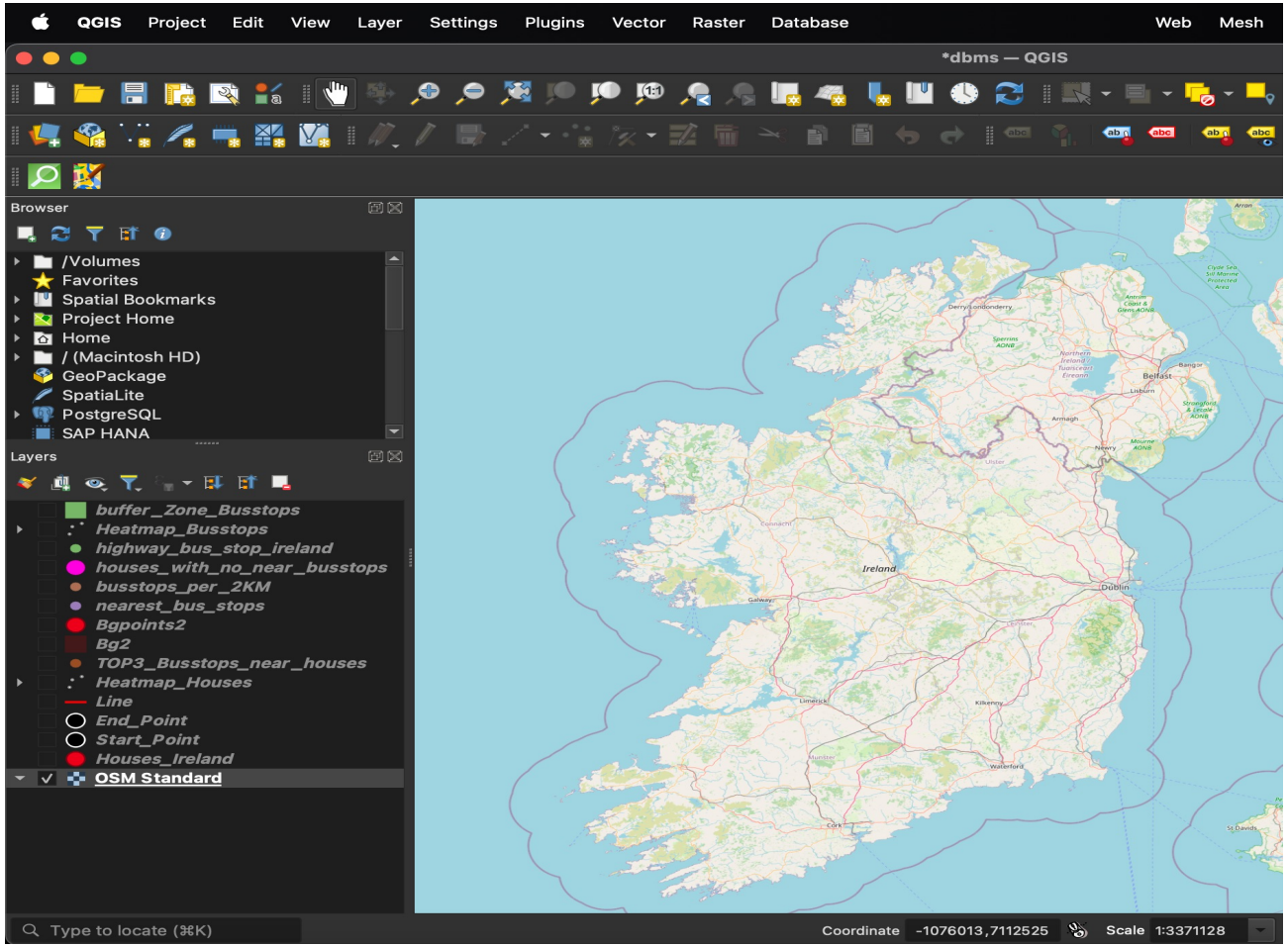
Spatial Databases

Project by : Kancharapu Vamsi Krishna

Module : CS621B[A] Spatial Databases

Spatial analysis of Housing & Transportation in Ireland

- I am exploring the distribution of accommodations and bus stops across Ireland using PostgreSQL, PostGIS, and QGIS. My goal is to analyze the spatial distribution of accommodations and their proximity to public transportation, particularly bus stops. This project is useful for students, travelers, and residents who want to find easily accessible accommodations near bus stops, improving convenience and travel planning.



Analysis

Visualizing the polygon map of Ireland

- **Map Representation:** Polygons can be used to represent and visualize geographical regions on a map
- **Thematic Maps:** Polygons allow us to create thematic maps, where different colors or patterns represent different attributes or characteristics of the regions.
- **Pathfinding:** Polygons can be used to model obstacles or restricted areas in routing and navigation systems.
- **Zoning Analysis:** Polygons can represent different zoning areas, helping in land-use planning and management.

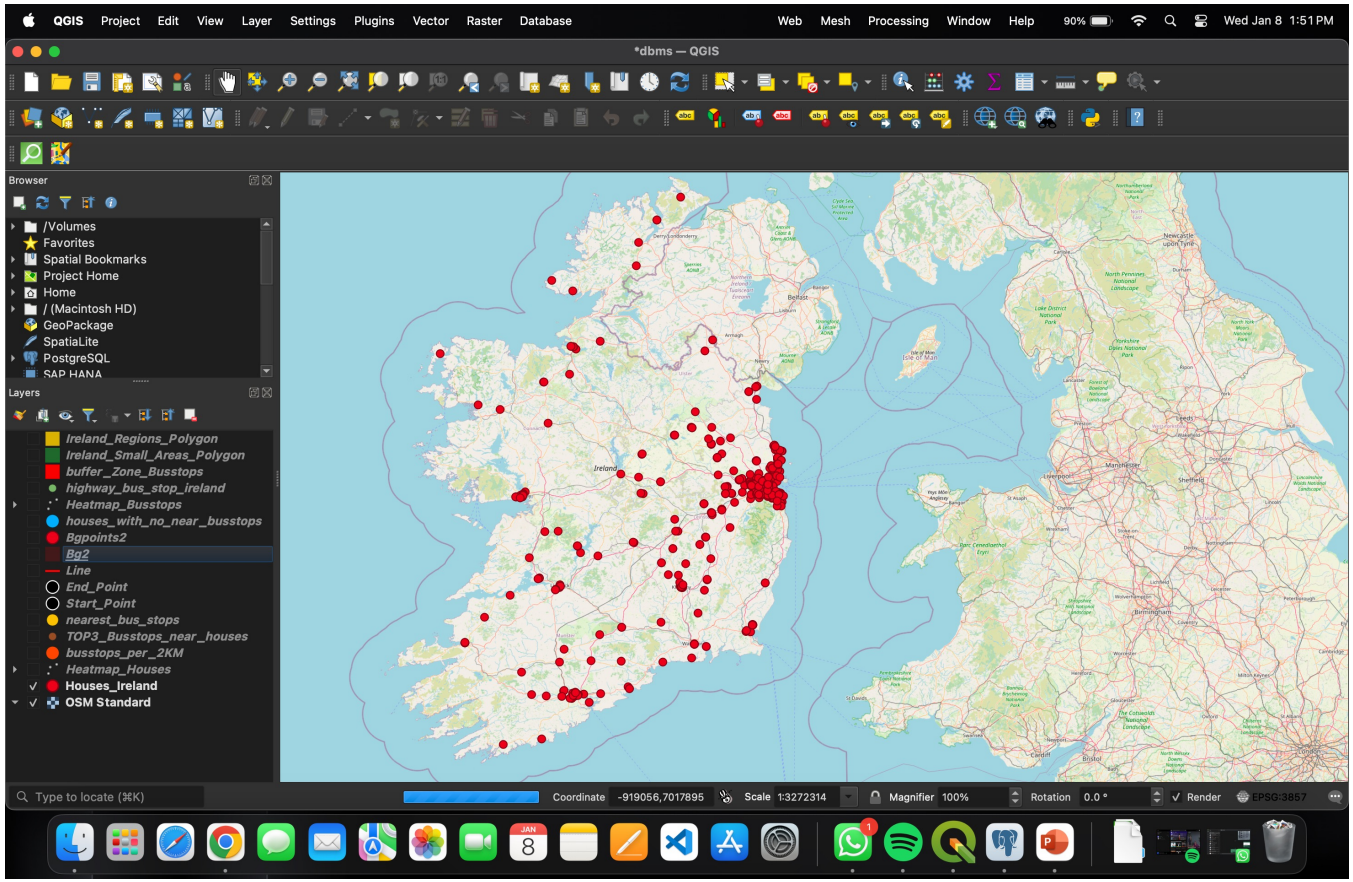
Analysis

Visualizing the Houses on Map

Mapping the houses in Ireland provides valuable insights into residential distribution and accessibility.

By visualizing these houses alongside public transport infrastructure, we can analyze commuting patterns and accessibility. The spatial data helps identify areas with strong public transport coverage and regions that may require better connectivity.

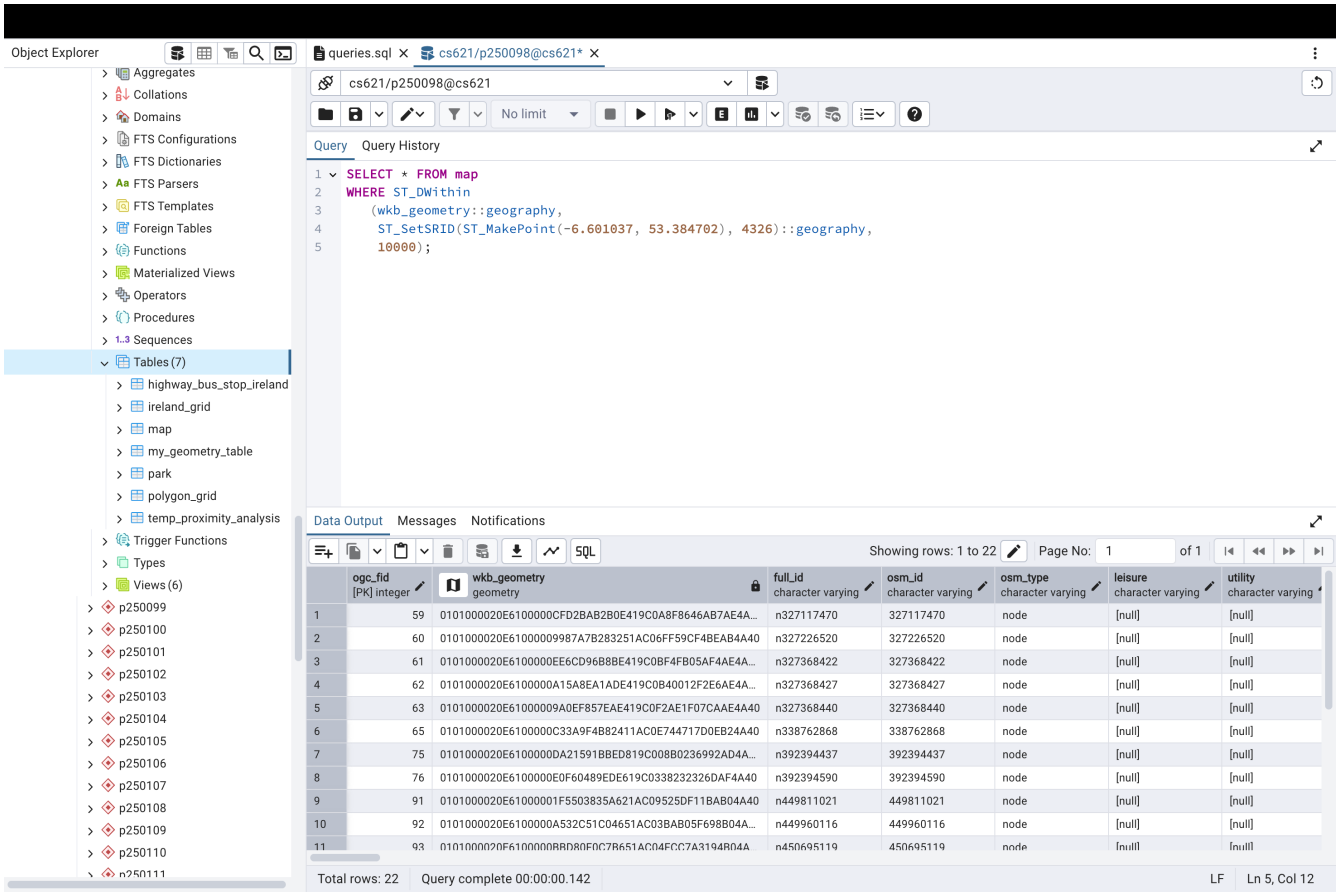
This analysis is crucial for urban planning, real estate development, and sustainable living solutions in Ireland.



Analysis

Retrieving All Houses within 10km of Maynooth University

This query retrieves all houses that are **within a 10km radius of Maynooth University**. It uses the **ST_DWithin** function to filter houses based on their spatial proximity to the university's geographic coordinates. The result includes **all columns** from the map table but only contains houses that fall within the specified distance.

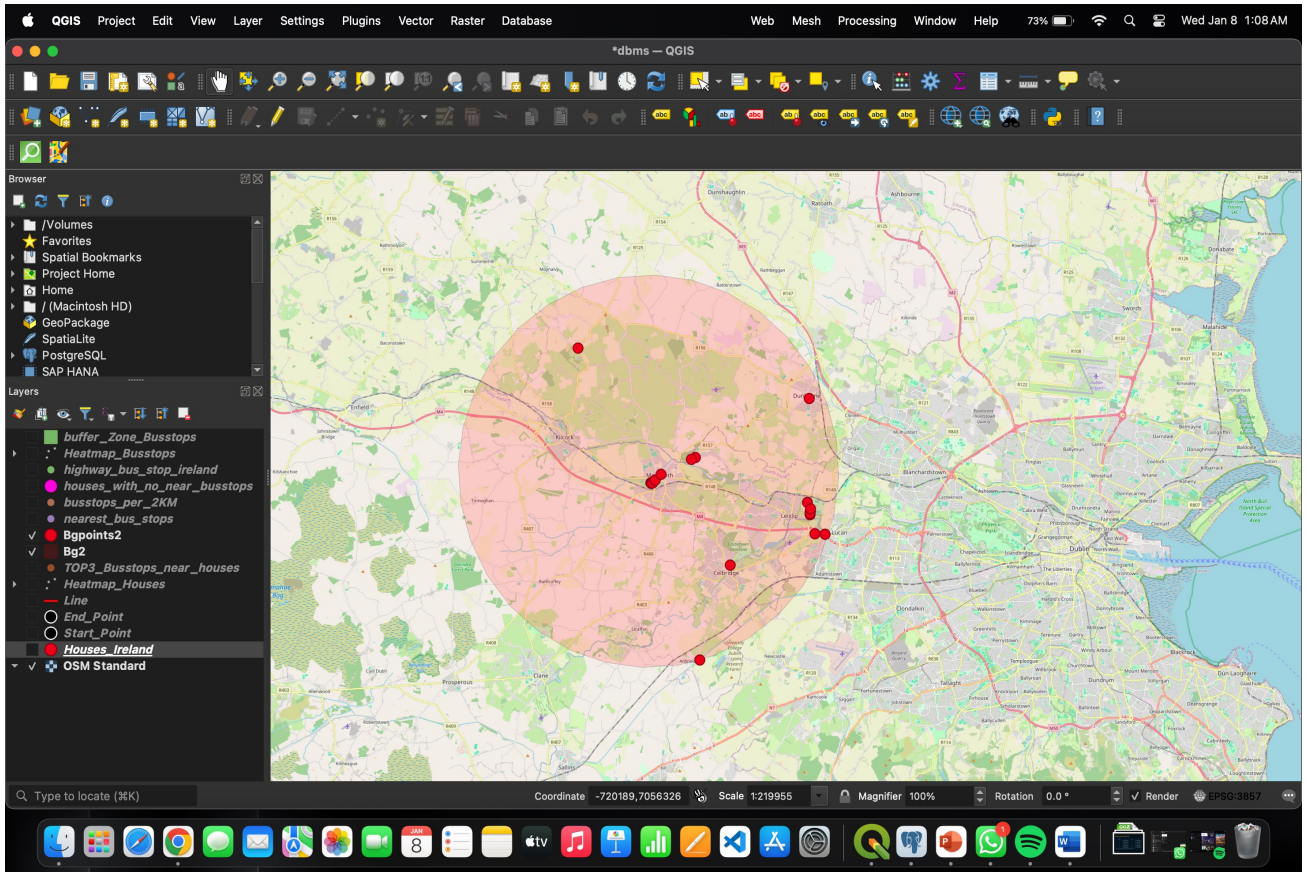


Analysis

Visualizing All Houses within 10km of Maynooth University

Maynooth University is one of Ireland's leading academic institutions, attracting students and faculty from across the country. A crucial factor for incoming students and staff is the availability of housing within a reasonable distance from the university. This query extracts all houses within a 10km radius, allowing for better insights into accommodation options.

By mapping these results in QGIS, we can identify clusters of housing density and evaluate their accessibility to the university. The findings can be further used to analyze rental trends and property values in the vicinity.

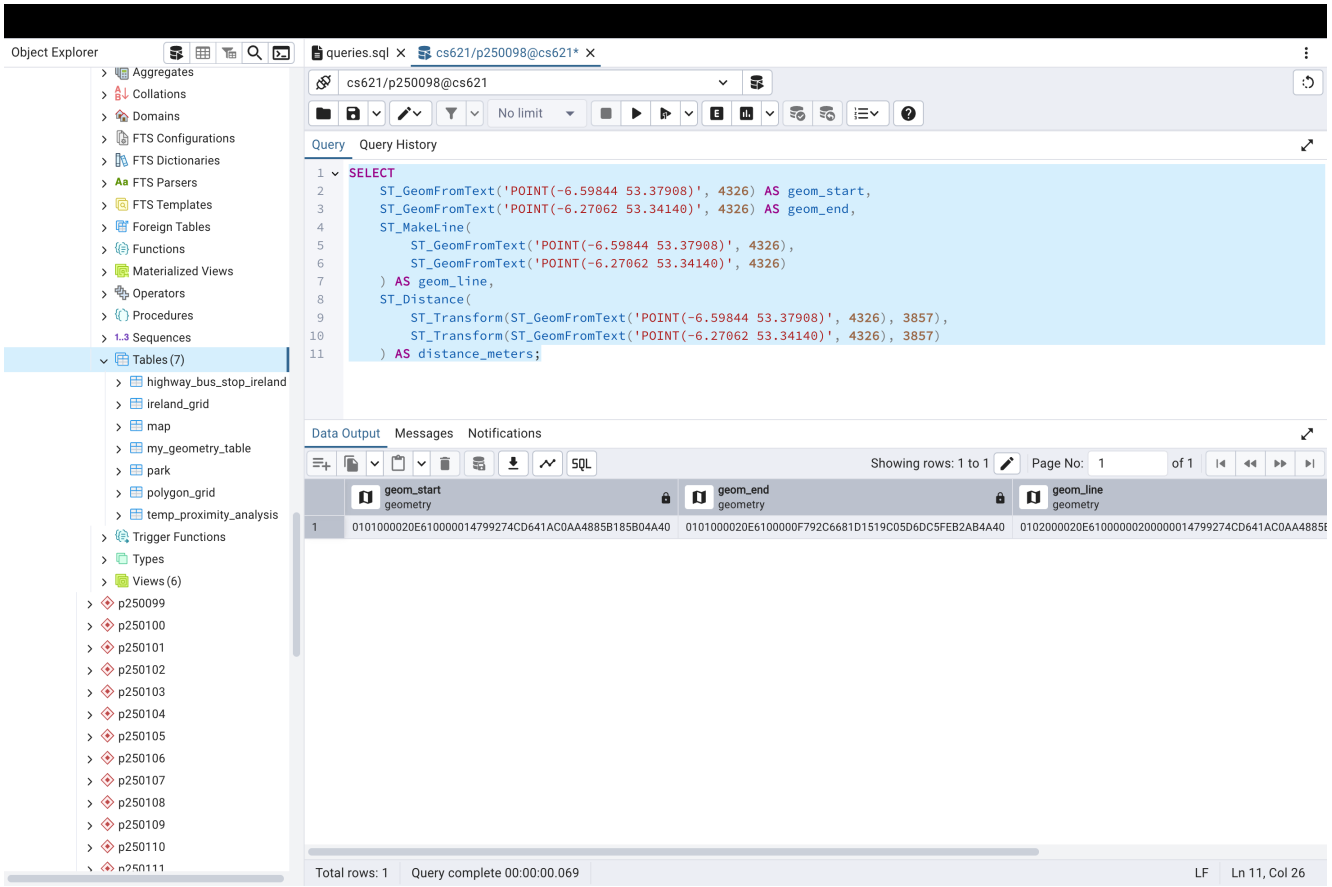


Analysis

Distance from Maynooth to Dublin City Center

This query calculates the **straight-line (Euclidean) distance** between Maynooth and Dublin City Center. It first defines the **start and end points** as geometry objects and then uses **ST_Distance** to compute the direct distance between them. The result includes:

- The **starting location (Maynooth)**
- The **destination (Dublin City Center)**
- The **line geometry** connecting both points
- The **calculated distance in meters**

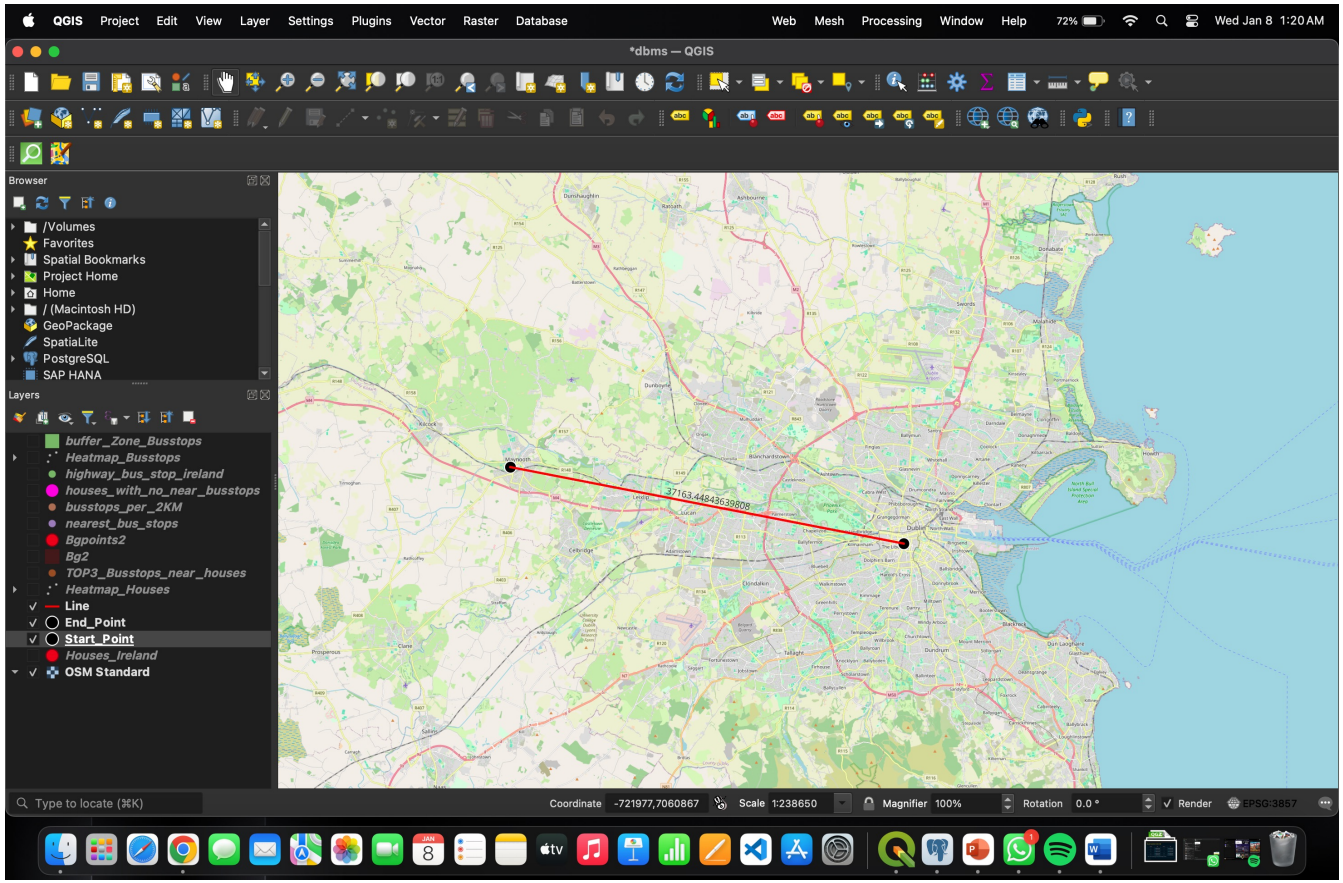


Analysis

Visualizing Distance from Maynooth to Dublin City Center

Maynooth is a suburban town with strong connections to Dublin City Center. Many residents commute daily, making the distance between the two locations a critical factor for urban planning and transportation analysis.

This query calculates the straight-line (Euclidean) distance from Maynooth University to Dublin City Center. The actual travel distance via roads and public transport may vary, but this base calculation provides a fundamental reference for travel time estimation and accessibility planning.

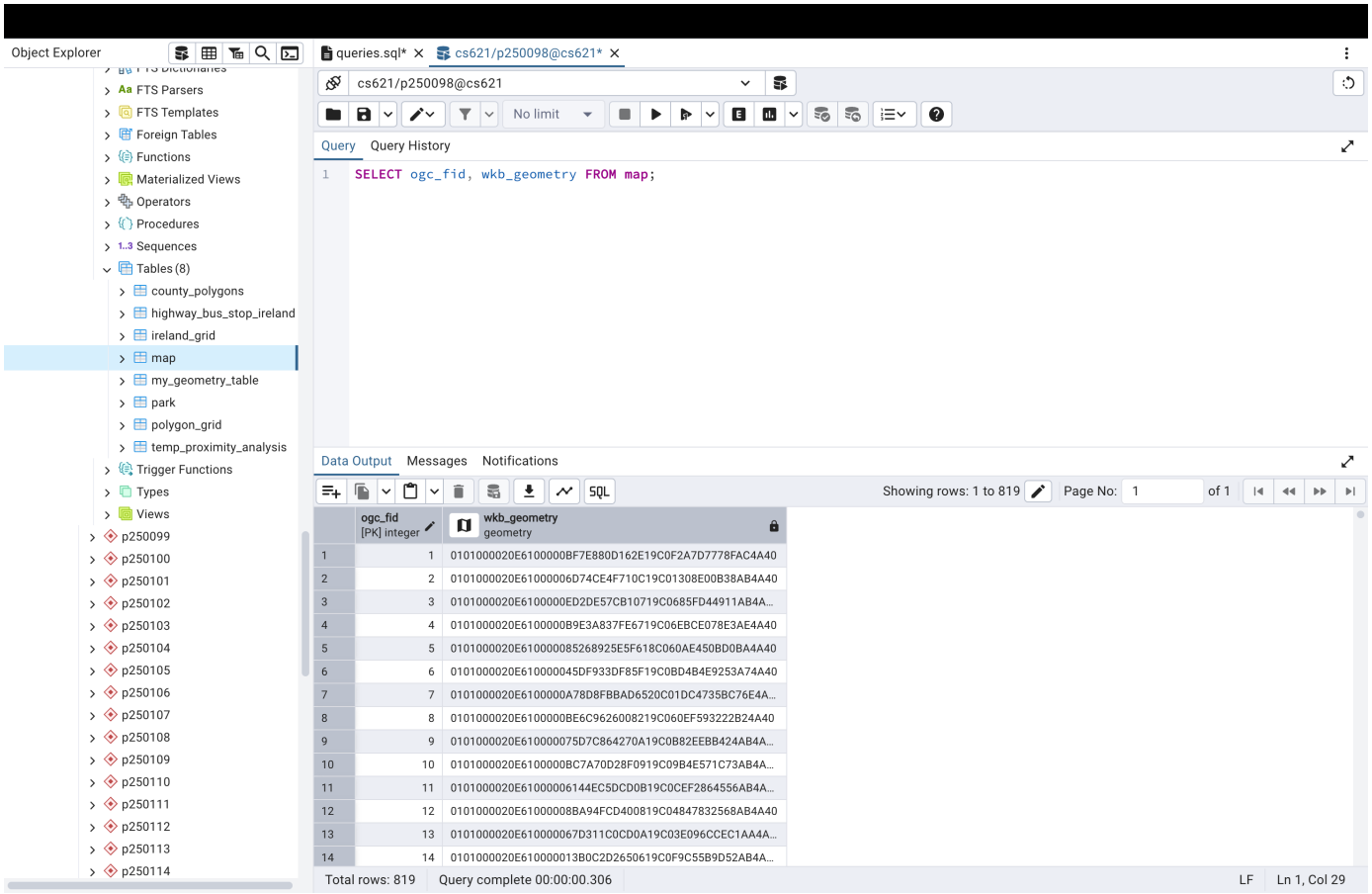


Analysis

Generating a Heatmap of Houses

This query selects all bus stop locations from the highway_bus_stop_ireland table.

These coordinates can be used to **generate a heatmap** in QGIS, helping visualize **bus stop density** across the study area.

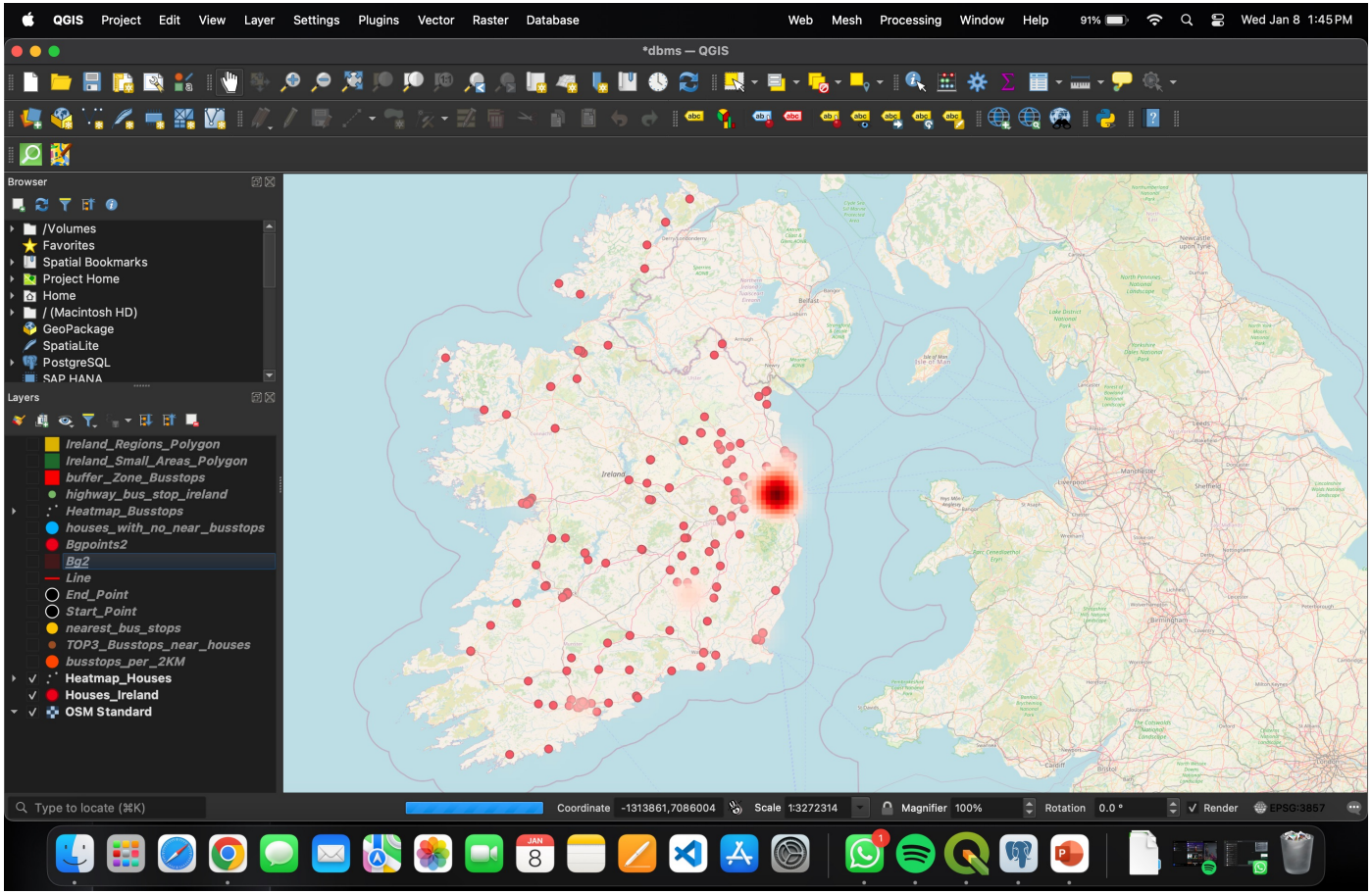


Analysis

Visualizing a Heatmap of Houses

To understand how well-connected different areas are in terms of public transport, a heatmap of Houses is generated. High-density areas may indicate well-serviced locations, while sparse areas may highlight potential zones for adding new houses in future.

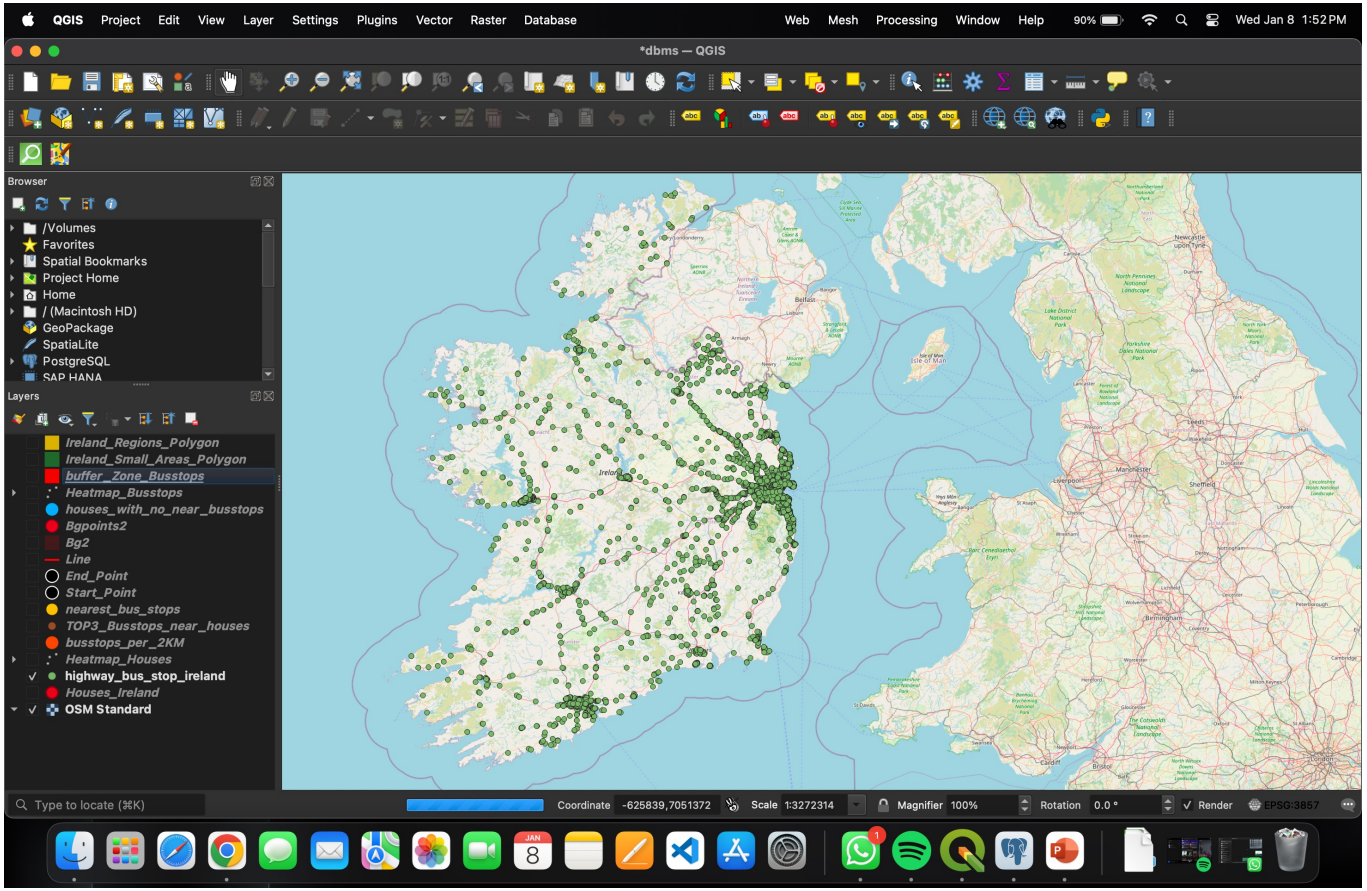
The visualization of this data in QGIS allows for easy identification of transit deserts—areas with limited houses.



Analysis

Visualizing the Bus Stops on Map

Mapping the bus stops in Ireland provides key insights into public transport accessibility and efficiency. The distribution of bus stops shows how well different areas are connected to the transport network, making it easier to assess commuting convenience for residents and students. By analyzing the spatial patterns of bus stops, we can identify well-served areas and transportation gaps where additional stops may be needed. This visualization plays a crucial role in urban planning, optimizing bus routes, and improving overall mobility in Ireland. 🚍📍

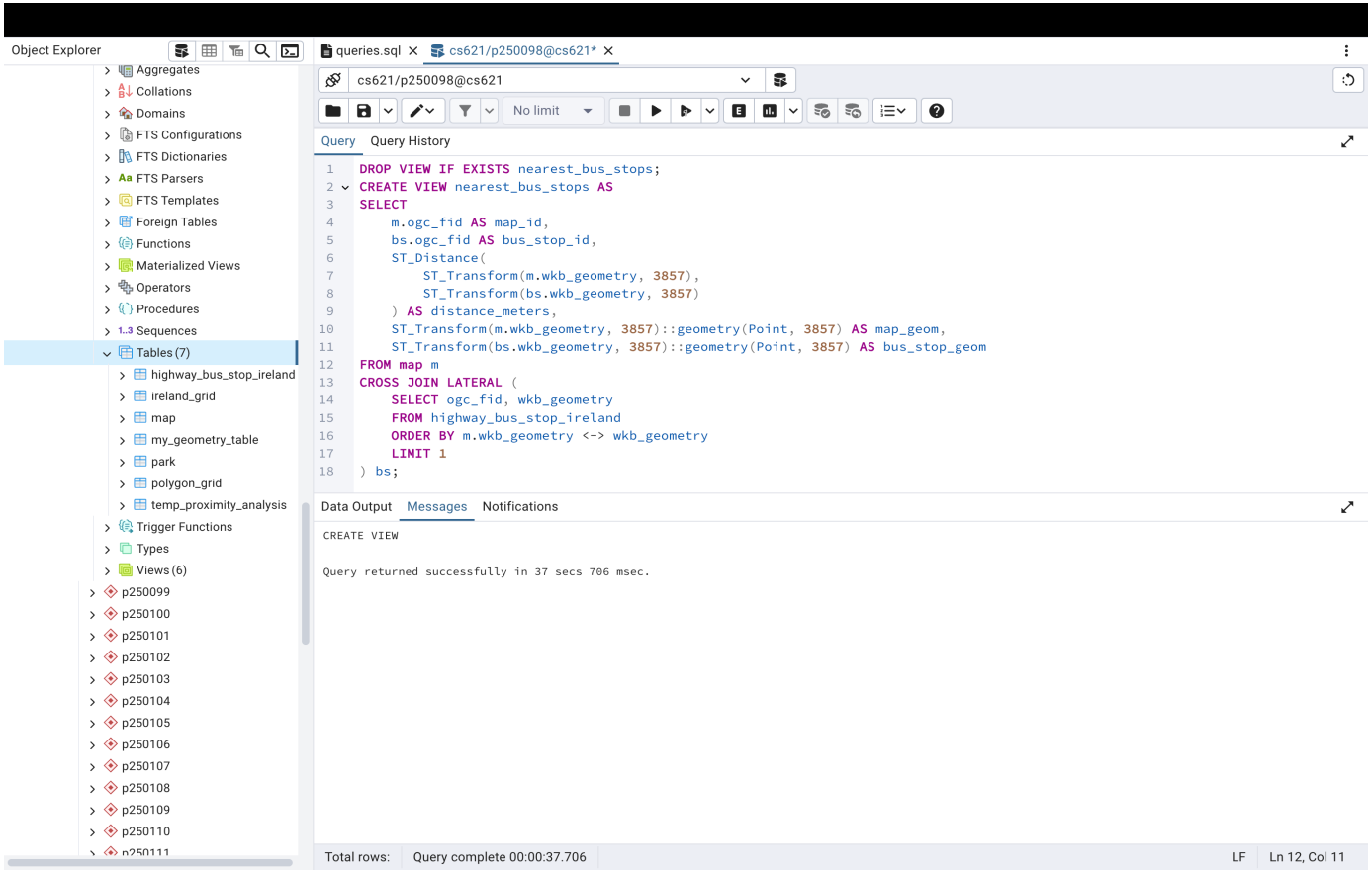


Analysis

Finding the Nearest Bus Stops to Houses

This query creates a **view** (nearest_bus_stops) that finds the **nearest bus stop** for each house in the map table. It uses **ST_Distance** to calculate distances between houses and bus stops and selects the closest one for each house. The result includes:

- The **house ID** (map_id)
- The **nearest bus stop ID** (bus_stop_id)
- The **distance in meters** between the house and the bus stop
- The **geometries of both the house and bus stop**

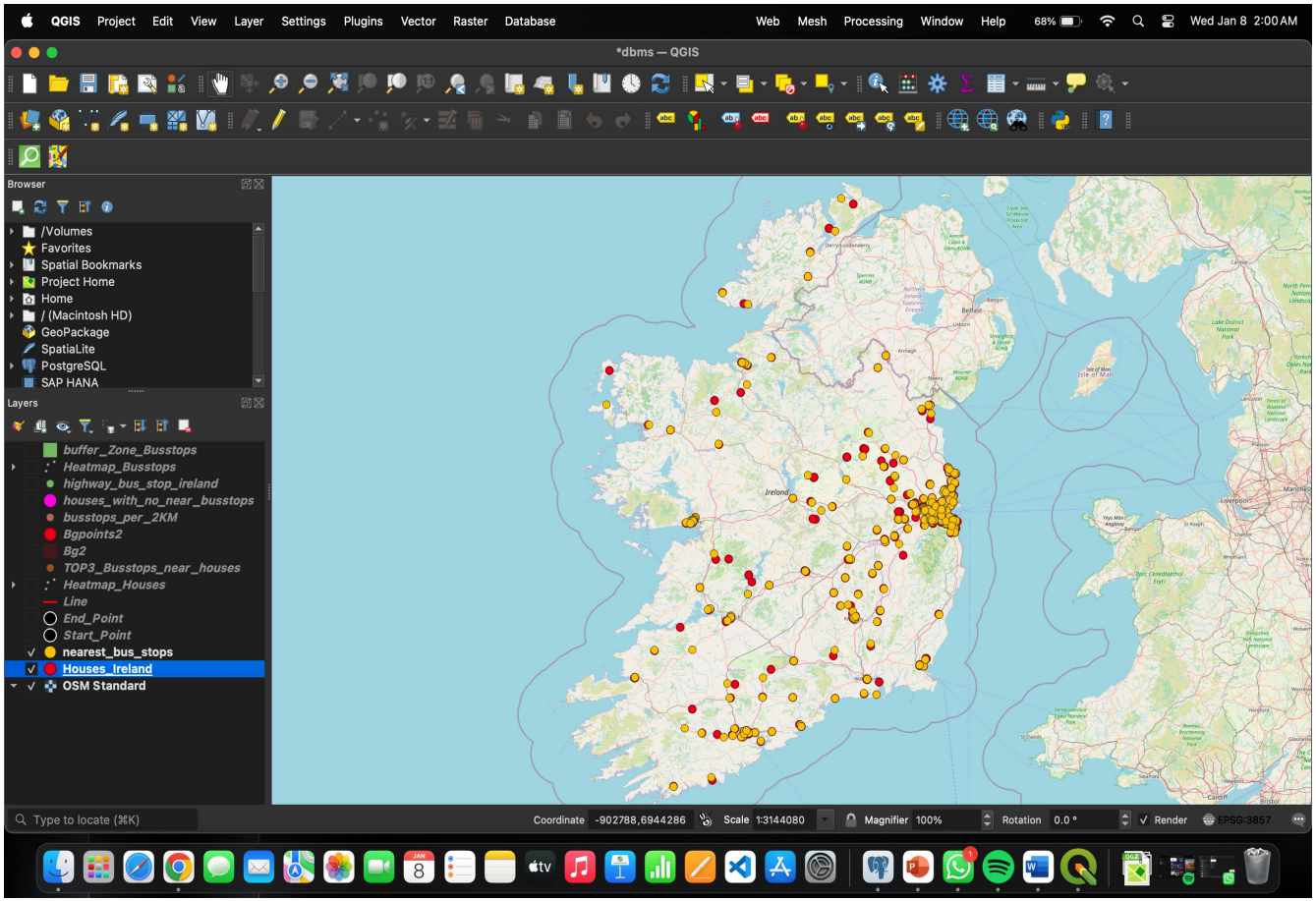


Analysis

Visualizing the Nearest Bus Stops to Houses

Public transportation plays a vital role in everyday commuting. This query identifies the nearest bus stop to each house, providing insights into public transport accessibility.

By visualizing the results in QGIS, we can observe gaps in public transportation coverage and propose solutions for better urban mobility. This data could be particularly useful for city planners and policymakers.

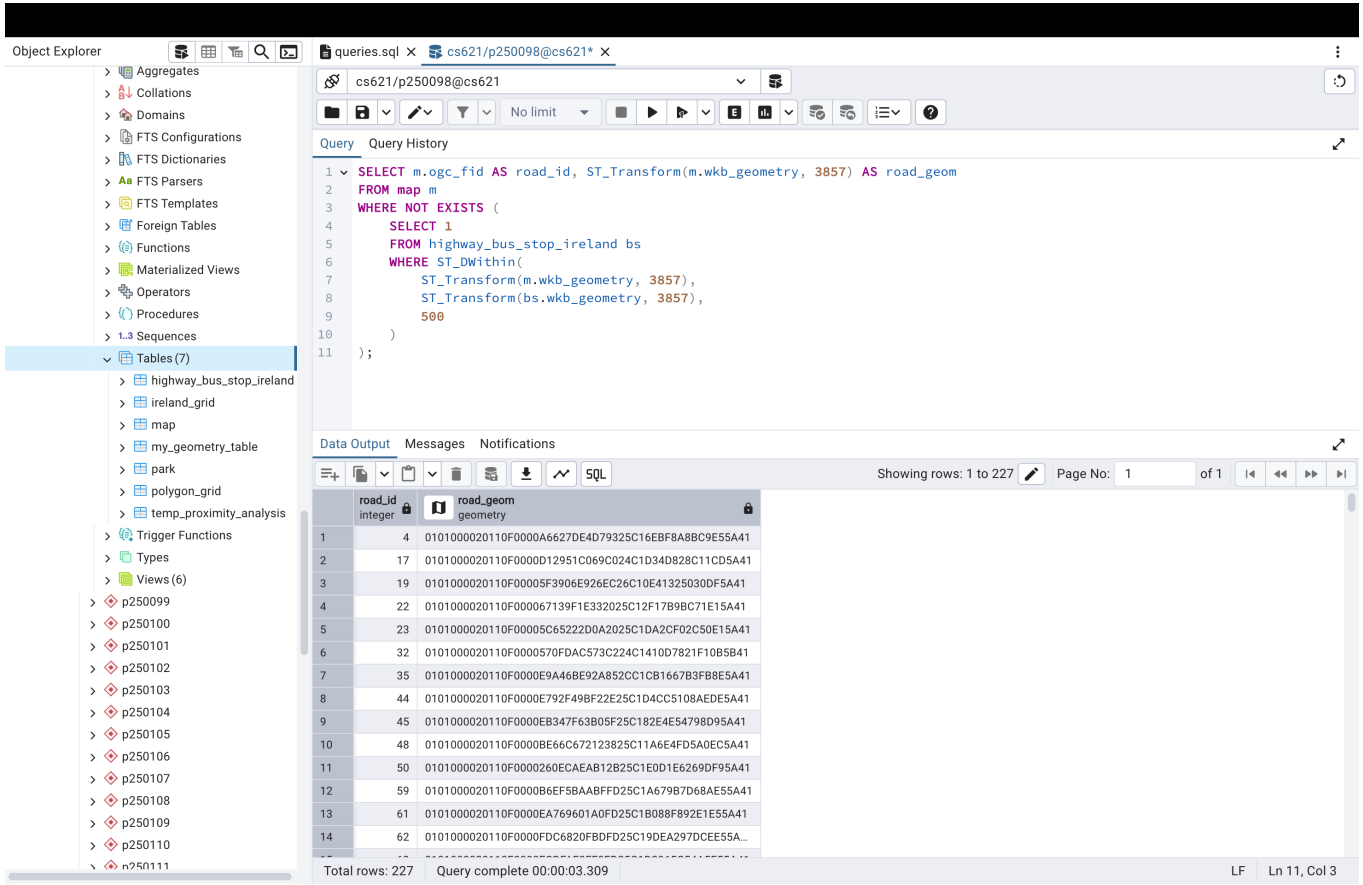


Analysis

Identifying Houses with No Bus Stops Within 500m

This query identifies **houses that do not have a bus stop within a 500m radius**. It does so by using **ST_DWithin** to check if any bus stop is within the specified distance and excludes houses that meet this condition. The result includes:

- The **house ID** (road_id)
- The **geometry of the house**

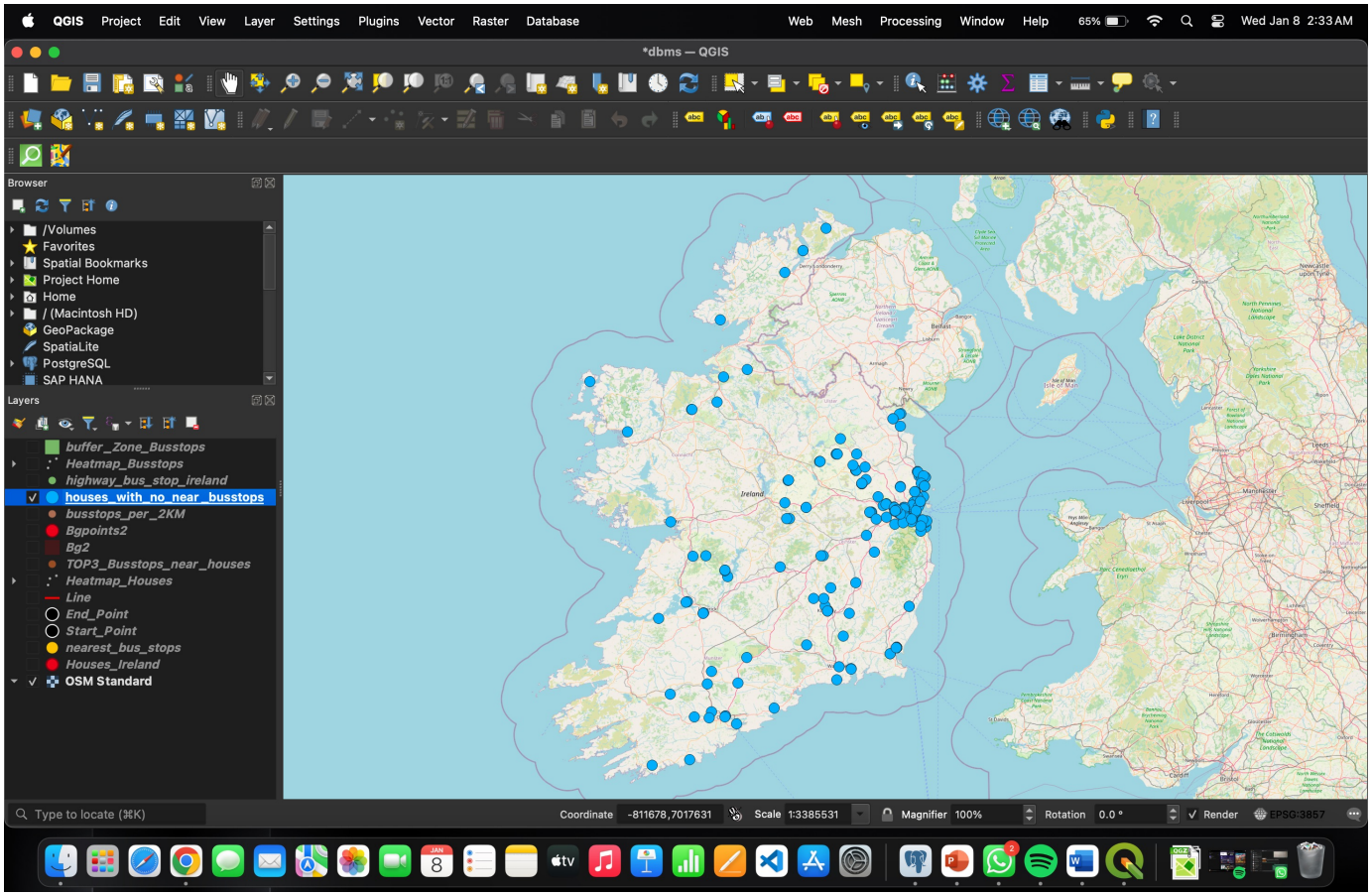


Analysis

Visualizing Houses with No Bus Stops Within 500m

Efficient public transportation is a necessity for urban and suburban communities. This query identifies houses that lack bus stops within a 500m radius, highlighting areas that may require additional transit services.

By analyzing these results, city planners can make data-driven decisions about future bus stop placements, ultimately improving urban mobility.

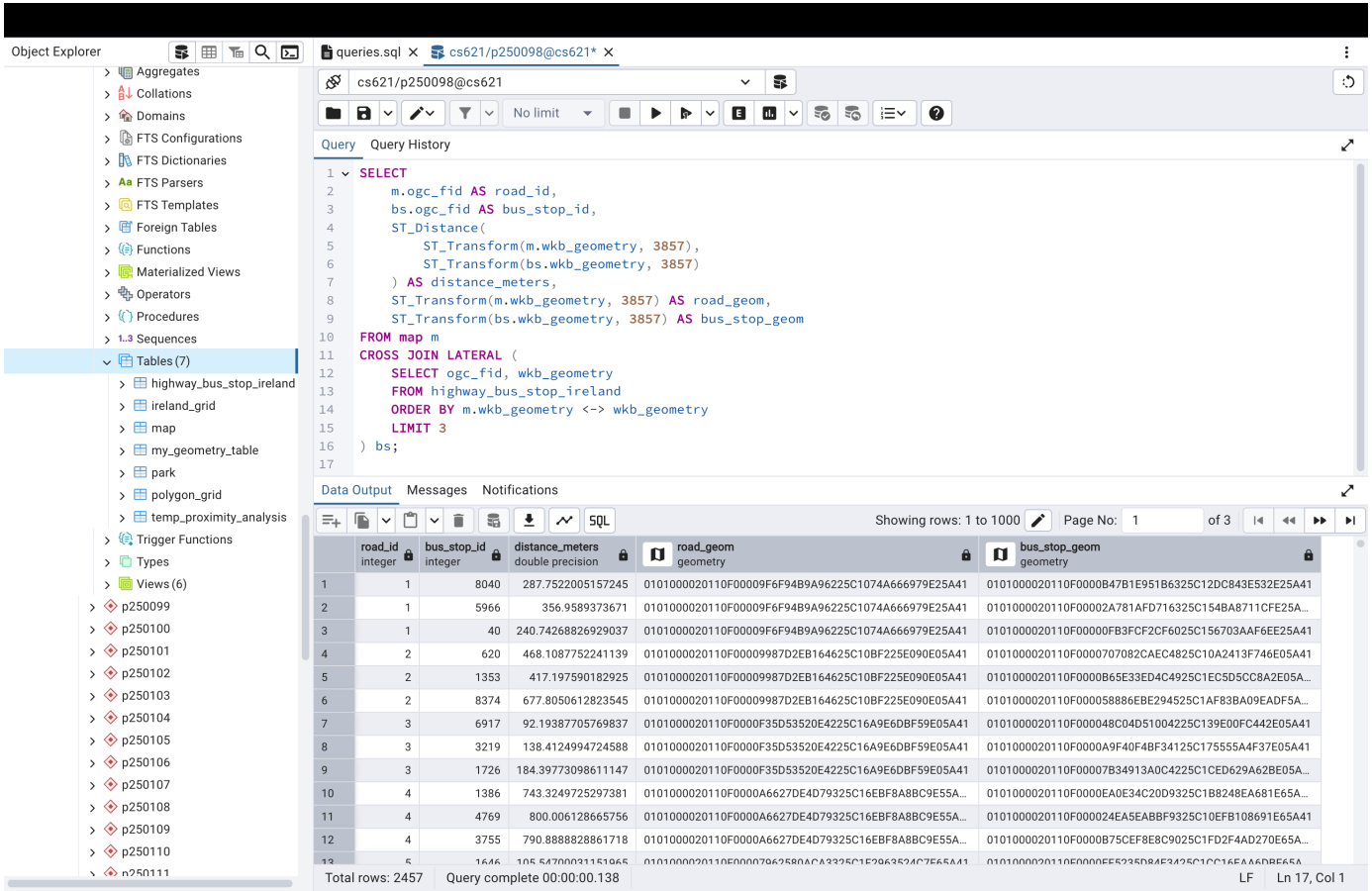


Analysis

Finding the Nearest Three Bus Stops for Each House

This query finds the **three closest bus stops** for each house by using **ST_Distance** and ordering the results based on proximity. The result includes:

- The **house ID** (road_id)
- The **bus stop IDs** of the three nearest stops
- The **distance in meters**
- The **geometries of the house and bus stops**

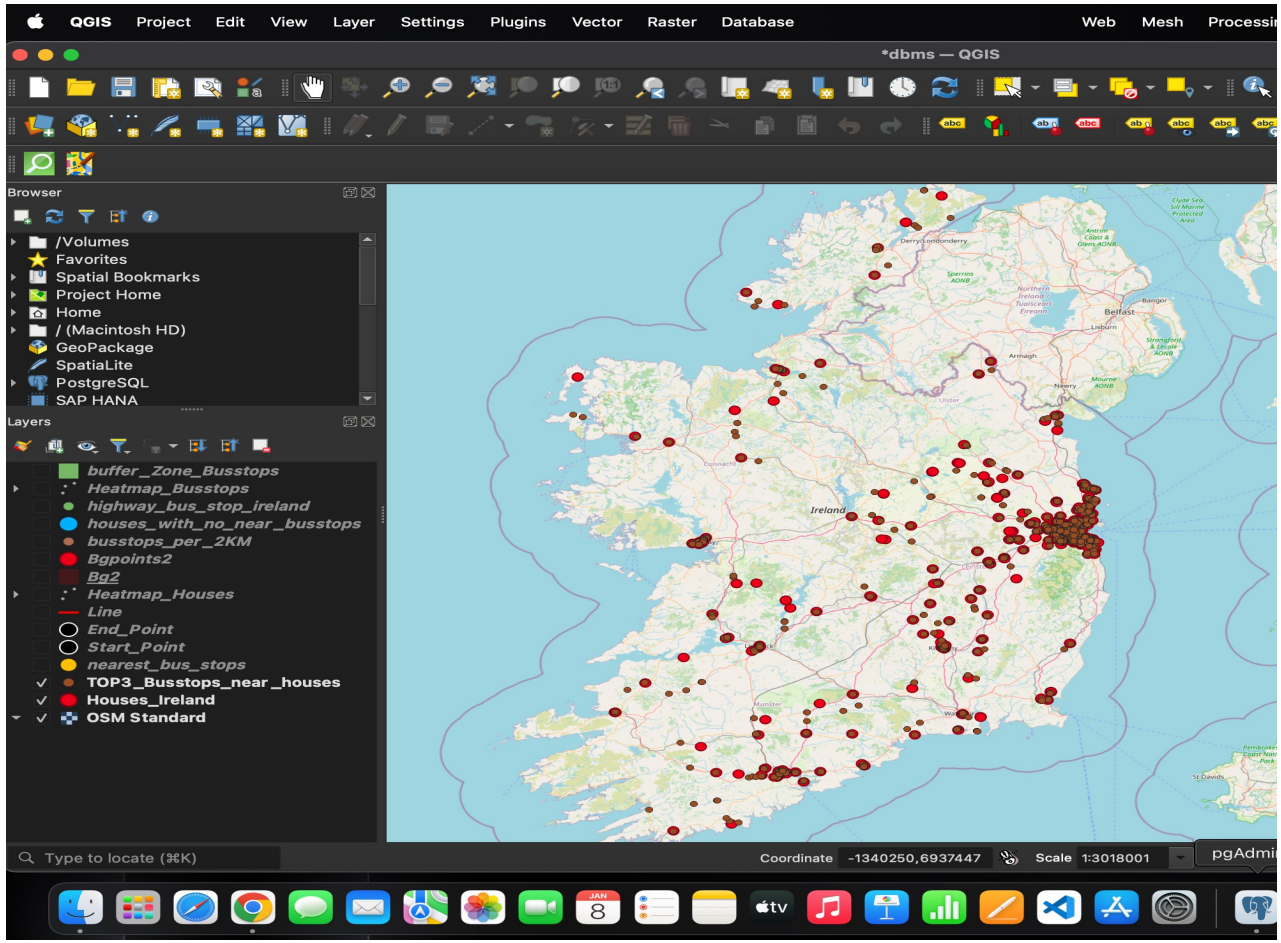


Analysis

Visualizing the Nearest Three Bus Stops for Each House

Accessibility to multiple bus stops gives commuters more flexibility in planning their routes. This query finds the three nearest bus stops to each house, offering a more comprehensive view of available public transport options.

This data can be used for optimizing public transport schedules and routes to serve residential areas more effectively.

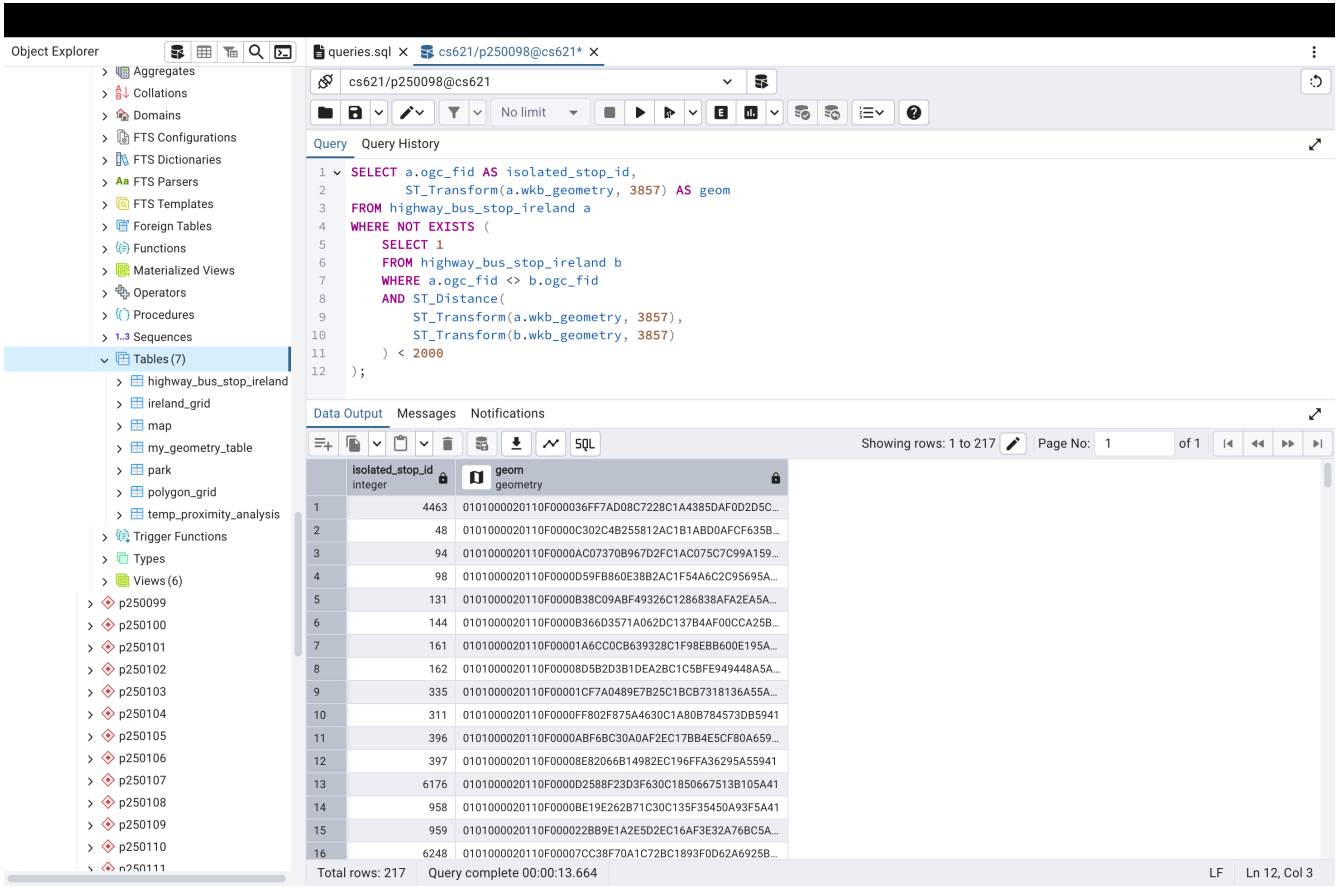


Analysis

Finding Isolated Bus Stops (More than 2km Away from Any Other Stop)

This query finds **bus stops that are isolated** (more than 2km from any other stop). It does this by checking for stops that do not have another stop within 2000 meters using **ST_Distance**. The result includes:

- The **bus stop ID** (isolated_stop_id)
- The **geometry of the isolated bus stop**

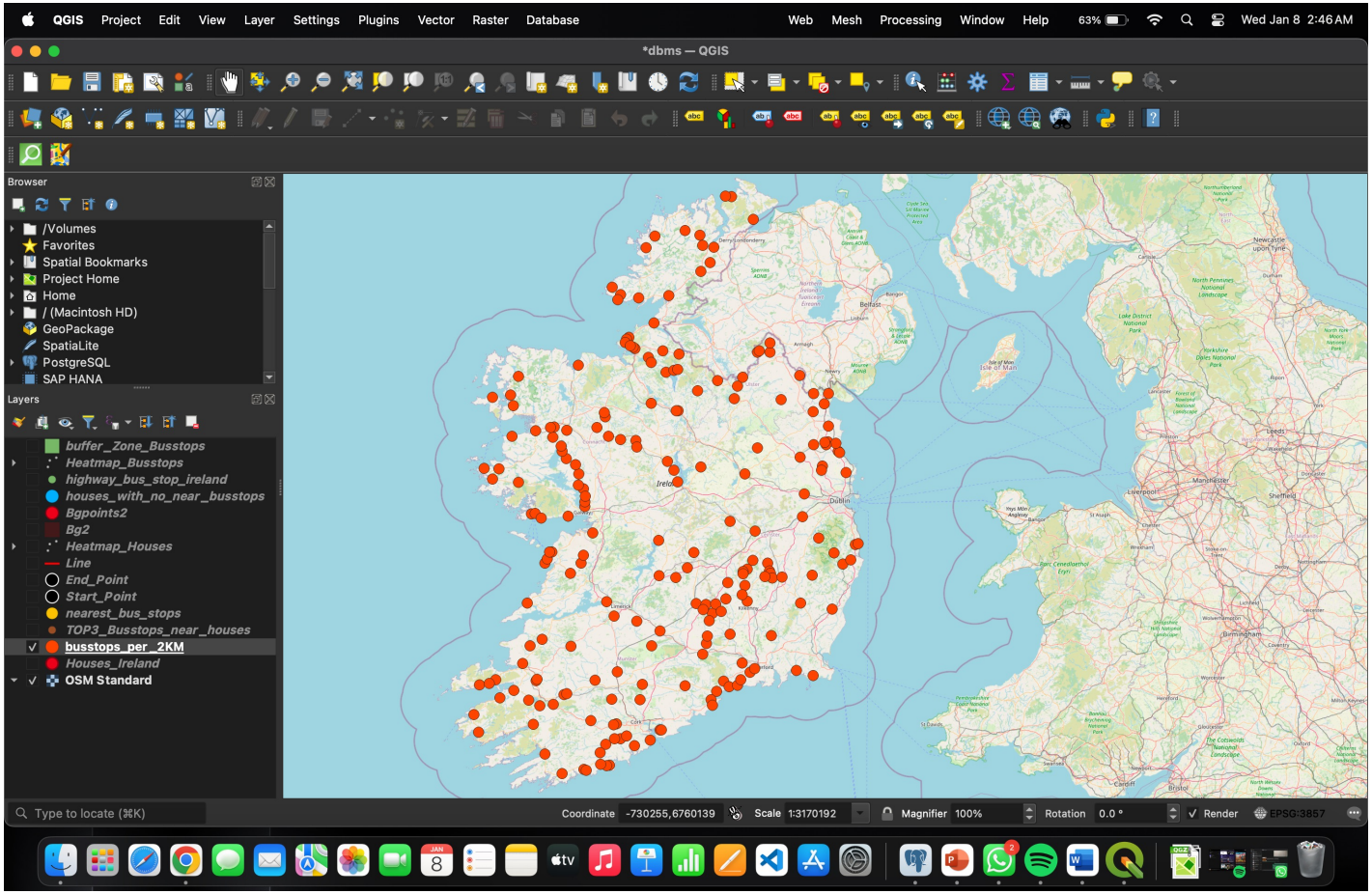


Analysis

Visualizing Isolated Bus Stops (More than 2km Away from Any Other Stop)

A well-connected transit network ensures easy accessibility to public transport for all residents. However, some bus stops might be isolated, making them inconvenient for most commuters.

This query identifies bus stops that are more than 2km away from any other stop, helping transport authorities optimize their routes and coverage.

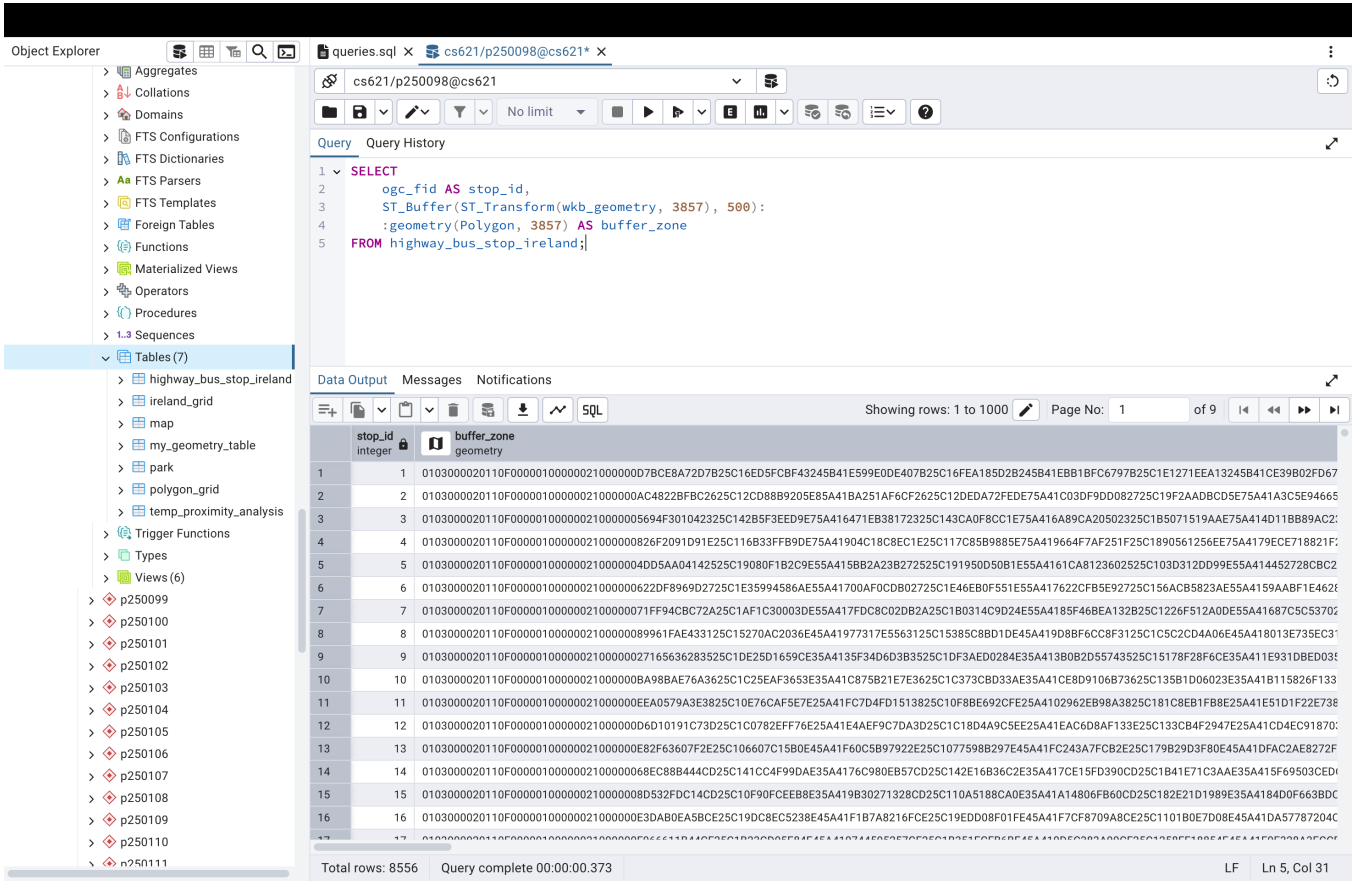


Analysis

Creating a 500m Service Area Around Bus Stops

This query generates a **500m buffer zone** around each bus stop to **visualize service areas**. It uses **ST_Buffer** to create a polygon surrounding each bus stop, representing the area **within walking distance** of public transport. The result includes:

- The **bus stop ID**
- The **buffer polygon geometry**

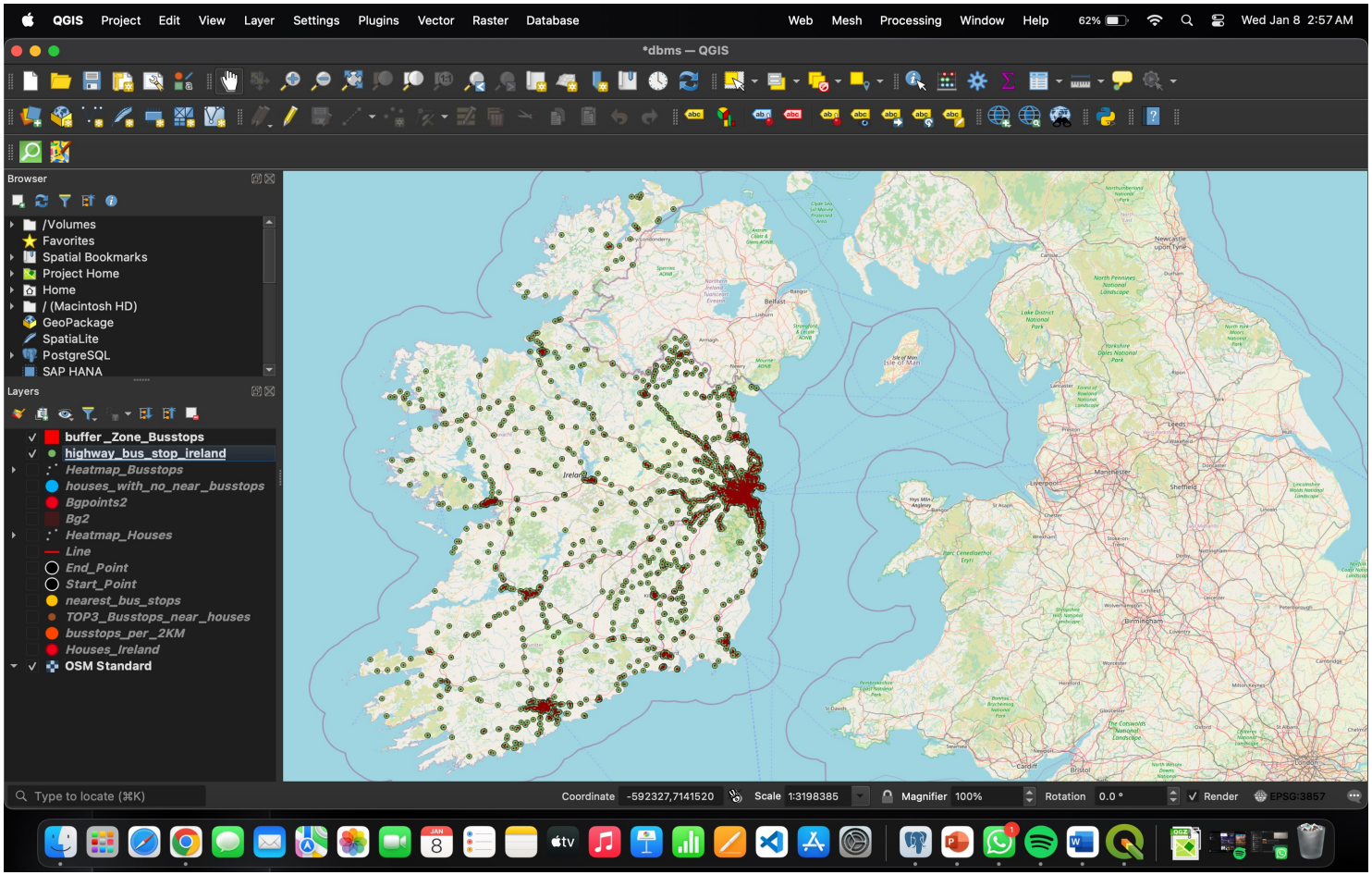


Analysis

Visualizing a 500m Service Area Around Bus Stops

Bus stops should ideally cover a substantial portion of the community. This query generates a 500m service area around each bus stop, creating buffer zones to visualize the areas well-served by public transportation.

By mapping these zones in QGIS, we can identify underserved areas and propose better bus stop placements.

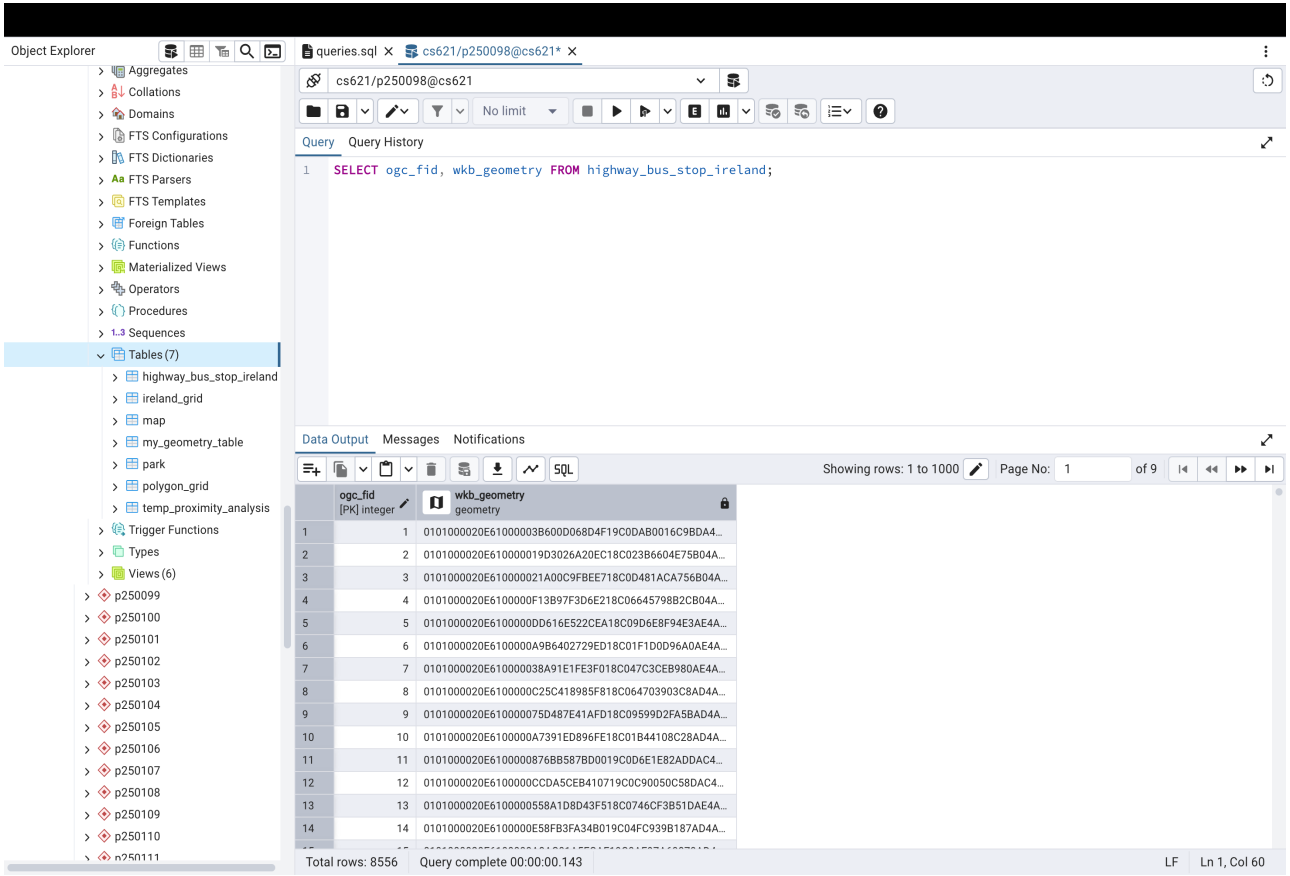


Analysis

Generating a Heatmap of Bus Stops

This query selects all bus stop locations from the highway_bus_stop_ireland table.

These coordinates can be used to **generate a heatmap** in QGIS, helping visualize **bus stop density** across the study area.

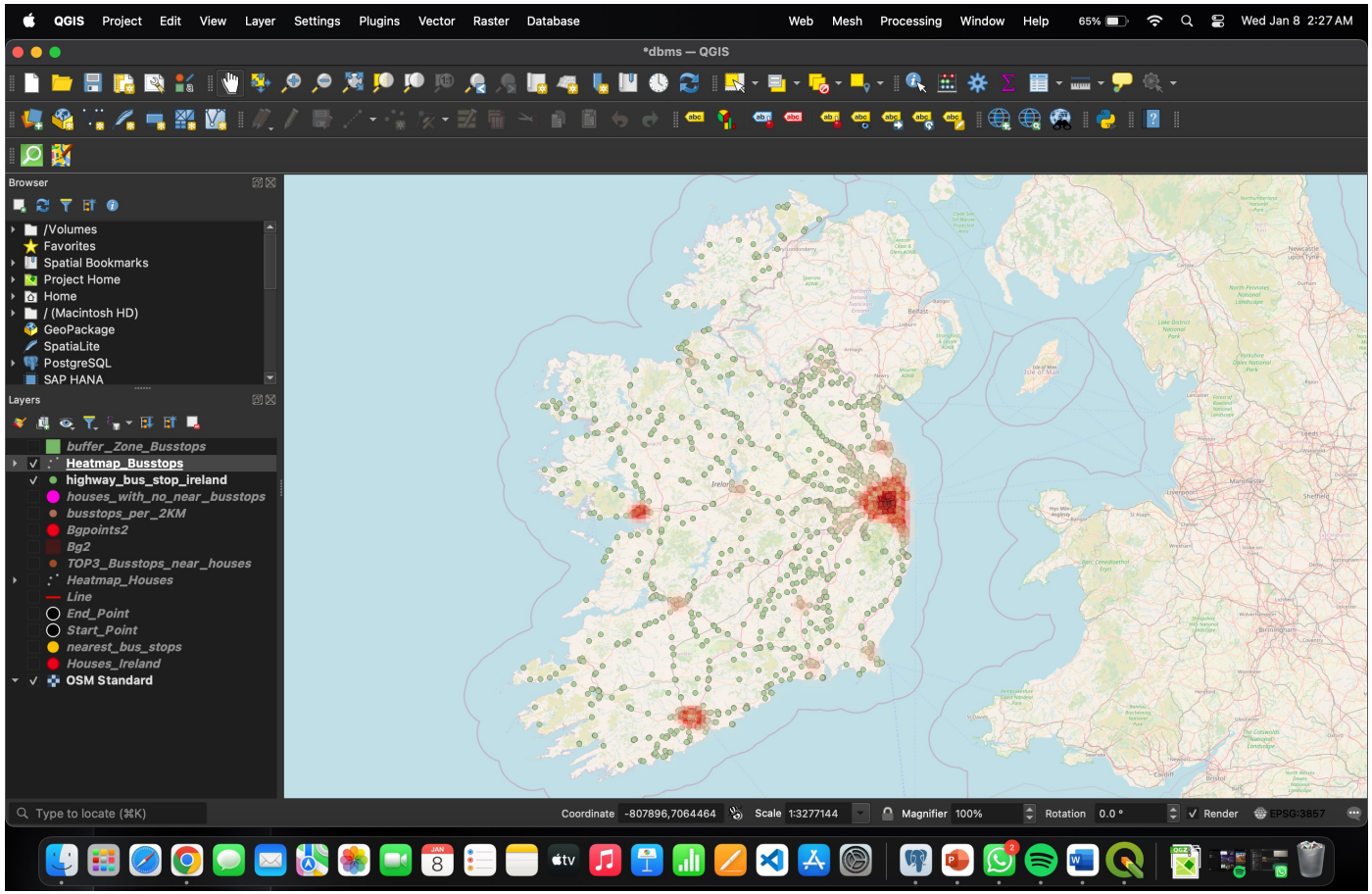


Analysis

Visualizing a Heatmap of Bus Stops

To understand how well-connected different areas are in terms of public transport, a heatmap of bus stops is generated. High-density areas may indicate well-serviced locations, while sparse areas may highlight potential zones for adding new bus routes.

The visualization of this data in QGIS allows for easy identification of transit deserts—areas with limited or no public transportation access.



Conclusion

- Our study on housing and public transport accessibility in Ireland revealed interesting patterns. We found that houses are clustered around Maynooth University, making it a key residential area for students and staff. Many homes are well-connected to public transport, while others lack nearby bus stops, indicating gaps in accessibility.
- We found that houses with nearby bus stops provide better commuting options for students and residents, ensuring easy access to essential locations such as the university, shopping centers, and workplaces.
- We also found that some bus stops are isolated and more than 2km away from any other stop, making them less effective for commuters. Additionally, the 500m service area analysis showed areas where public transport coverage is insufficient, suggesting opportunities for new bus stops to improve connectivity.
- By optimizing bus stop placements and improving transport coverage, Ireland can offer better living conditions and more efficient commuting options for students and residents.

Thank You