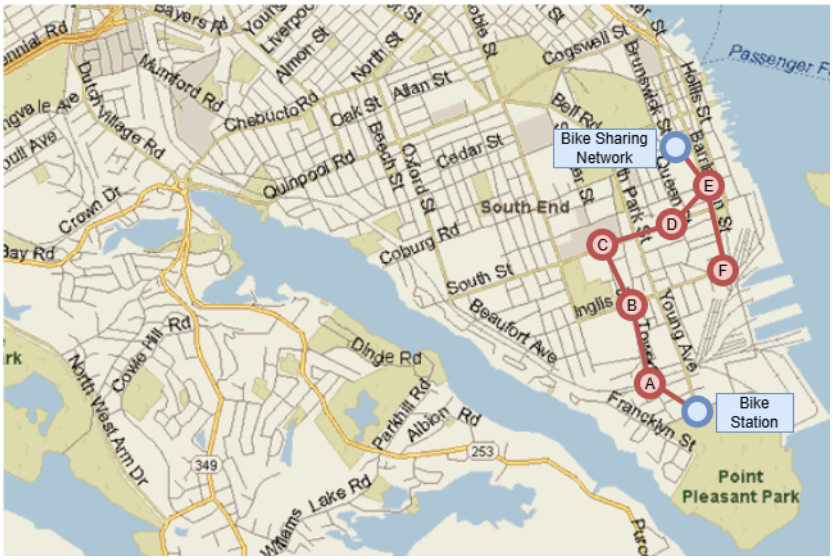
Building a Channel (Advanced)

- **Description.** Bell pairs are an important part of superdense coding. We saw in the Encoding a Message activity that simply sending the first letter of a word from Bob to Alice can require four Bell pairs. Moreover, once Alice performs the Bell measurement to decode Bob's message, the Bell pair is destroyed and cannot be reused. This means that Alice would need to share many Bell pairs with Bob if they wanted to send large messages back and forth. If Alice and Bob are really far apart, this might be a problem. For example, let's consider the following map of Halifax.



  The bike station (Bob) at the bottom of the map would like to send a message back to the bike sharing network. However, the bike station is too far from the bike sharing network to safely move a qubit from the bike sharing network to the bike station. Thankfully, there are some bike stations in-between (the red dots on the map), which are close enough to share Bell pairs. These Bell pairs are indicated by lines on the map. Using this information, think of a way for the bike sharing network to securely send a qubit to the bike sharing station at the bottom of the map.

- **Hint.** This activity might be easier if you have spent some time thinking about quantum teleportation. We recommend reading through the details of **Challenge 2.A** if you get stuck.

- **Submission.** A short paragraph.