Nation-level Antibiotic Resistance Geography: Developing a prototype WMS system

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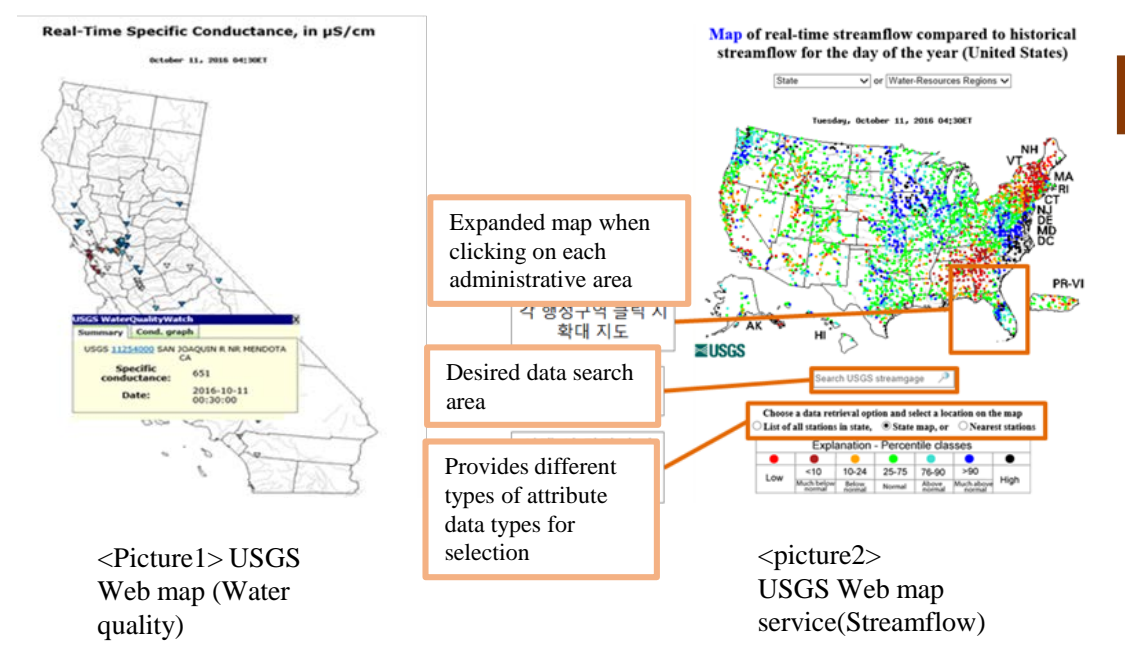
Introduction

An antibiotic resistance, a deadly threat to future of humanity is emerged as a serious problem in recent years. Our society needs to understand about occurrence, spread and evolution of resistance. We developed the database of antibiotic resistance matters on four big rivers in South Korea adopting the technology of antibiotic resistance monitoring system. We made a prototype web mapping system, a national antibiotic resistance based on GIS, to control and predict these distributions. We used WMS(Web Map Service) and also designed data schema structure of connectivity between antibiotic, degrees of resistance, water quality and location of the sampled point on the rivers. It will be contributed to reduce social cost and economic loss caused by increase of antibiotic resistance.

Process

| Defining Map Function | Environment set-up | Making schema | System detail function realization | User test and supplement |

1st step → 2nd step → Result

1st step – Defining Map Function

The purpose of this project was to **construct spatial database which contain antibiotic resistance and publish GIS Map Service** in South Korea.

To finish this goal, we used open source GIS software for this research which provide antibiotic resistance database and spatial information to user
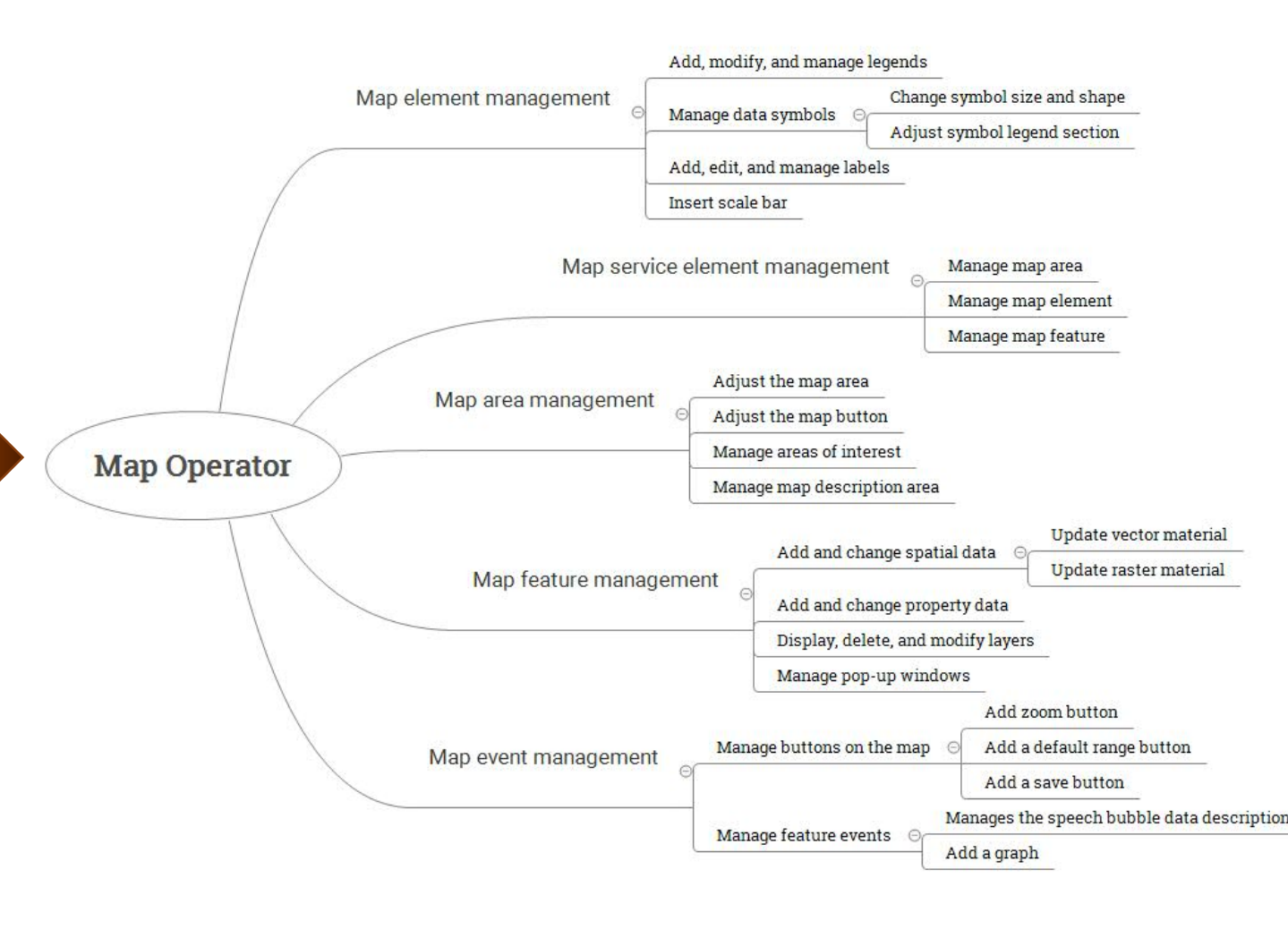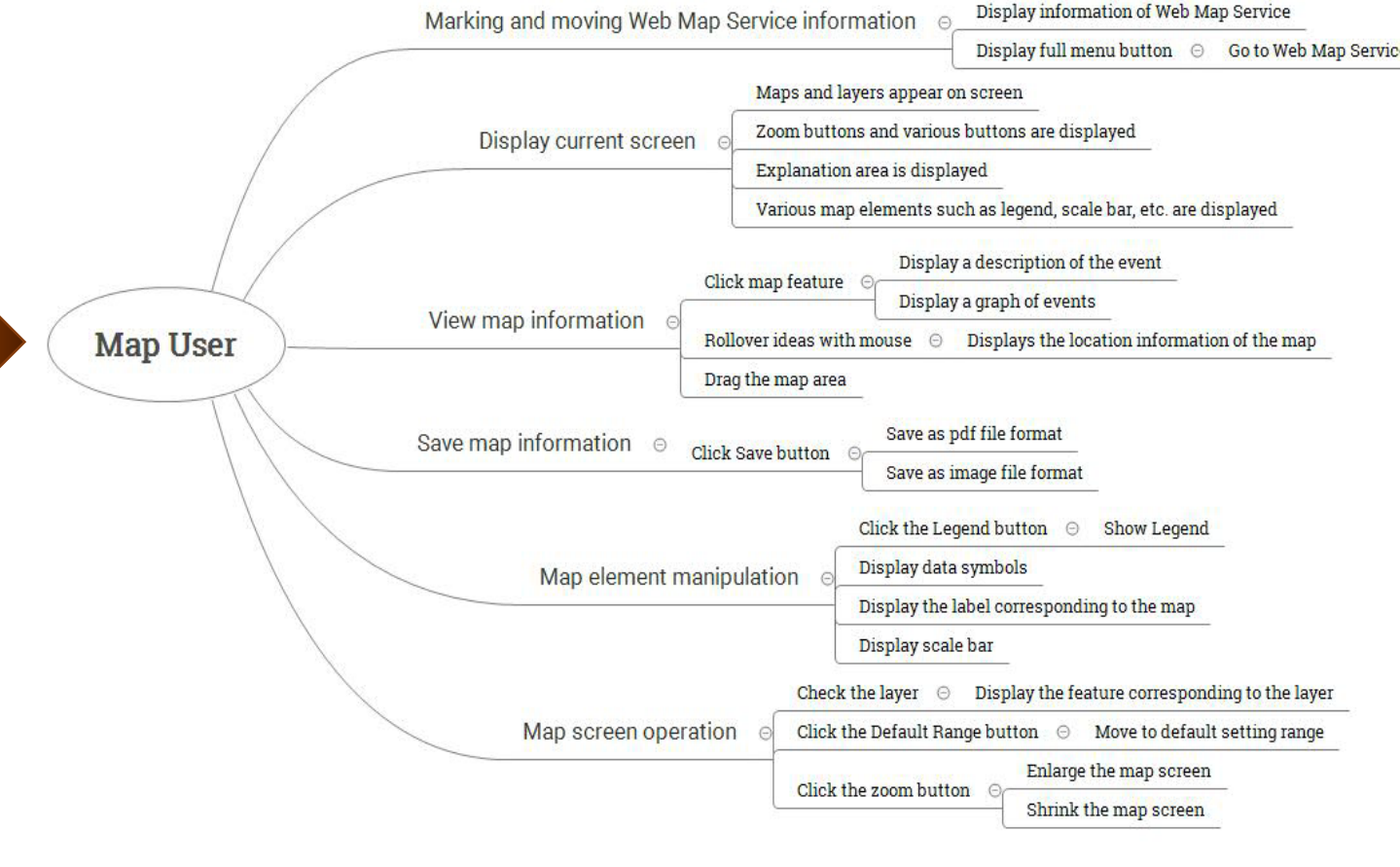
As shown in the picture, we used benchmarking approach to derive acceptance contents. Because of two problem.
One is that to access generalized elements was inappropriate in detail. The other is that specification of process, program, network, and hardware for the whole system model was not defined.

<Picture1> USGS Web map (Water quality)
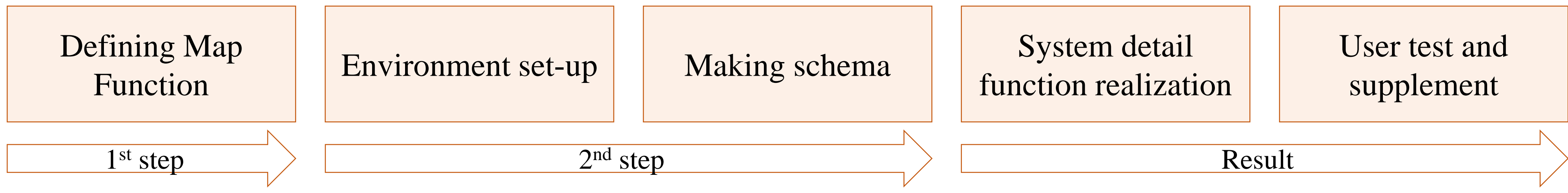<picture2> USGS Web map service(Streamflow)

The requirements to be applied to the Web Map of this study are derived through the five Web Map Service now provided.
The main benchmarks were chosen to focus on the delivery methods and capabilities to be applied to the business

【 Map User 】

Procedure definition	Procedure process	Required data	Source of data
Information recognition of web map	- Recognizing the information provided and move to the required service	- Service Information	
Main Screen Recognition	- Identifying the elements displayed on the main screen		
Map screen operation	- Manipulating the layer by turning on and off the layer - Clicking Default setting range button to move to default setting range	- Basic map	
Map element manipulation	- Turning the legend on and off allows you to manipulate the legend		
View map information	- Click map map to view description and graph - Show location info	- Data required for map service	- Acquired through the entire research project
Save map info	- Click the output button to save the map	- Data required for map service	- Acquired through the entire research project

【 Map Operator 】

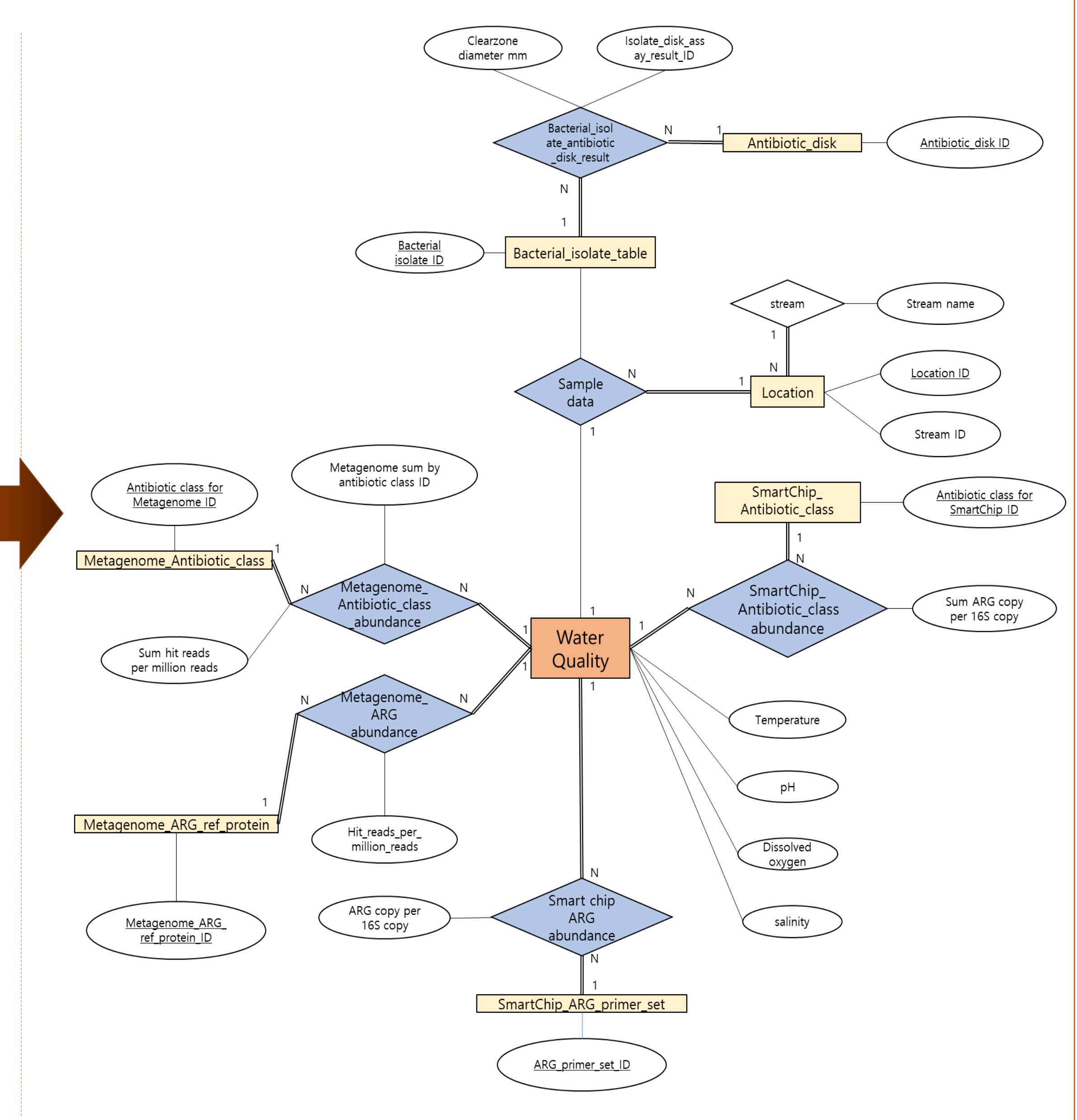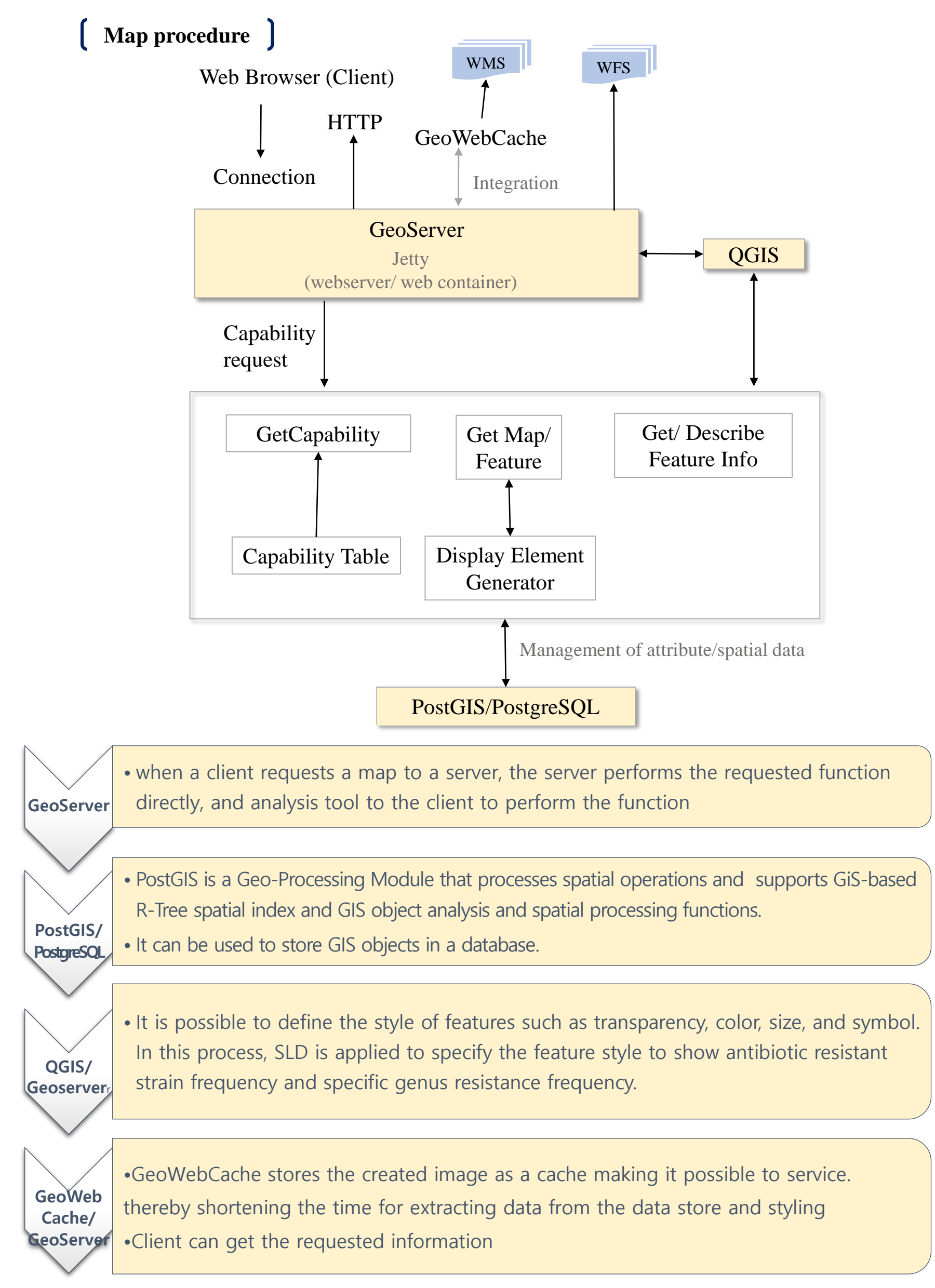| Procedure definition	Procedure process	Required data	Source of data
Map service element management	- Logging in system - Data Register, edit, delete	- Data required for map service	- Acquired through the entire research project
Map area management	- Adjust the map area and add, configure, and modify layers - Manage map settings area	- Administrative district map - Stream data	- Statistical Office - National Space Information Portal
Map element management	- Create, modify, and manage legends, symbols, labels, and scale bars		
Map feature management	- Add or change spatial data - Add or change property data - Managing pop-up content for vector-based objects - Manage pop-up windows	- Data required for map service	
Map event management	- Manage balloon preview content of vector-based objects - Manage map zoom, pan, pan and save buttons		

2nd step – Environment set-up & Schema

The components of the Web-GIS system as a management tool for domestic antibiotic monitoring system are as follows. To serve the map shown in Figure 1, this research uses Post-GIS, PostgreSQL, QGIS, and Geo Server as open source software.

【 Map procedure 】

Web Browser (Client) — HTTP — Connection — GeoServer Jetty (webserver/ web container) — QGIS — Capability request

WMS / WFS — GeoWebCache — Integration

GetCapability / Get Map/Feature / Get/ Describe Feature Info
Capability Table / Display Element Generator

Management of attribute/spatial data

PostGIS/PostgreSQL

- **GeoServer**: when a client requests a map to a server, the server performs the requested function directly, and analysis tool to the client to perform the function
- **PostGIS/PostgreSQL**: PostGIS is a Geo-Processing Module that processes spatial operations and supports GIS-based R-Tree spatial index and GIS object analysis and spatial processing functions. It can be used to store GIS objects in a database.
- **QGIS/Geoserver**: It is possible to define the style of features such as transparency, color, size, and symbol. In this process, SLD is applied to specify the feature style to show antibiotic resistant strain frequency and specific genus resistance frequency.
- **GeoWeb Cache/ GeoServer**: GeoWebCache stores the created image as a cache making it possible to service, thereby shortening the time for extracting data from the data store and styling. Client can get the requested information

Results