

Site Location for Affordable Housing Development with Neighbourhood Analysis in Manchester



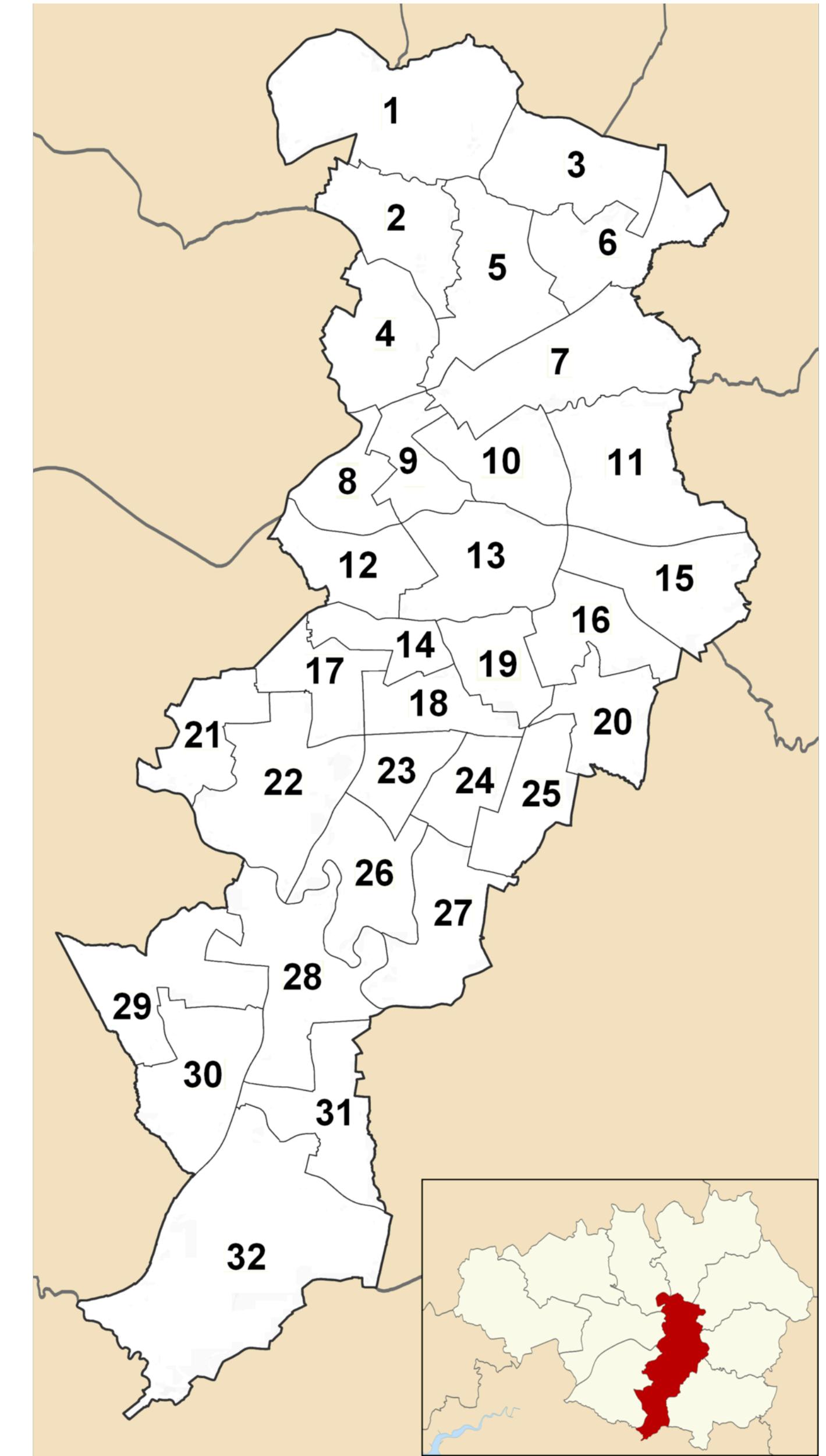
Site Location for Affordable Housing Development with Neighbourhood Analysis in Manchester

Capstone Project Week 2

Junyan Chen, 03 May 2021

Project Background

- Manchester City Council is the local government authority for Manchester, England. It is composed of 96 councillors, three for each of the 32 electoral wards of Manchester.
- A new council-run house building company will be established in Manchester in a bid to boost the delivery of affordable homes
- Delivery at least 500 homes per year hence location of lower average house price and lower average transactions
- Deliver a mix of affordable homes and market homes (with the latter helping to subsidise the affordable homes)
- Helping local community and small local business



Data Gathering and Cleaning

Data Requirement

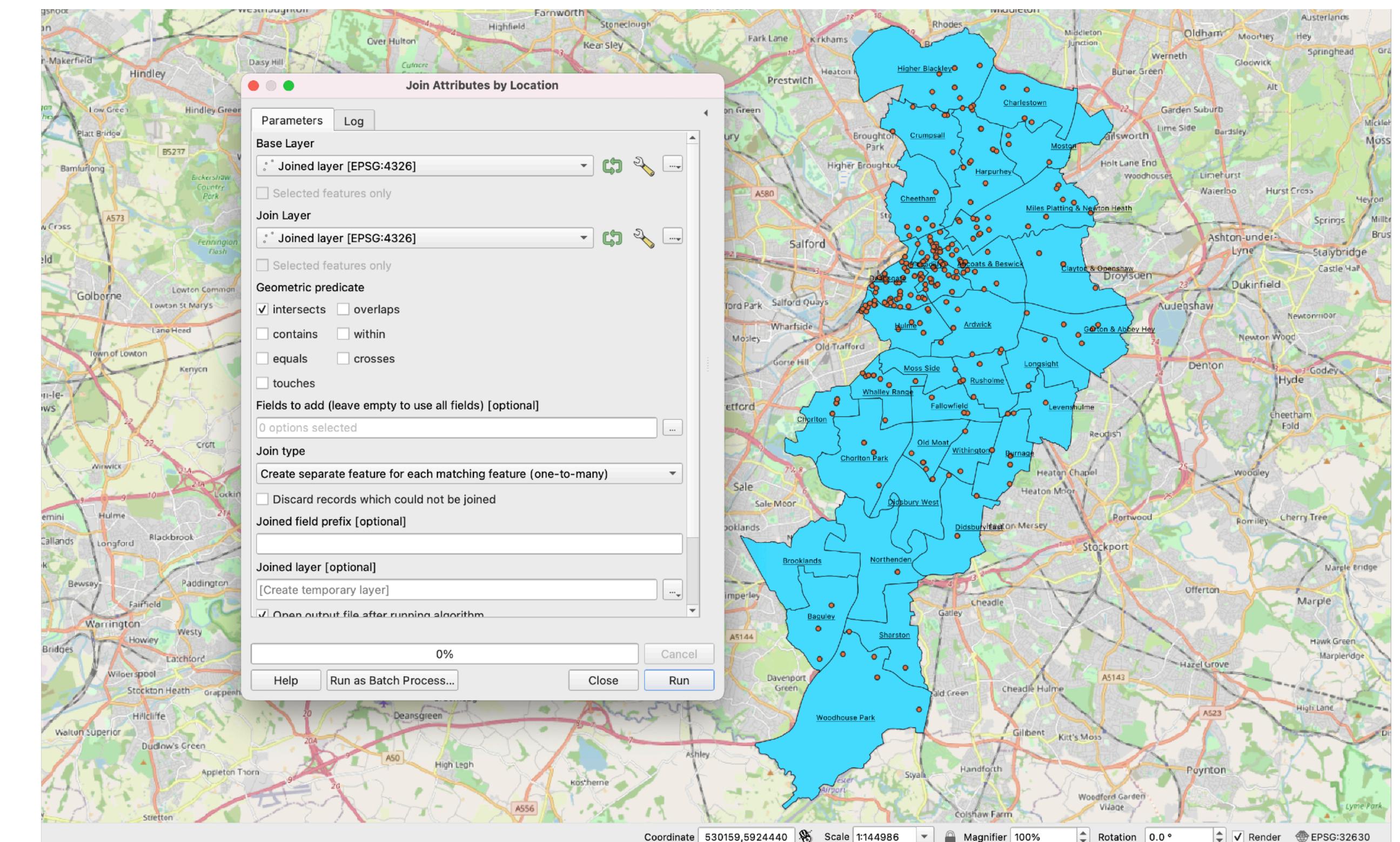
For the purposes of this project, which is to identify site for potential development location, the following data will be required to allow data analysis, mapping and clustering:

- Area boundaries and corresponding coordinates within the City of Manchester • Existing available site locations
- Existing nearby venues and their features using Foursquare
- Recent mean and median housing price

Most of the data required can be obtained from the Manchester City Council site and Office for National Statistics (ONS). However due to the scope of this project and estimation purposes, some data will need to be manipulated to the form required using ArcGIS or QGIS

Use of GIS Tools

- Boundary information is available as kmz file from Manchester City Council site. QGIS is used here to import the kmz file for centroid calculation and geoJSON which will be used for mapping during the analysis
- These point data are also imported into QGIS in order to analyse which ward a site belongs to, as this action is spatial analysis based on ward boundaries, which is difficult to achieve within the notebook.

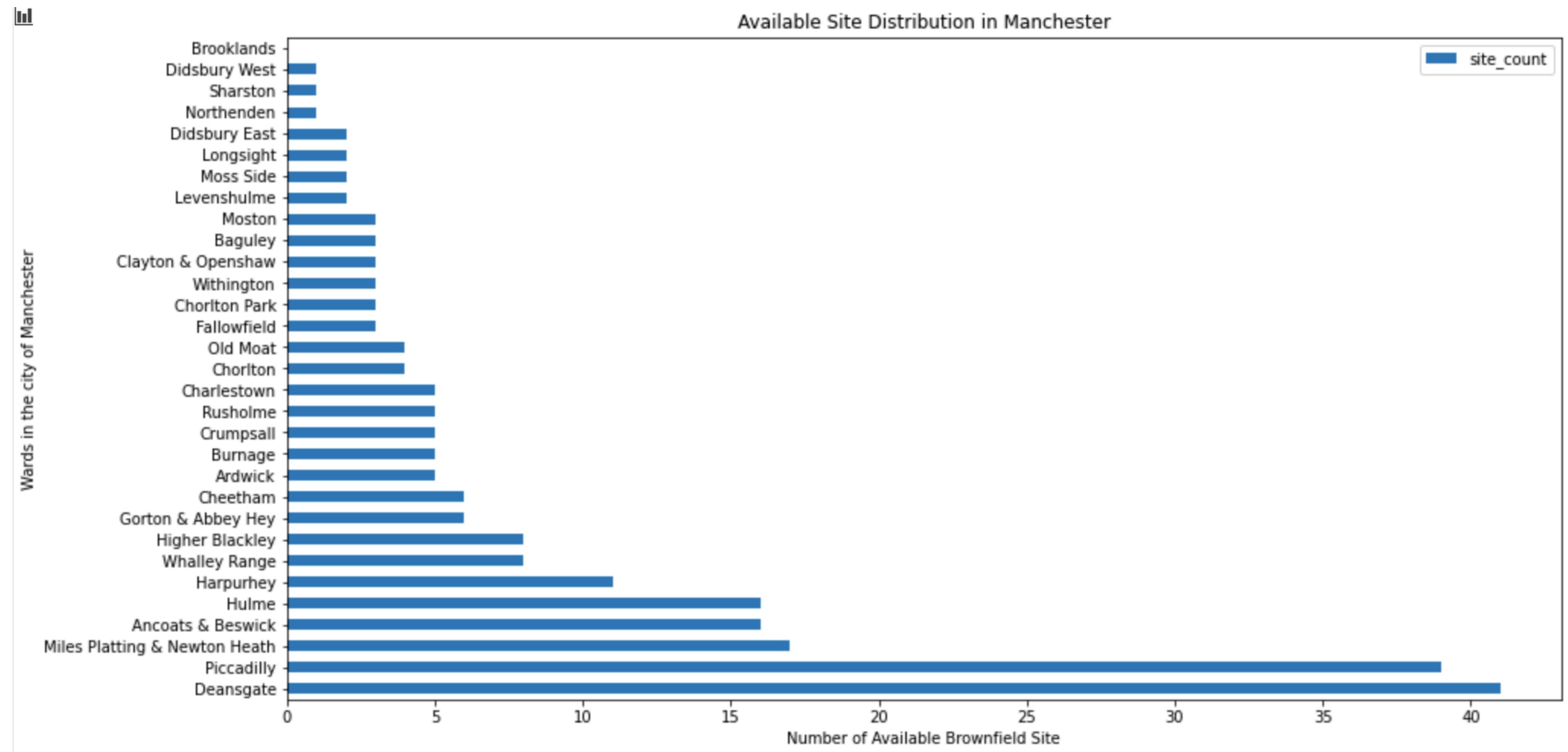
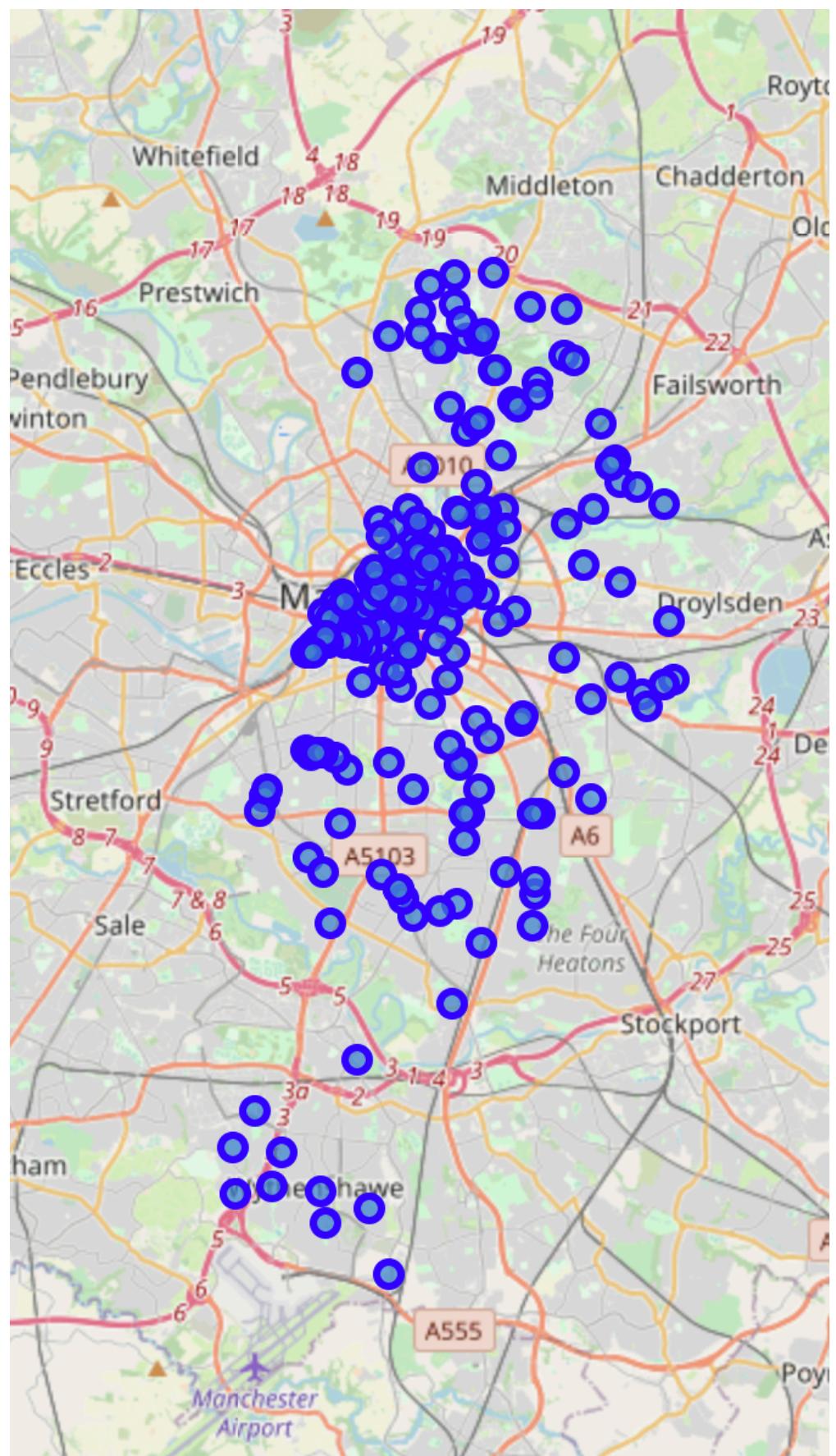


Data Gathering

- Existing nearby venues and their features using Foursquare:
Using centroid coordinates of each ward in Manchester city, API calls to Foursquare can be used to get access to POI data for venues within each ward, and search rank venues and get real-time data access.
- Recent mean and median housing price:
Mean and median price paid for residential property in England and Wales, by property type and electoral ward produced by Office of National Statistics and HM Land Registry

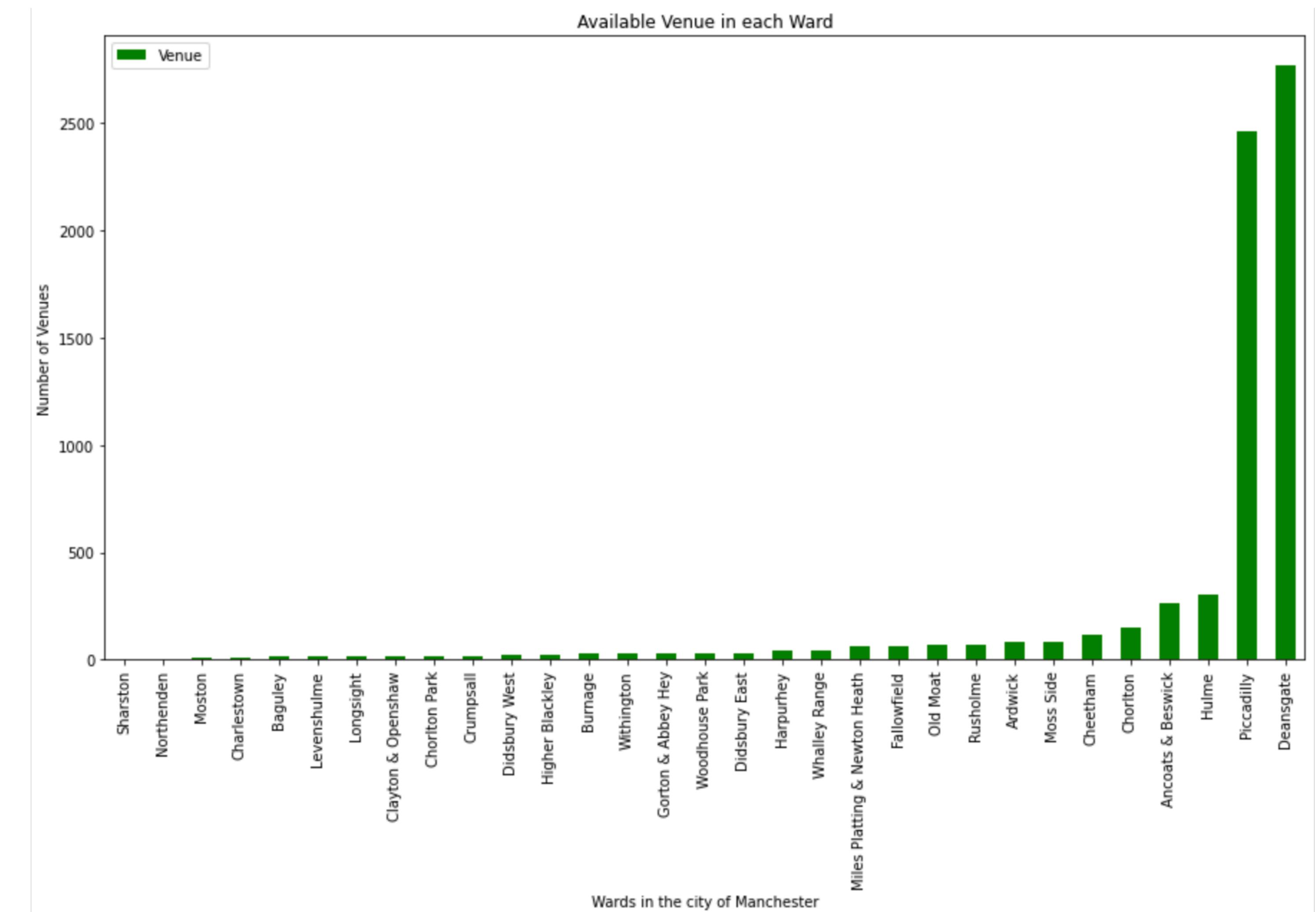
Local authority name	Ward code	Ward name	Year ending Dec 2019	Year ending Mar 2020	Year ending Jun 2020	Year ending Sep 2020
Manchester	E05011350	Ancoats & Beswick	230,000	240,000	237,000	250,000
Manchester	E05011351	Ardwick	204,498	210,995	218,995	222,495
Manchester	E05011352	Baguley	152,750	155,500	158,000	160,000

Exploratory Data Analysis



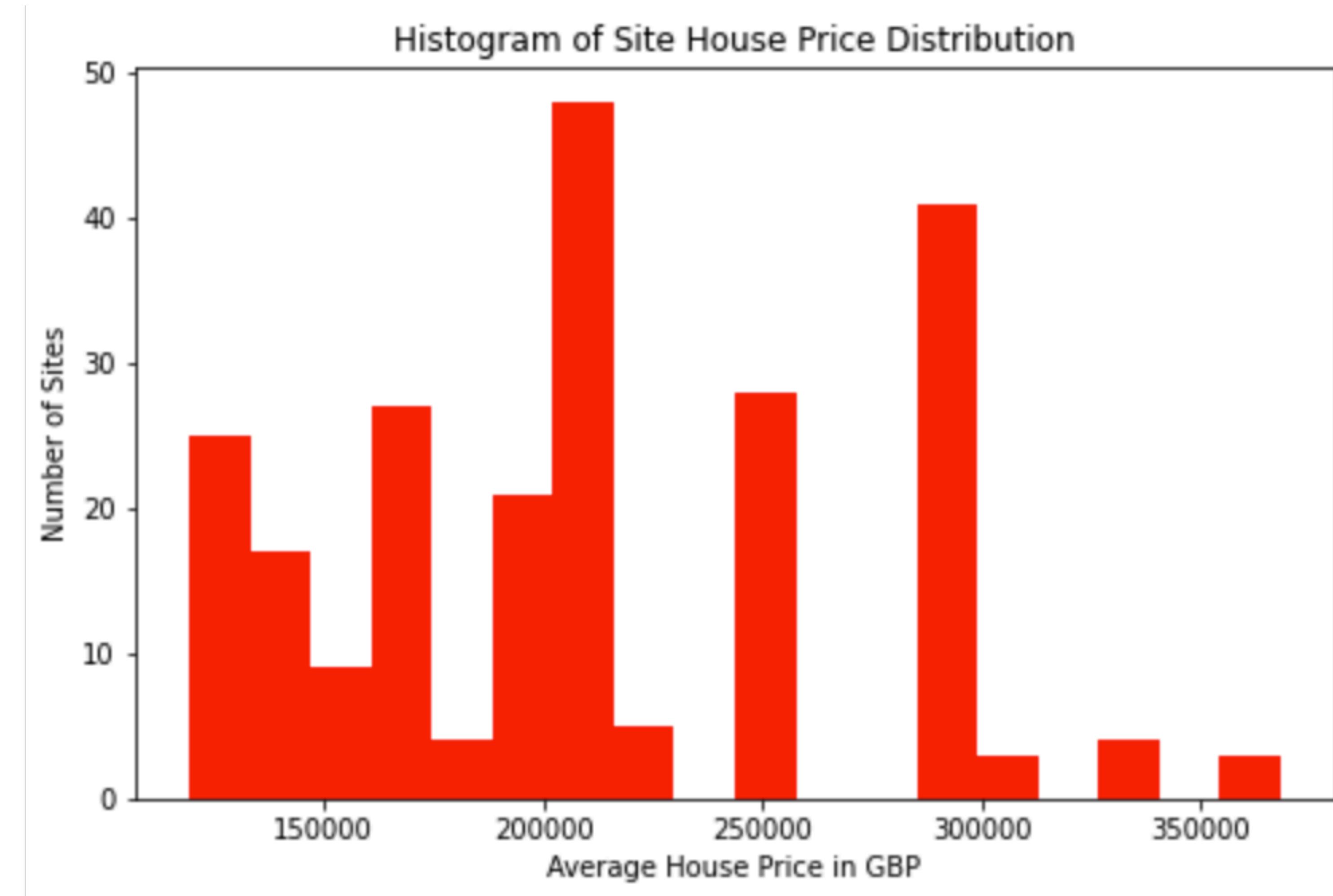
Nearby Venues for each Site from Foursquare

Foursquare API is utilised to explore each site and segment them. The limit of 100 venue and the radius 500 meter is used for each site from the corresponding latitude and longitude. Here is a head of the list Venues name, category, latitude and longitude informations from Foursquare API.



Average House Price by Area in Manchester

The point data, after identify ward zone for each of them, are then joined with the average house price data from National Statistics. By plotting a histogram, the distribution of sites in different price range can be observed.



Methodology

In this project we will direct our efforts on detecting sites in Manchester that have low venues density, low existing house price.

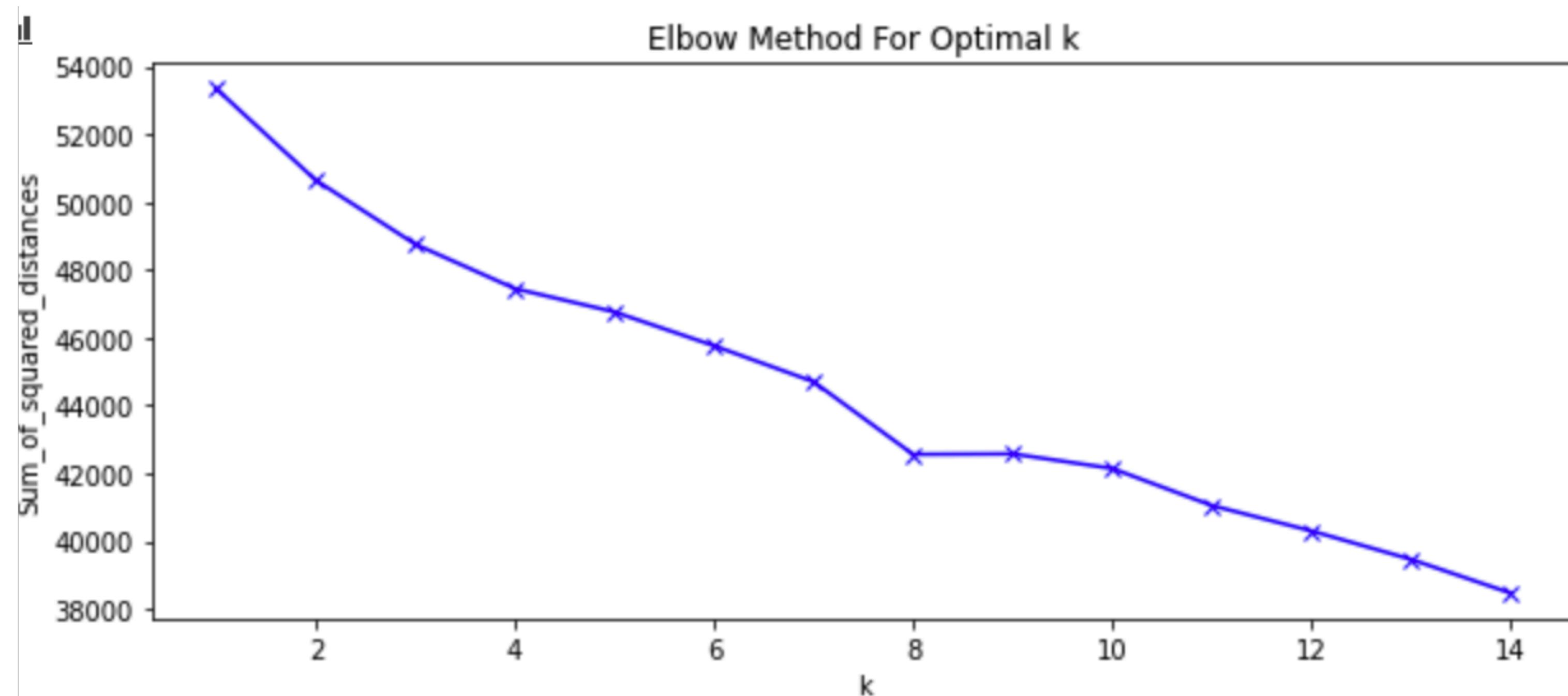
During data collection, manipulation and data exploratory analysis above, the essential data is collected:

- Location and category of all the venues within 500m from each site
- Identified and calculate average house price in each ward and assign it to each site
- Distribution of site in each ward

avg_price	Adult Boutique	Antique Shop	Art Museum	Astrologer	Athletics & Sports	Australian Restaurant	BBQ Joint
163799.5	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
139247.00	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
226502.50	0.0	0.0	0.0	0.0	0.0	0.000000	0.0
290092.75	0.0	0.0	0.0	0.0	0.0	0.014085	0.0

Analysis

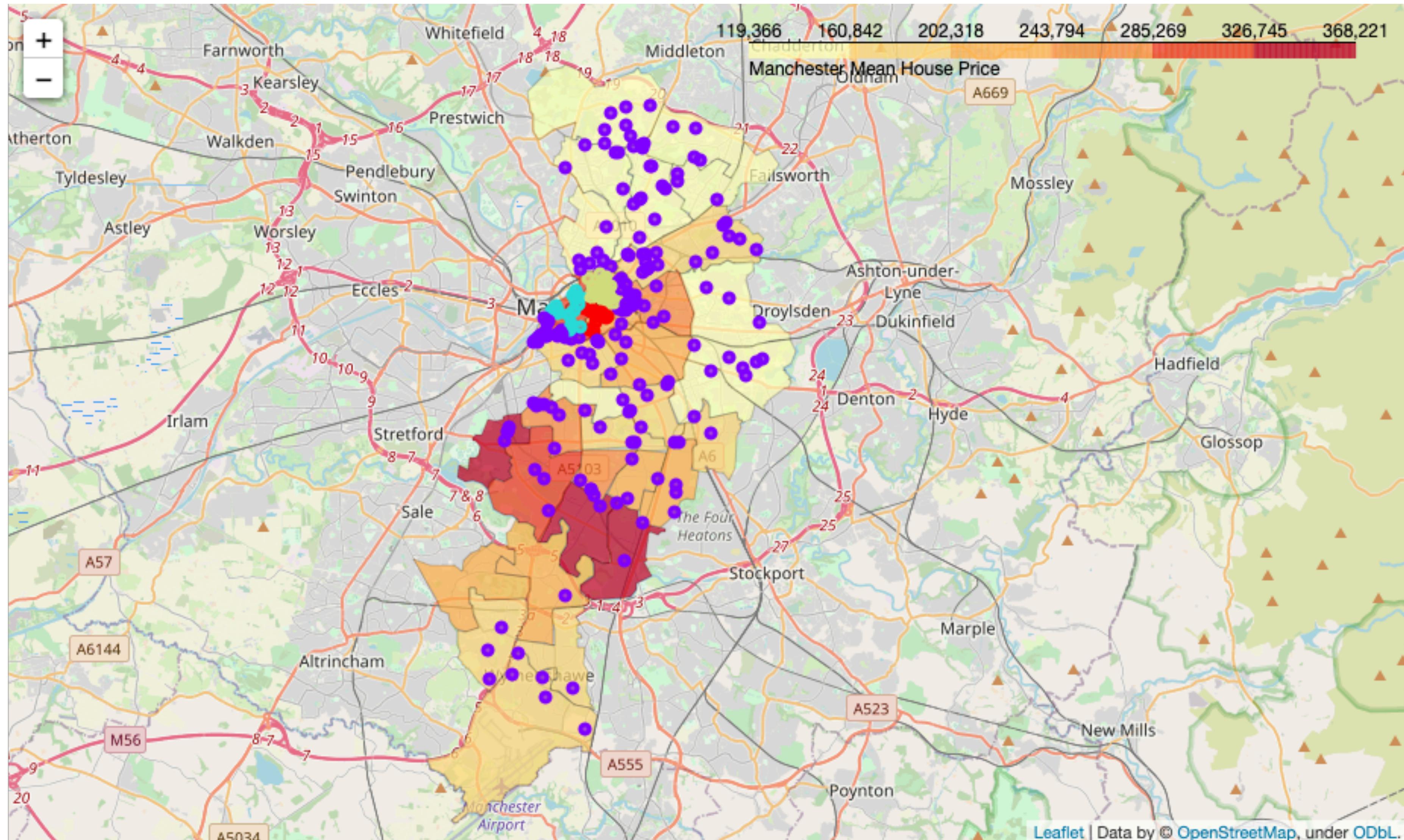
- K-Means algorithm is used for unsupervised learning.
- The elbow method was used to ensure the optimum k was chosen.
- Increasing K will always decrease the error. Based on the line plot above the k_cluster of 4 is used



Analysis Output

	site_id	latitude	longitude	area	ward	avg_price	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	62	53.446061	-2.277369	1300.0	Chorlton	337410.75	1	Bar	Pub	Grocery Store	Café	Pizza Place	Turkish Restaurant
1	91	53.446061	-2.277369	1300.0	Chorlton	337410.75	1	Bar	Pub	Grocery Store	Café	Pizza Place	Turkish Restaurant
2	150	53.443306	-2.279022	17500.0	Chorlton	337410.75	1	Bar	Pub	Grocery Store	Café	Pizza Place	Deli / Bodega
3	166	53.447113	-2.276849	2800.0	Chorlton	337410.75	1	Pub	Bar	Grocery Store	Gastropub	Pharmacy	Tea Room
4	145	53.425988	-2.235446	2600.0	Didsbury West	360035.75	1	Pub	Italian Restaurant	Indian Restaurant	Bar	Pizza Place	Deli / Bodega
5	68	53.523338	-2.242365	26800.0	Crumpsall	158125.75	1	Business Service	Construction & Landscaping	River	Sporting Goods Shop	Adult Boutique	Performing Arts Venue
6	104	53.511354	-2.225136	3300.0	Crumpsall	158125.75	1	Adult Boutique	Pool Hall	Museum	Music Venue	New American Restaurant	Nightclub
7	105	53.521111	-2.227360	2400.0	Crumpsall	158125.75	1	Café	Coffee Shop	Pharmacy	Grocery Store	Adult Boutique	Performing Arts Venue
8	126	53.516955	-2.251392	4200.0	Crumpsall	158125.75	1	Fried Chicken Joint	Gelato Shop	Halal Restaurant	Park	Pedestrian Plaza	Museum
9	227	53.521037	-2.228596	3800.0	Crumpsall	158125.75	1	Home Service	Pharmacy	Café	Health & Beauty Service	Coffee Shop	Outdoor Supply Store

Analysis Output



Results and Discussion

- Our analysis shows that although there is wide spread of data, the biggest cluster based on nearby venues and average house price wraps around the city centre.
- Highest concentration of venues available from Foursquare was detected found in the Manchester city centre, and therefore many sites in the Manchester city centre may share the same features during cluster analysis.
- The results are also reflected in the folium map distribution - that any site locations outside of the city centre forms the same cluster.
- This also matches what is observed in reality, that most of the Manchester city centre is for commercial, entertainment and offices. Hence sites in the outskirt cluster are suitable for our project aim.

Results and Discussion

- Based on the house price output on folium mapping, the relatively lower average house price ranges are £119,366 to £160,842 and £160,842 to 202,318. Therefore, sites within the desired cluster with ward average price lower than £202,318 can be selected as the recommendation - there are 103 sites match the criteria.
- The wards that are suitable for affordable housing are:
['Crumpsall', 'Fallowfield', 'Harpurhey', 'Rusholme', 'Longsight', 'Higher Blackley', 'Charlestown', 'Miles Platting & Newton Heath', 'Moston', 'Clayton & Openshaw', 'Gorton & Abbey Hey', 'Cheetham', 'Baguley', 'Sharston', 'Moss Side', 'Woodhouse Park', 'Hulme', 'Levenshulme']

Conclusion

- Purpose of this project was to identify site location in areas with relatively lower house price, not located within city center, and with low number of venues (especia) in order to aid stakeholders in narrowing down the search for optimal location for a new development site.
- Final decision on optimal site location will be made by Manchester city council based on specific characteristics of neighbourhoods and locations in every recommended brownfield site, taking into consideration additional factors like attractiveness of each location, surrounding environment, size of the brownfield sites, realistic availability of every neighbourhood.