COVID VULNERABILITY MAPS FOR IDPs IN URBAN CENTRES

IOM DISPLACEMENT TRACKING MATRIX

BAGHDAD CITY – TEST CASE

Since March 2020, Iraq has been dealing with the coronavirus disease 2019 (COVID-19) pandemic. As the government has limited capacity to provide assistance to affected populations, and the public health-care system is weak, it is vital to gain a better understanding of the areas of the country that are most vulnerable to the rapid spread and impact of COVID-19 to plan for the humanitarian response. IOM DTM Iraq GIS team has undertaken a vulnerability-mapping analysis, beginning in July 2020, to understand how existing data sources can be used to highlight geographic locations that might be more vulnerable in the event of exposure to COVID-19, because of the potential for the disease to quickly spread among the population, and of the limited availability of health-care services for treatment, particularly in relation to areas with a high IDP and/or returnee caseload that are known to be already a more vulnerable population group.

Following a detailed review of available secondary data sources, three key variables were selected for further examination, based on relevance to the management of COVID-19, availability (as new data collection is particularly challenging at this time) and potential for clear and coherent mapping:[1]

1. The IDP and/or returnee population of a city and the density of the population per neighbourhood, taken from IOM DTM Master List, with higher population density indicating greater potential for disease transmission among vulnerable groups;[2]
2. The number of health-care facilities available in a city, taken from Open Street Map, with a lower density highlighting potentially reduced access to health-care for the IDP/returnee population.[3]
3. The number of congregation points present within a city, taken from Open Street Map, with a higher density of congregation points showing greater risk in terms of disease transmission.[4]

These variables were analysed with prevalence determined according to the number of congregation points/health-care facilities per square kilometre. Baghdad was the first city used to test the mapping of these variables. The level of vulnerability was calculated in three steps: first, neighbourhoods of the city were classified as more vulnerable to rapid spread of the virus when presenting a high IDP and/or returnee density, combined with a low prevalence per square kilometre of health-care facilities. Second, neighbourhoods of the city were considered as more vulnerable when the IDP and/or returnee density was high, combined with a high (or in some cases medium) prevalence of congregation points per square kilometre.[5] Third, after identifying through these steps the neighbourhoods likely to be most vulnerable in each case, the maps were overlaid to see which, if any neighbourhoods, were considered vulnerable in both stages of the analysis. Where overlap did occur, these neighbourhoods were identified as the most vulnerable to rapid transmission and high impact of COVID-19. In the event that there was no overlap in the neighbourhoods highlighted in both stages of the analysis, then those neighbourhoods highlighted in step one with low prevalence of health-care facilities and high IDP and/or returnee population density were considered to be the most vulnerable within that city.[6] The two steps were mapped separately, as the data points were too numerous to put on one map without posing readability issues. For Baghdad, the test maps were developed as follows:

Map 1 1 showed the IDP/returnee density per neighbourhood using shading, as well as the location of the health-care facilities (hospitals and clinics, both public and private, as identified by Open Street Maps). The prevalence of health-care facilities is shown in the form of circles where the larger the circle, the more health-care facilities per square kilometre present in the neighbourhood.[7],[8]

Map 2 showed the IDP/returnee density per neighbourhood using shading, as well as the location of the congregation points using relevant symbols. The prevalence of congregation points is shown in the form of circles where the larger the circle, the more congregation points per square kilometre present in the neighbourhood.[9],[10]

Map 3 overlayed the findings shown in maps 1 and 2, and highlights the neighbourhoods found to be the most vulnerable, that is, the ones where 1) high IDP/returnee density + low density of health-care facilities was shown; and 2) high IDP density + high/medium number of congregation points intersects. The neighbourhoods highlighted through this process show characteristics that could make the location particularly vulnerable to the rapid spread of COVID-19 in case of an outbreak within the neighbourhood, and the impact could be more severe based on lower-than-average availability of health-care services.[11]

The most vulnerable neighbourhoods of Baghdad identified through this process were Muthanna-Zayonna, Adhamiyah, and Maghreb.

1 *IOM DTM acknowledges that there are many additional variables that can be used to determine vulnerability, however these are thought to be the most relevant for a GIS analysis*
2 *IOM DTM Master List round 116, available from: http://iraqdtm.iom.int/MasterList*
3 *Data available from: https://www.openstreetmap.org/*
4 *The number of congregation points present within a city, taken from Open Street Map, with a higher density of congregation points showing greater risk in terms of disease transmission*
5 *The high, medium and low classification is arbitrarily done by the GIS software based on the counts of each variable, which means that the numbers differ for all the three variables for the same class.*
6 *For the congregation points, both high and medium densities are taken into consideration because the high congregation and high IDP densities did not overlap with the high IDP densities and low health facility density.*
7 *Open Street Maps does not have data on the status of the health care facilities as public or private, so all were included for the sake of this analysis the analysis.*
8 *Low density of health care facilities constituted 0-0.02 facilities per capita, medium 0.03-0.05 facilities per capita and high 0.06-0.16. These thresholds were determined using GIS software based on the neighbourhood level data.*
9 *The circles indicate the overall density situation in the neighborhood. Mapping both the density as circles and showing the actual locations shows if a neighborhood has a high density of facilities and to see the actual location of the facilities, if the facilities are evenly distributed, clustered in one part of the neighborhood, etc. In terms of congregation points per capita, 0-0.5 is low, 0.6-1.4 medium and 1.5-3.25 high.*
10 *Low IDP/returnee population density was considered to be <30 individuals per sq km, medium density 31-98 individuals per sq km, and high density 99-302 individuals. per sq km. These thresholds were determined using GIS software based on the neighbourhood level data.*
11 *It should be noted that the intersection could be a null value in some cases, i.e. there is no overlap in the areas found to be particularly vulnerable in the two stages of analysis. In such cases, those neighborhoods where the healthcare facility is low and population density is high were considered as the most vulnerable disregarding the congregation points.*

These maps and the methodology were developed in collaboration with the IOM Health Unit. The outcomes were shared with the Assessment Working Group (AWG) and Information Management Working Group (IMWG) for review. Following this review, some modifications were made to the methodology, whereby it was agreed that per capita availability of these facilities for the returnee/IDP population would be a better indicator of availability of these services at the location level. The DTM GIS team applied this adapted methodology to Baghdad, as well as to other locations across the country for which the shape files were available and a considerable number of IDPs/returnees were present. The locations covered are: Mosul, Erbil, Dahuk, Sulaymaniyah, Soran, Kirkuk, Ramadi and Zakho. The maps and findings for each of these locations are outlined below.

MOSUL (MAPS 4–6)

Map 4 below highlights the neighbourhoods of Mosul identified as having a high IDP/returnee population density and low per capita prevalence of health-care facilities, and map 5 highlights the population density in relation to the congregation points across the city. When comparing the two maps, no overlap can be seen between the two vulnerability analyses. As a result, the high vulnerability neighbourhoods were determined based on the high population density and low per capita availability of medical facilities only. The four neighbourhoods considered to be the most vulnerable were Al-Ezdihar, Al-Amel, Tal Al-Romman, Al-Eslah Al-Zeraee and Al-Mayasa, as shown in map 6.

ERBIL (MAPS 7–9)

During step 1 of the analysis, very few of the neighbourhoods of Erbil were found to have high IDP population density and low prevalence of health-care facilities per capita. Step 2 of the analysis showed that the main areas of congregation throughout the city are located away from the main IDP-hosting neighbourhoods, again leaving only a few neighbourhoods with high IDP population density and high prevalence of congregation points. When overlapping the two maps, there was no overlap shown between the most vulnerable areas highlighted in step 1 and step 2. Therefore, the neighbourhoods with high IDP population density with low per capita prevalence of health-care facilities were considered to be the most vulnerable. The ten neighbourhoods identified were Bestu Shashi Gulan, Rustm Palace Center, 108 Ankawa, Iskan, Zanko 1, Grupi Andazyaran, Aynda 1, Dashti Bahasht City, Ozal City and Shahan City as shown in map 9.

DAHUK (MAPS 10–12)

Following the two-step analysis, Dohuk again showed that there were no overlapping neighbourhoods identified in both maps. As a result, the neighbourhoods highlighted in step 1 showing a high IDP/returnee population density in the same areas as a low per capita availability of health-care facilities were considered to be the most vulnerable areas of Dahuk. The five neighbourhoods identified were Shahidan, Avro City, Sarhldan 2, Gre Base, and Barushka Rozh Halat, as shown in map 12.

SULAIYMANIYAH (MAPS 13–15)

Sulaymaniyah again showed that there were no overlapping neighbourhoods identified as most vulnerable in steps 1 and 2 of the analysis. As a result, the neighbourhoods highlighted as the most vulnerable in step 1 showing a high IDP population density in the same areas as low per capita availability of health-care facilities were considered to be the most vulnerable neighbourhoods of Sulaymaniyah. The three neighbourhoods identified were Sarchnar, Mashkhalan and Khabat-2 as shown in map 15.

SORAN (MAPS 16–18)

Soran is a relatively small town with only six neighbourhoods that have IDPs present and no returnees. Following the two-step analysis, one neighbourhood was found to have medium population density as well as high per capita prevalence of congregation points and low per capita availability of health-care facilities. The neighbourhood found to be most vulnerable was Chami Rezan, as shown in map 18.

KIRKUK (MAPS 19–21)

Analysis of Kirkuk showed that the neighbourhoods shown in the two steps of analysis did not overlap. Therefore, the neighbourhoods with the highest IDP/returnee population density and the lowest per capita availability of health-care facilities were considered to be the most vulnerable. In Kirkuk, the four neighbourhoods found to be most vulnerable were Darwaza, Al-Qadisssiya (Rabareen) 1, Al Hurriyah, and Rahim Awa as shown in Map 21.

RAMADI (MAPS 22–24)

In Ramadi, the analysis showed that the neighbourhoods highlighted in the two steps of the analysis did not overlap, and therefore the most vulnerable areas of the city were determined based on the IDP/returnee population density and the prevalence of health-care facilities in the city. The IDP/returnee population is relatively concentrated in the central areas of the city, and the as a result this is where the cities considered to be the most vulnerable are located – Al Azeziya, Al Aadil and Al Shuqaq Al Bidh.

HADITHA (MAPS 25–26)

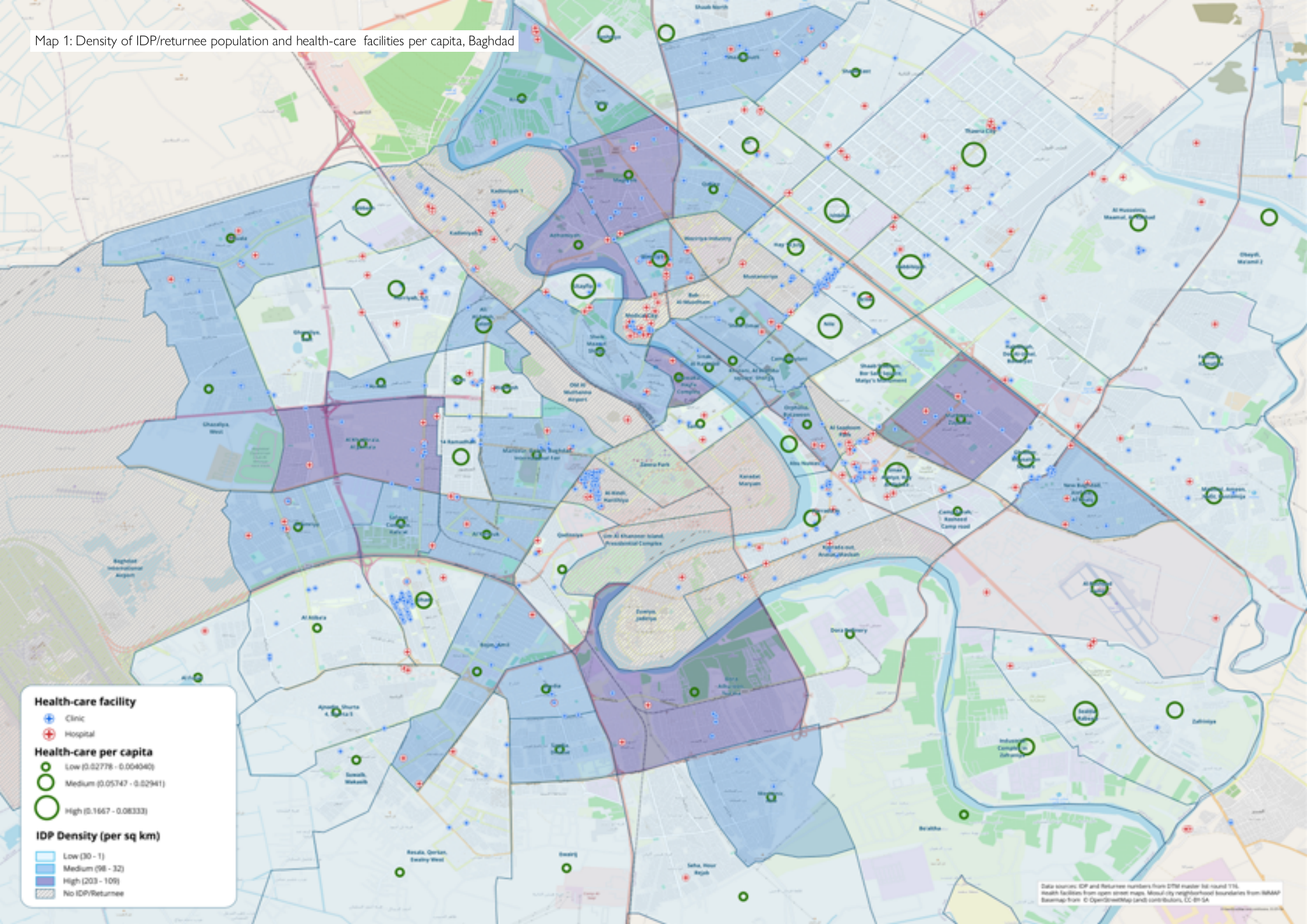
For Haditha, data on health-care facilities was not available on Open Street Map, and therefore it was not possible to conduct the first step of the analysis.[12] As a result, the vulnerable neighbourhoods were selected based on the density of congregation points and the IDP/returnee population data, with the density of congregation points being the dominant factor. Some neighbourhoods with a high population density of IDPs/returnees were not selected as the most vulnerable, because there was a low or medium density of congregation points in these areas. Two neighbourhoods were found to have both high density of congregation points as well as high IDP/returnee population, and therefore were considered the most vulnerable: Hay Khalid Ibn Al Walid and Ibn Bittar.

ZAKHO (MAPS 27–29)

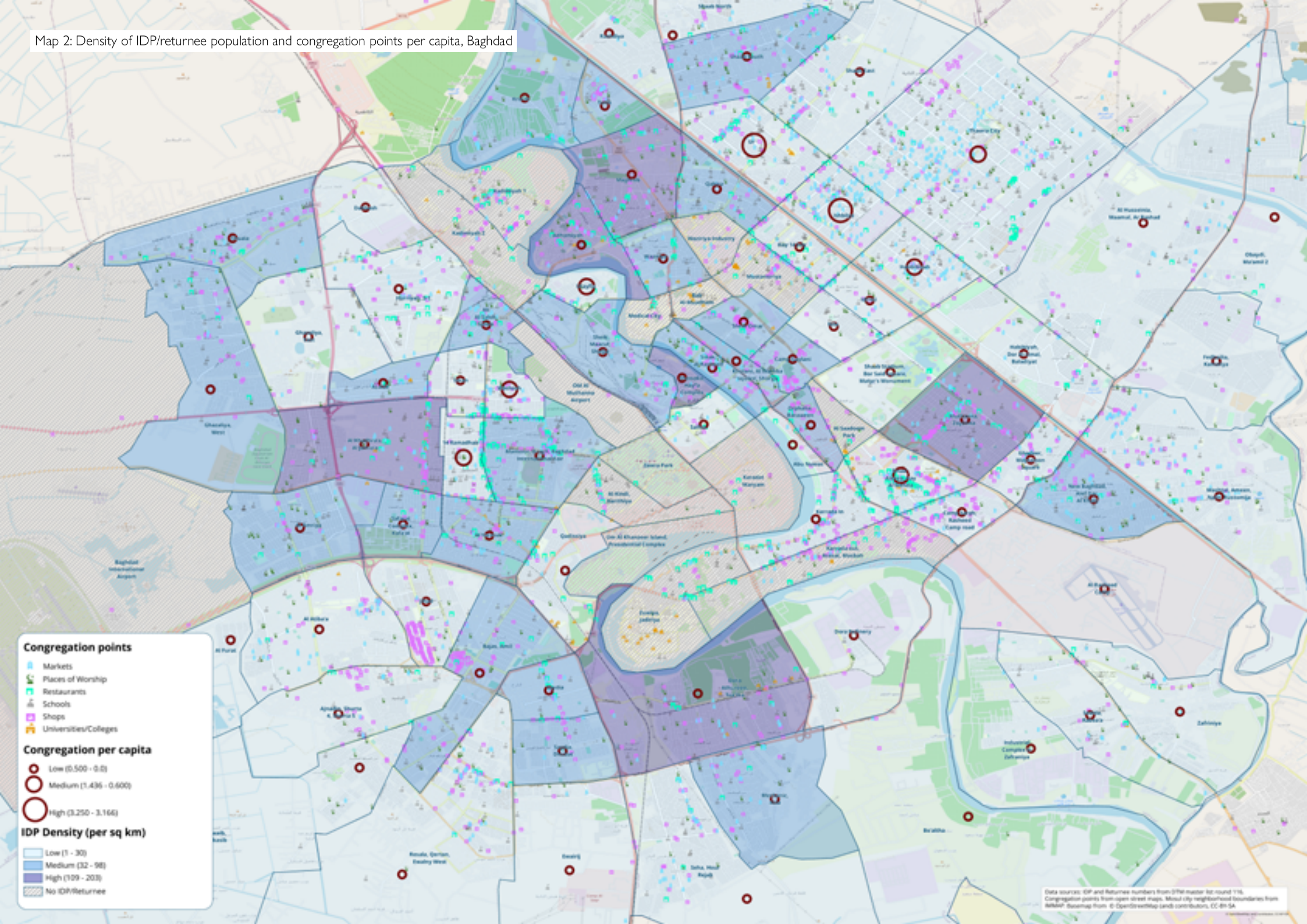
As there are no returnees in Zakho, only IDPs were used for the analysis of this town. Provision of health-care services is poor throughout, and all neighbourhoods with high or medium IDP population density had no health-care services present within the neighbourhood according to the data available through Open Street Map. Density of congregation points was not significant in these neighbourhoods, having little impact. The neighbourhoods that were considered to be the most vulnerable in Zakho were Hzr, Sarhaldan, Kesta, and Goran.

12 OCHA are in the process of verifying this data with the Health Cluster before it will be publicly available.

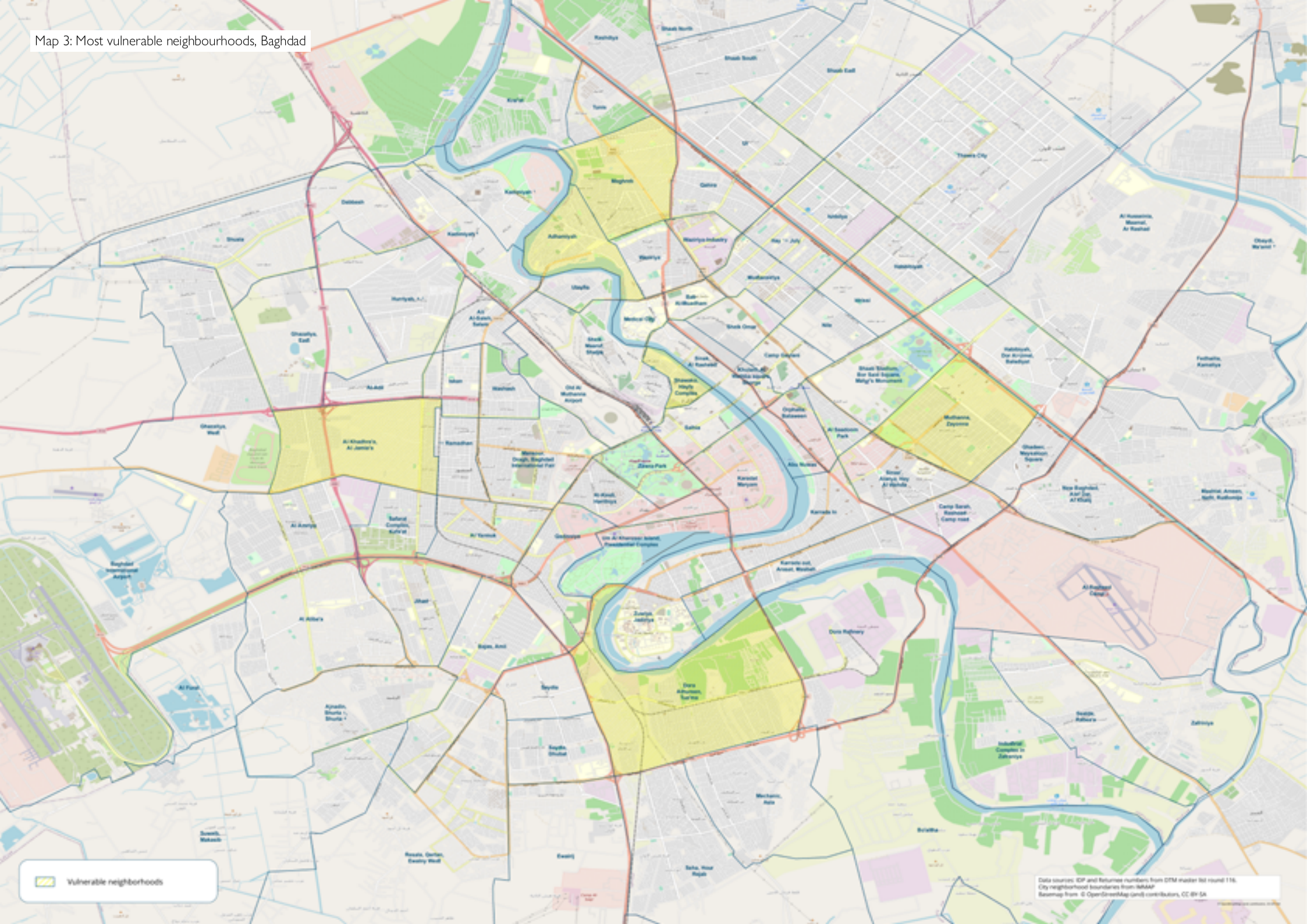
Map 1: Density of IDP/returnee population and health-care facilities per capita, Baghdad



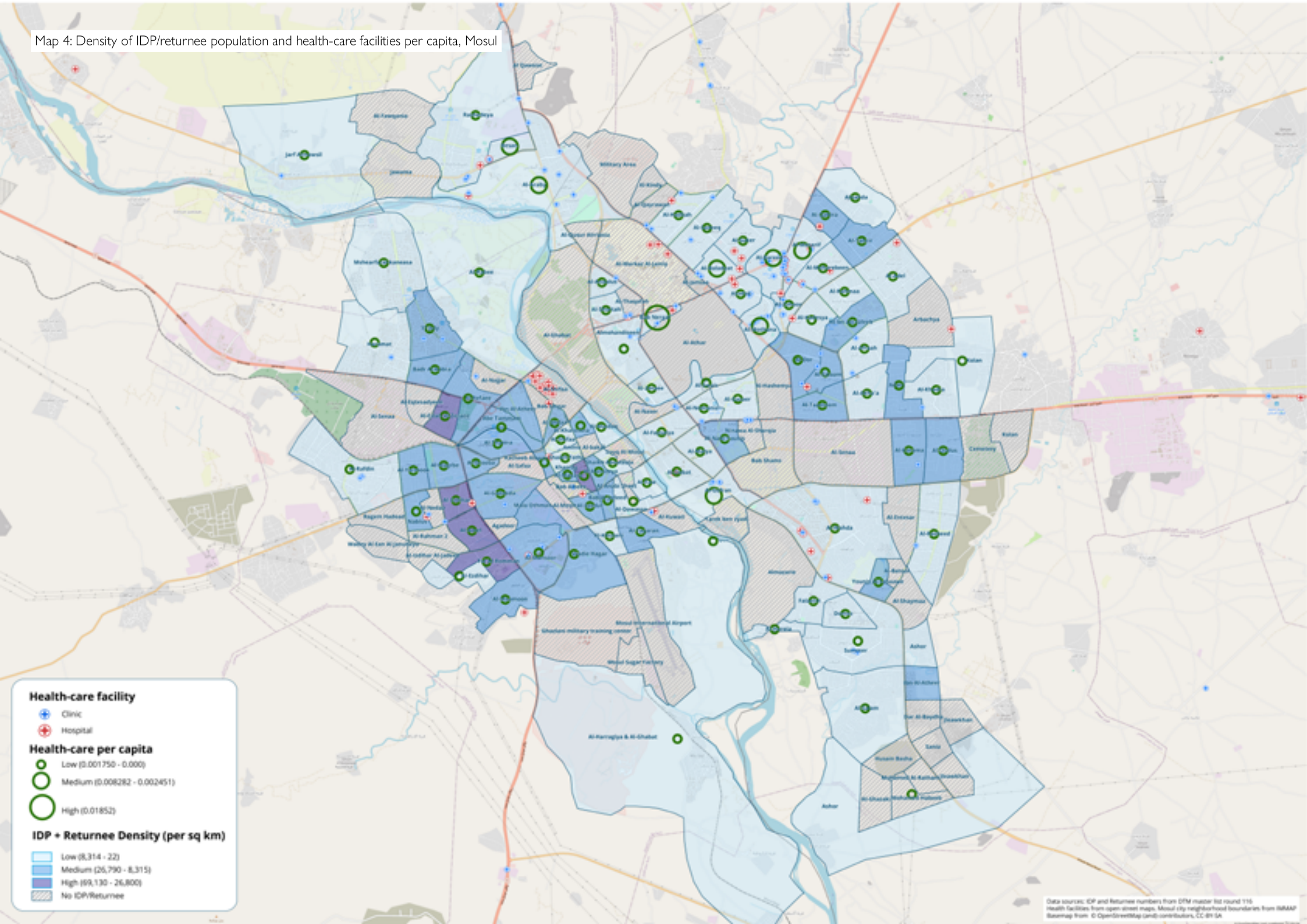
Map 2: Density of IDP/returnee population and congregation points per capita, Baghdad



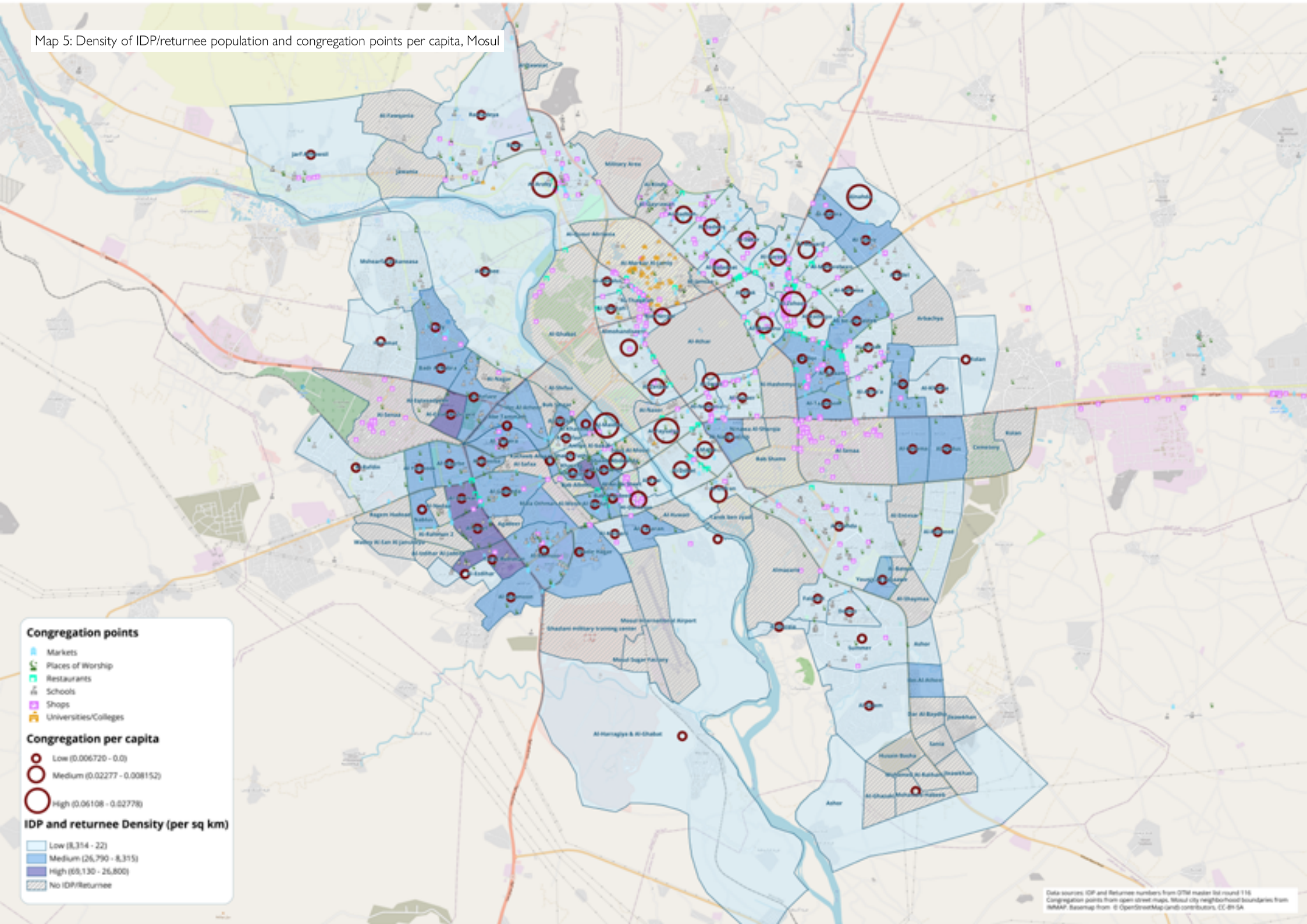
Map 3: Most vulnerable neighbourhoods, Baghdad



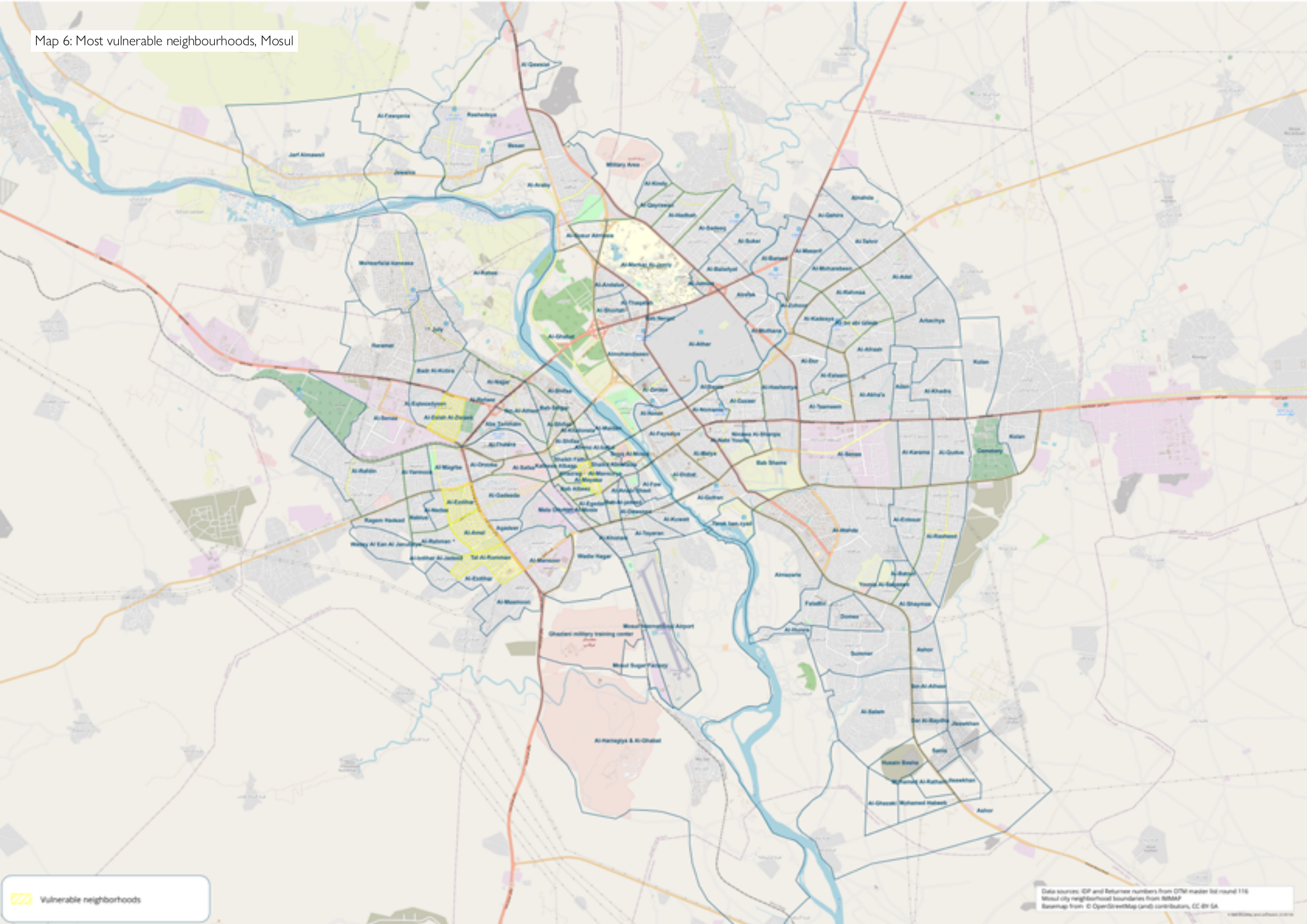
Map 4: Density of IDP/returnee population and health-care facilities per capita, Mosul



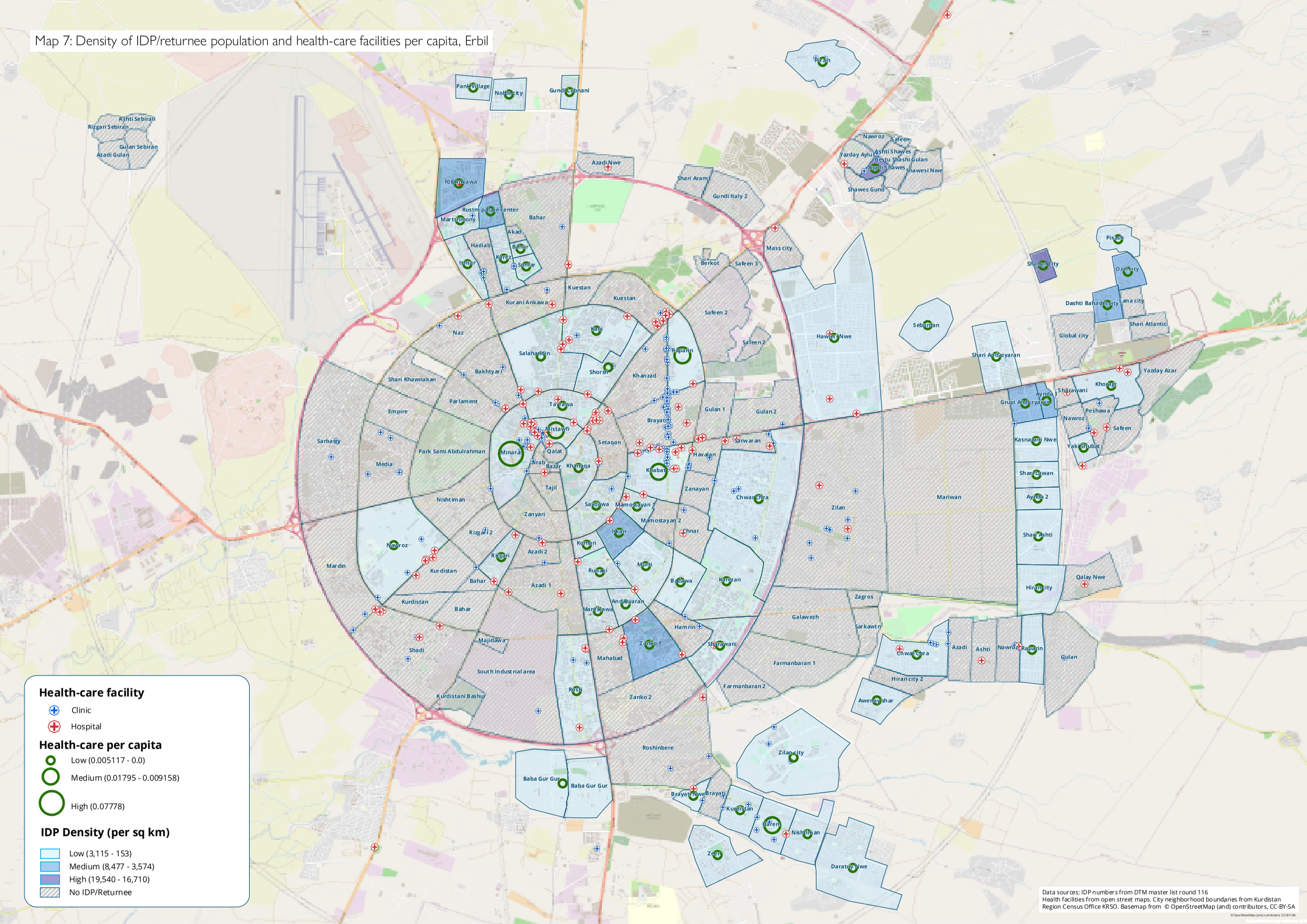
Map 5: Density of IDP/returnee population and congregation points per capita, Mosul



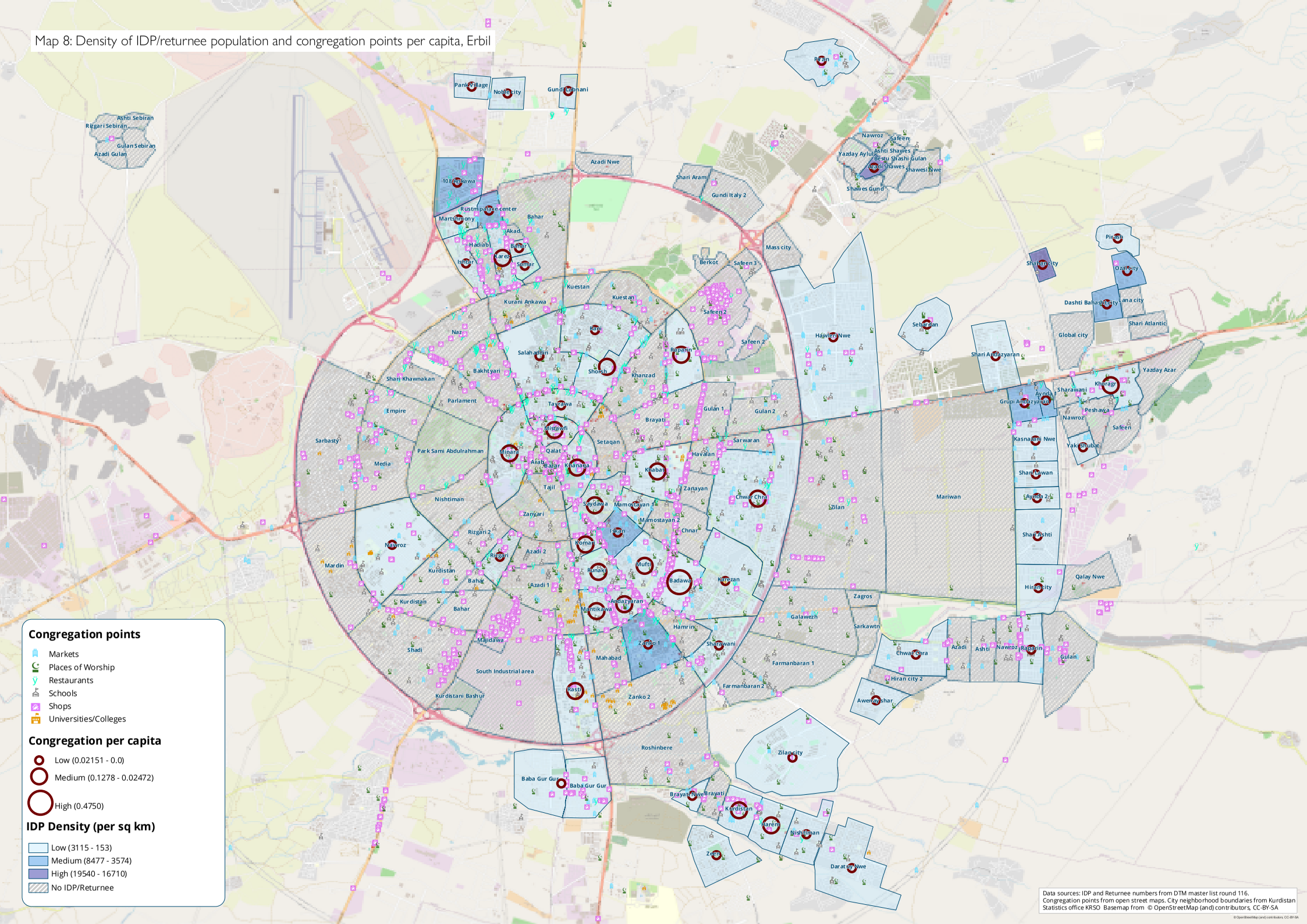
Map 6: Most vulnerable neighbourhoods, Mosul



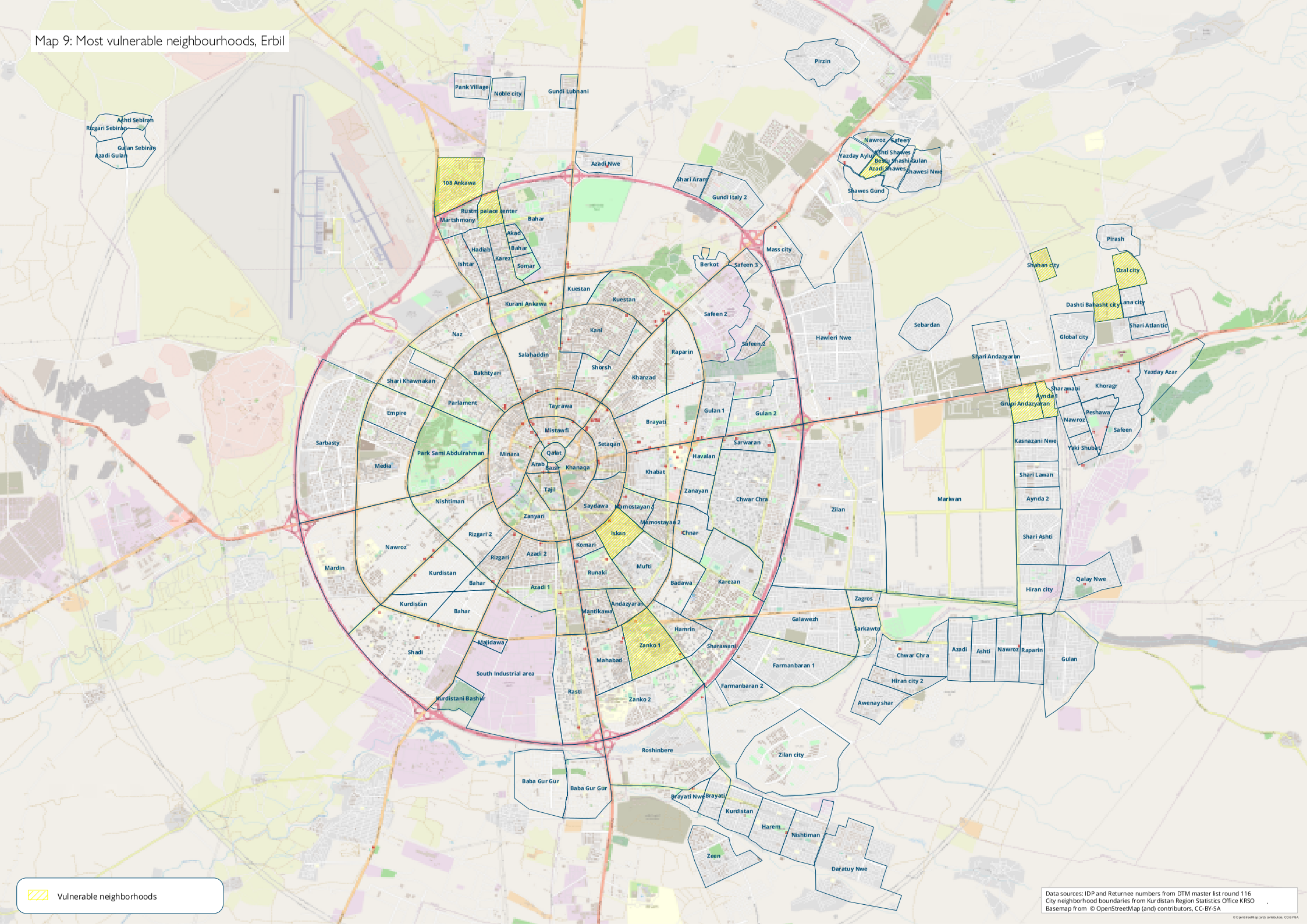
Map 7: Density of IDP/returnee population and health-care facilities per capita, Erbil



Map 8: Density of IDP/returnee population and congregation points per capita, Erbil



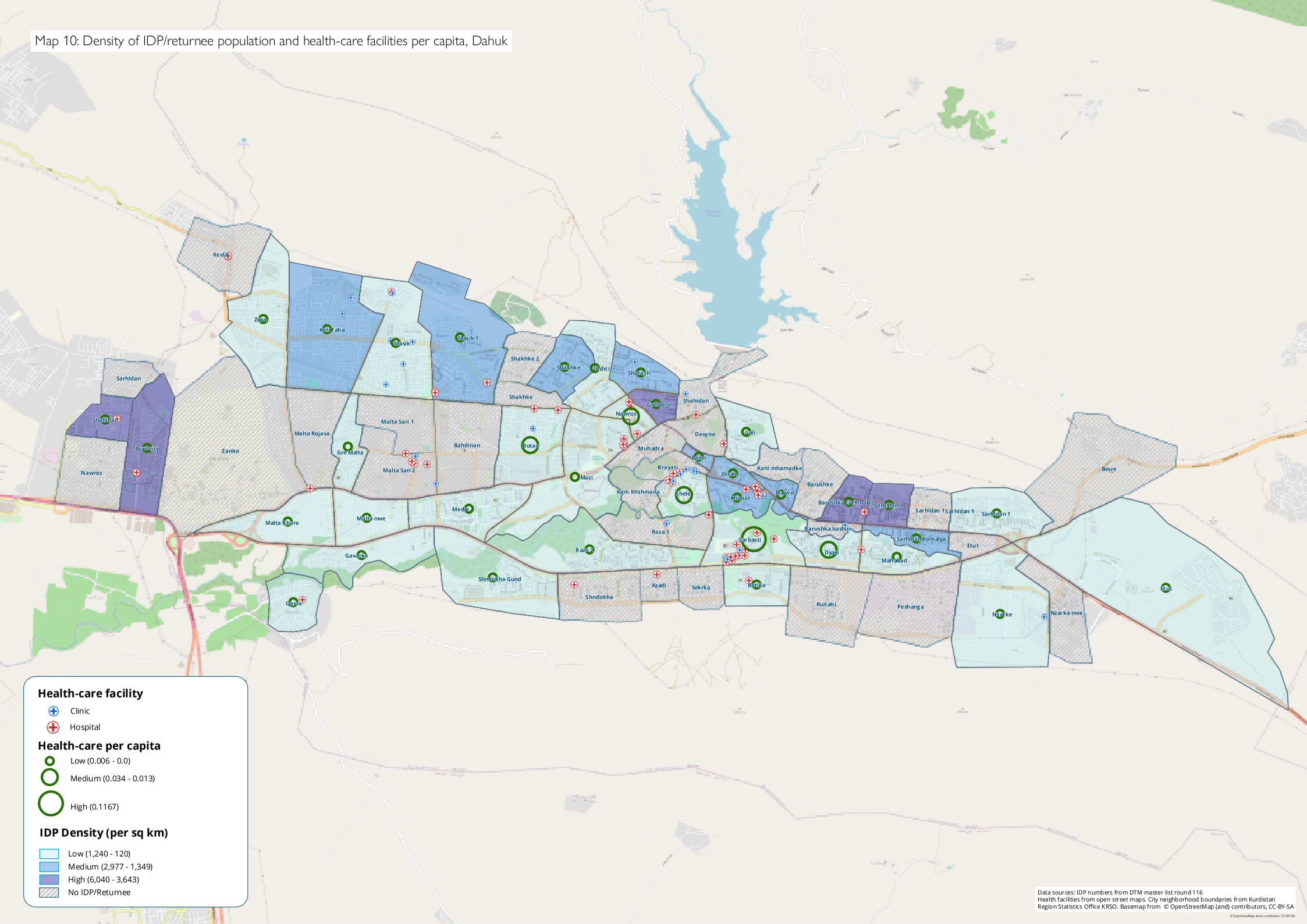
Map 9: Most vulnerable neighbourhoods, Erbil



Vulnerable neighborhoods

Data sources: IDP and Returnee numbers from DTM master list round 116
City neighborhood boundaries from Kurdistan Region Statistics Office KRSO
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 10: Density of IDP/returnee population and health-care facilities per capita, Dahuk



Health-care facility

- Clinic
- Hospital

Health-care per capita

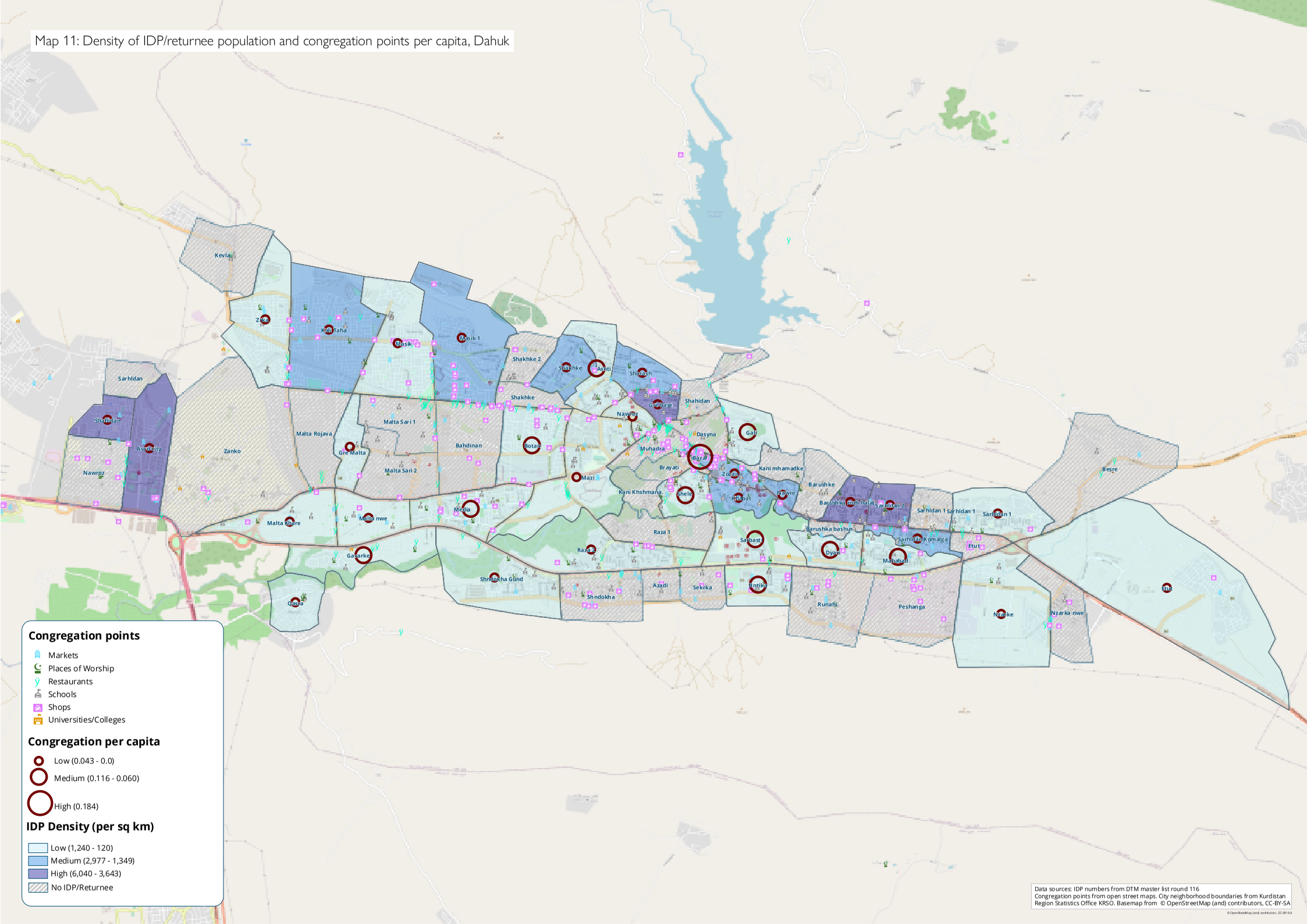
- Low (0.006 - 0.0)
- Medium (0.034 - 0.013)
- High (0.1167)

IDP Density (per sq km)

- Low (1,240 - 120)
- Medium (2,977 - 1,349)
- High (6,040 - 3,643)
- No IDP/Returnee

Data sources: IDP numbers from DTM master list round 116
Health facilities from open street maps. City neighborhood boundaries from Kurdistan Region Statistics Office KRSO. Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 11: Density of IDP/returnee population and congregation points per capita, Dahuk



Congregation points

- Markets
- Places of Worship
- Restaurants
- Schools
- Shops
- Universities/Colleges

Congregation per capita

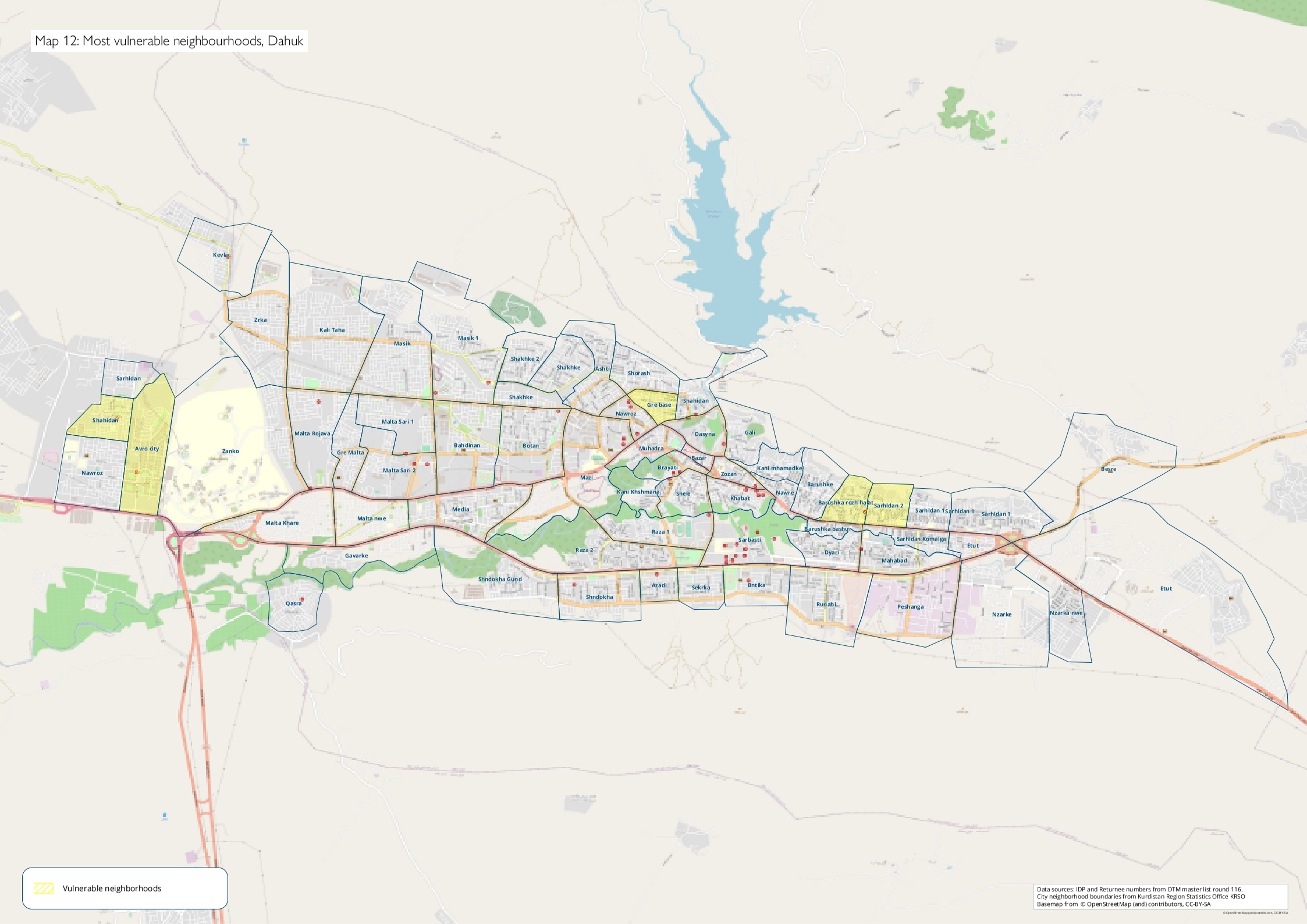
- Low (0.043 - 0.0)
- Medium (0.116 - 0.060)
- High (0.184)

IDP Density (per sq km)

- Low (1,240 - 120)
- Medium (2,977 - 1,349)
- High (6,040 - 3,643)
- No IDP/Returnee

Data sources: IDP numbers from DTM master list round 116
Congregation points from open street maps. City neighborhood boundaries from Kurdistan Region Statistics Office KRSO. Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

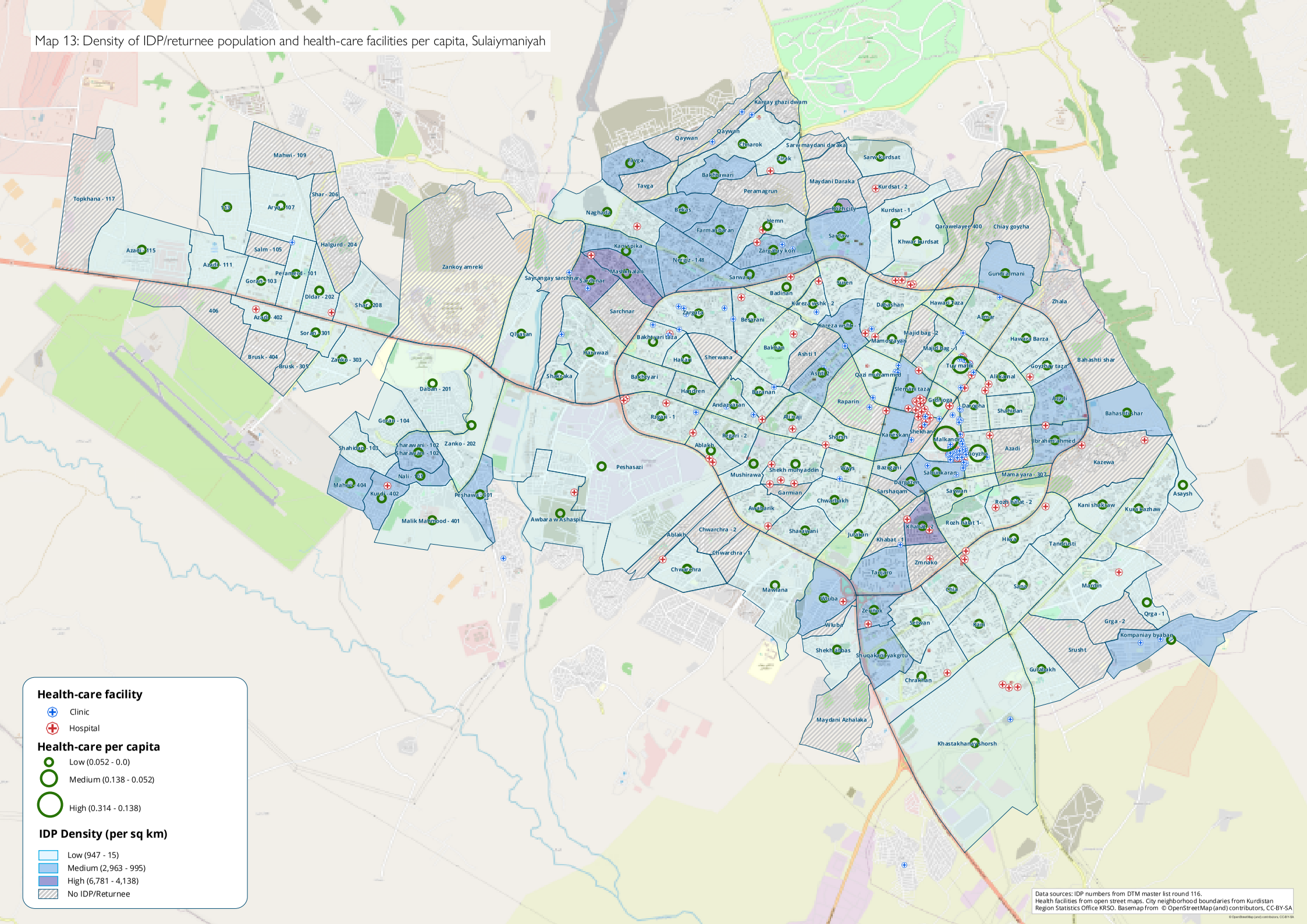
Map 12: Most vulnerable neighbourhoods, Dahuk



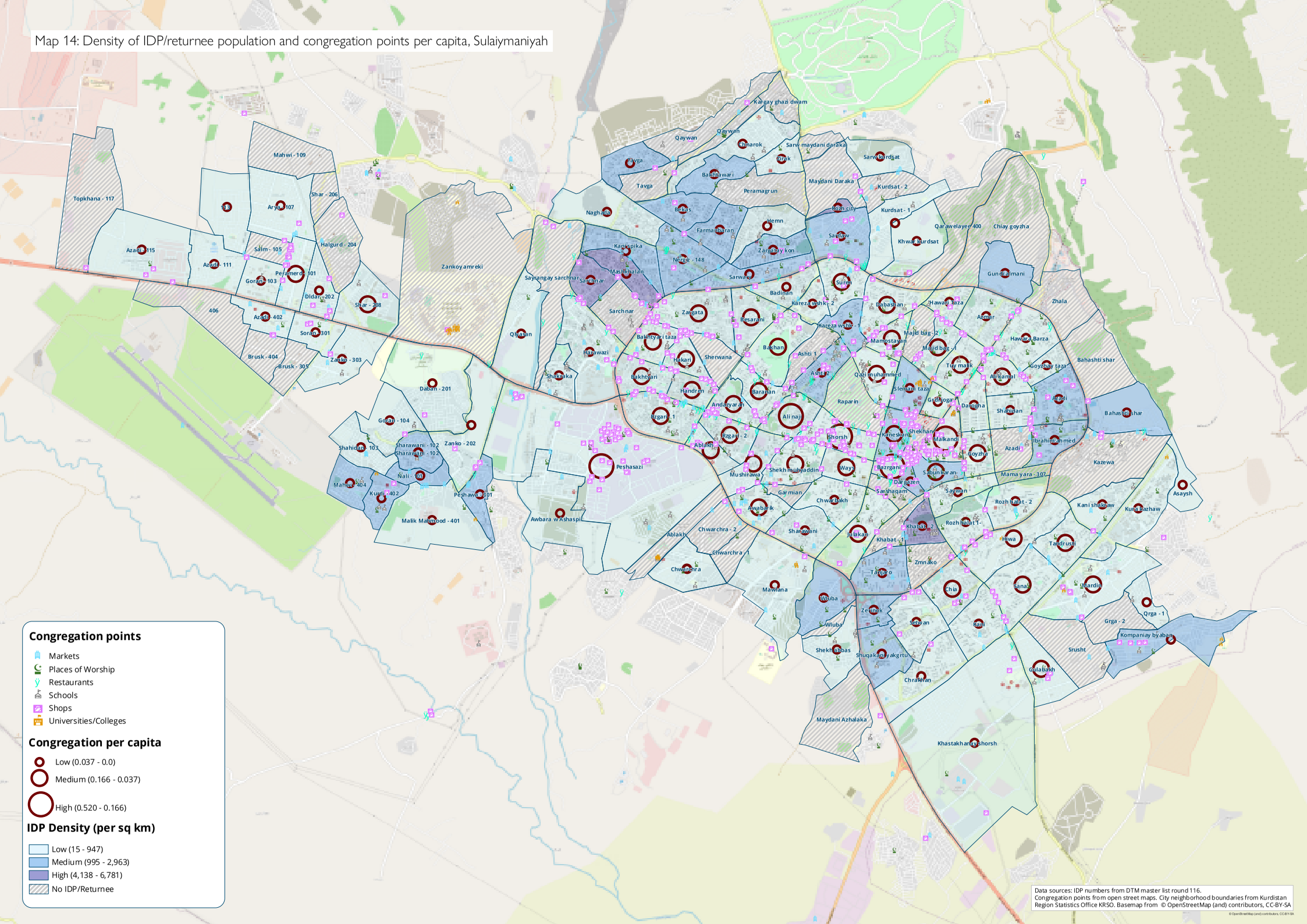
Vulnerable neighborhoods

Data sources: IDP and Returnee numbers from DTM master list round 116.
City neighborhood boundaries from Kurdistan Region Statistics Office KRSO
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

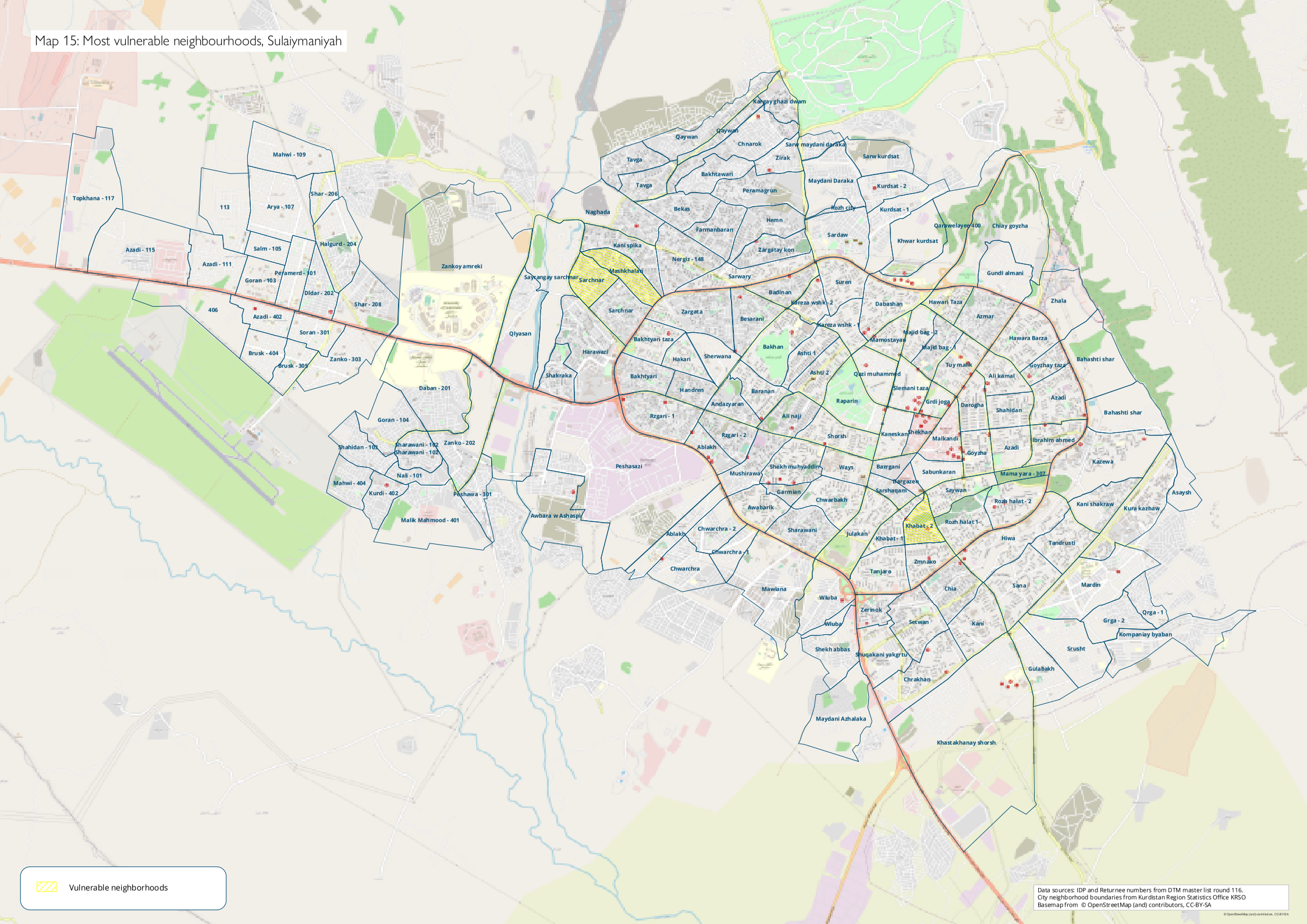
Map 13: Density of IDP/returnee population and health-care facilities per capita, Sulaymaniyah



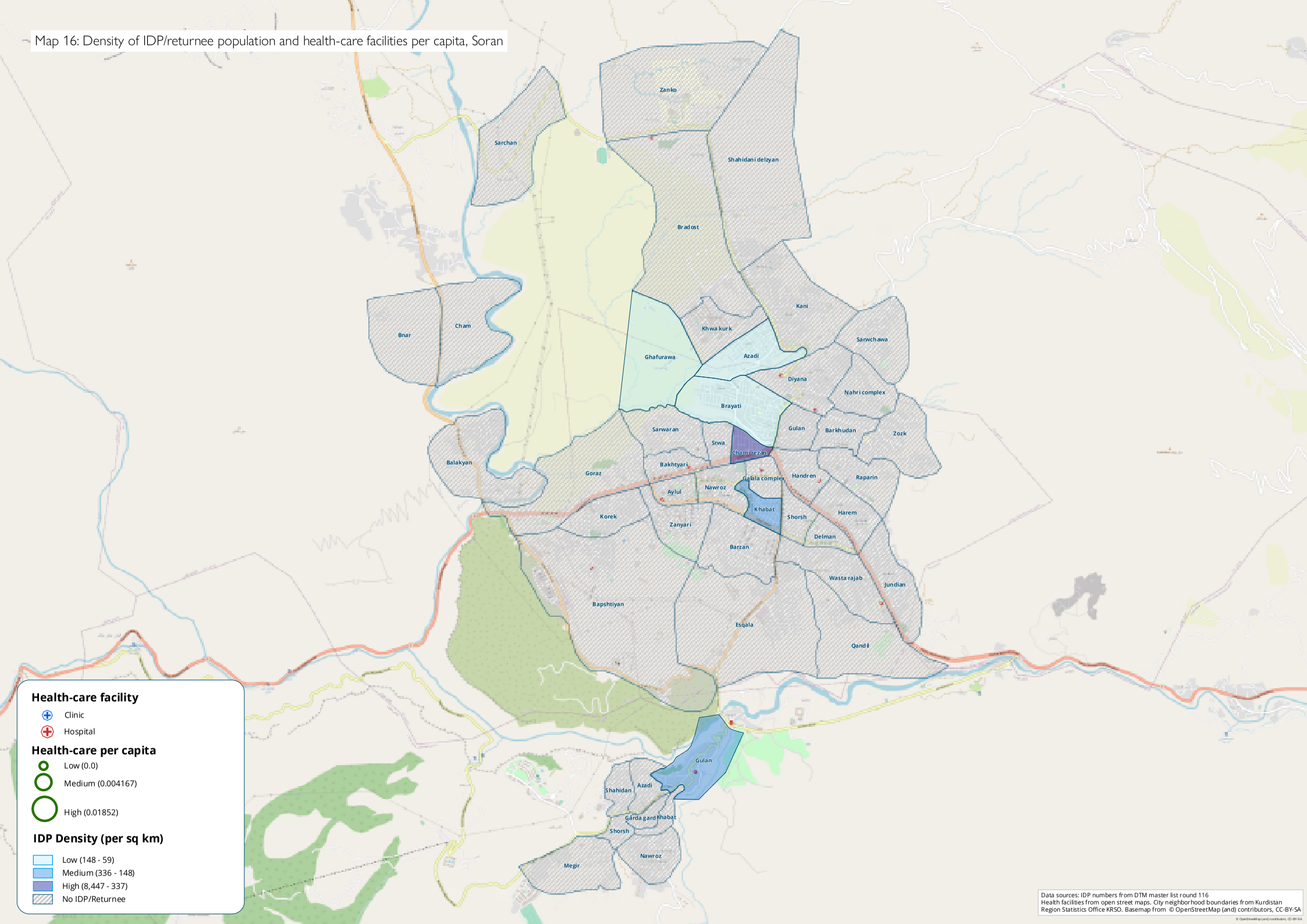
Map 14: Density of IDP/returnee population and congregation points per capita, Sulaiymaniyah



Map 15: Most vulnerable neighbourhoods, Sulaiymaniyah



Map 16: Density of IDP/returnee population and health-care facilities per capita, Soran



Health-care facility

- Clinic
- Hospital

Health-care per capita

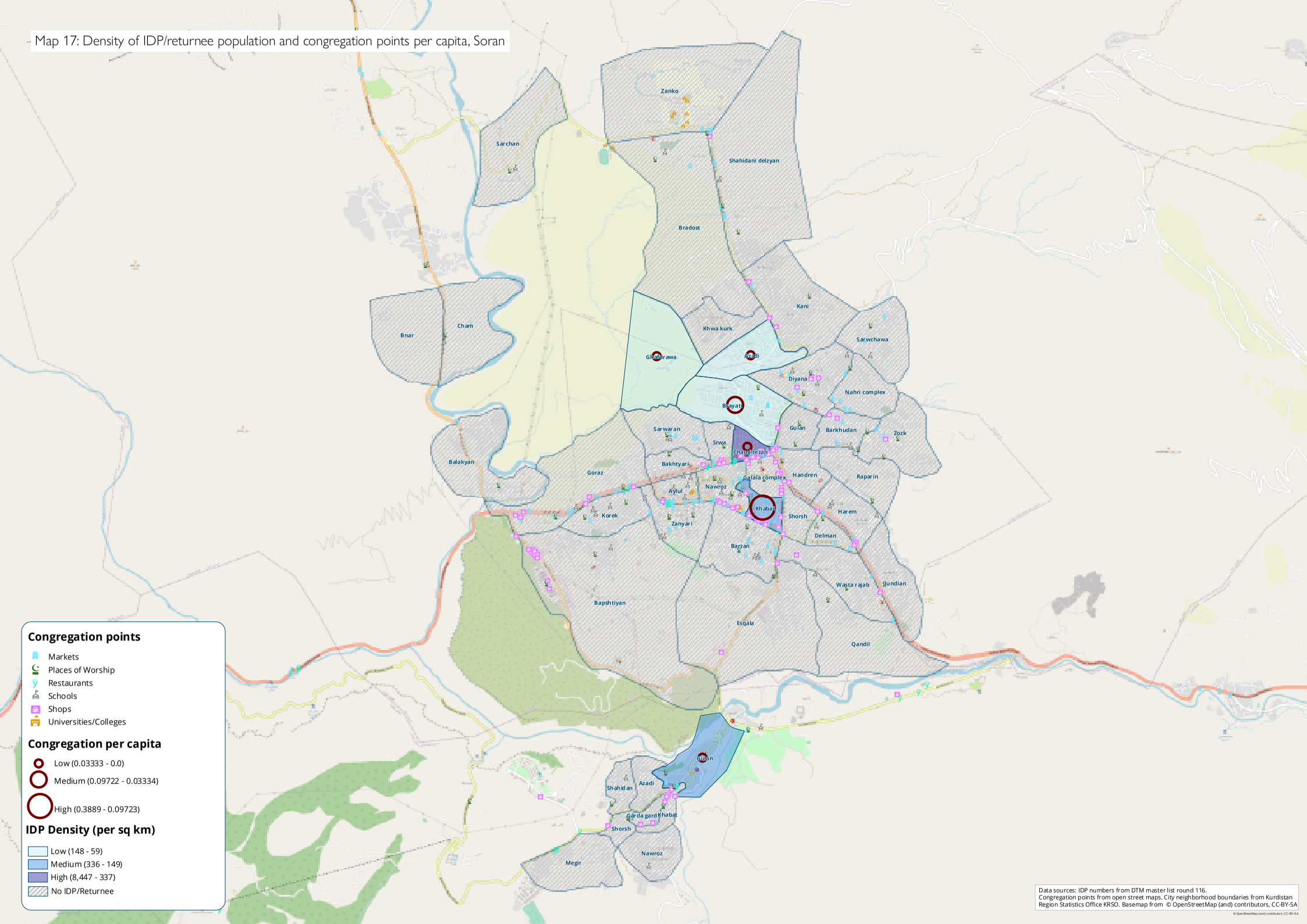
- Low (0.0)
- Medium (0.004167)
- High (0.01852)

IDP Density (per sq km)

- Low (148 - 59)
- Medium (336 - 148)
- High (8,447 - 337)
- No IDP/Returnee

Data sources: IDP numbers from DTM master list round 116
Health facilities from open street maps. City neighborhood boundaries from Kurdistan Region Statistics Office KRSO. Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 17: Density of IDP/returnee population and congregation points per capita, Soran



Congregation points

- Markets
- Places of Worship
- Restaurants
- Schools
- Shops
- Universities/Colleges

Congregation per capita

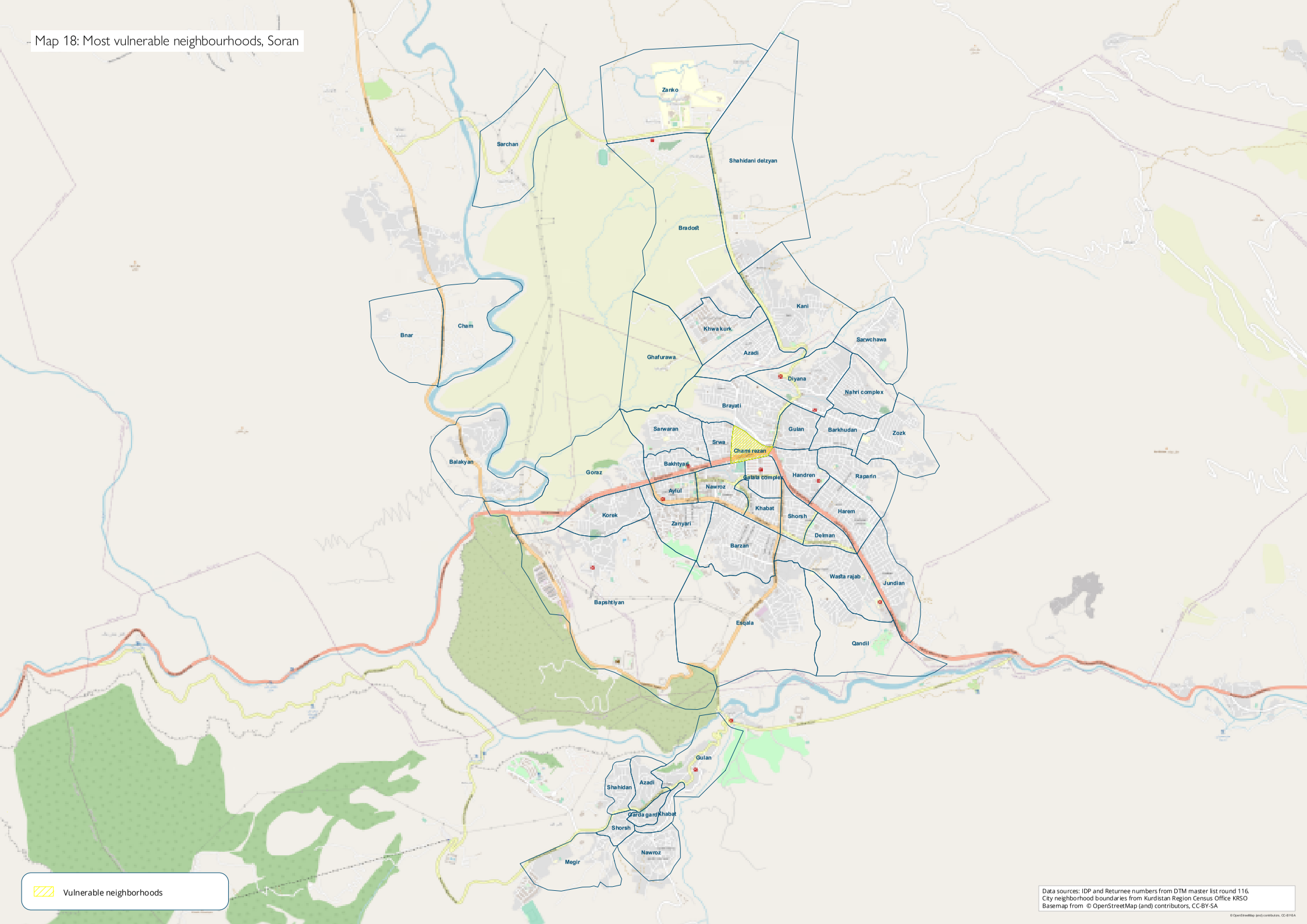
- Low (0.03333 - 0.0)
- Medium (0.09722 - 0.03334)
- High (0.3889 - 0.09723)

IDP Density (per sq km)

- Low (148 - 59)
- Medium (336 - 149)
- High (8,447 - 337)
- No IDP/Returnee

Data sources: IDP numbers from DTM master list round 116.
Congregation points from open street maps. City neighborhood boundaries from Kurdistan Region Statistics Office KRSO. Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

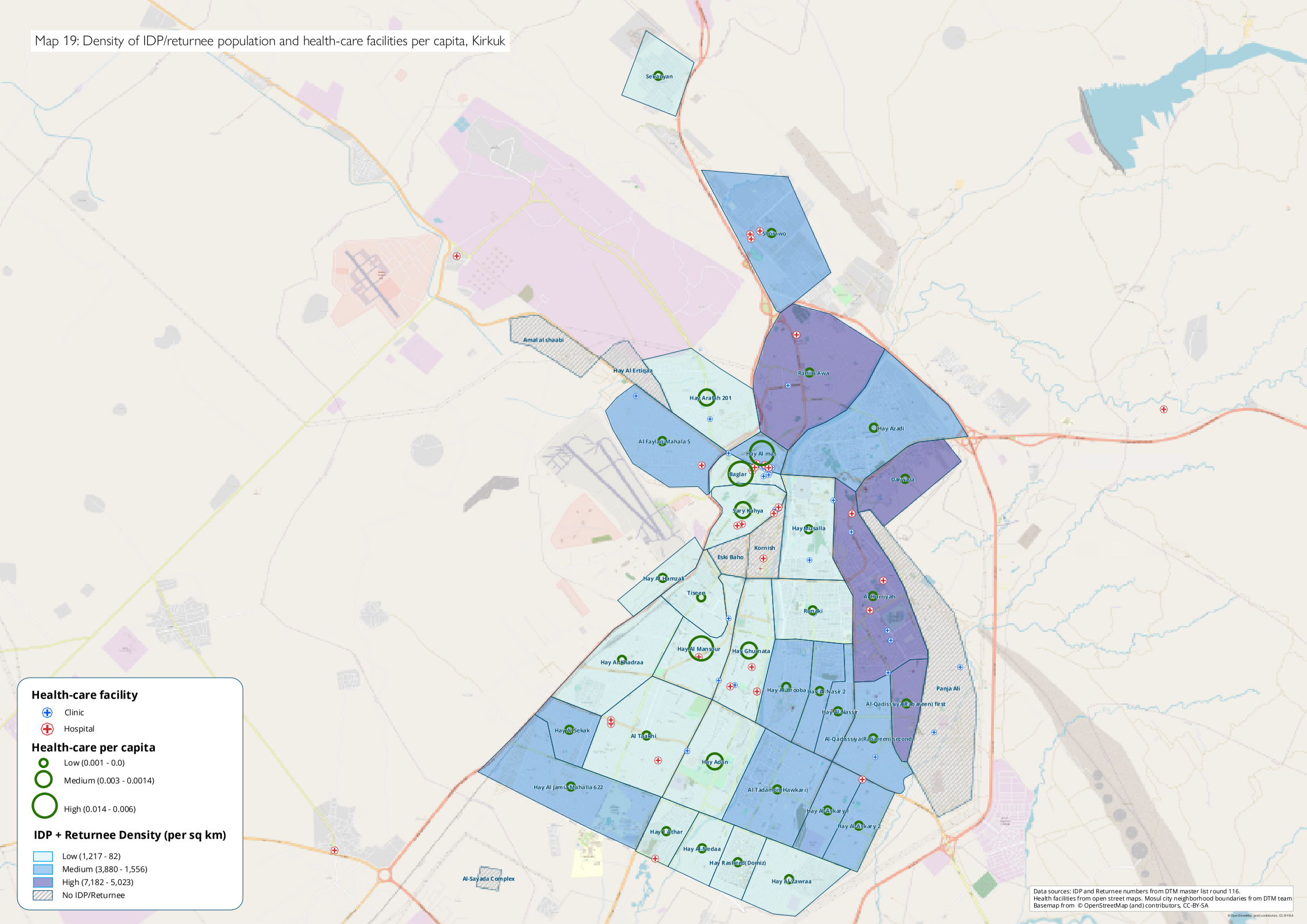
Map 18: Most vulnerable neighbourhoods, Soran



Vulnerable neighborhoods

Data sources: IDP and Returnee numbers from DTM master list round 116.
City neighborhood boundaries from Kurdistan Region Census Office KRSO
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 19: Density of IDP/returnee population and health-care facilities per capita, Kirkuk



Health-care facility

- Clinic
- Hospital

Health-care per capita

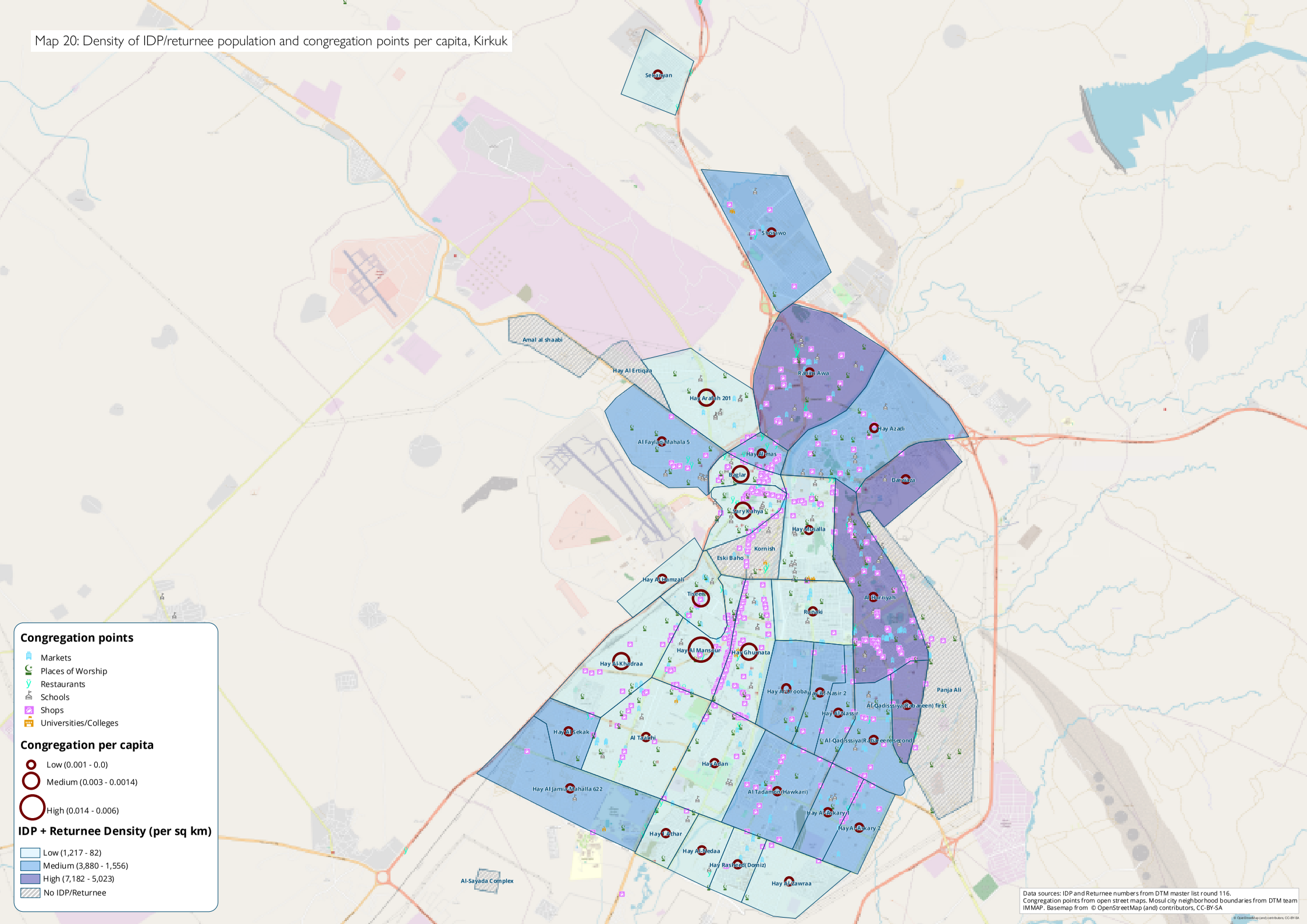
- Low (0.001 - 0.0)
- Medium (0.003 - 0.0014)
- High (0.014 - 0.006)

IDP + Returnee Density (per sq km)

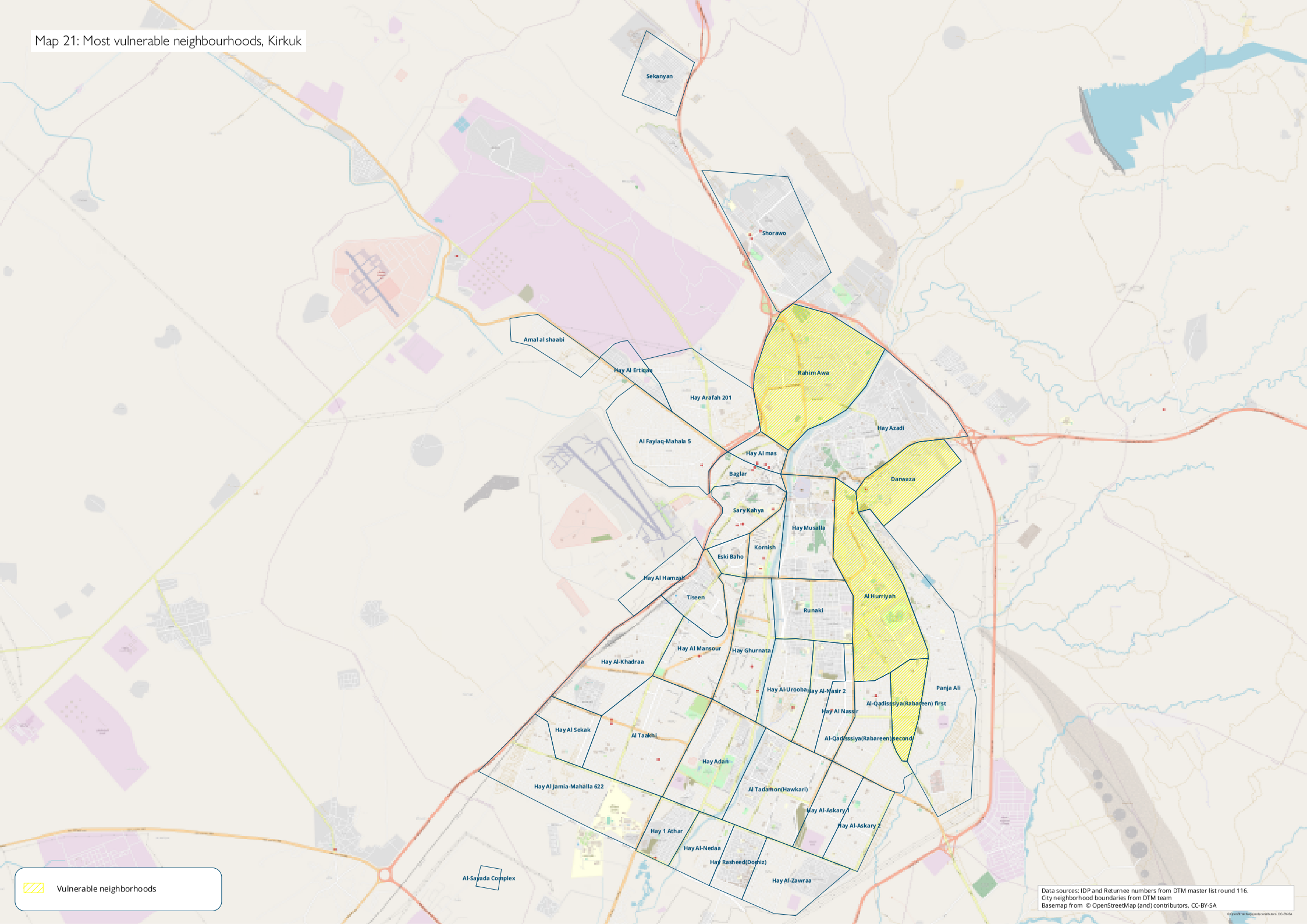
- Low (1,217 - 82)
- Medium (3,880 - 1,556)
- High (7,182 - 5,023)
- No IDP/Returnee

Data sources: IDP and Returnee numbers from DTM master list round 116.
Health facilities from open street maps. Mosul city neighborhood boundaries from DTM team
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

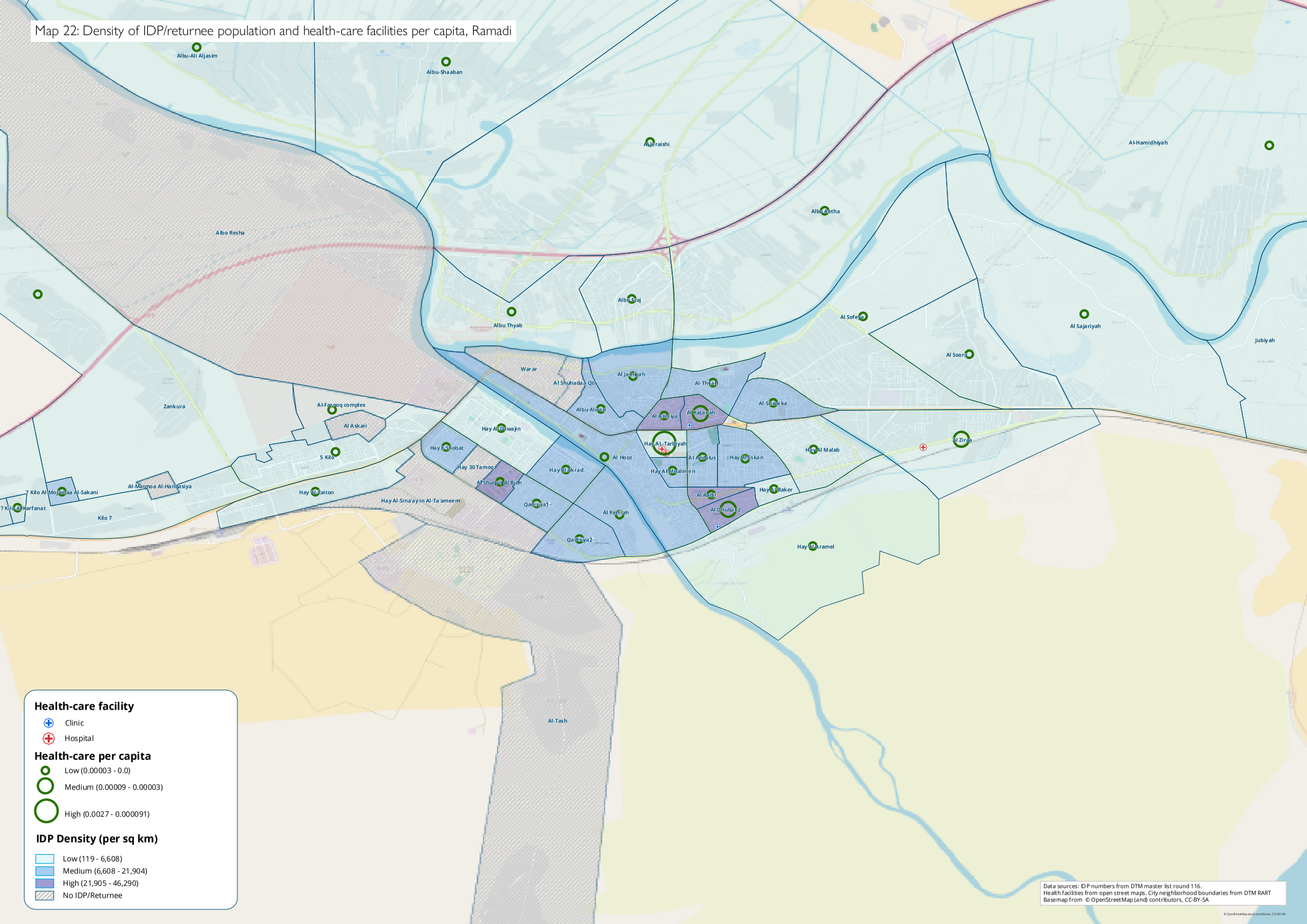
Map 20: Density of IDP/returnee population and congregation points per capita, Kirkuk



Map 21: Most vulnerable neighbourhoods, Kirkuk



Map 22: Density of IDP/returnee population and health-care facilities per capita, Ramadi



Health-care facility

- Clinic
- Hospital

Health-care per capita

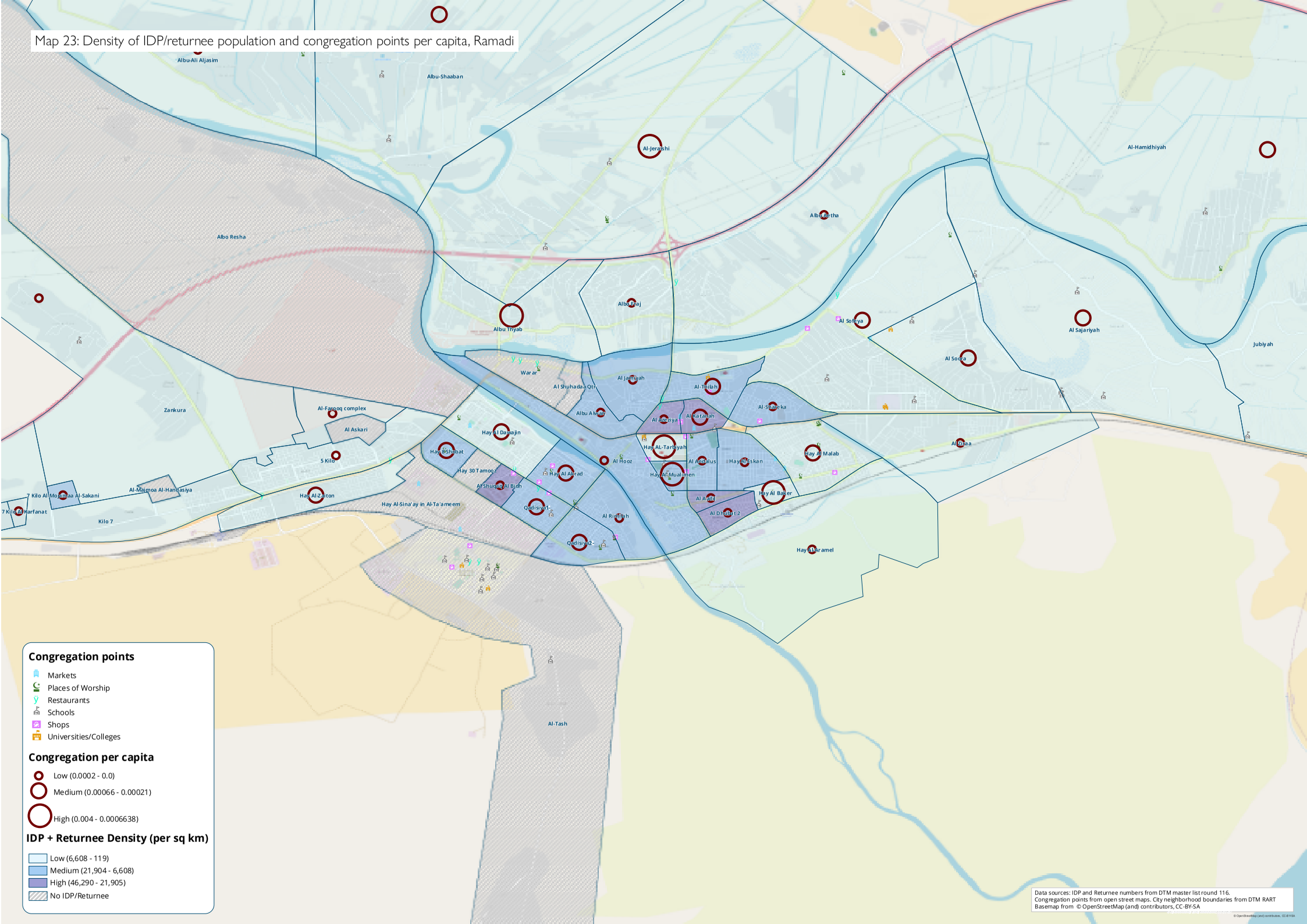
- Low (0.00003 - 0.0)
- Medium (0.00009 - 0.00003)
- High (0.0027 - 0.000091)

IDP Density (per sq km)

- Low (119 - 6,608)
- Medium (6,608 - 21,904)
- High (21,905 - 46,290)
- No IDP/Returnee

Data sources: IDP numbers from DTM master list round 116.
Health facilities from open street maps. City neighborhood boundaries from DTM RART
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 23: Density of IDP/returnee population and congregation points per capita, Ramadi



Congregation points

- Markets
- Places of Worship
- Restaurants
- Schools
- Shops
- Universities/Colleges

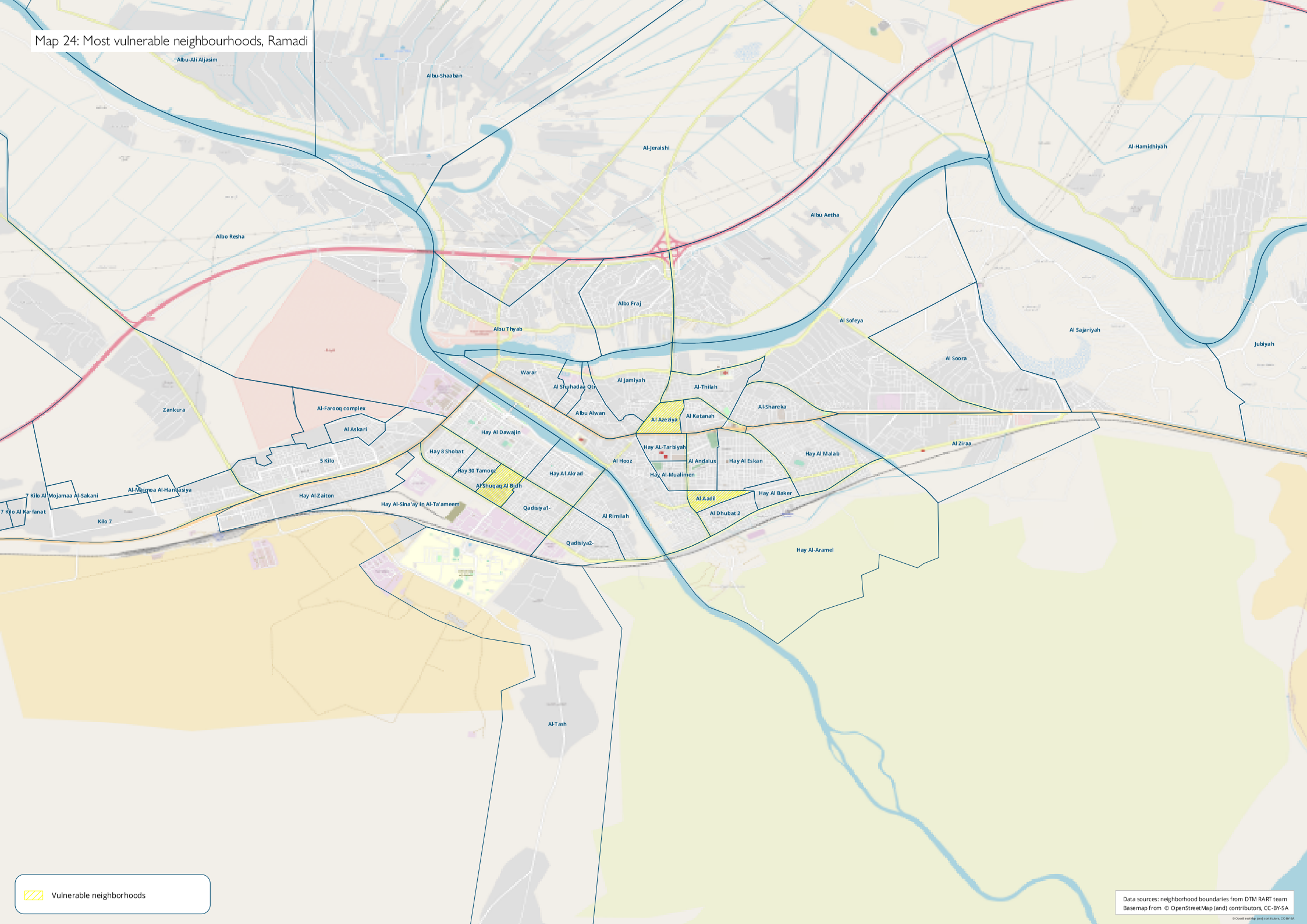
Congregation per capita

- Low (0.0002 - 0.0)
- Medium (0.00066 - 0.00021)
- High (0.004 - 0.0006638)

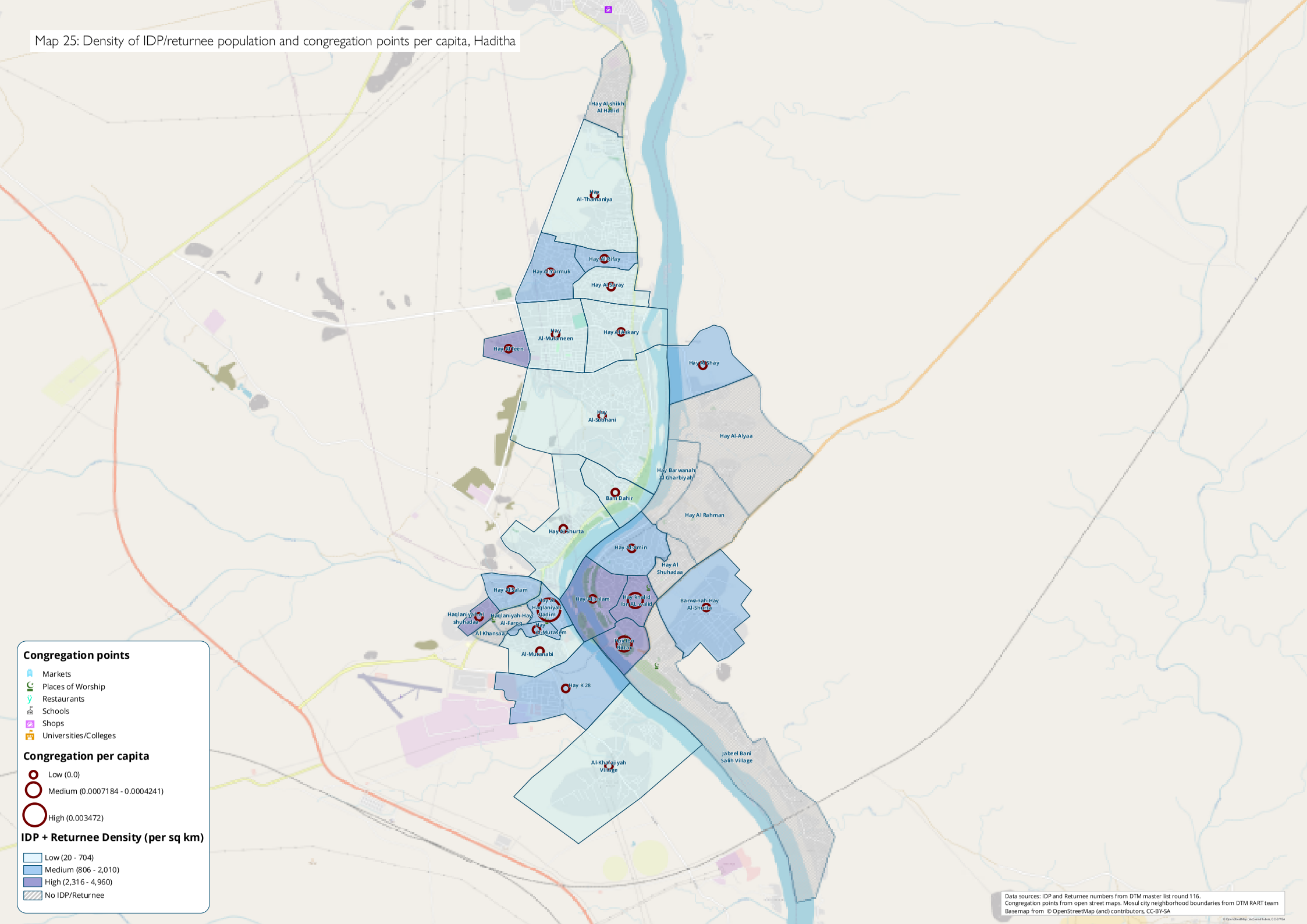
IDP + Returnee Density (per sq km)

- Low (6,608 - 119)
- Medium (21,904 - 6,608)
- High (46,290 - 21,905)
- No IDP/Returnee

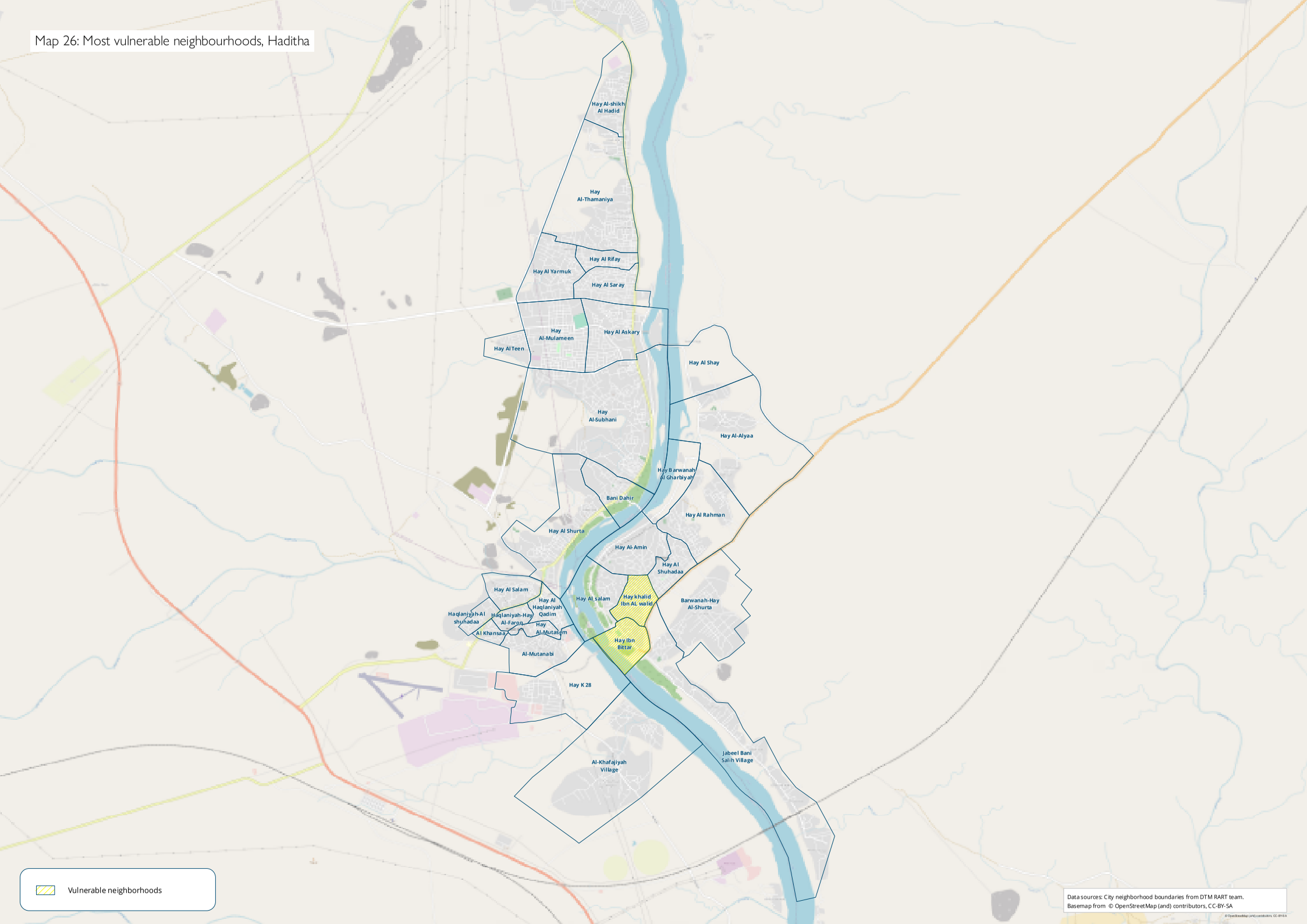
Data sources: IDP and Returnee numbers from DTM master list round 116.
Congregation points from open street maps. City neighborhood boundaries from DTM RART
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA


Map 24: Most vulnerable neighbourhoods, Ramadi
Albu-Ali Aljasim
Albu-Shaaban
Al-Jeraishi
Al-Hamidhiyah
Albu Aetha
Albo Resha
Albo Fraj
Albu Thyab
Al Sofeya
Al Sajariyah
Jubiyah
Al Soora
Warar
Al Shuhadaa Qtr
Al Jamiyah
Al-Thilah
Al-Shareka
Albu Alwan
Al Azeziya
Al Katanah
Zankura
Al-Farooq complex
Al Askari
Hay Al Dawajin
Hay 8 Shobat
Hay AL-Tarbiyah
Al Ziraa
5 Kilo
Hay 30 Tamooz
Al Hooz
Al Andalus
Hay Al Eskan
Hay Al Malab
Hay Al Akrad
Hay Al-Mualimen
Al Shuqaq Al Bidh
7 Kilo Al-Mojamaa Al-Sakani
Al-Maamoa Al-Handasiya
Hay Al-Zaiton
Al Aadil
Hay Al Baker
Hay Al-Sina'ay in Al-Ta'ameem
Qadisiya1-
Al Dhubat 2
7 Kilo Al Karfanat
Kilo 7
Al Rimilah
Qadisiya2-
Hay Al-Aramel
Al-Tash
Vulnerable neighborhoods
Data sources: neighborhood boundaries from DTM RART team
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

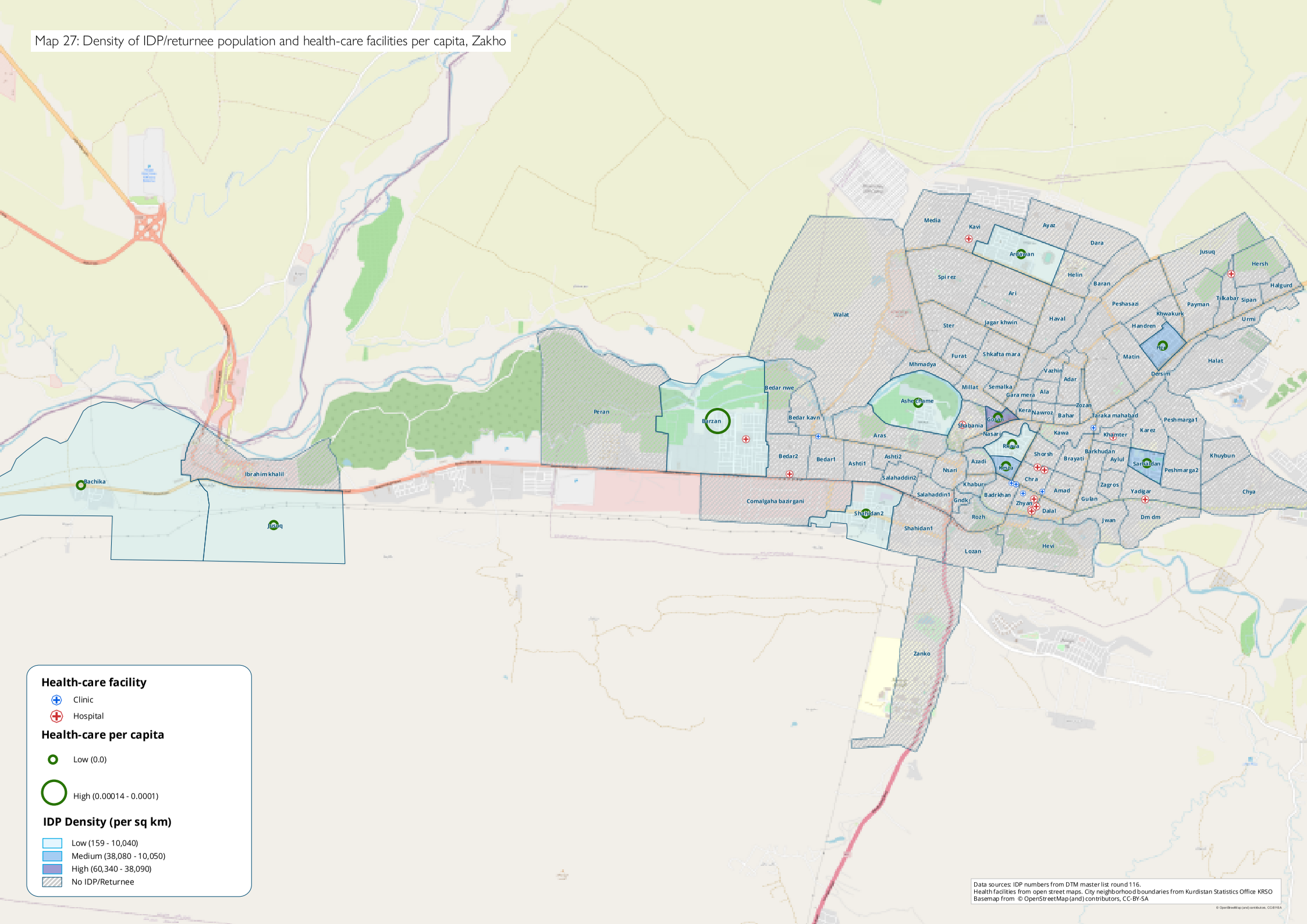
Map 25: Density of IDP/returnee population and congregation points per capita, Haditha



Map 26: Most vulnerable neighbourhoods, Haditha

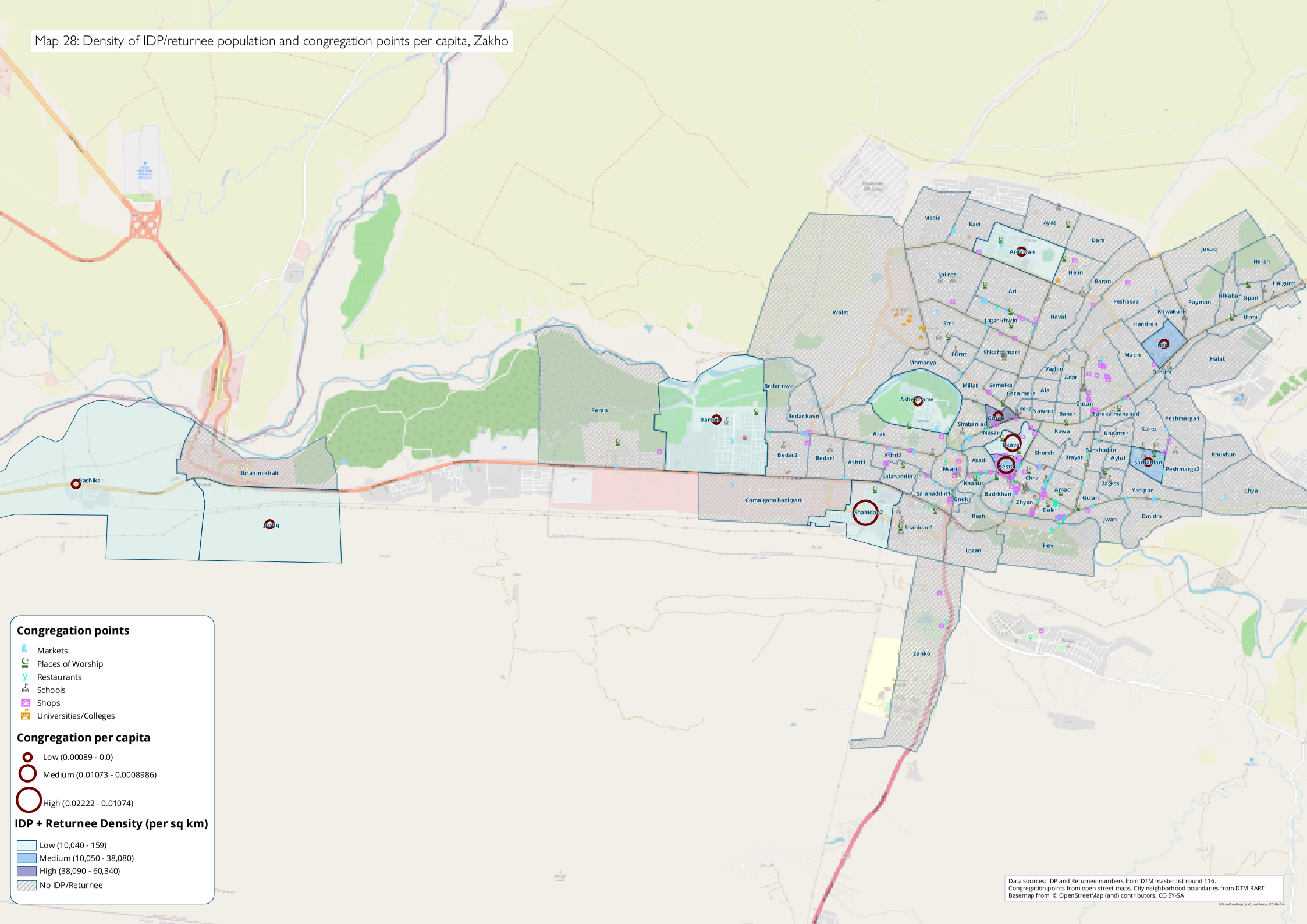


Map 27: Density of IDP/returnee population and health-care facilities per capita, Zakho



Data sources: IDP numbers from DTM master list round 116.
Health facilities from open street maps. City neighborhood boundaries from Kurdistan Statistics Office KRSO
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 28: Density of IDP/returnee population and congregation points per capita, Zakho



Congregation points

- Markets
- Places of Worship
- Restaurants
- Schools
- Shops
- Universities/Colleges

Congregation per capita

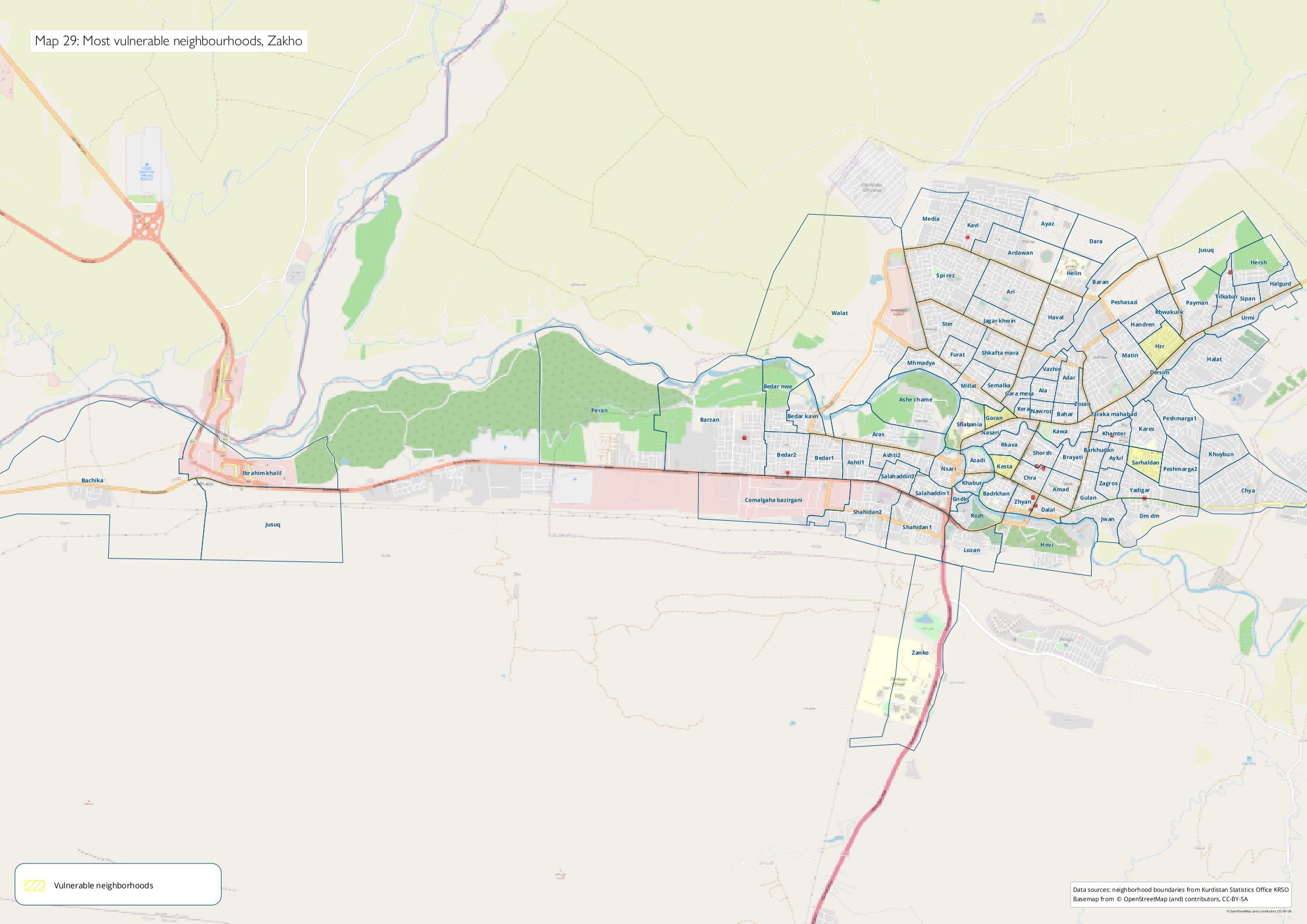
- Low (0.00089 - 0.0)
- Medium (0.01073 - 0.0008986)
- High (0.02222 - 0.01074)

IDP + Returnee Density (per sq km)

- Low (10,040 - 159)
- Medium (10,050 - 38,080)
- High (38,090 - 60,340)
- No IDP/Returnee

Data sources: IDP and Returnee numbers from DTM master list round 116.
Congregation points from open street maps. City neighborhood boundaries from DTM RART
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA

Map 29: Most vulnerable neighbourhoods, Zakho



Vulnerable neighborhoods

Data sources: neighborhood boundaries from Kurdistan Statistics Office KRSO
Basemap from © OpenStreetMap (and) contributors, CC-BY-SA