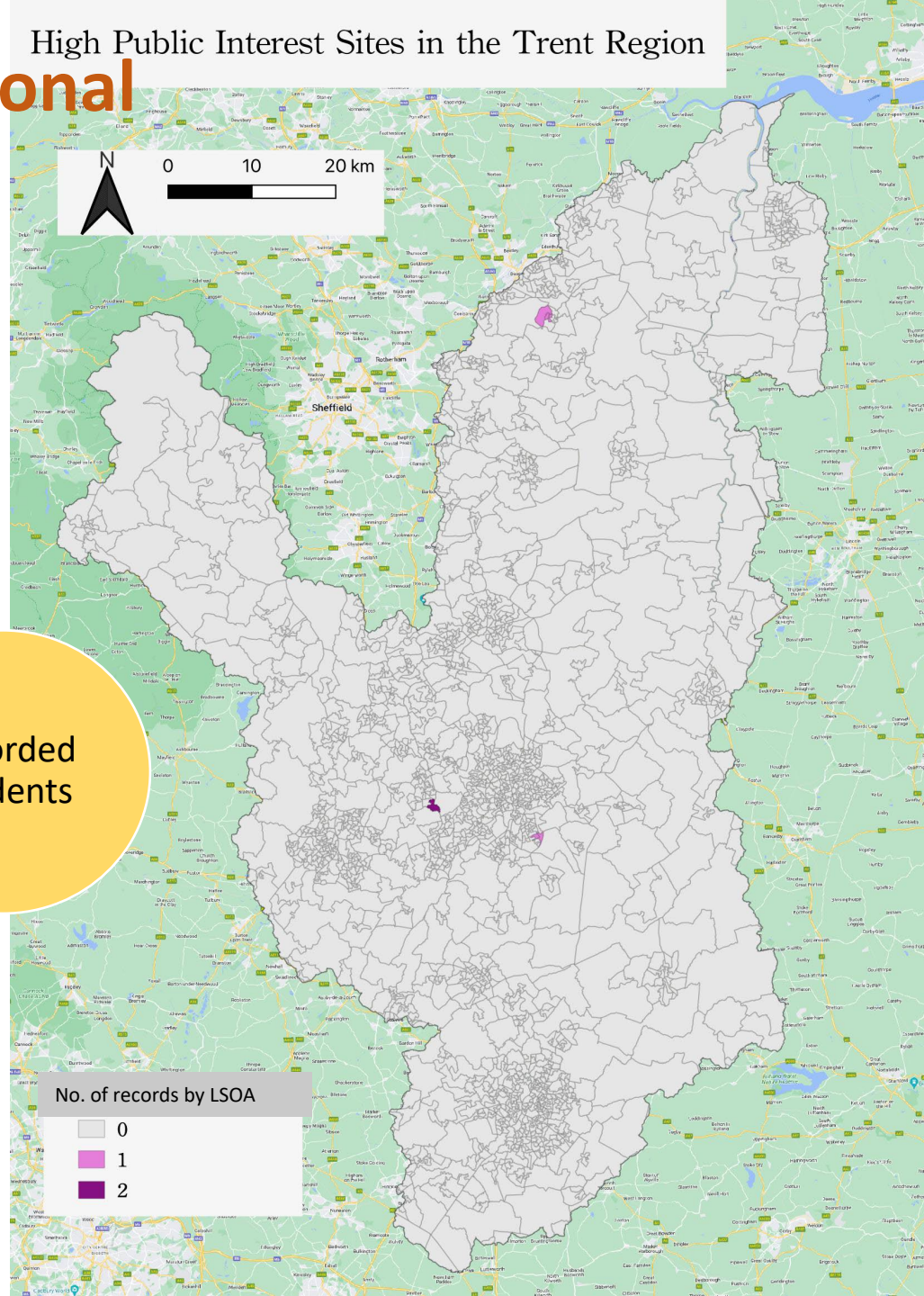
Recorded Incidents – Spatial and distributional

High Public Interest

The location of High Public Interest reports are shown opposite and their distribution by IMD below. Given the small number of High Public Interest incidents we have compared the distribution of the actual reports to an expected distribution based on the number of 'sites' in each IMD decile. It is noted that the number of records is small and hence it is difficult to draw firm conclusions.



Recorded incidents

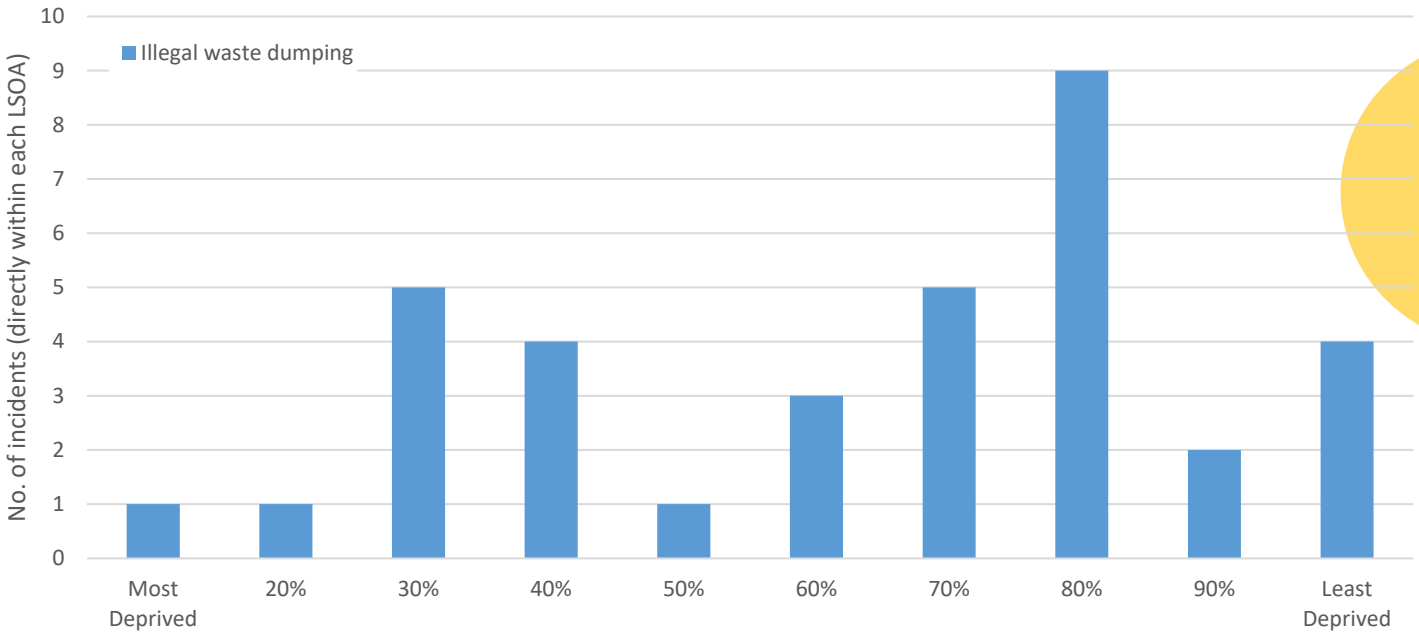


Data used: A spatial join of *Trent_LSOA.shp* with *High_Public__Interest_Sites.shp* provided by Environment Agency (August 2022).

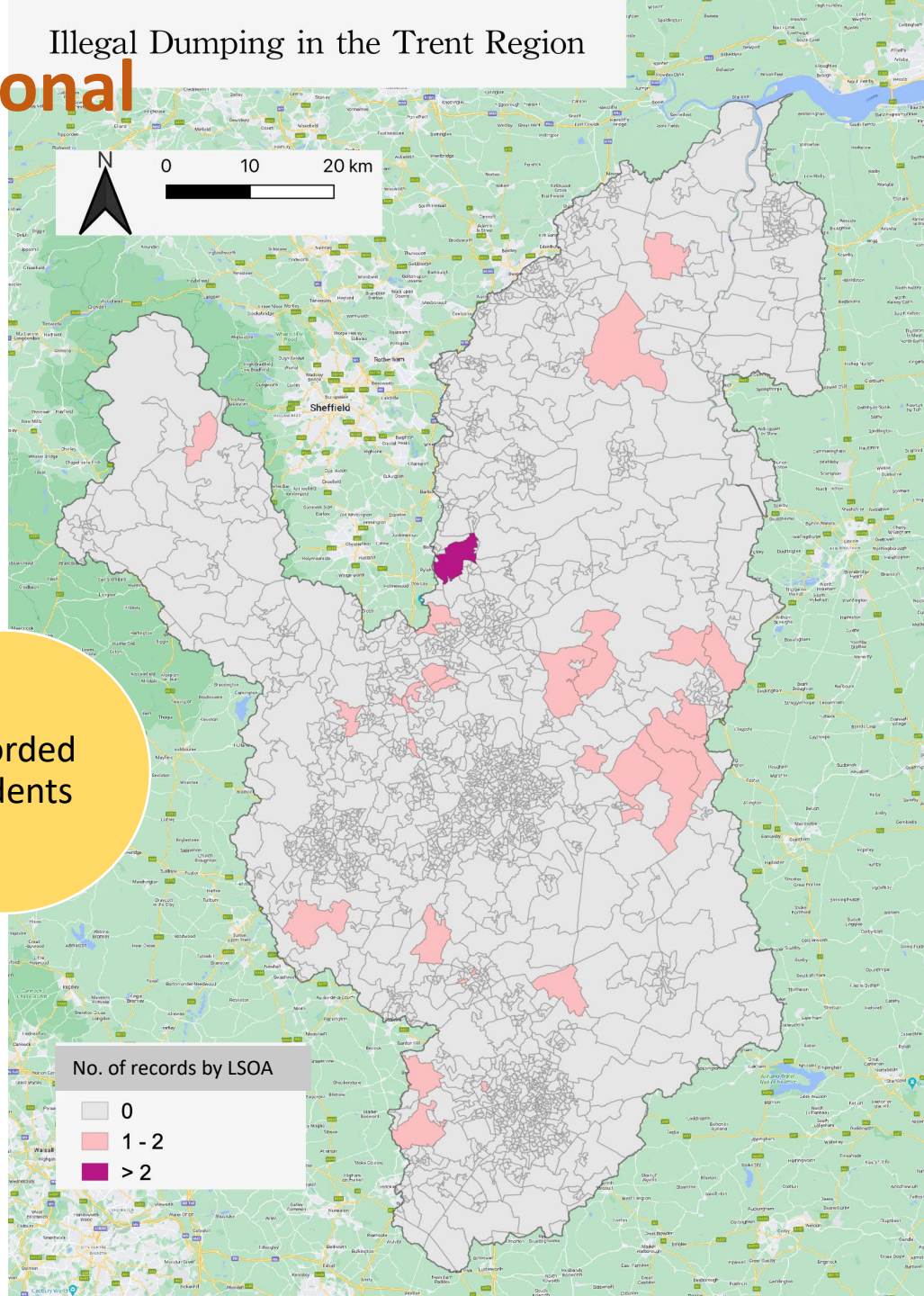
Recorded Incidents – Spatial and distributional

High public interest
Illegal waste dumping

Illegal dumping records reflect complaints from the public (mapped opposite). The reported incidents tend to be bias towards the less deprived neighbourhoods as shown below.



Recorded incidents

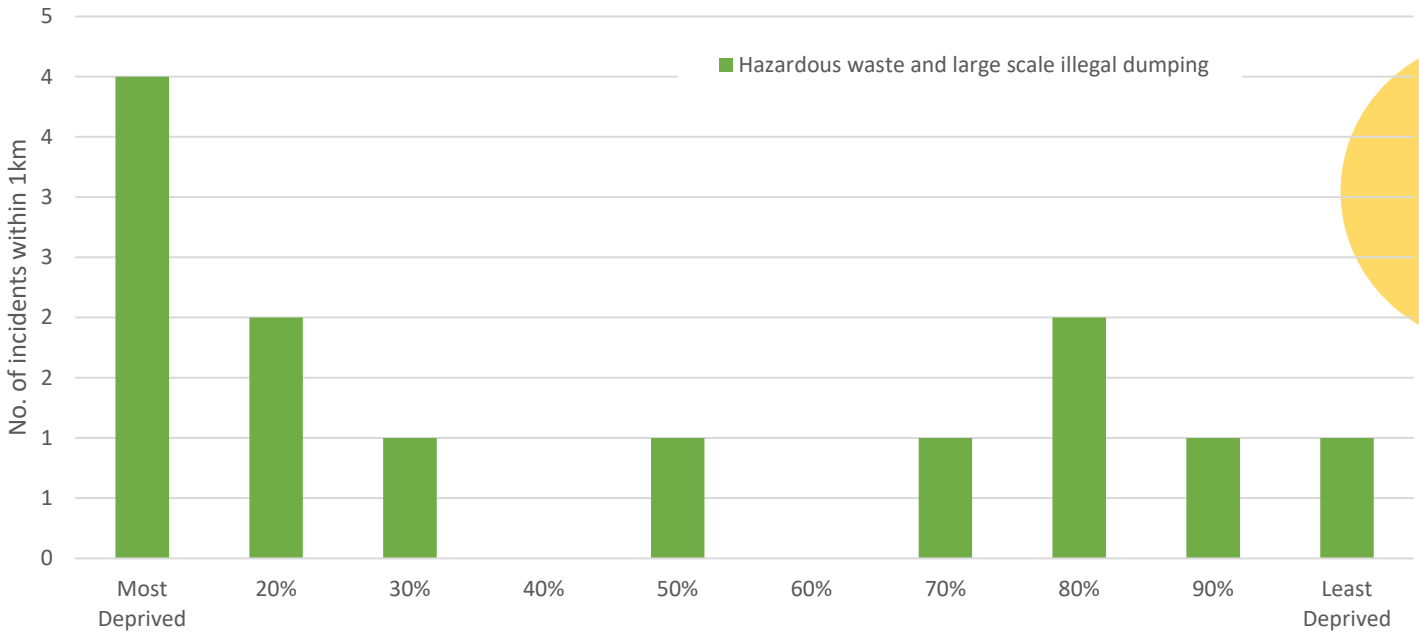


Data used: A spatial join of Trent_LSOA.shp with Illegal_Dumping.shp provided by Environment Agency (August 2022).

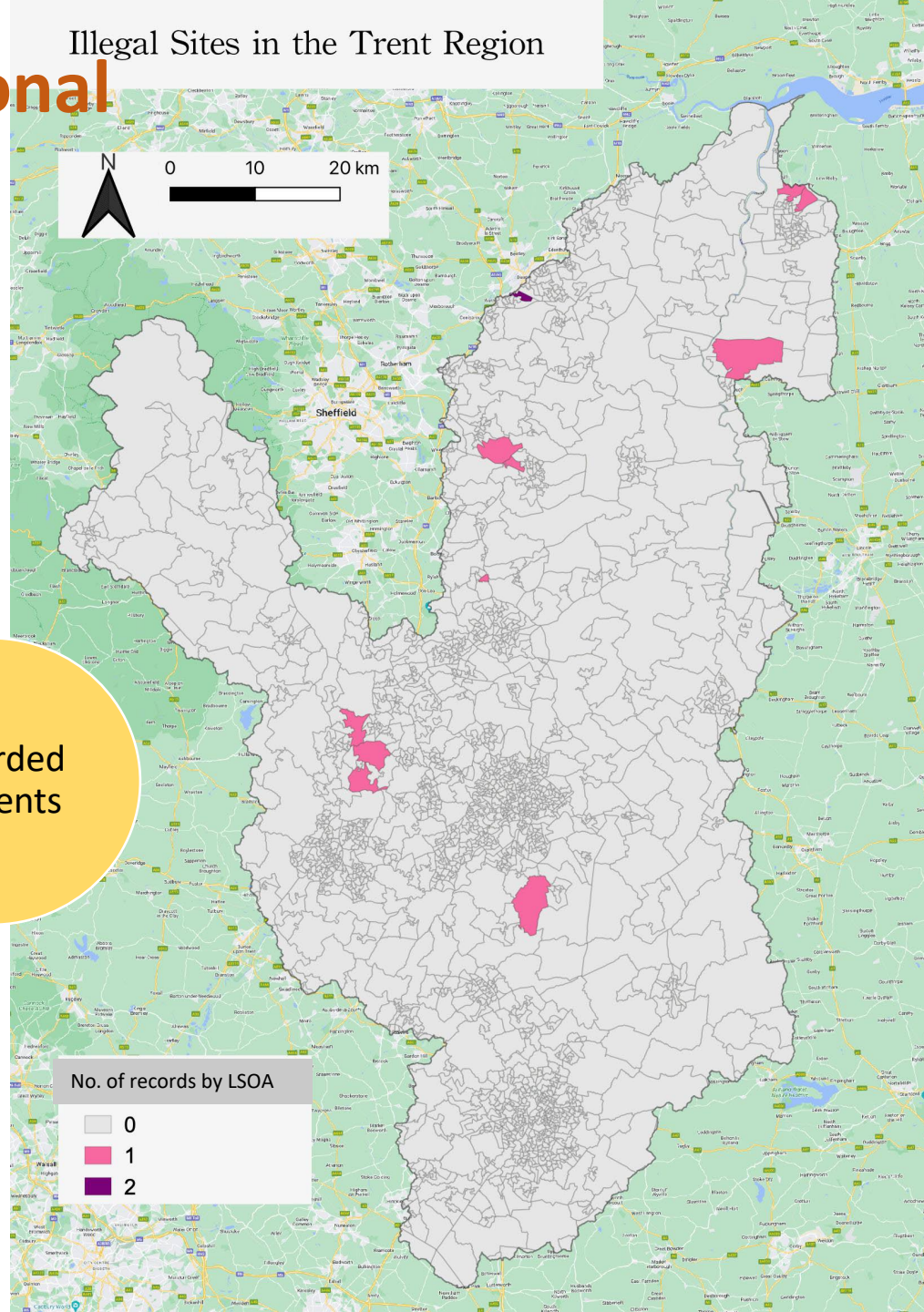
Recorded Incidents - Spatial and distributional

High public interest
Illegal waste dumping
Hazardous waste and large-scale illegal dumping

Complaints around large-scale illegal dumping and hazardous are typically investigated by the Agency and verified remotely (although often not first-hand). Within this category, incidents are more likely to impact the most deprived neighbourhoods (within 1km of the incident).



Recorded incidents



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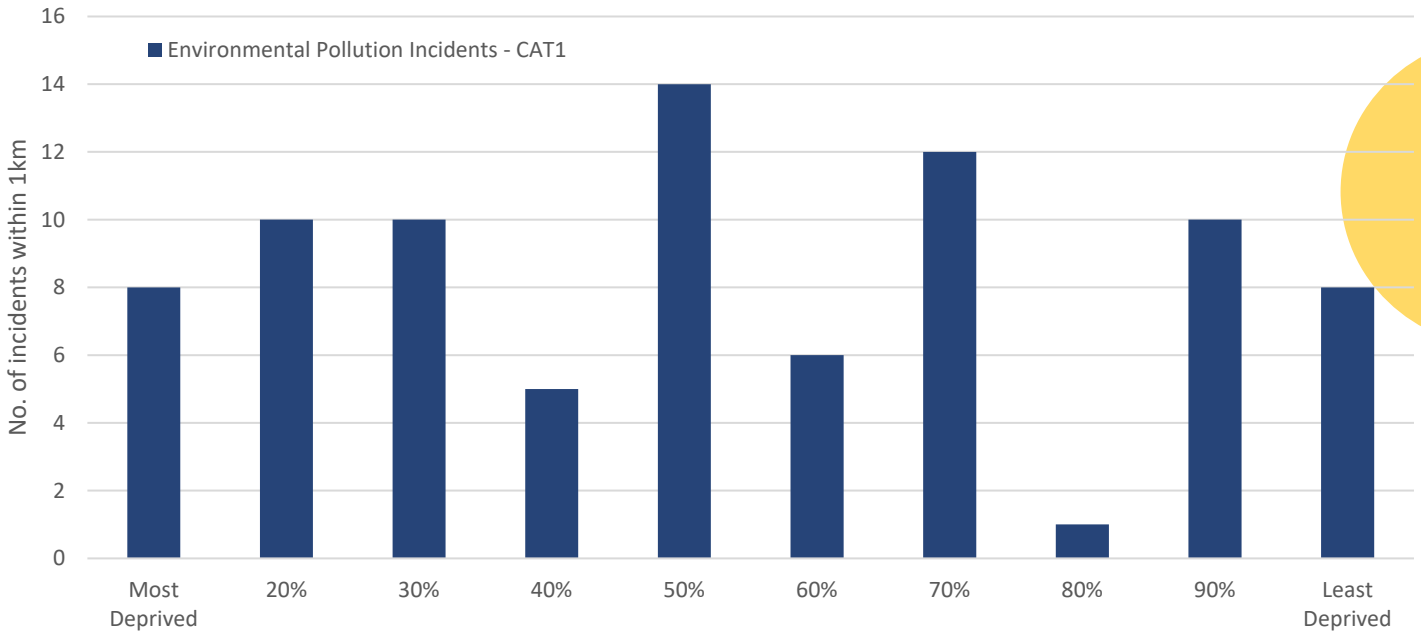
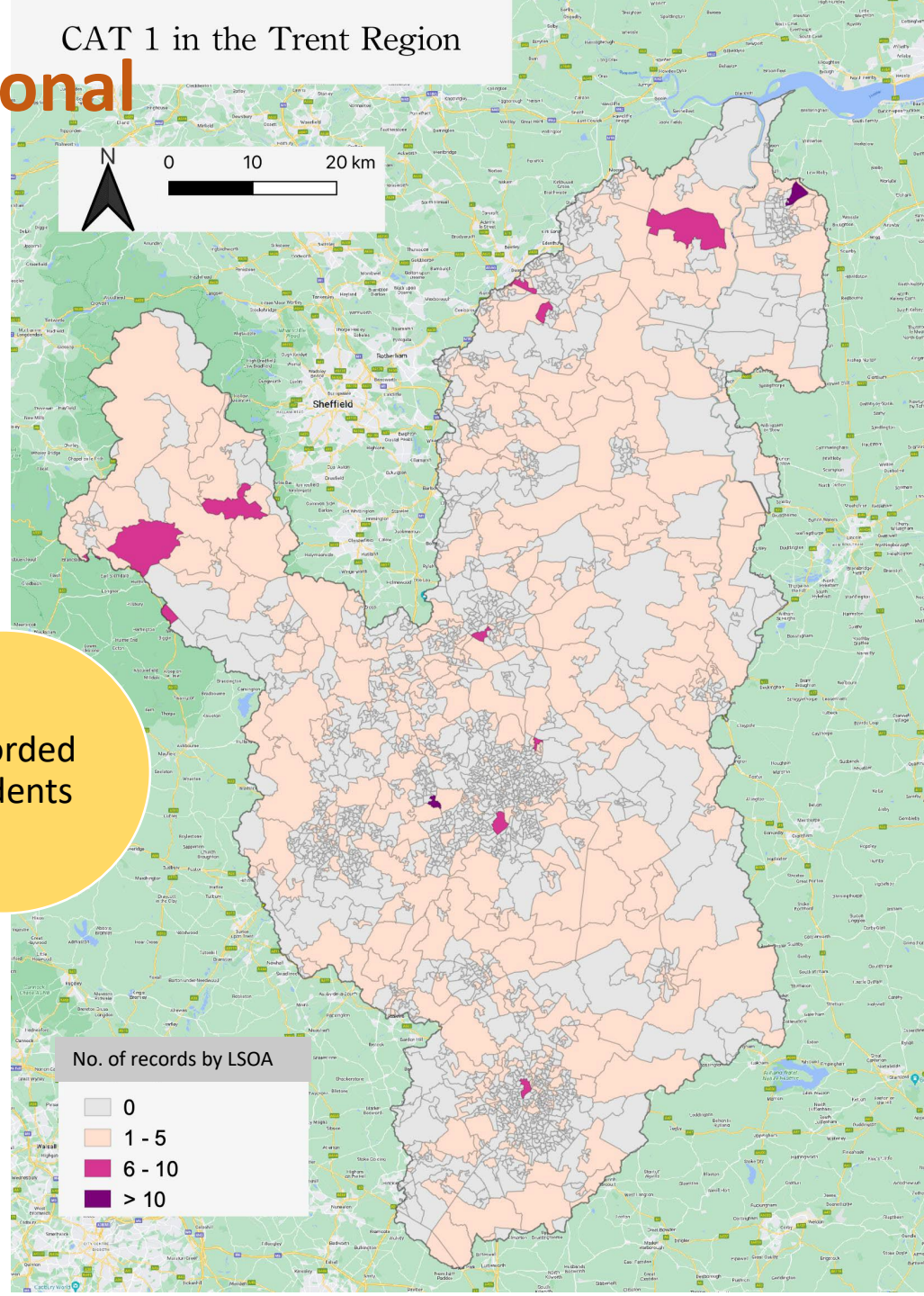
Data used: A spatial join of Trent_LSOA.shp with Illegal_Waste_Sites.shp provided by Environment Agency (August 2022).

Recorded Incidents – Spatial and distributional

High public interest
Illegal waste dumping (fly-tipping)
Hazardous waste and large-scale illegal dumping
Environmental Pollution Incidents
CAT1 (from 2001-22) – All reported



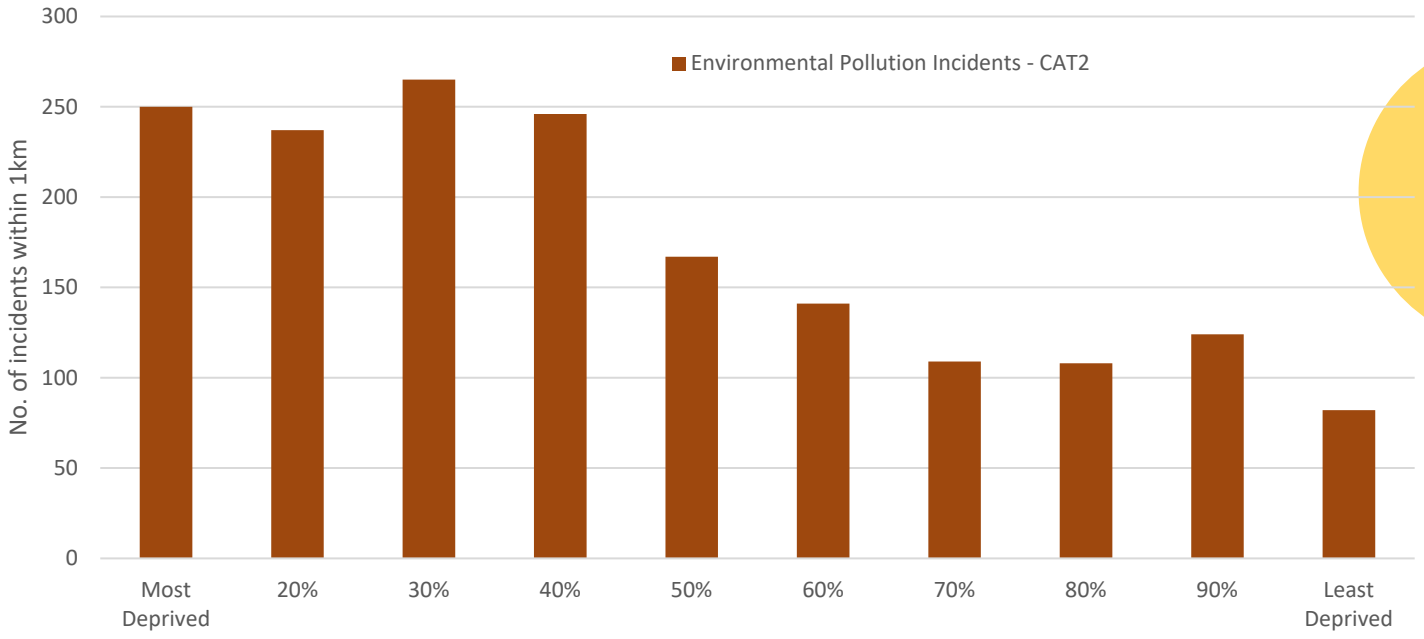
Recorded incidents



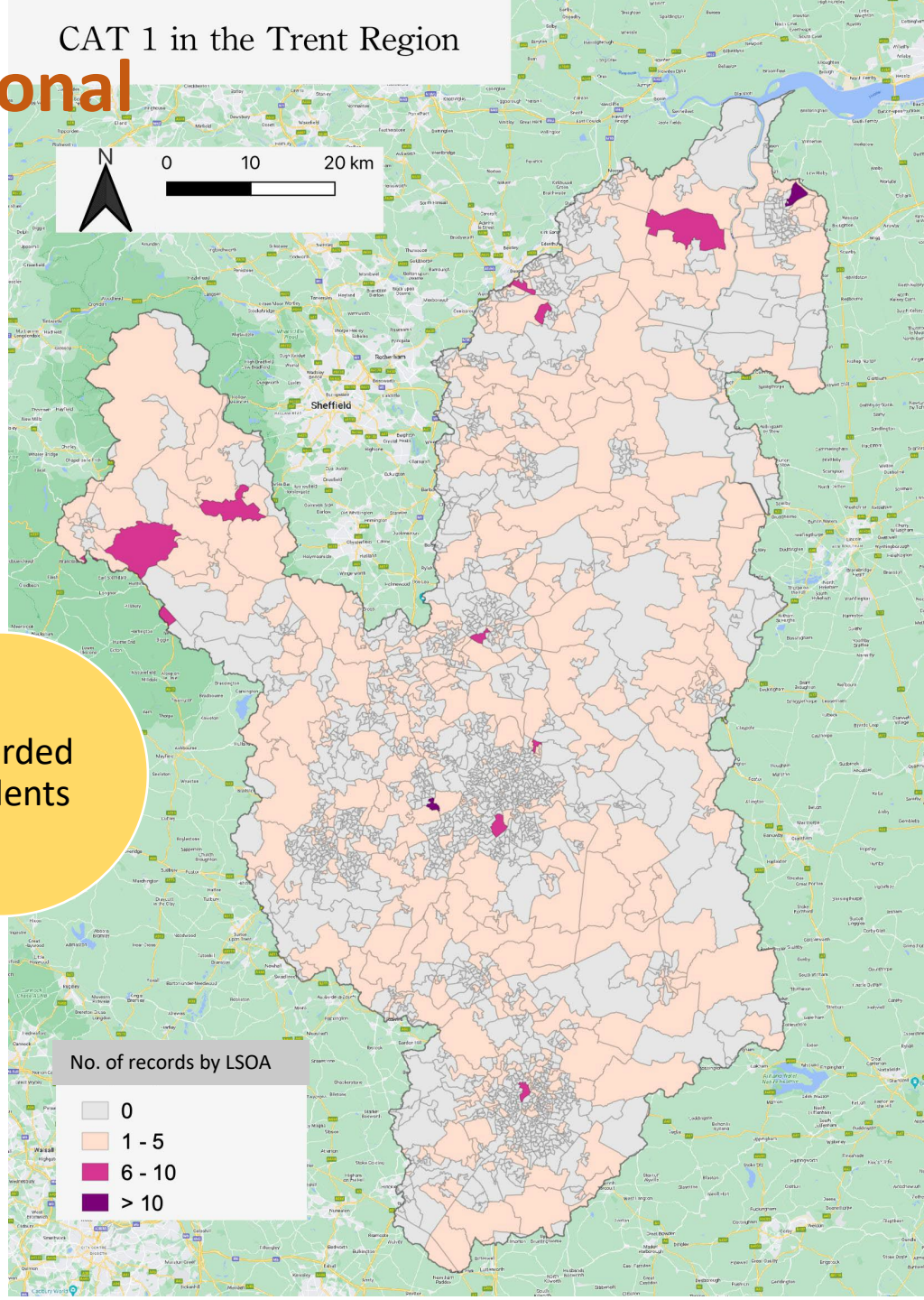
Data used: A spatial join of Trent_LSOA.shp with NIRS_CAT1_2_2021.shp and NIRS_CAT1_2_01_22.shp provided by Environment Agency (August 2022).

Recorded Incidents – Spatial and distributional

High public interest
Illegal waste dumping (fly-tipping)
Hazardous waste and large-scale illegal dumping
Environmental Pollution Incidents
CAT1 (from 2001-22) – All reported
CAT2 (from 2001-22) – All reported



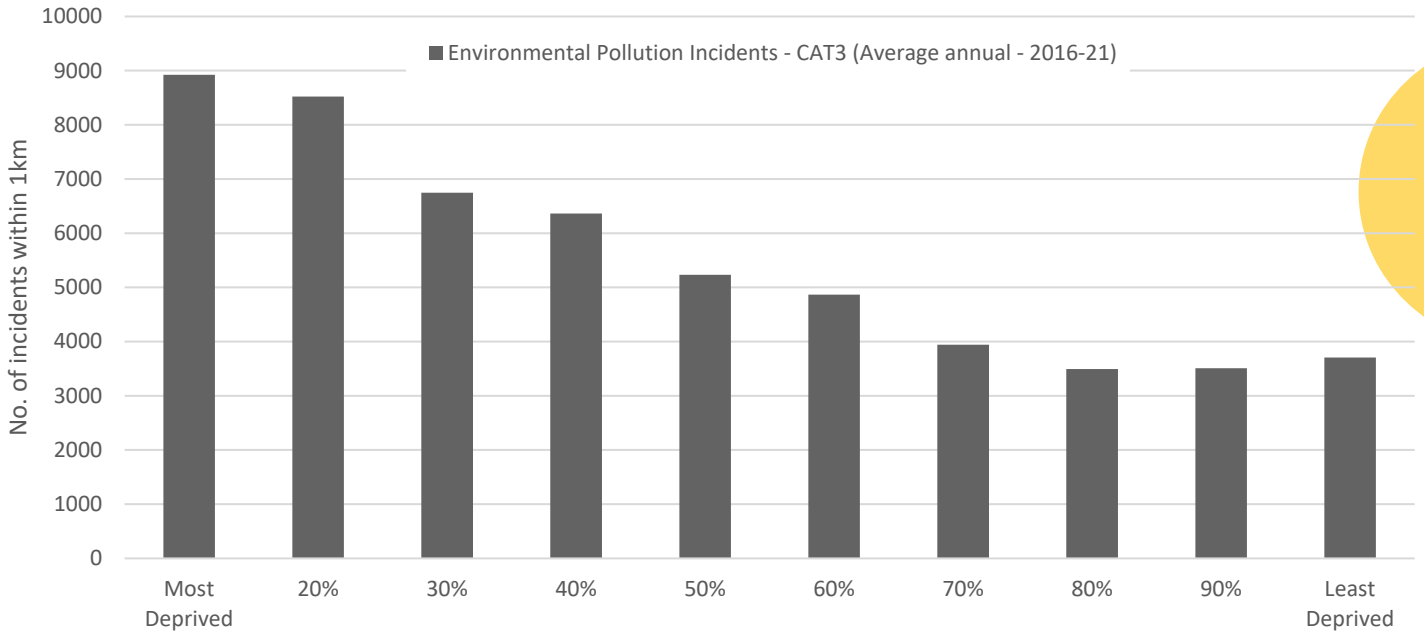
Recorded incidents



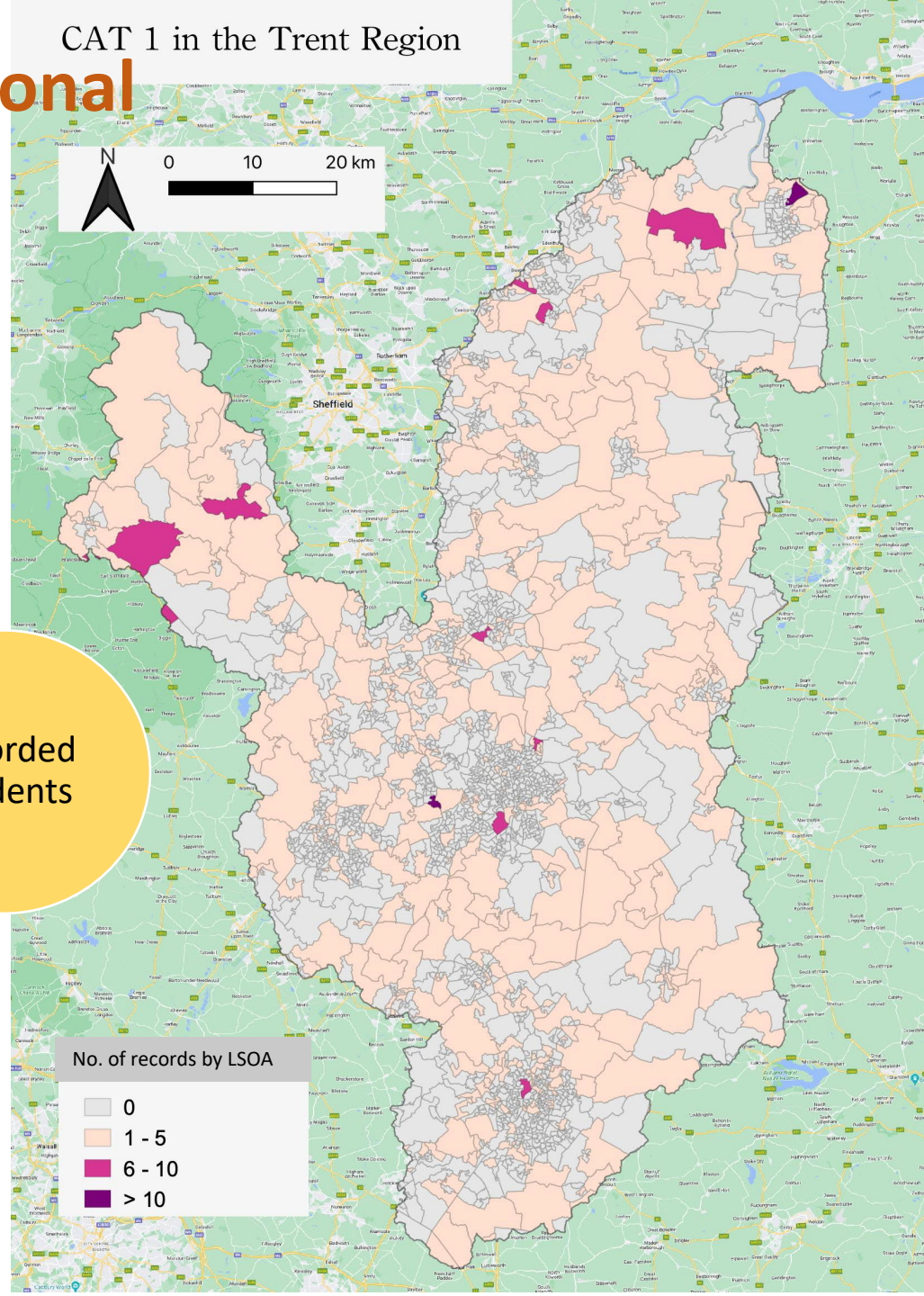
Data used: A spatial join of Trent_LSOA.shp with NIRS_CAT1_2_2021.shp and NIRS_CAT1_2_01_22.shp provided by Environment Agency (August 2022).

Recorded Incidents – Spatial and distributional

High public interest
Illegal waste dumping (fly-tipping)
Hazardous waste and large-scale illegal dumping
Environmental Pollution Incidents
CAT1 (from 2001-22) – All reported
CAT2 (from 2001-22) – All reported
CAT3 (2016-2021) – All reported



Recorded incidents



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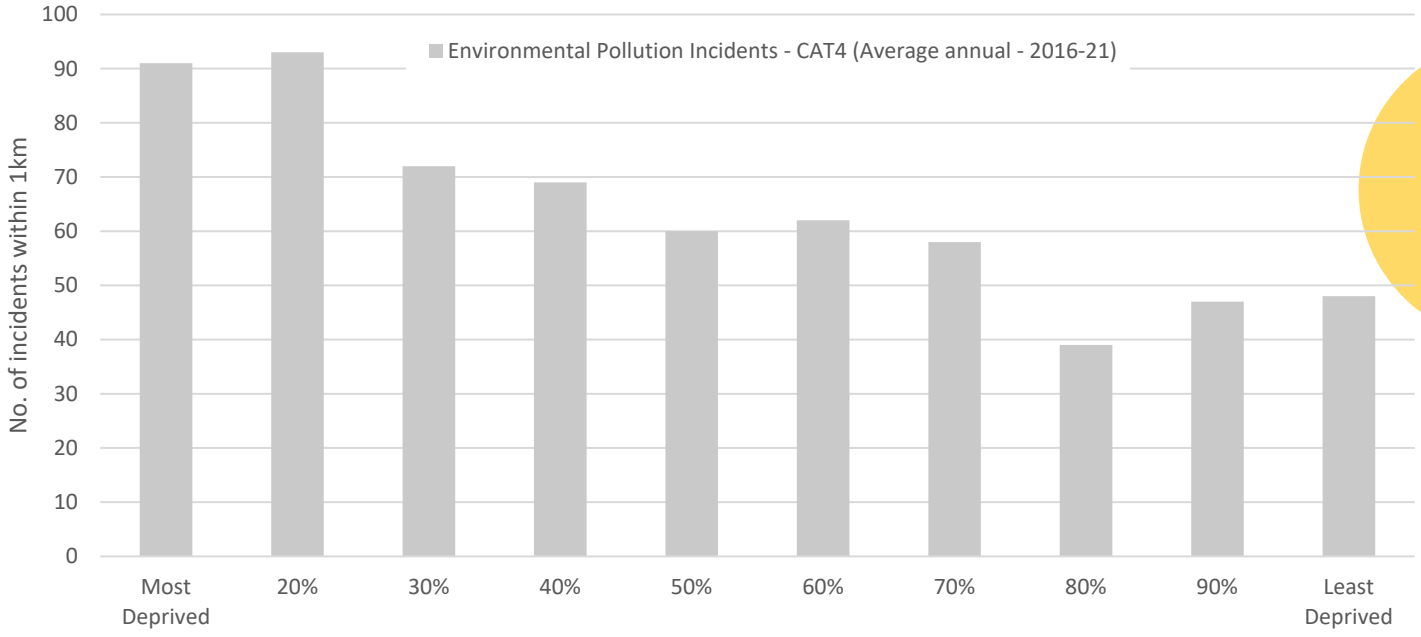
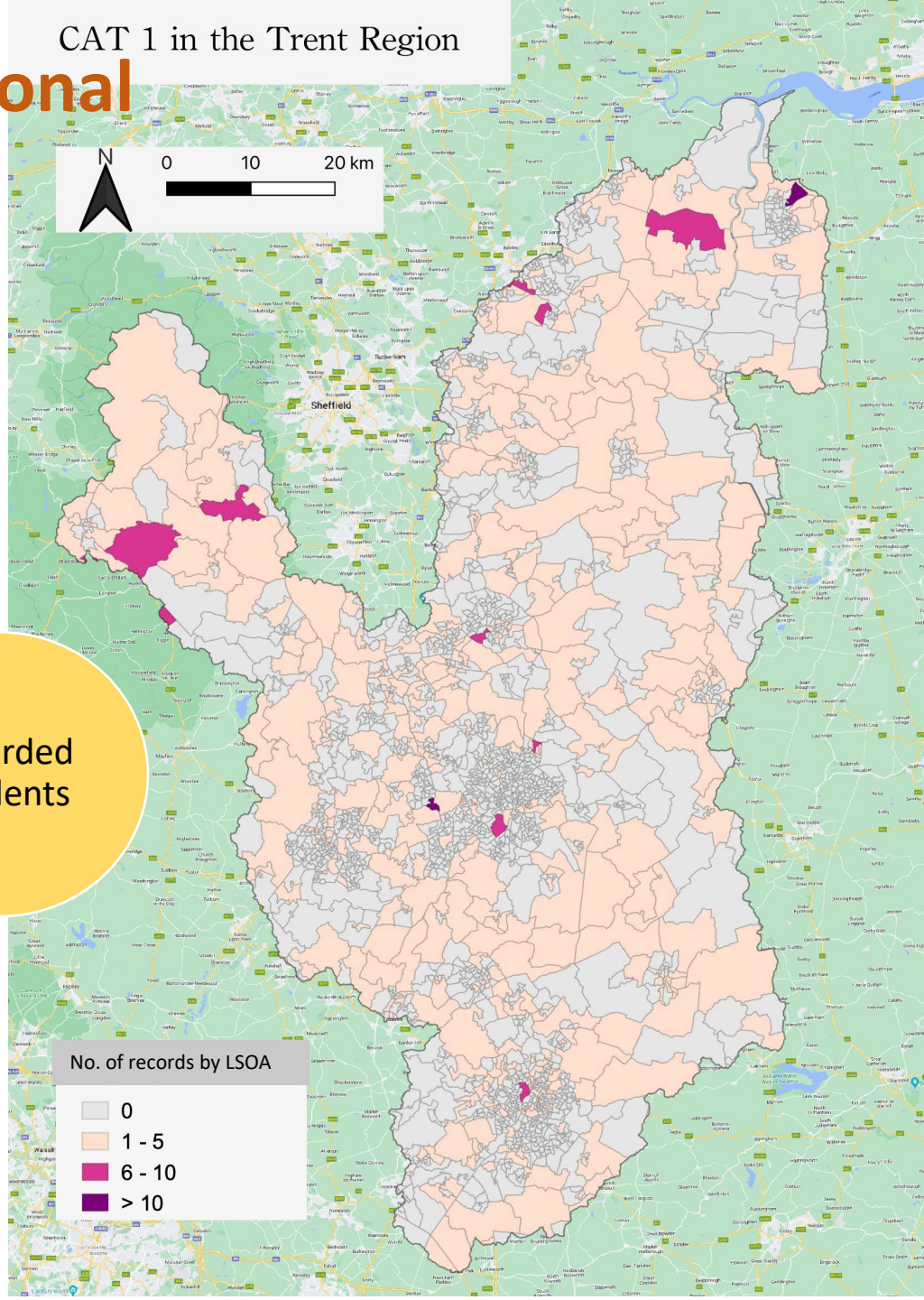
Data used: A spatial join of Trent_LSOA.shp with NIRS_CAT3_16_21.shp provided by Environment Agency (August 2022).

Recorded Incidents – Spatial and distributional

High public interest
Illegal waste dumping (fly-tipping)
Hazardous waste and large-scale illegal dumping
Environmental Pollution Incidents
CAT1 (from 2001-22) – All reported
CAT2 (from 2001-22) – All reported
CAT3 (2016-2021) – All reported
CAT4 (2016-2021) – Verified only



Recorded incidents



Data used: A spatial join of Trent_LSOA.shp with NIRS_16_21_S_Pot_CAT4.shp provided by Environment Agency (August 2022).

Recorded Incidents – Distributional analysis of all records

Based on the annual average of all incidents (as recorded in the NIRS data for CAT1,2,3, and 4 provided) there is a strong bias towards the most deprived neighbourhoods (see chart below).

33% of all incidents occur within 1km of the 20% most deprived neighbourhoods. This represents a significant systemic disadvantage. If only CAT1 and 2 incidents are considered this reduces slightly to 28%.

A person living in the 20% most deprived neighbourhoods is 2.6 times more likely to be affected* by an environmental incident (CAT1 to 4) than a person living in the 20% least deprived neighbourhoods and 2.3 times as likely to be affected by a CAT1 or 2 incident.

Recorded incidents

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* Affected is used here to denote an incident occurring within 1km of the centroid of the neighbourhood in which a person lives

A quantitative assessment of Regulatory Services expenditure across activities and outcomes

Part 5 - A quantitative assessment of Regulatory Services expenditure across activities and outcomes

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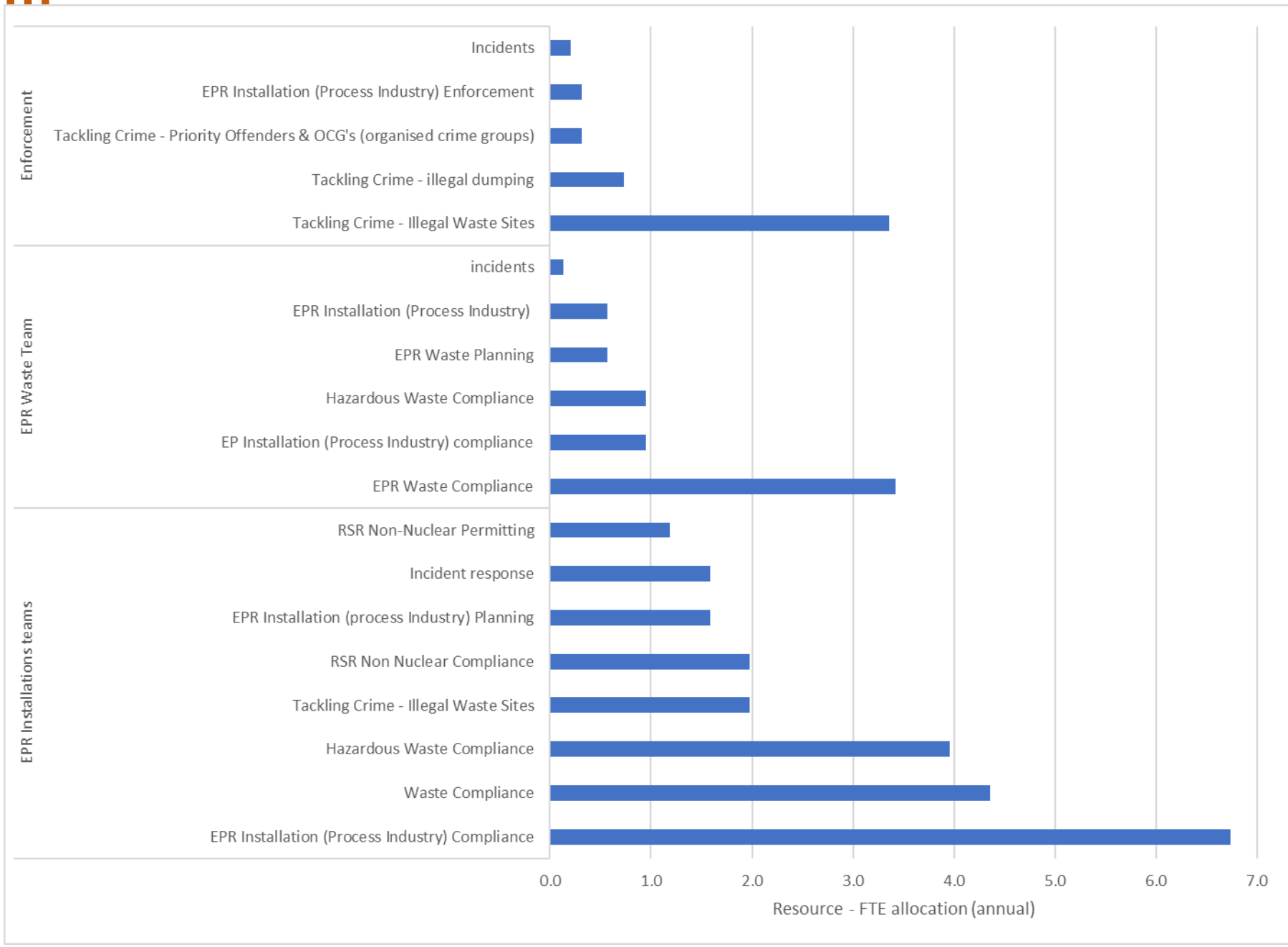
Expenditure - By team

Time recording data provided by the Agency (27 April 2023) has been linked to the activities presented in earlier slides.

The results highlight a significant proportion of resources are spent on compliance activities and responding to incidents.

This may suggest there is an opportunity to spend more on proactive engagements with communities (although this inference based on the resource records and not primary interviews with staff)



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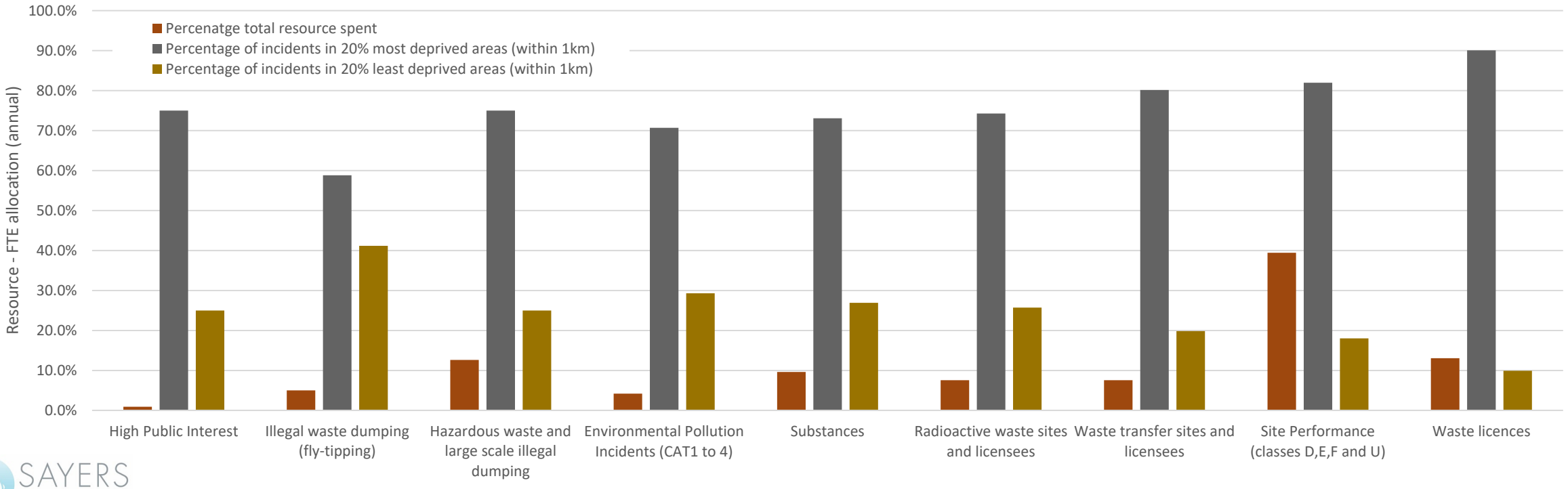
Expenditure – By incident and social distribution

The chart below shows the distribution of spend and recorded incidents and activities. The y-axis shows:

- The % of incidents within 1km of the 20% least and most deprived LSOAs as a proxy for the number of people affected

And

- The % of the total resource spent on frontline services (i.e., excluding appraisals, training etc) assigned to each class of incident.



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Concluding insights

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Legacy of decisions

- The distribution of sites and licences reflects decisions taken and developments over many years.

Sites and licences

- There is a strong bias towards sites being located in the most deprived areas. This is also the case for licences.

Incidents

- Distributional analysis of all reported incidents suggest people living in the most deprived neighbourhoods experience a higher number of incidents than those in living in less deprived neighbourhoods.

Why the inequity?

- The reasons for the inequitable distribution are difficult to determine, but are likely to reflect legacy choices and urban deprivation. Self-declaration of the need for a licence and reliance on the reporting of incidents may influence the analysis here.

Distribution of resources

- It is difficult to relate regulatory resources to outcomes, but based on the data provided resources do not appear to be linked to responding to the regulatory activities with the greatest number of reported incidents.

Data

- This analysis represents a first scoping use of the data to explore issues of equity and fairness in the regulatory services.
- Developing the process of recording time resources, incidents and impacts would aid further analysis.

Further research

- This study is an initial analysis with insights that are hopefully relevant with Trent but also nationally. To take forward the analysis and get to a heart of the issues and the how best to respond, will require significant further research and analysis.

Project Record

Part 7 – Project Record

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A project record has been provided to Kathryn Sharp that includes:

P1173 - GIS Data received record

- Sites and Incidents

P1173 - Non spatial data received record

- NIRS spreadsheets
- Expenditure records

P1173 - Workshop PPT and notes

- Held on July 2022

P1173 - Analysis and charts

- GIS Technical note
- Distributional analysis and charts

Thank you

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