Ukraine

Residential Building Damage Assessment
Chernihiv, February-April 2022

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Funded by:

Partners:

Cover images: World-View 3 satellite image (Maxar Technologies) of residential buildings after damage in Chernihiv City (Chernihivska oblast, Ukraine) acquired on 28 April 2022.

ABOUT REACH:

REACH is a leading humanitarian initiative providing granular data, timely information and in-depth analysis from contexts of crisis, disaster and displacement. The work of REACH directly feeds into aid response and decision-making by providing accessible and precise information on the humanitarian situation of crisis-affected populations.

Created in 2010, REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Operational Satellite Applications Programme (UNOSAT). REACH activities are conducted in support and within the framework of inter-agency coordination mechanisms at field and global levels to enabling more efficient aid planning and response.

UKRAINE – Chernihiv residential damage assessment

Chernihiv, February-April 2022

Context

Since the start of the Russian invasion on the 24th of February 2022, Chernihiv City (282,000 inhabitants), a settlement in the northern part of Ukraine (66 km to a state border with Belarus), has suffered numerous damages to residential buildings and infrastructure. The most intensive destructions were caused during February-March siege when Chernihiv was encircled and shelled.[1]

The siege ended in the beginning of April, after which images emerged showing **extensive damage to residential buildings** in the city's outskirts and neigbouring villages.[2] Local authorities reported that **70% of buildings of all types had been damaged**.[3]

To support the humanitarian response, IMPACT Initiatives has conducted a residential damage analysis to estimate the number of affected residents in Chernihiv City. The analysis is based on recent high-resolution satellite imagery (acquired on 28 April, 2022) and follows a similar approach as the one used for the Irpin City damage assessment conducted in July 2022.[4]

Methodology

This factsheet presents the estimated number of people who have been affected by damages to residential structures, based on remote sensing analysis conducted by UNOSAT with data from the end of April 2022.

It should be noted that, while remote sensing data (i.e., satellite imagery) can be used to estimate the degree of structural damage, light damage (e.g., broken windows) cannot be detected.[5] The absence of up-to-date information on the number of people who were living in buildings with detected damage directly prior to the impact also limits the precision of the estimates.

Image 1 and 2: Examples of detected damage to residential buildings in Chernihiv based on satellite imagery. Red circles depict buidlings with clearly visible damage while the orange circle depicts a building likely to be damaged (based on visual inspection)

The identification of residential buildings and their subsequent classification into single-household apartments and multi-apartment buildings is based on visual inspection of buildings marked as damaged by UNOSAT, using pre and post-damage high-resolution imagery acquired by World-View satellite, and Google Street View mode in Google Earth.

Information on the number on the apartment units in the multi-apartment buildings was determined on the basis of an analysis of Google StreetView software, based on images from Maxar, during which the number of floors and entrances were counted for estimations. For each unique combination of those floors and entrances a distinct number of apartments was assigned to the building.

The total number of apartments was multiplied by the average number of household members in Chernihivska oblast (2.29 people, according to 2021 data from the State Statistics Services of Ukraine).[6] As such, each apartment unit was assumed to have 2.29 people, regardless of the size of the apartment.

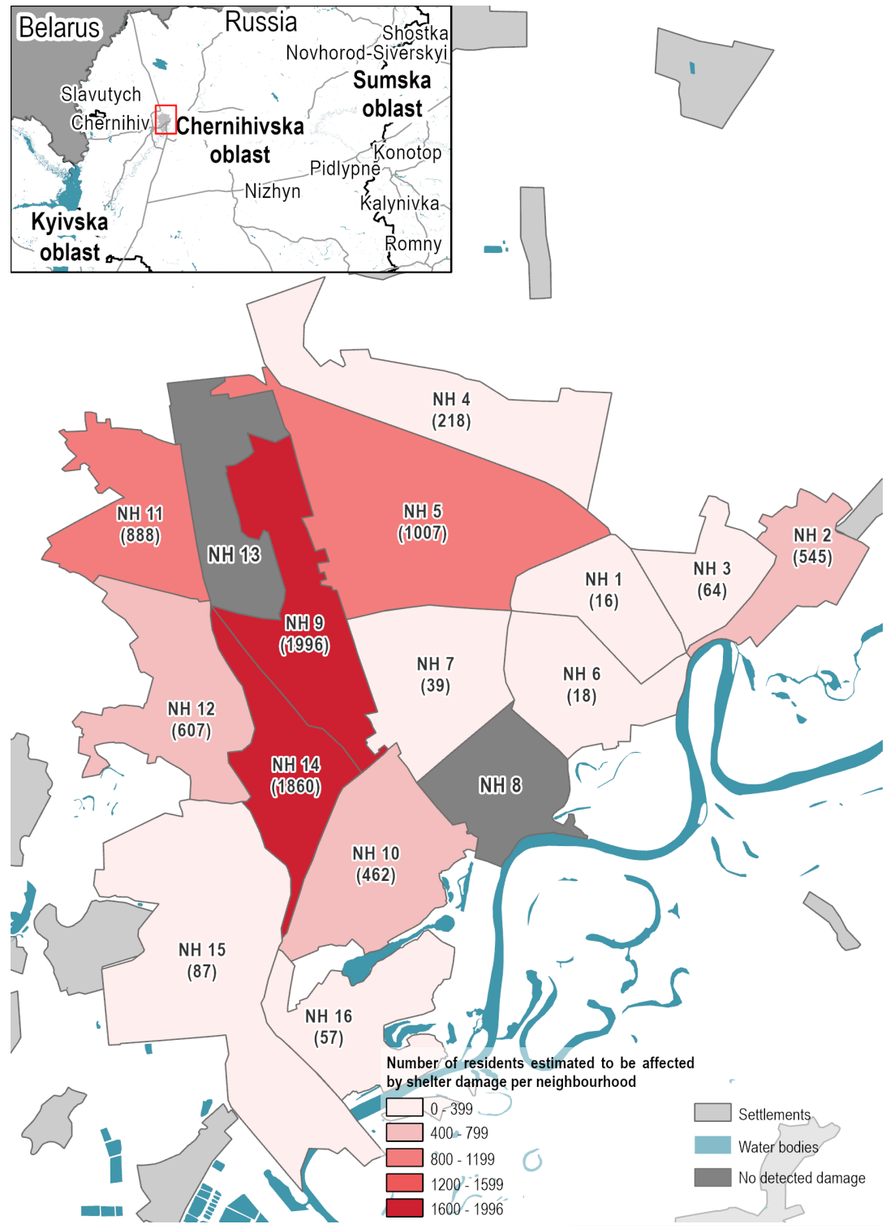
Every residential building labeled by UNOSAT as damaged or possibly damaged was considered as a damaged building, with affected residents, in this analysis. The same rule was applied to the multi-apartment buildings, meaning that also apartment buildings with damage to only a part of the structure were considered as damaged buildings.

In the absence of official and available information on neighbourhood divisions and other spatial subunits in Chernihiv City, REACH used satellite imagery, city development plans, and street networks data extracted from OpenStreetMaps to draw neighbourhood demarcations (16 in total). This factsheet presents findings for 14 of these neighbourhoods (excluding neighborhood 8 and 13 where no damaged buildings were identified).

Key Findings

In total, visible damage was detected for **19 apartment buildings and 601 apartments**; an estimated **7,816 residents** were likely affected by the detected shelter damage. **The highest number of residential buildings with detected damage was found in neighbourhoods 9 and 14,** which are located in the western part of Chernihiv City near industrial facilities.

The image below depicts the estimated number of individuals affected by detected damage to residential buildings.



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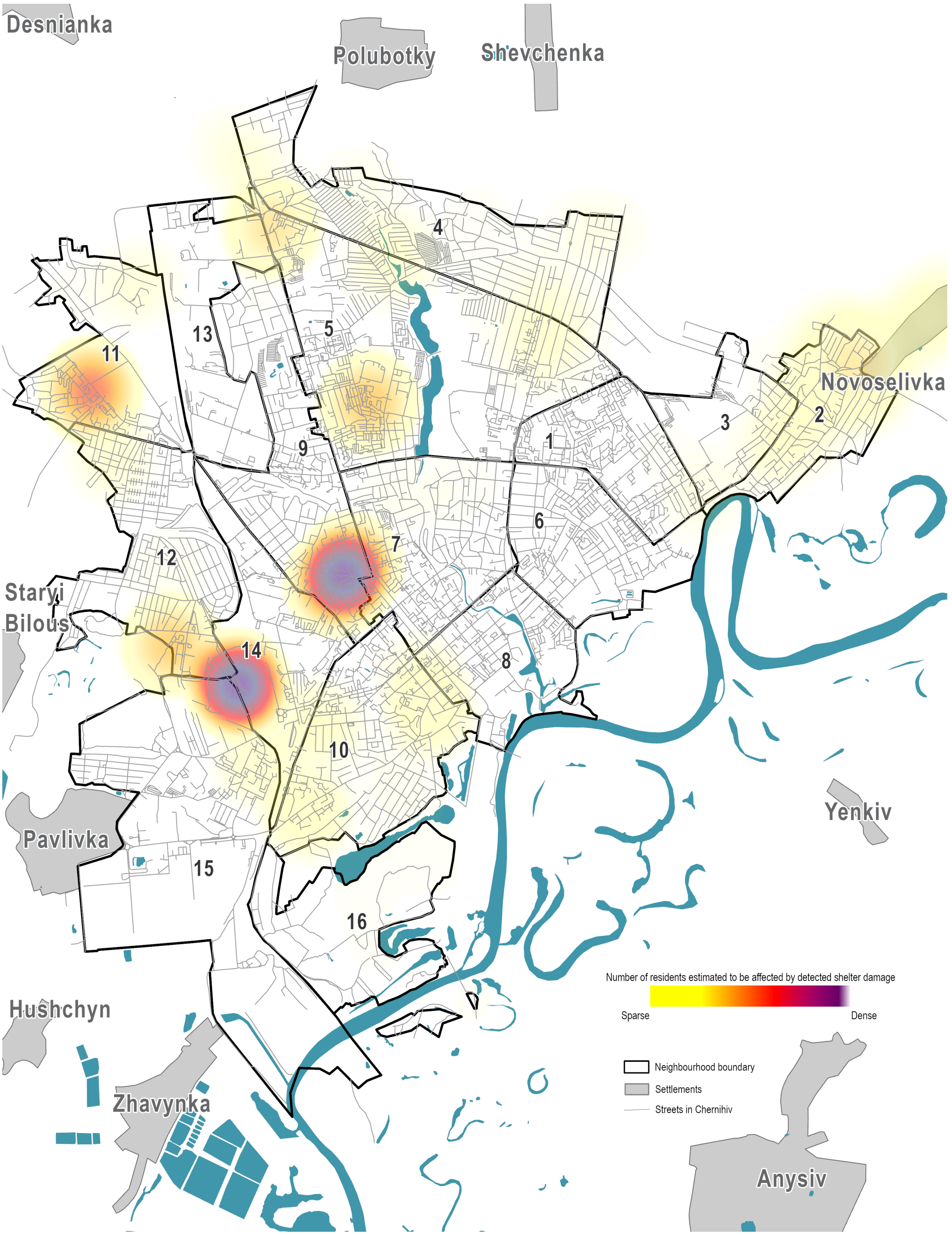
Damage density map



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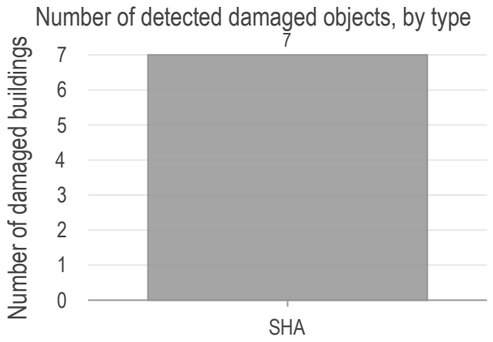
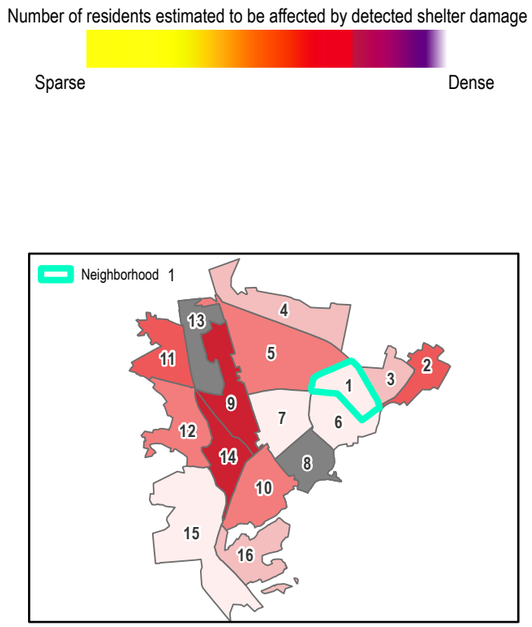
Neighbourhood 1



Note: AB - apartment building, SHA - single-household apartment



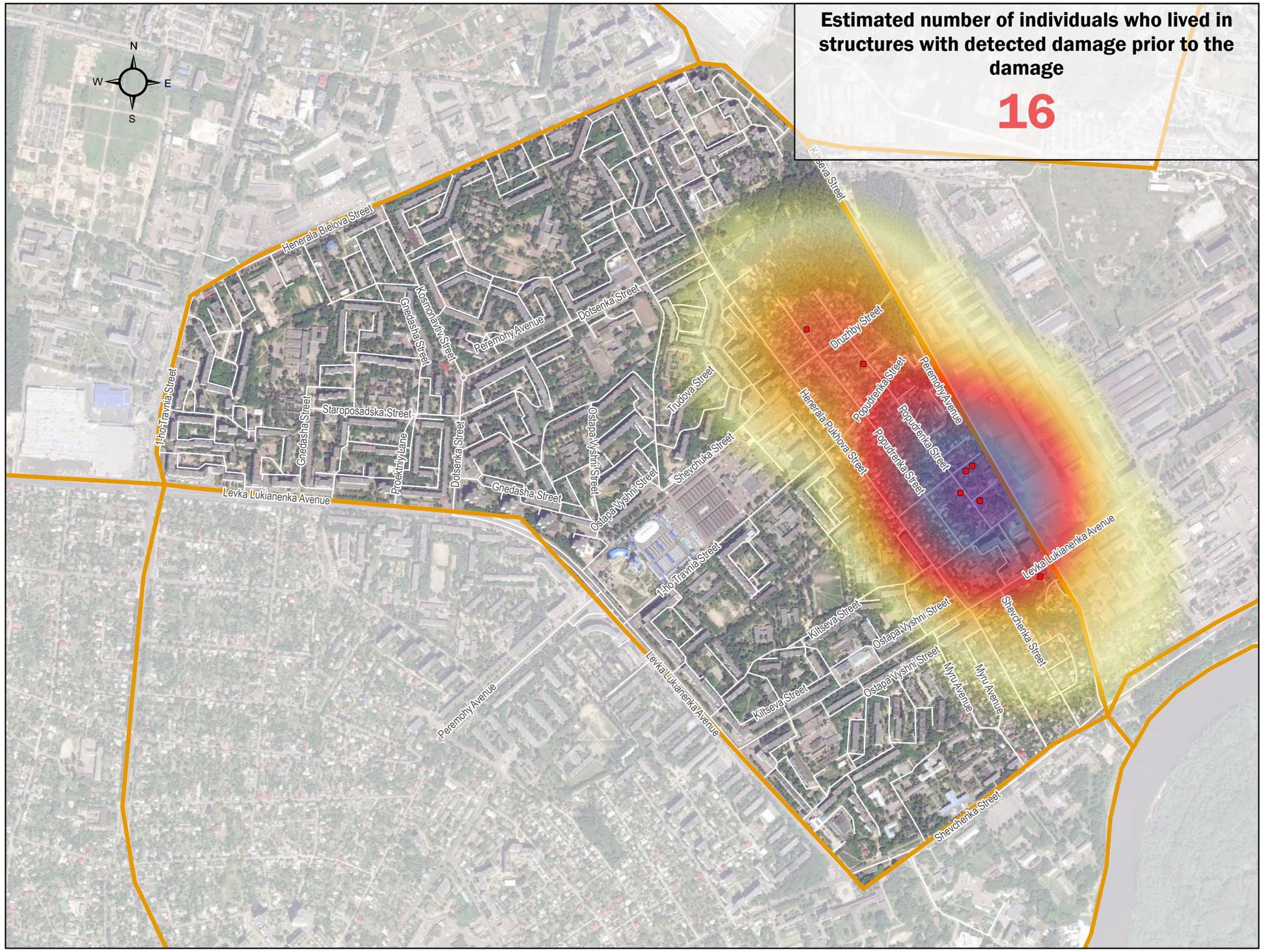
Number of residents estimated to be affected by detected shelter damage

Sparse — Dense

Apartment building

Single-household apartment

Neighbourhood boundary



Estimated number of individuals who lived in structures with detected damage prior to the damage

16

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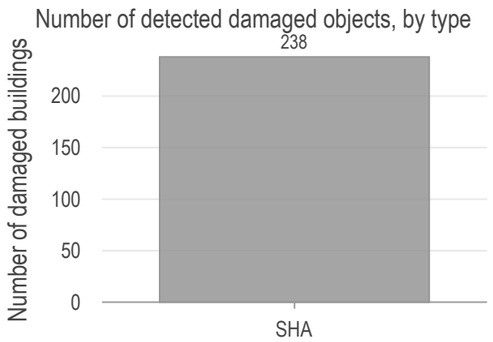
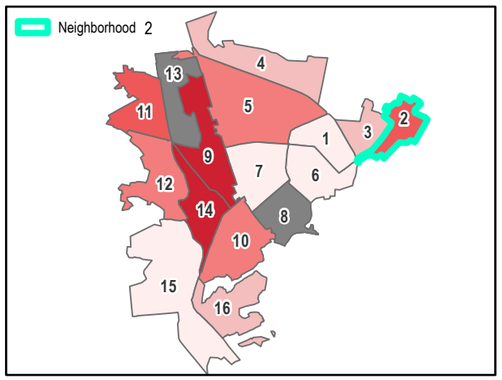
Neighbourhood 2



Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

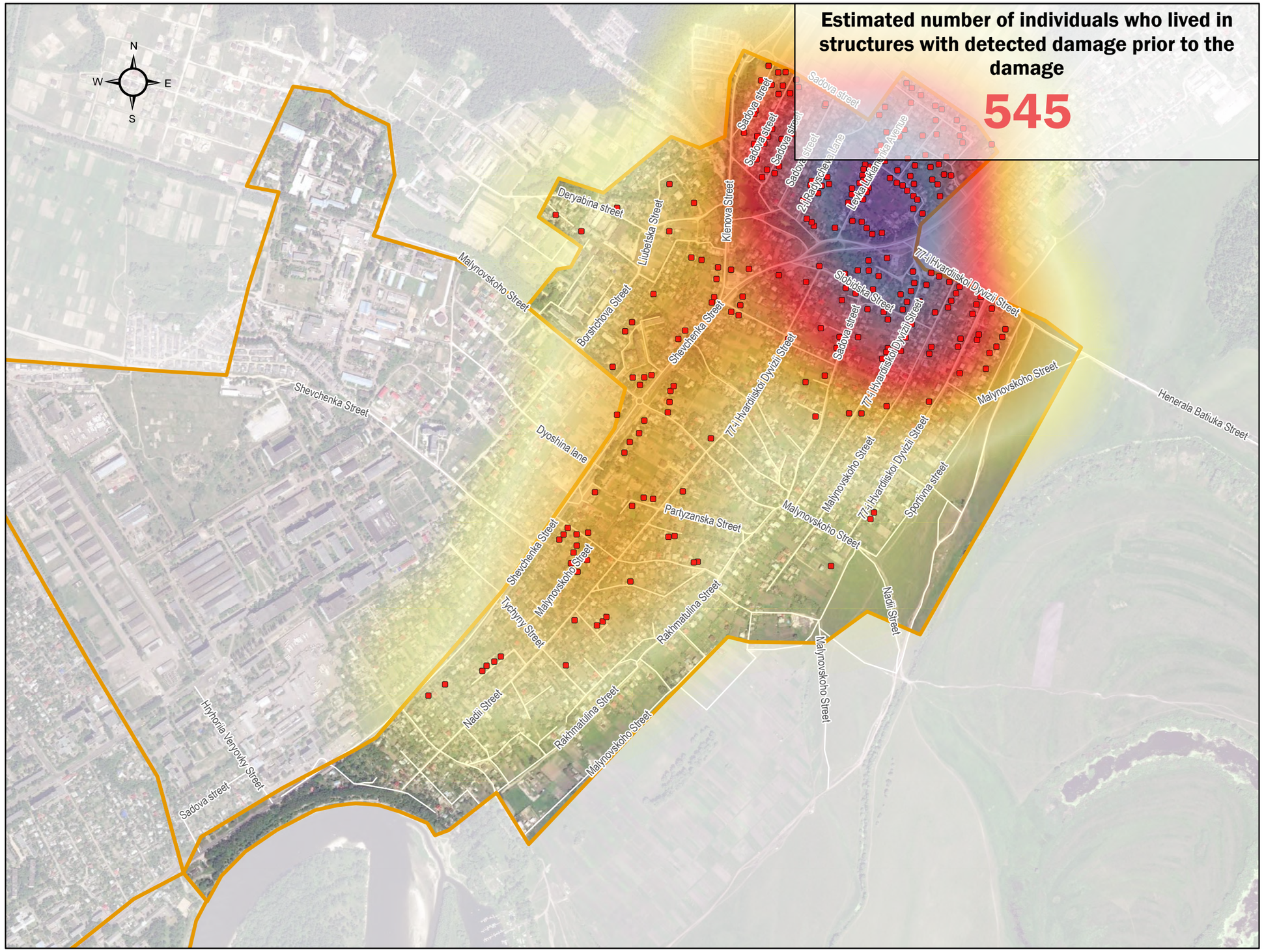
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



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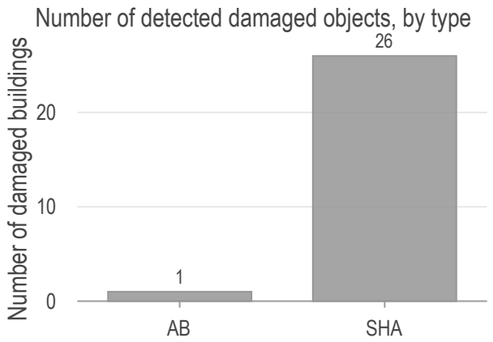
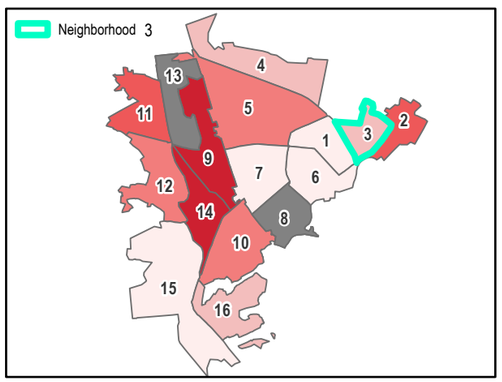
Neighbourhood 3



Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

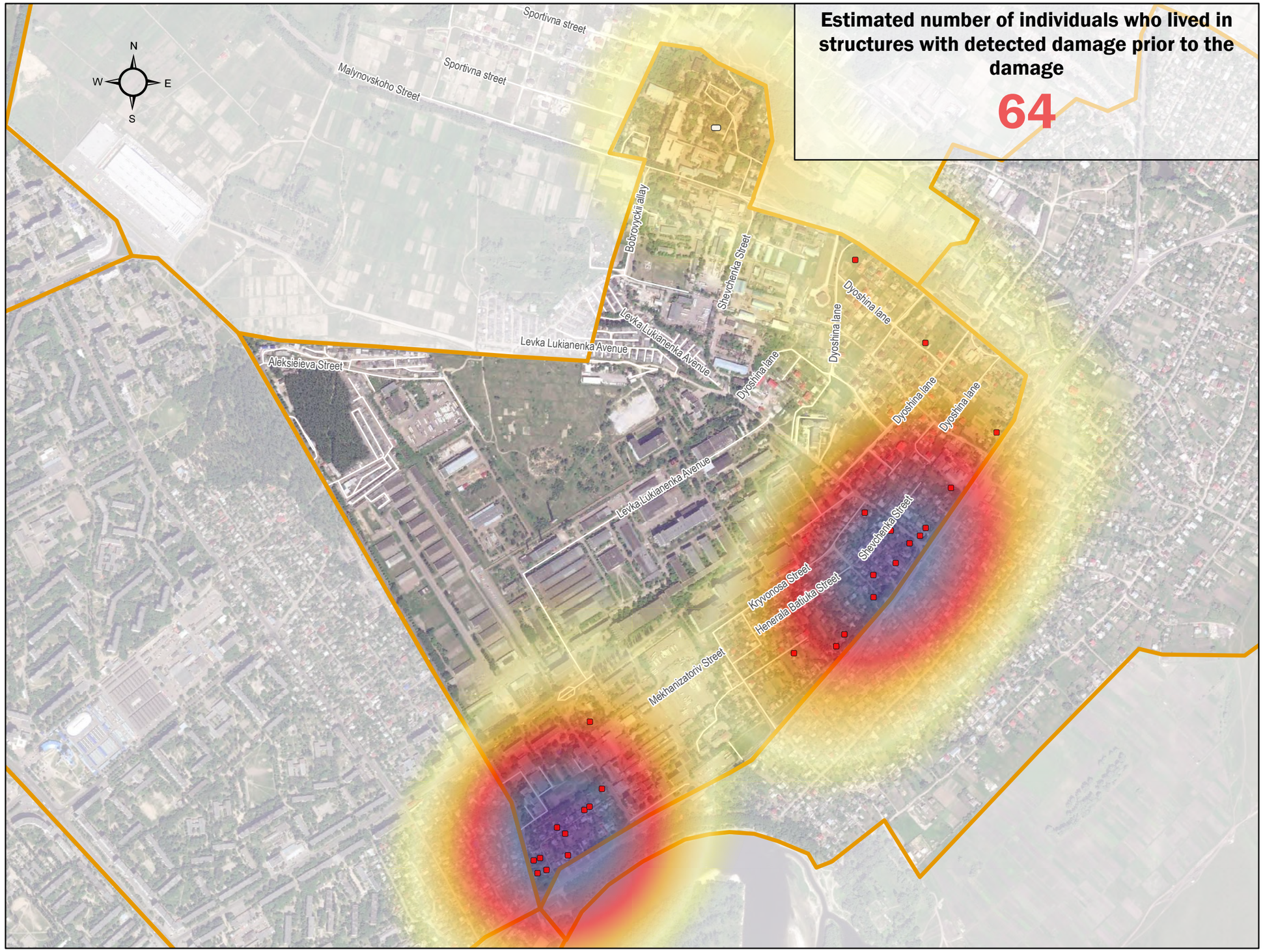
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



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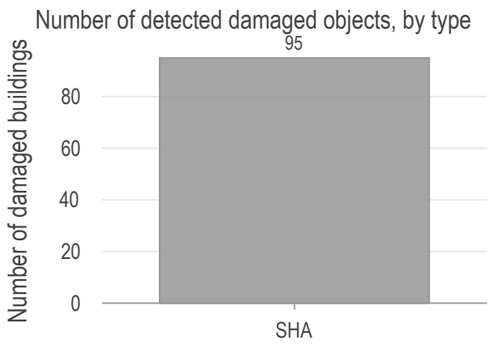
Neighbourhood 4



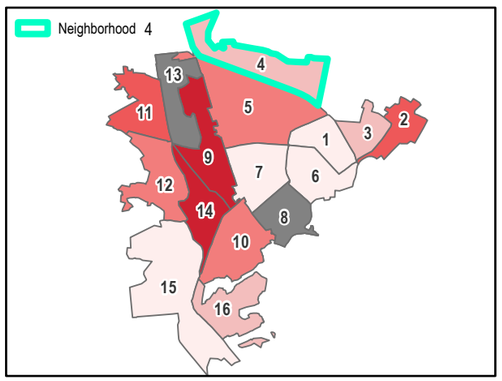
Note: AB - apartment building, SHA - single-household apartment

Estimated number of individuals who lived in structures with detected damage prior to the damage

218

Number of residents estimated to be affected by detected shelter damage

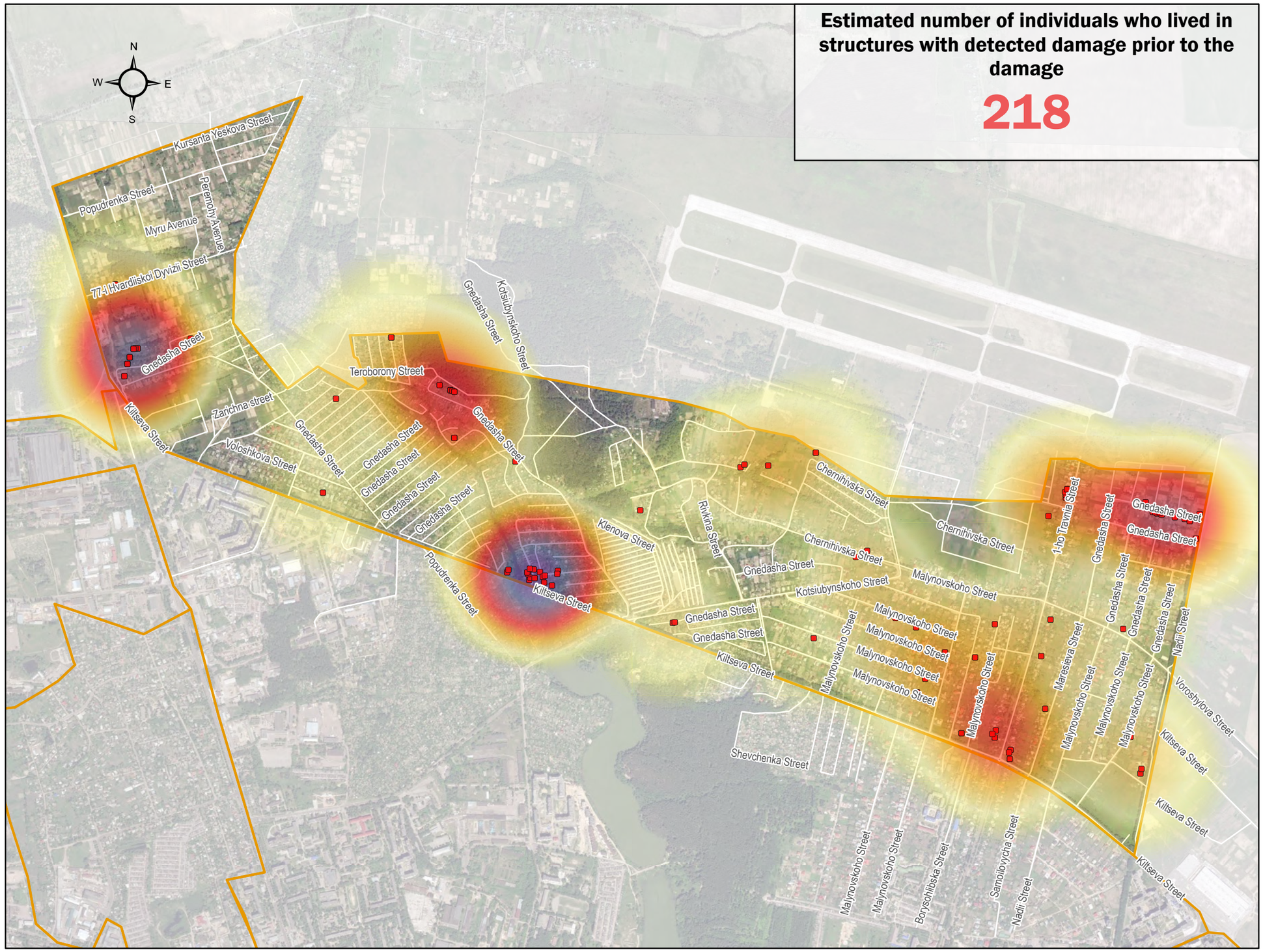
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



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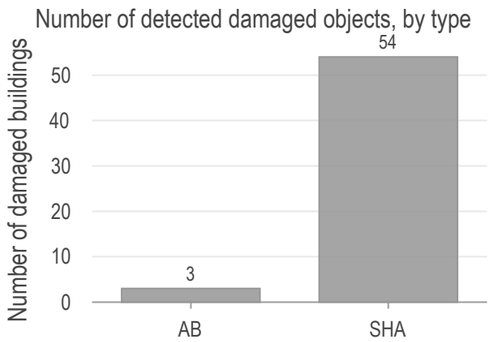
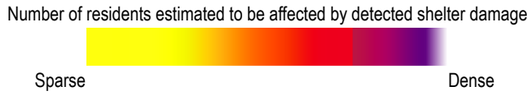
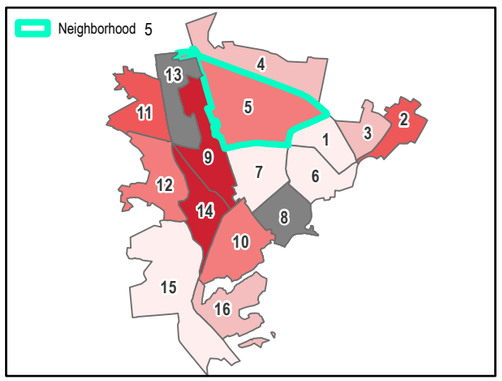
Neighbourhood 5

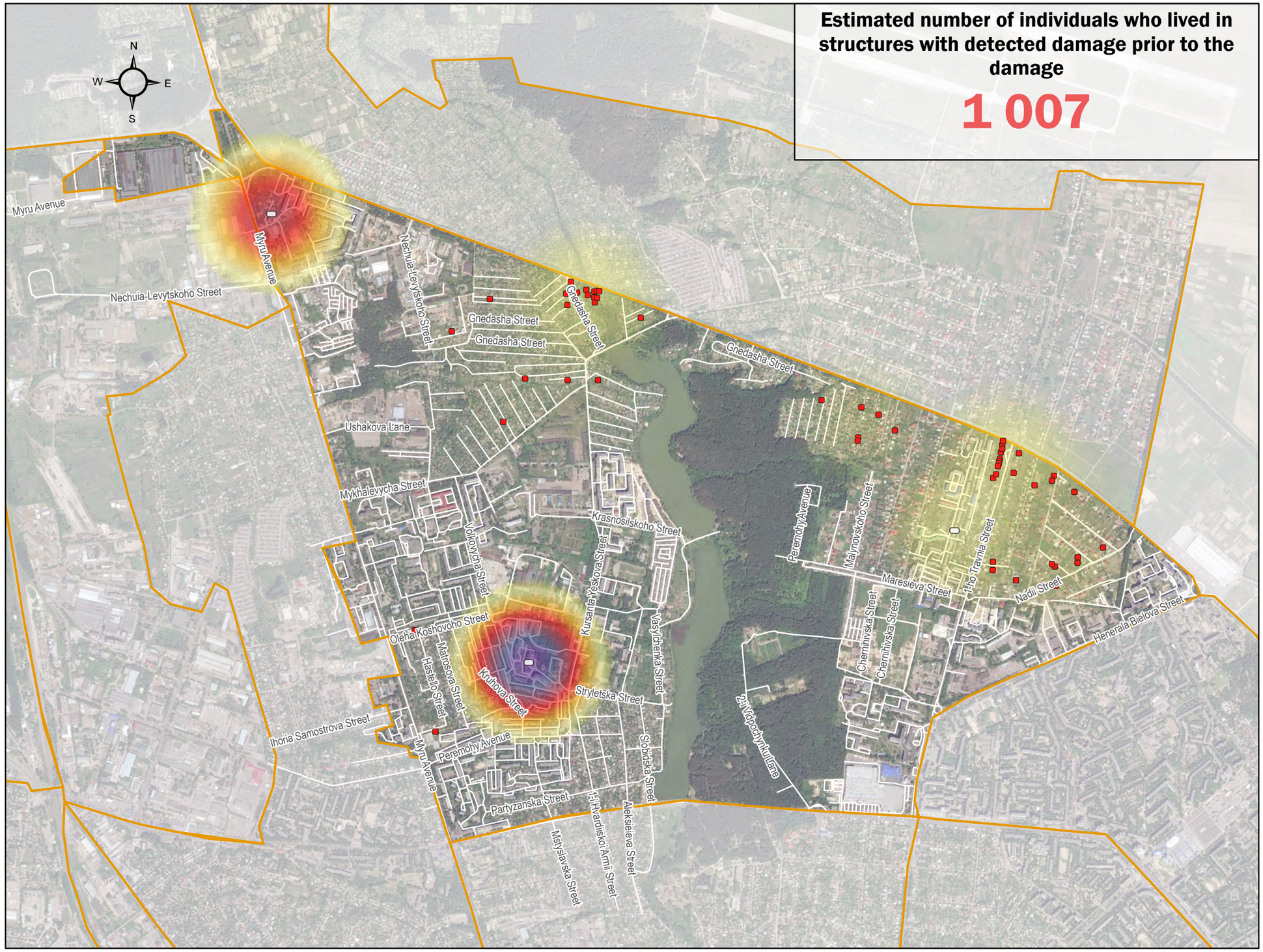


Note: AB - apartment building, SHA - single-household apartment





Apartment building
Single-household apartment
Neighbourhood boundary



Estimated number of individuals who lived in structures with detected damage prior to the damage

1 007

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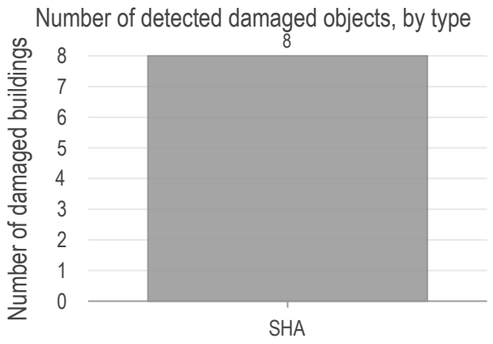
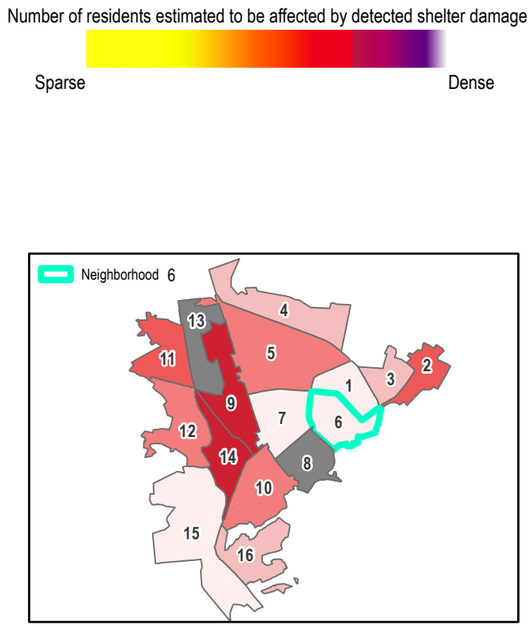
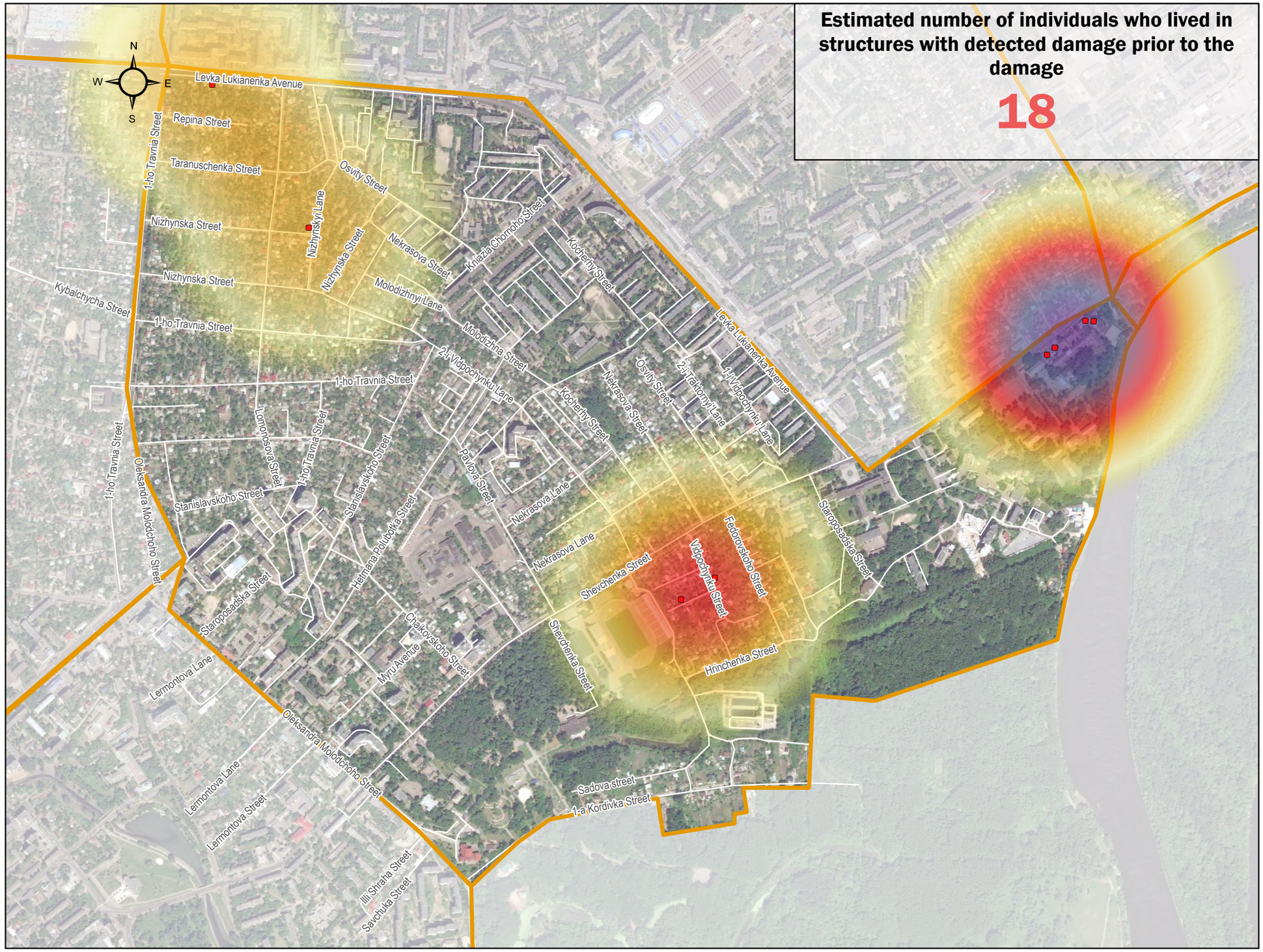
Neighbourhood 6



Note: AB - apartment building, SHA - single-household apartment



Apartment building
Single-household apartment
Neighbourhood boundary



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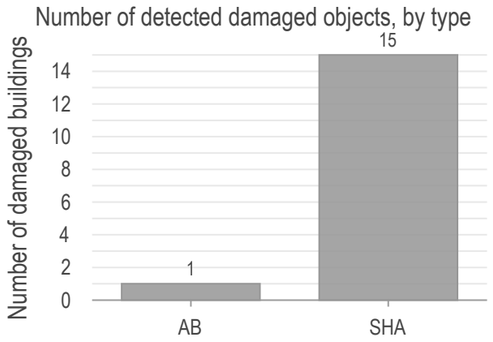
Neighbourhood 7



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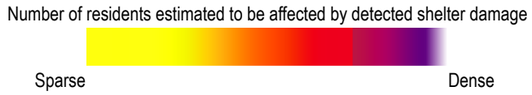
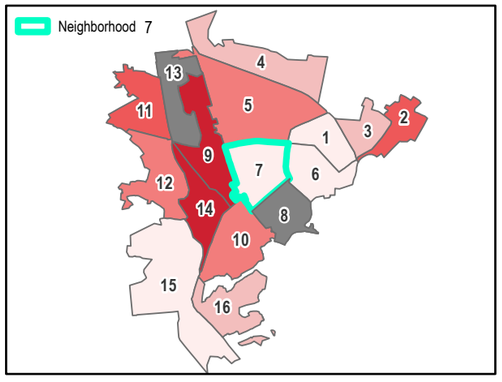
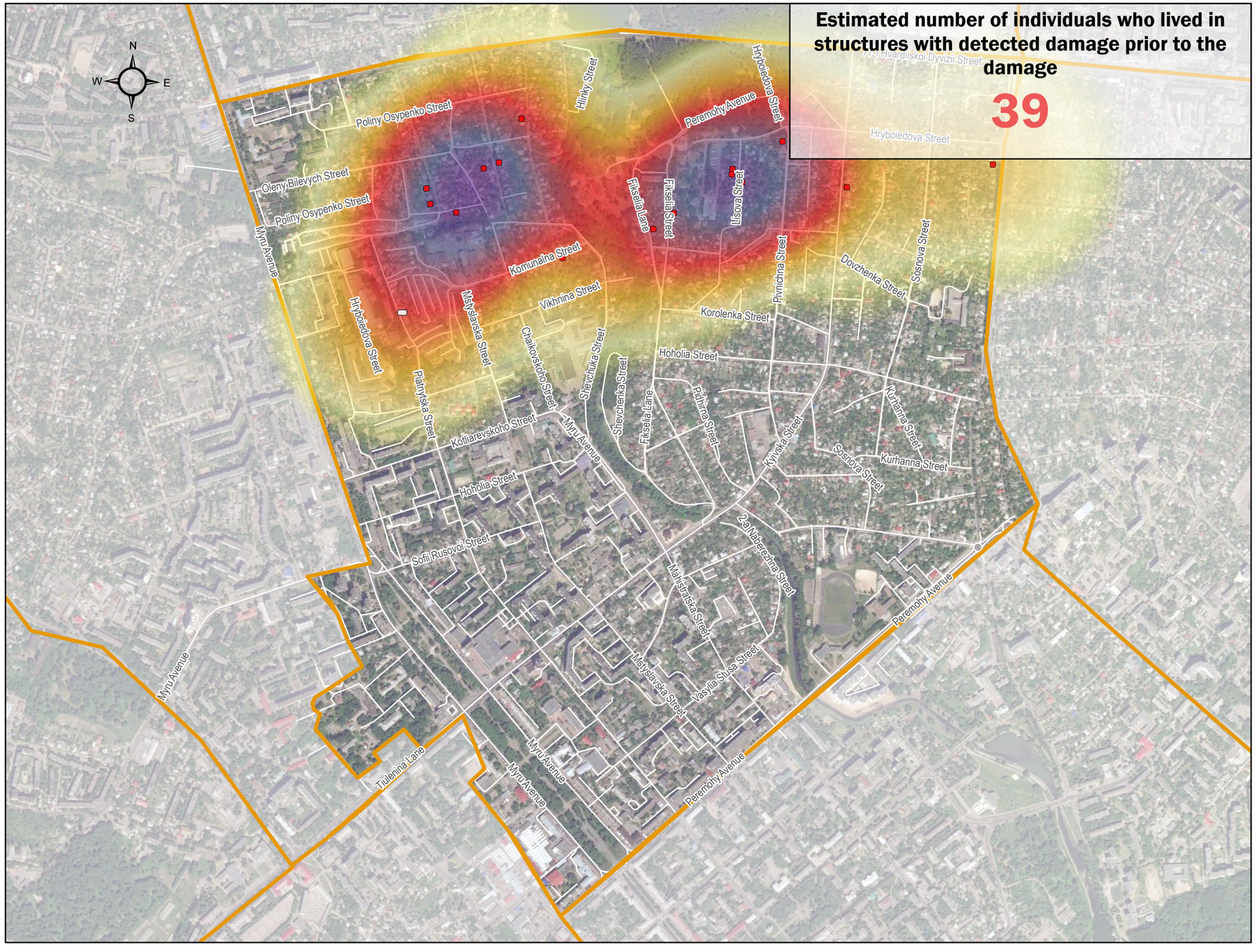




Apartment building
Single-household apartment
Neighbourhood boundary



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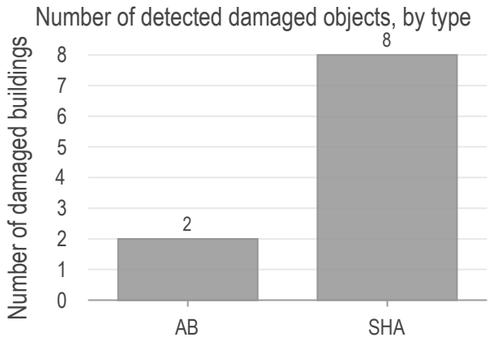
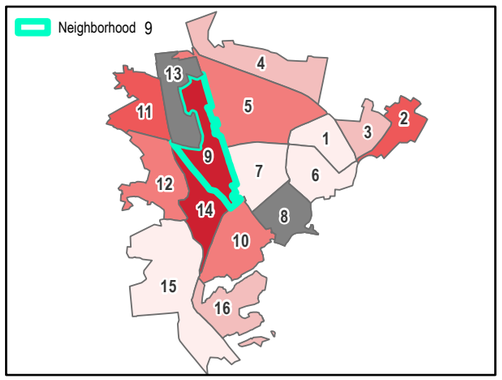
Neighbourhood 9



Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

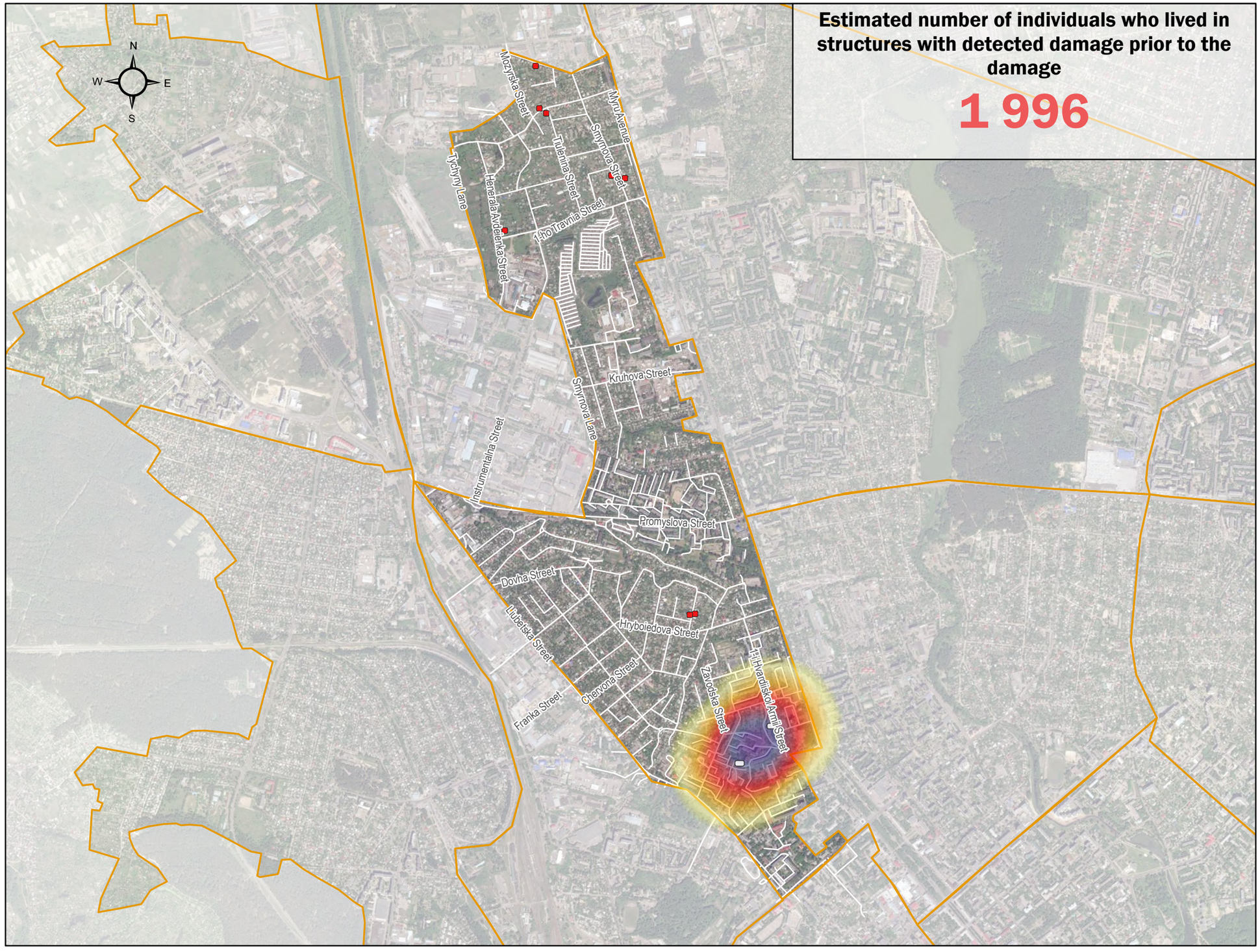
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



Estimated number of individuals who lived in structures with detected damage prior to the damage

1 996

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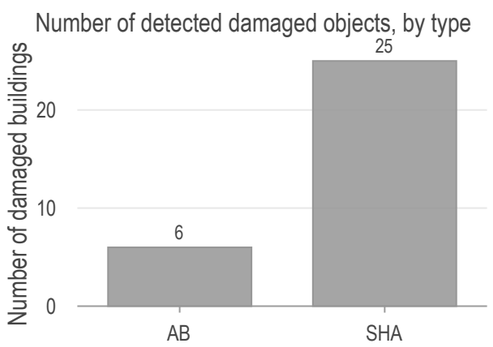
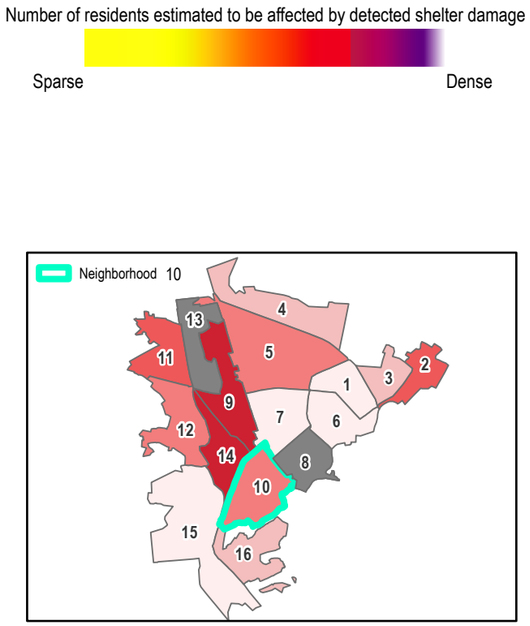
Neighbourhood 10



Note: AB - apartment building, SHA - single-household apartment



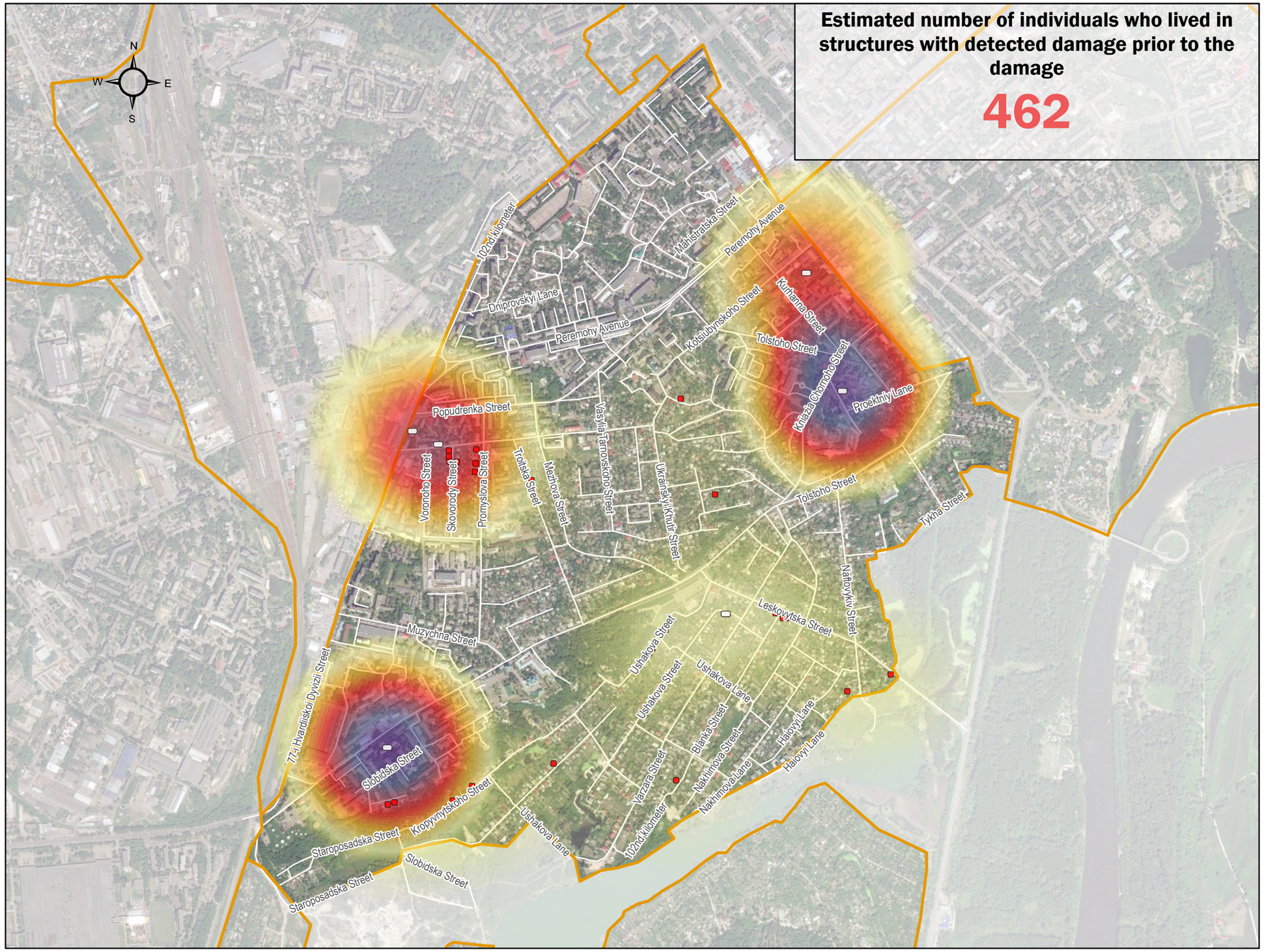
Number of residents estimated to be affected by detected shelter damage

Sparse — Dense

Apartment building

Single-household apartment

Neighbourhood boundary



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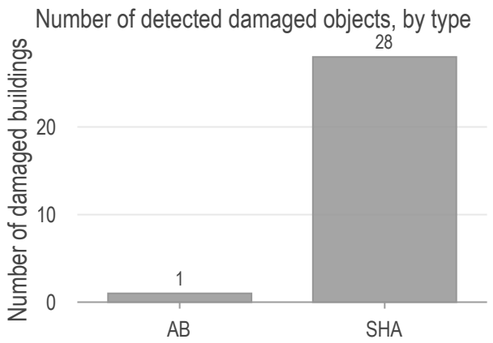
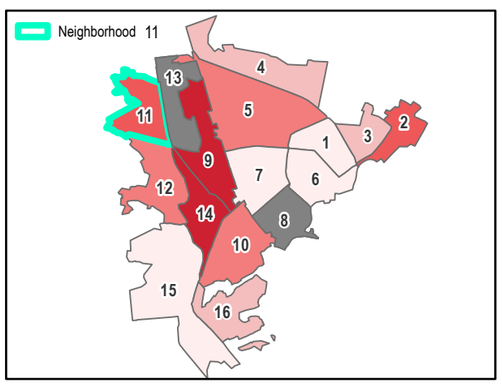
Neighbourhood 11



Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

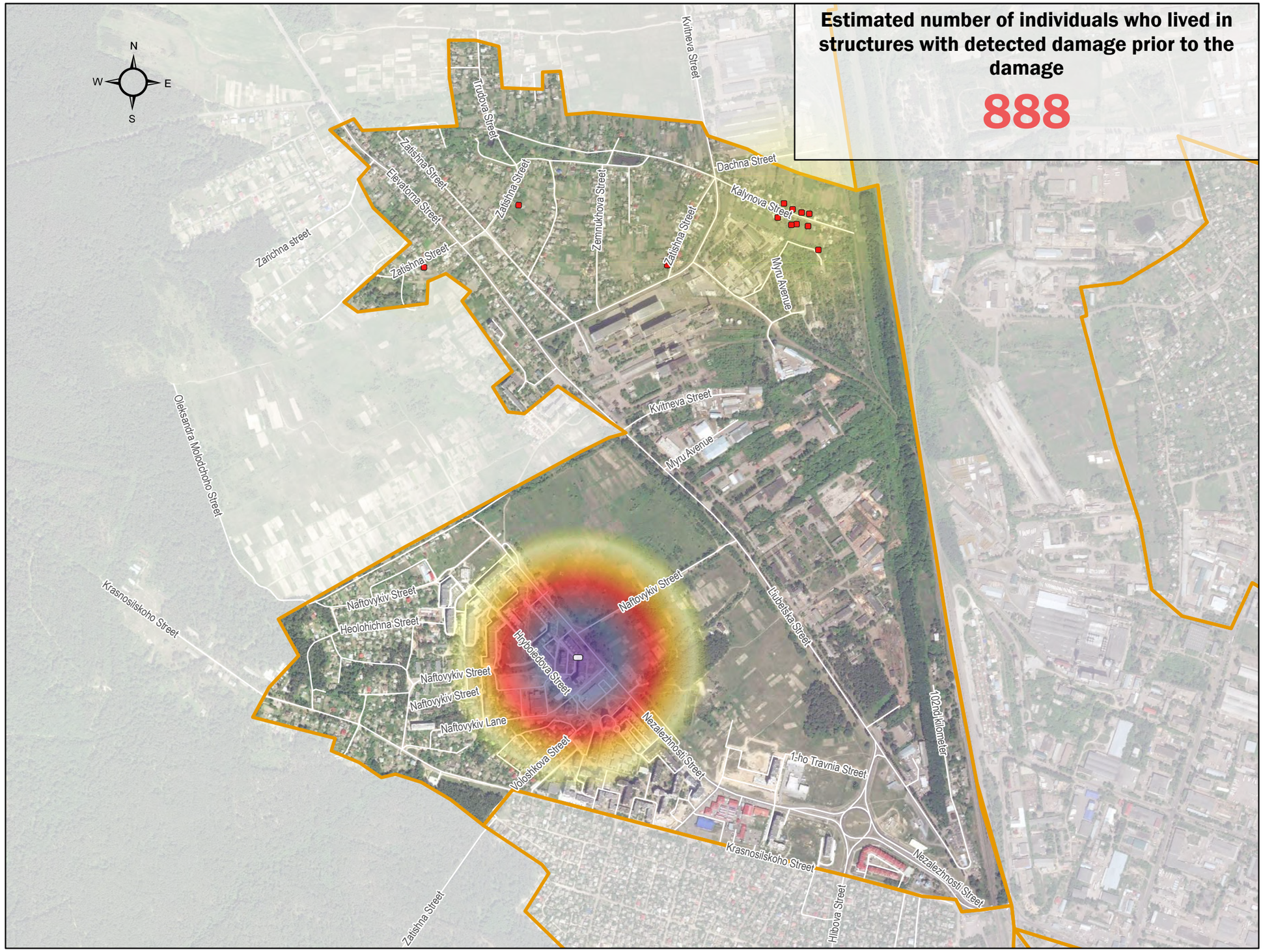
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



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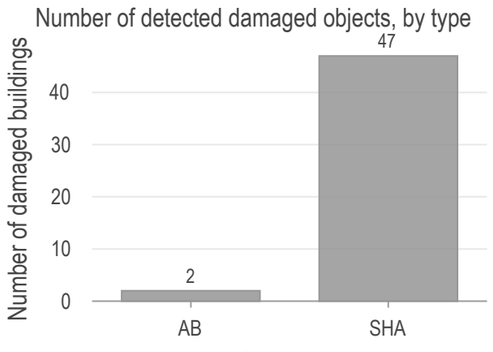
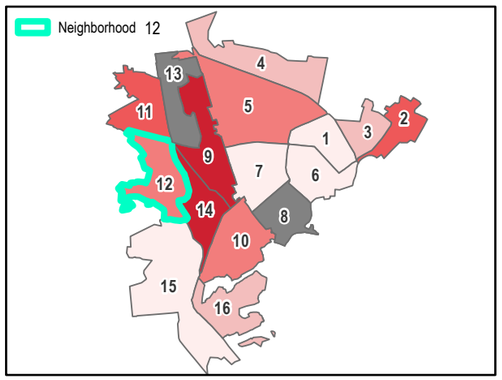
Neighbourhood 12



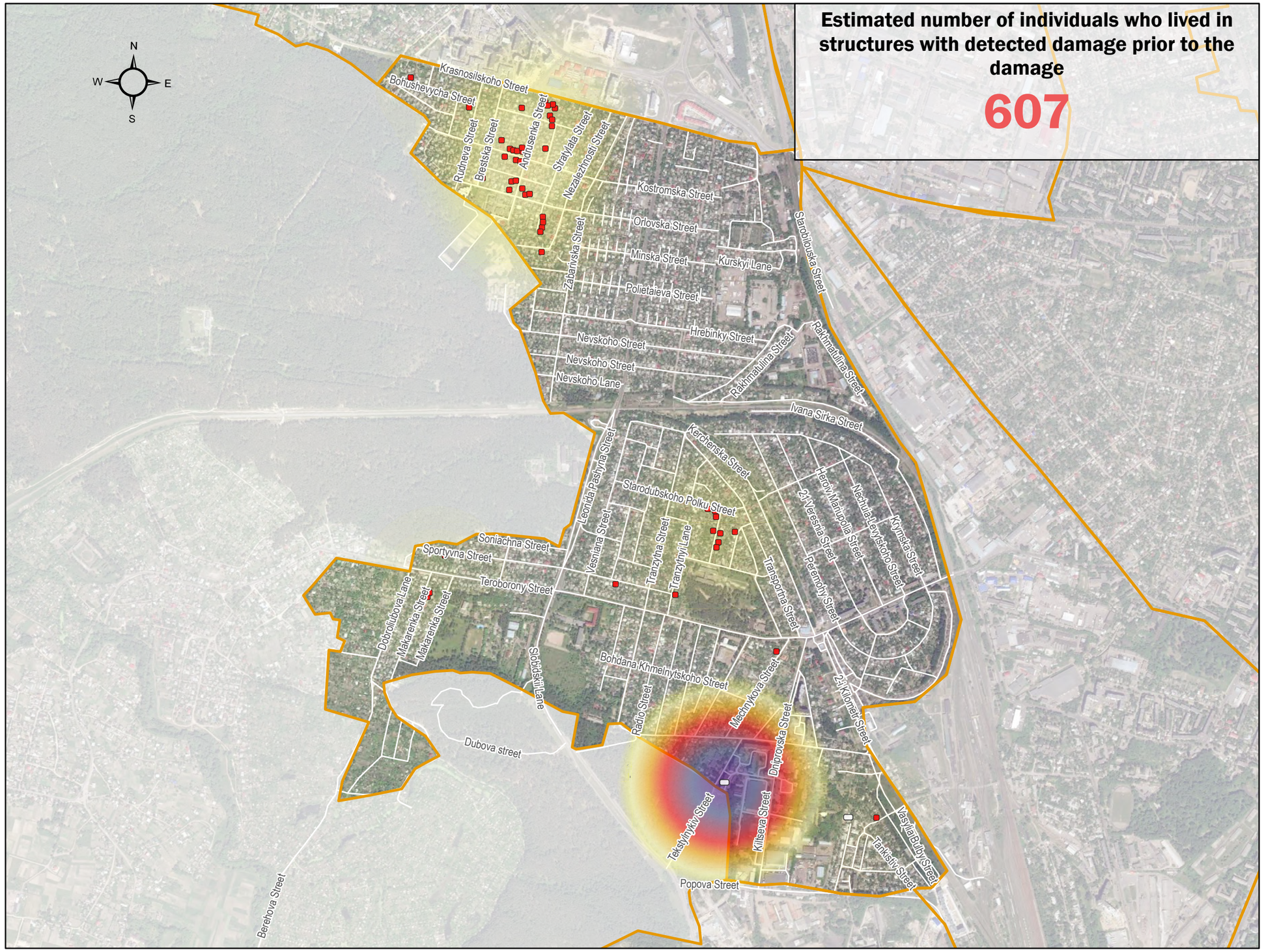
Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

Sparse — Dense



- Apartment building
- Single-household apartment
- Neighbourhood boundary



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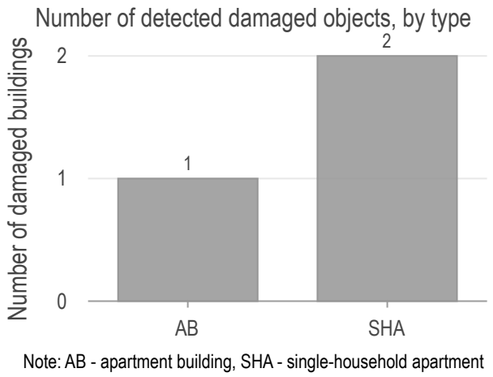
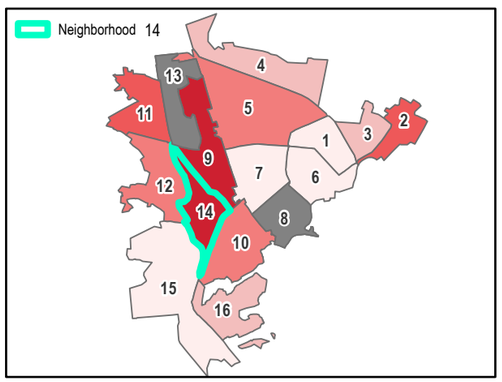
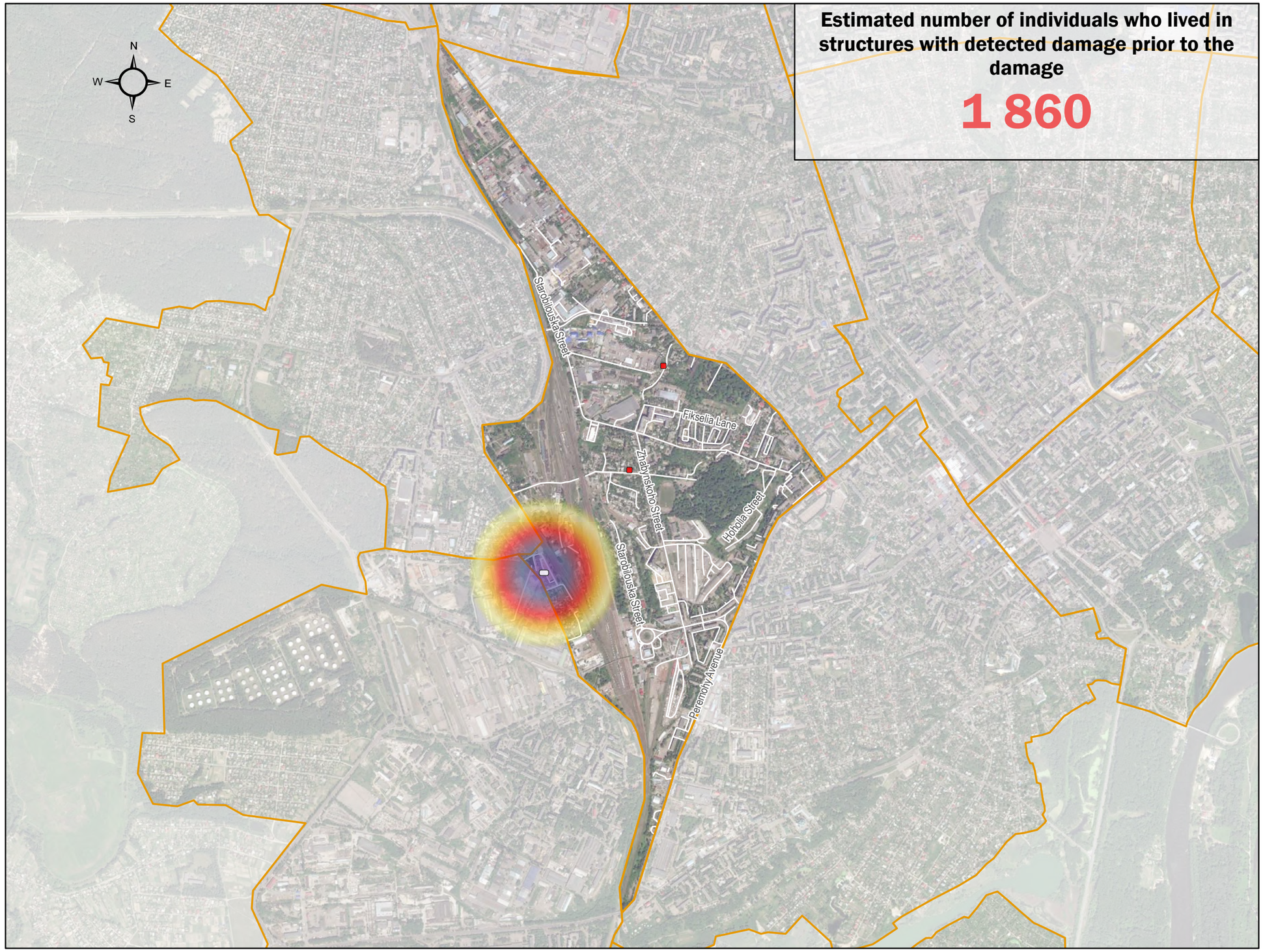
Neighbourhood 14



Note: AB - apartment building, SHA - single-household apartment



Apartment building
Single-household apartment
Neighbourhood boundary



Estimated number of individuals who lived in structures with detected damage prior to the damage

1 860

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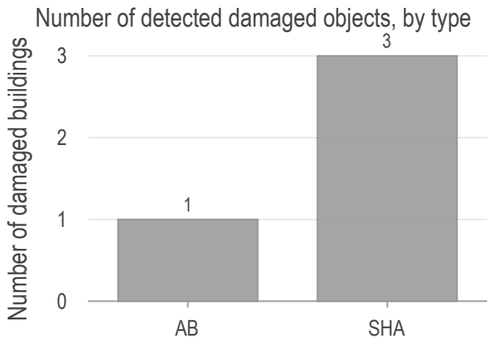
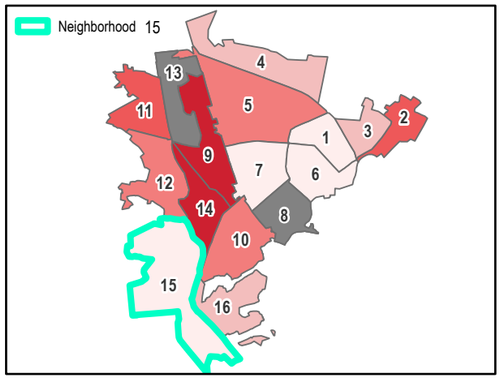
Neighbourhood 15



Note: AB - apartment building, SHA - single-household apartment

Number of residents estimated to be affected by detected shelter damage

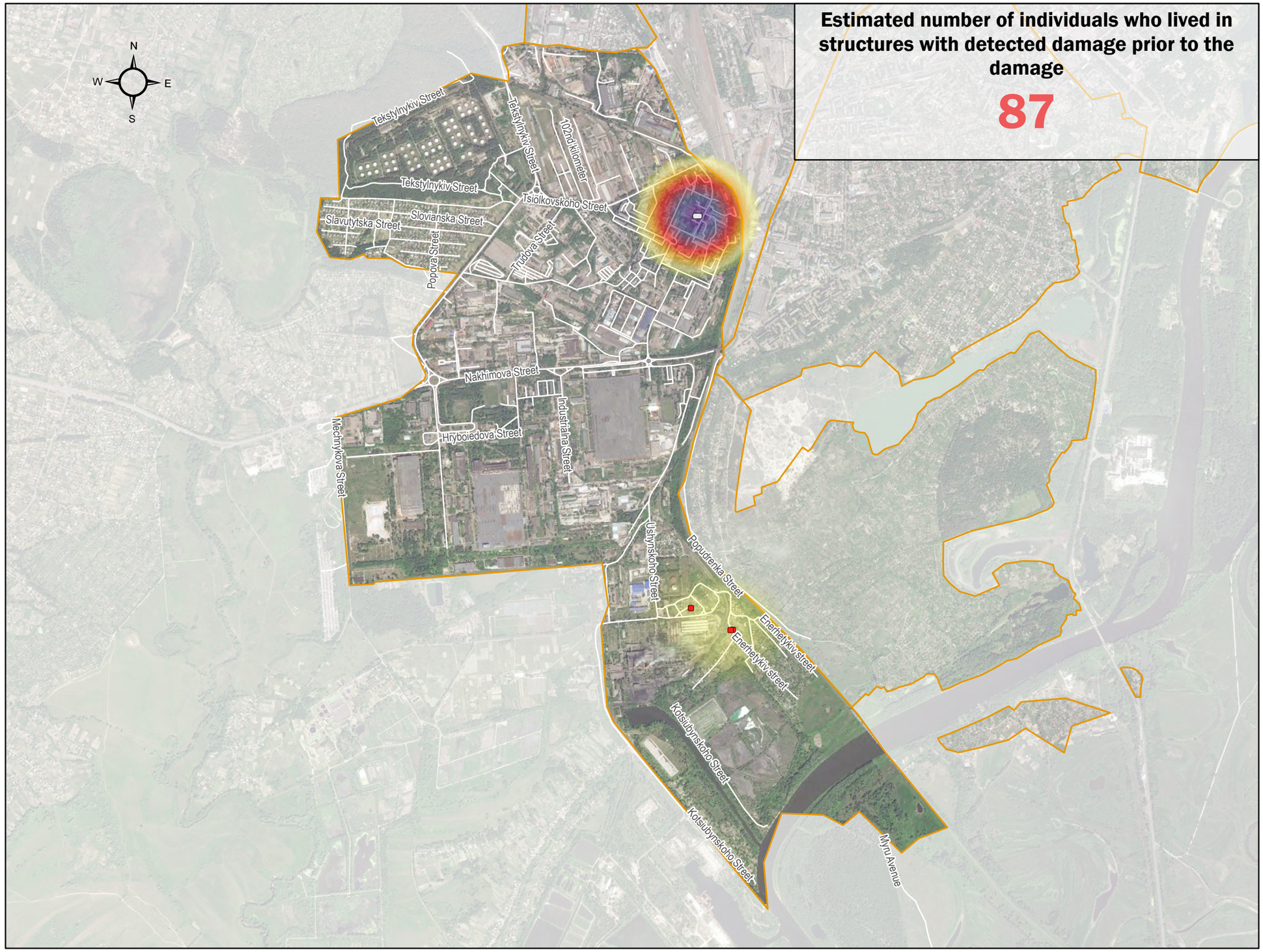
Sparse — Dense



Apartment building

Single-household apartment

Neighbourhood boundary



Estimated number of individuals who lived in structures with detected damage prior to the damage

87

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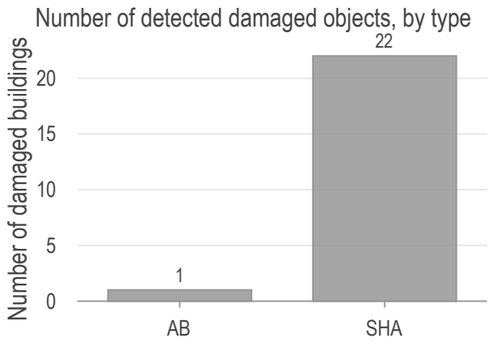
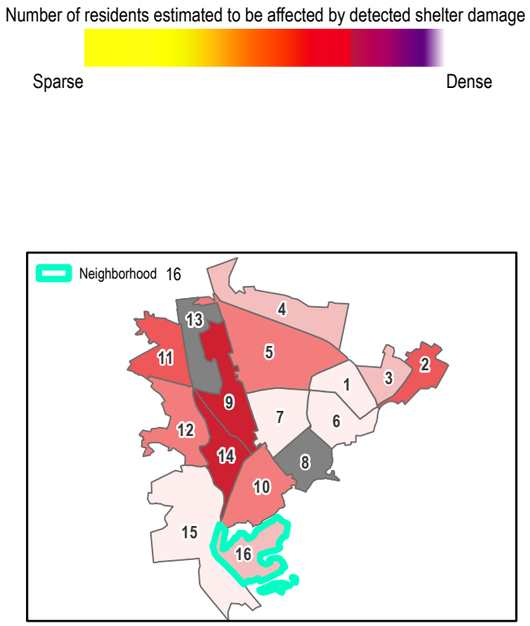
Neighbourhood 16



Note: AB - apartment building, SHA - single-household apartment



Apartment building
Single-household apartment
Neighbourhood boundary

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Reference List

1 The Washington Post, **Seven days in Chernihiv, a Ukrainian city under siege**, 26 March 2022
2 The New Yorker, **The siege of Chernihiv**, 15 April 2022
3 Global News, **The siege of Chernihiv: Residents recount five weeks of horror under Russian terror**, 04 May 2022
4 REACH, **Irpin Residential Damage Analysis**, July 2022
5 More advanced methods to assess and triangulate damage (e.g., drone surveys and 3-dimensional surface modeling) could not be employed for this assessment due to the prohibition of civil drone flights in areas in the vicinity of hostilities.
6 **State Statistics Service in Chernihivska Oblast**, January 2022