

**The Phibbs Bus Exchange Redesign:  
*From Concrete and Asphalt to Raingardens and Bridges!***

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## **Abstract**

The Phibbs Exchange is a major bus Exchange located at the northern foot of the Second Narrows Bridge on the TransCanada Highway in the District of North Vancouver (DoNV). It serves 18 bus routes and 15,700 daily passenger trips. The Exchange provides connections between buses running to East Vancouver and Burnaby, and across the North Shore. Due to its poor passenger environment and its existing and long-term operational and capacity deficiencies, the Exchange was identified as a priority for upgrade in TransLink's *North Shore Area Transit Plan (NSATP)*, as well as DoNV's *Lower Lynn Transportation Strategy and Master Transportation Plan*.

The Exchange has a number of safety and operational deficiencies and challenges, exacerbated by the following:

- *Capacity* - The Exchange does not have enough bus bays to accommodate the current bus services that operate at the Exchange, resulting in buses double-parking in bays.
- *Transit Circulation* – The current transit circulation result in numerous conflict points and unsafe conditions for pedestrians, passengers, operators and cyclists.
- *Passenger Environment* - Phibbs Exchange has long been perceived by passengers as unsafe and unwelcoming. This is partly due to the Exchange's configuration which locates passenger areas on an island separated from the adjoining neighbourhood by bus drive aisles and a Highway 1 off-ramp. In addition, passenger amenities are inadequate; the lighting does not contribute to a safe and comfortable environment, particularly due to the extent of evening operations; passenger shelter areas are deficient; and the Exchange is primarily a hard surface resulting in significant stormwater runoff, with a detention pond and ditches that are primarily grassed and not aesthetically pleasing.

The Exchange upgrade is integral to supporting the transit-oriented community vision established for Lower Lynn and to achieving the NSATP's goal of increasing transit mode share in the sub-region. The Preliminary Design Concept that was developed reconfigures the existing Exchange within the existing footprint, allowing the full future bus program to be accommodated without the relocation of the existing Highway 1 off-ramp, and removes an unsafe bus merge onto Highway 1, thereby also improving highway mobility and reliability.

The design includes two pedestrian islands and a perimeter passenger boarding area with clearly marked crossings for access and egress, reducing the number of conflict points with transit vehicles. Major bus routes and thus passenger activity are located on the perimeter boarding platform, thereby reducing the need for pedestrians to cross the path of bus traffic. A multi-use path is provided along the southern edge which helps to separate pedestrian and cyclist through traffic from bus queuing areas. The design also includes an extensive raingarden system within the islands. These serve primarily to manage stormwater however the pedestrian scale bridges and landscaping significantly contributes to an improved user experience and aesthetically pleasing environment. In addition, passenger amenities, including bus shelters, pedestrian-scaled lighting, landscaping, a retail kiosk and provisions for potential future public washrooms, are provided.

A key factor of the design is the staging of construction in order to ensure that the Exchange remains fully operational at all times throughout its construction. Complicating this further is the fact that the current Exchange is orientated in a north-south direction with one pedestrian island in the middle, and is being converted to an east-west orientation with four pedestrian islands. A five stage construction plan

was therefore formulated to accommodate these changes and to minimize disruptions to highway and local traffic, transit and passengers.

Project partners include TransLink, BC Ministry of Transportation and Infrastructure, and DoNV. There was ongoing liaison with all three partners throughout the project, including TransLink's operating subsidiary, Coast Mountain Bus Company.

## **Paper**

### **1.0 Introduction**

Phibbs Exchange is a major bus Exchange located at the northern foot of the Second Narrows Bridge (or Ironworkers Memorial Bridge) in the District of North Vancouver on the North Shore of Vancouver. It serves 18 bus routes and 15,700 daily passenger trips. These passenger volumes are approximately equivalent to those of a mid-sized SkyTrain Station such as Scott Road Station in Surrey or Nanaimo Station in Vancouver. The Exchange provides connections between buses running to East Vancouver and Burnaby south of the Burrard Inlet, and across the North Shore to the north of the Inlet.

The Exchange was identified in TransLink's 2012 North Shore Area Transit Plan (NSATP), as well as the District of North Vancouver's 2011 Lower Lynn Transportation Strategy and draft Master Transportation Plan, as a priority for upgrade due to its poor passenger environment and its existing and long-term operational and capacity deficiencies.

The Exchange has a number of safety issues, including several conflict points that create traffic safety issues. These safety issues are exacerbated by the following deficiencies at the Exchange:

- **Capacity** - The Exchange currently does not have enough bus bays to accommodate the bus services that currently operate at the Exchange. This results in buses double-parking in bays. This double-parking forces passengers accessing the outer bus to board in the bus drive aisle which is unsafe and passengers using mobility aids cannot access these buses. Capacity constraints at the Exchange also limit future transit expansion on the North Shore, including many of the most significant routes.
- **Transit Circulation** – The current transit circulation into, out of and through the Exchange has numerous conflict points, resulting in unsafe conditions for pedestrians, transit passengers, transit operators and cyclists:
  - For buses approaching and leaving the Exchange via Oxford Street, they must cross the Highway 1 southbound (SB) off-ramp that serves uncontrolled, high speed traffic.
  - Buses also experience conflict at this location with pedestrians and cyclists that are using the same uncontrolled crossing to access the Exchange.
  - Buses using Highway 1 northbound (NB) to access the Exchange from the Second Narrows Bridge must merge from the high-speed off-ramp onto Main Street westbound (WB), and then over a very short distance access the Exchange. This raises the risk of rear-end collisions.
  - When leaving the Exchange to access Highway 1 SB, these buses must negotiate a slip lane that is on a tight horizontal curve and gradient in order to merge back onto the highway.
  - The Exchange's current configuration and overcrowding have also resulted in unsafe circulation within the Exchange itself as foot passenger volumes have increased and pedestrians cross the bus drive aisle resulting in conflicts with transit vehicles.
- **Passenger Environment** - Phibbs Exchange has long been perceived by passengers as unsafe and unwelcoming:

- This is partly due to the Exchange’s configuration which locates passenger areas on an island separated from the adjoining neighbourhood by bus drive aisles and a highway off-ramp.
- In addition to poor integration with the neighbourhood, the passenger amenities at Phibbs Exchange are inadequate.
- The lighting at Phibbs Exchange does not contribute to a safe and comfortable passenger environment as it mostly highway grade lighting that does not uniformly cover the entire Exchange. There is no pedestrian scale lighting at the bus bays which results in shadowing of the passengers areas. This is of particular concern due to the number of hours of evening operations at this Exchange.
- Passenger area shelters are deficient. Today, passenger shelters are located in the centre of the island whereas most passengers wait in curbside queues that are a significant distance from the current shelters. This makes the existing shelters of little use to passengers who are exposed to the elements. This is seen in the images in **Figure 1**. This too contributes to passengers’ general perceptions of the Exchange as unwelcoming.
- Also as seen in the images in **Figure 1**, the Exchange is primarily a hard surface resulting in significant stormwater runoff, with a detention pond and ditches that are primarily grassed and not aesthetically pleasing.

**Figure 1: Passenger Queuing Areas versus Shelter Location and Extent of Hard Surfaces**



## 2.0 Project Goals

The goals of the Phibbs Exchange Concept Design Review and Preliminary Design project were to:

- Support the transit service outlined in TransLink’s NSATP and the District’s vision for the neighbourhood, as outlined in the District of North Vancouver Official Community Plan (OCP) and the Lower Lynn Town Centre Vision.
- Support highway access and egress that meets a standard acceptable to the BC Ministry of Transportation and Infrastructure (MoTI).
- Demonstrates best practice in customer experience, transit operations, place-making, environmental sustainability, and cost effectiveness. Key to this are weather protection and lighting that makes the Exchange a comfortable place for transit users with an increased sense of safety and security.
- Design an Exchange that is an integral part of the new Town Centre and that provides an enhanced gateway into North Vancouver.

- Improve integration of the Exchange with its immediate surroundings, including adjacent land uses and the surrounding road, bicycle, and pedestrian networks.
- Maintain and build on the agreed principles and ideas that were captured as part of the “Phibbs Exchange Conceptual Design Study” completed in March 2014 and prepared by *Nelson \ Nygaard Consulting Associates*.

### **3.0 Design Elements**

To best understand the extent of the redesign of the Exchange, “before” and “after” images are shown in **Figures 2 and 3** respectively, with **Figure 3** being a rendering of the upgraded Exchange. The various elements of the design are described below.

#### **3.1 TransCanada Highway (Highway 1)**

The design that was developed reconfigures the existing Exchange within the existing footprint, allowing the full bus program to be accommodated without the relocation of the existing highway off-ramp. Although the Highway 1 off-ramp would not need to be relocated, its southern end would need to be realigned in order to accommodate two-way traffic between Oxford Street and Main Street.

The design removes the transit-only slip lane that requires buses to make an unsafe merge onto Highway 1 SB, thereby also improving overall highway mobility and reliability. In order to achieve this, it is necessary to widen the Highway 1 on-ramp on the south side of Main Street to accommodate two left turn lanes onto the ramp. It would also be necessary to widen Main Street.

#### **3.2 Phibbs Exchange**

##### **3.2.1 Overall Layout**

The design for the Exchange includes two pedestrian islands with clearly marked crossings for access and egress. A third island is accessible only to bus operators. Pedestrian crossings have been located in areas that will serve the majority of pedestrian activity, which will reduce the number of conflict points with transit vehicles. A multi-use path is provided along the southern edge of the Exchange which helps to separate pedestrian and cyclist through traffic from bus queuing areas.

##### **3.2.2 Drainage and Raingardens**

The current Exchange contains a detention pond which provides stormwater management for the surrounding neighbourhood. The general surface water flow in the existing Exchange runs from north to south, and offsite flows come into the Exchange through storm sewers and a culvert. All site flows merge into a primary detention pond located north-east of the Main Street, Orwell Street intersection, which retains the flows and conveys it across Main Street through an existing culvert, with the offsite water then flowing by ditch to the Seymour River. These drainage features are shown in the images in **Figure 4**. In general, all onsite flows are currently directed through rain gardens then to the pond to encourage infiltration.

Figure 2: Existing Phibbs Exchange Layout

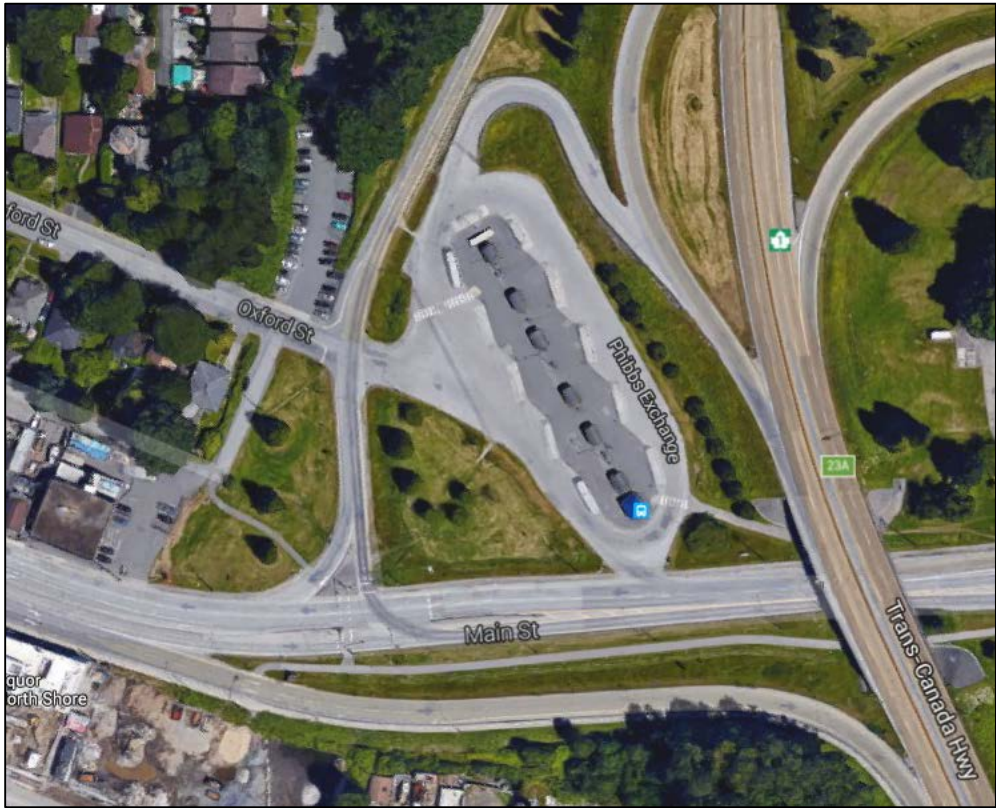


Figure 3: Rendering of the Future Phibbs Exchange



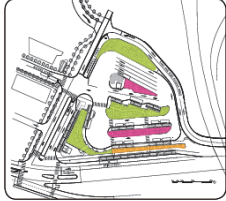






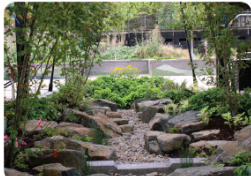


**Figure 4: Existing Site Drainage and Stormwater Management**



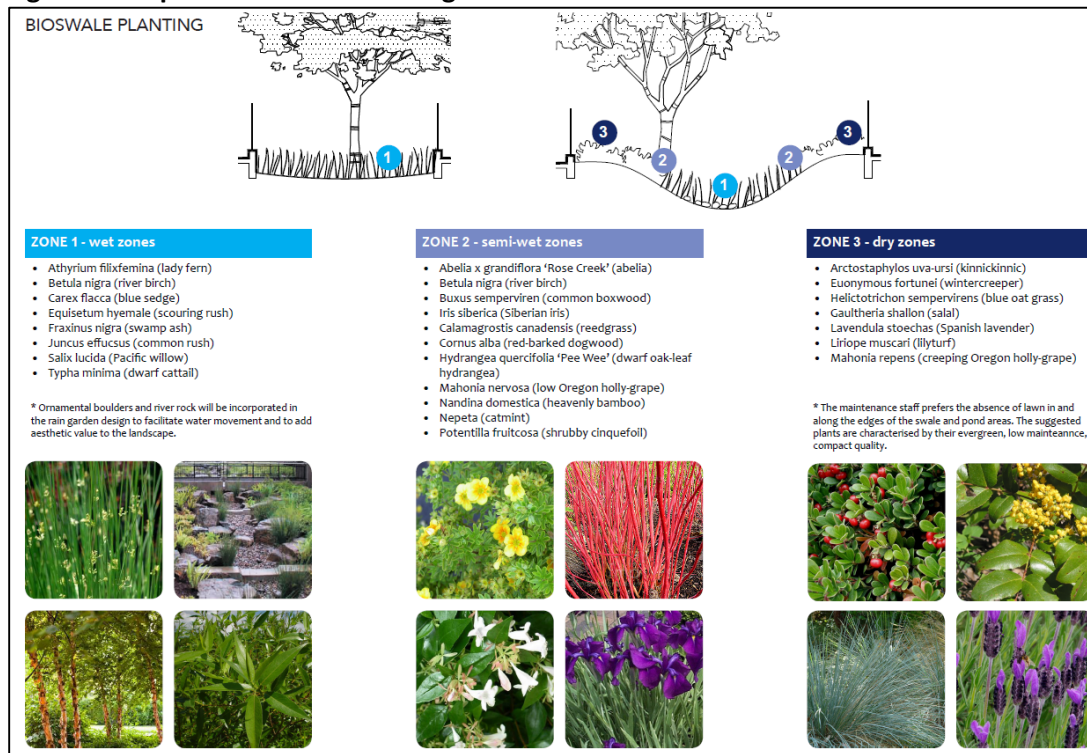
The new Exchange design replaces the primary detention pond with a new stormwater management system that includes raingardens on the passenger platforms. These serve primarily to manage, filter, and clean water stormwater, which together with pedestrian scale bridges and landscaping, significantly contributes to an improved user experience and aesthetically pleasing environment. This is the first raingarden system to be designed by TransLink for a transit passenger facility.

The rain garden system is essentially large bioswales designed to detain stormwater and limit its flow offsite. Since the entire site drains through a limited capacity culvert under Main Street into the Seymour River, the design requires that water be detained on the site for as long as possible. The raingarden system meanders the water through the site, slowing its flow and maximizing infiltration. The selected landscaping is specific to help reduce the pollutants in the water leaving the site. The proposed bioswale typology and planting are shown in **Figures 5 and 6** respectively.

**Figure 5: Proposed Bioswale Typology**

BIOSWALE TYPOLOGY	URBAN SWALE	LINEAR RAIN GARDEN	LARGE RAIN GARDEN
<ul style="list-style-type: none"> <li>Urban aesthetics</li> <li>Defined edges</li> <li>Tidy structured planting</li> <li>Shallow rain garden</li> <li>Crossings to direct pedestrian circulation</li> </ul>	<ul style="list-style-type: none"> <li>Softer edges</li> <li>Informal planting arrangement</li> <li>Combination of river rock and boulders along watercourse with aquatic and bank planting</li> <li>Crossings to direct pedestrian circulation</li> </ul>	<ul style="list-style-type: none"> <li>Softer edges</li> <li>Informal planting arrangement</li> <li>Combination of river rock and boulders along watercourse with aquatic and bank planting</li> <li>Larger capacity for water retention</li> <li>Crossings to direct pedestrian circulation</li> </ul>	
 <p>PRECEDENTS KEY</p>			
 	 	 	

**Figure 6: Proposed Bioswale Planting**



### 3.2.3 Pedestrian Bridges

Key landscape architecture features determined by PFS Studio include rain gardens (bioswales) and pedestrian walkways which cross these gardens. The rain gardens take advantage of the requirement to detain stormwater on site to maximize infiltration. These features help achieve the following project goals:

- Demonstrate best practice in customer experience, transit operations, place-making, environmental sustainability, and cost effectiveness.
- Design an Exchange that is an integral part of the new Town Centre and that provides an enhanced gateway into North Vancouver.

### 3.2.4 Passenger Queuing Areas

Data received from TransLink described the boarding activity for each bus route at the Phibbs Exchange. From that data the magnitude and timing of peak loading conditions for each route was determined by Nelson\Nygaard Consulting Associates. Peak boardings volumes represent 120% of the average daily peak boardings. An additional 20% buffer was added to allow for future ridership growth in the absence of service frequency increases. These were then converted into square meter queuing requirements based on the Transit Capacity and Quality of Service Manual for given levels of service for waiting passengers. TransLink's Bus Passenger Facility Guideline specifies the desired waiting passenger level of service as a level of service (LOS) B, however the square footage for lesser levels of service was also calculated to allow for design flexibility.



### 3.2.5 Lighting

A preliminary electrical design for the Exchange was done by PBX Engineering. The design covered the following major components:

- Lighting Design
- Traffic Signal Design
- Transit Exchange Electrical Design

For the transit Exchange area, the design is in accordance with TransLink's Bus Infrastructure Design Guidelines, and lighting is separated into four different categories: Platform Area; Crosswalk; Bus Layover Area; and Internal Road (to the possible future Park and Ride access). Continuous Roadway Lighting and Intersection Lighting were required within MoTI's site jurisdiction. While no architectural davit or landscape lighting is included in the design, future options might include decorative luminaire poles, tree well lighting, or illuminated bollards. Examples are shown in **Figure 7**.

**Figure 7: Examples of Architectural Lighting**



### 3.3 Future Park and Ride (Optional)

This design reserves space for an access road to connect to a future possible park and ride to be located to the east of the Exchange, within the northbound Highway 1 off-ramp parclo loop. Construction of this park and ride would be led by the Ministry of Transportation and Infrastructure, if approved in future.

## 4.0 Key Considerations and Challenges

### 4.1 Safety

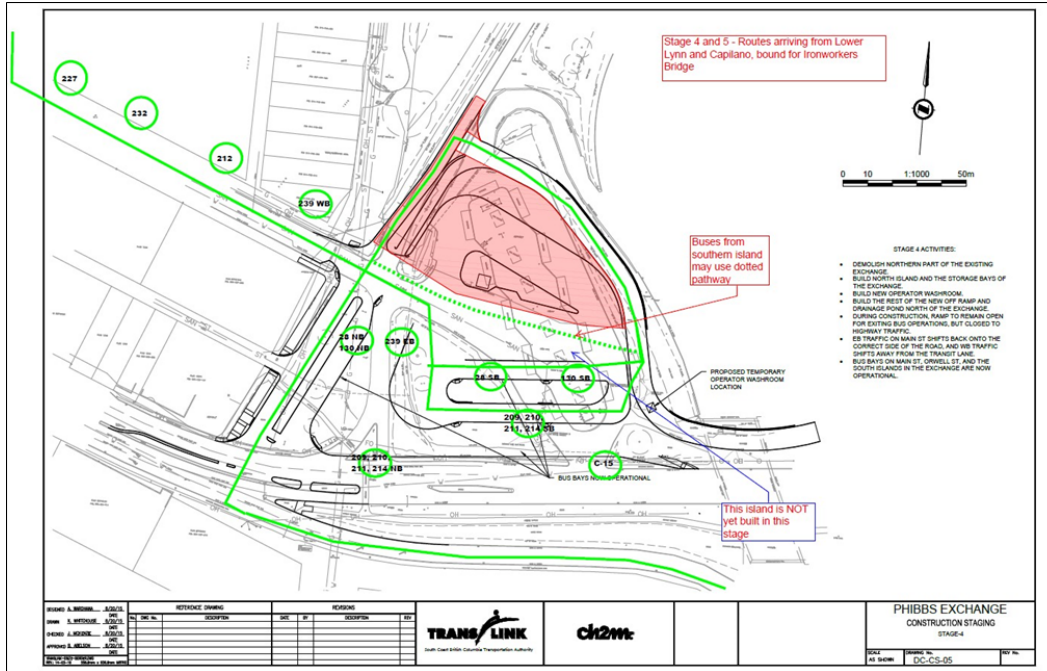
The current Exchange consists of a large central pedestrian island with circulating bus movements. Pedestrian crossing locations are not ideal and people are able to walk to the Exchange from multiple different areas. This creates a number of unwanted conflict points between pedestrian traffic and transit vehicles at unmarked crossings. The design for the Exchange includes four pedestrian islands with clearly marked crossings for access and egress. These crossings have been located in areas that will serve the majority of pedestrian activity, which will significantly reduce the number of conflict points with transit vehicles. Cyclist activity has also been reviewed as part of the design and a multi-use path is provided along the southern and western edges of the Exchange which helps to separate pedestrian and cyclist through traffic from bus queuing areas. The lighting of the Exchange has also been improved as part of the design in response to customer concerns about personal safety and security when dark.

### 4.2 Construction Staging

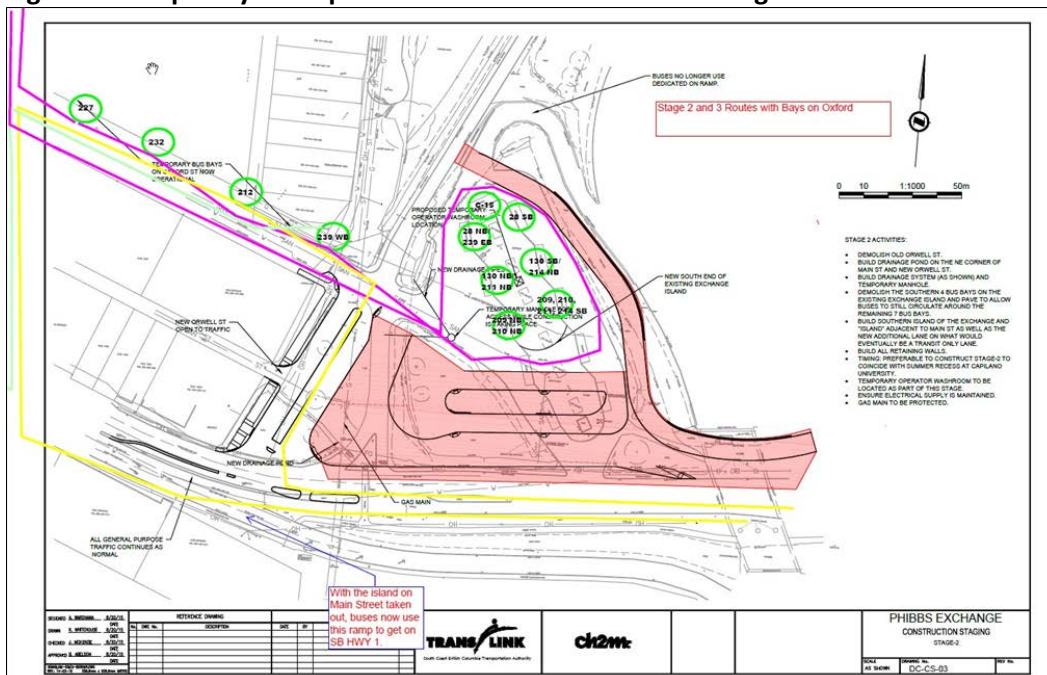
A key factor of the Preliminary Design for Phibbs Exchange is the staging of construction in order to ensure that the Exchange remains fully operational at all times throughout its construction. Complicating this further is the fact that the Exchange is currently orientated in a north-south direction

with one pedestrian island in the middle and is being converted to an east-west orientation with four pedestrian islands. A five stage construction plan was formulated to accommodate these changes and to minimize highway traffic, transit and passenger disruptions. In addition, two bus operations plans were developed in order to reduce passenger confusion, and therefore safety, at the Exchange. The first operations plan will in operations during Construction Stages 1, 2 and 3 while the second plan will be implemented during Stages 4 and 5. These plans are shown in **Figures 8 and 9.**

**Figure 8: Temporary Bus Operations Plan for Construction Stages 1, 2 and 3**



**Figure 9: Temporary Bus Operations Plan for Construction Stages 4 and 5**



Further complicating construction is that some work areas are required to be kept operational at all times during construction, and some stages are recommended to be scheduled at certain times of the year. For example:

- It is preferable to schedule one construction stage to coincide with summer recess at Capilano University.
- For another stage, instead of night time construction, closure of the Exchange for a period (3 to 4 days over a holiday weekend) is preferred to allow for Exchange access and egress roadway paving, and also when Capilano University is out of session.

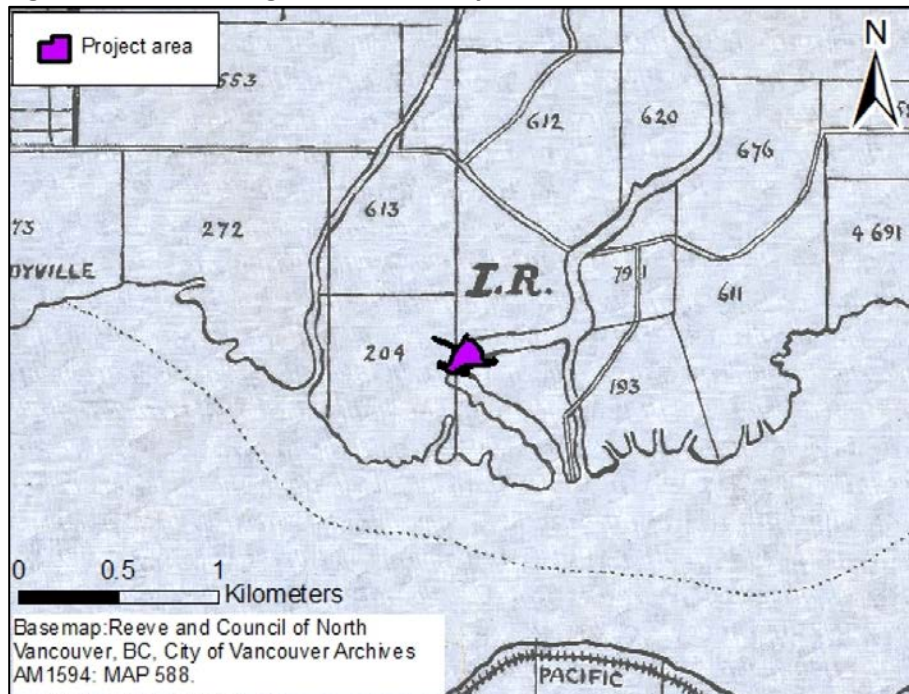
Pedestrian circulation is a safety concern throughout the construction period, requiring constant on-site supervision and traffic control to minimize the potential for bus-pedestrian conflicts.

Since the Exchange has considerable operational volume that occurs during hours of darkness in the short days of winter, and given that the demolition of part of the existing island will likely disrupt the present illumination of the Exchange, temporary lighting is a key requirements during construction.

#### 4.3 Archaeological

An Archaeological Overview Assessment (AOA) was conducted by *Millennia Research Limited*. The scope of the study was to identify and assess the potential for archaeological sites within the proposed project area in order to ensure compliance with the Heritage Conservation Act (HCA). The assessment identified that the project area overlies what once was the western banks of a small island, Cutter Island, near the mouth of the Seymour River. Multiple ethnographic and historic sources describe a sizeable village which was located on the western banks of the Seymour River, near its mouth. The location of the Exchange relative to the earlier watercourse is shown in **Figure 10**.

**Figure 10: Historic Alignment of the Seymour River**



Given its location along a riverbank and proximity to the known village, the potential for archaeological material to have once been located within the project area is high. However, the landscape has been heavily modified since the middle of the 20th century for transportation related developments, and, in particular, the project area is centred over the historical western branch of the Seymour River which was filled in for the construction of the Second Narrows Bridge. It is likely that any archaeological deposits present are deeply buried, and/or disturbed.

Since the scope of the present project requires minimal deep excavation, the potential for archaeological material to be encountered during the scope of the present project is considered to be low for most of the project area. Deeper excavation for the ditches and storm water ponds could encounter archaeological material, if present. Given that the majority of the project area is paved, and is likely capped by fill, an Archaeological Impact Assessment (AIA) was not considered practical.

#### **4.4 Partnerships / Collaboration**

Project partners for Phibbs Exchange included TransLink, BC Ministry of Transportation and Infrastructure (BC MoTI), and the District of North Vancouver (DoNV). Throughout the design related tasks there was ongoing liaison with all three partners, including TransLink's operating subsidiary, Coast Mountain Bus Company.

In general, the project process was highly collaborative, being sure to engage all affected stakeholders upfront in order to address all anticipated challenges that might arise in both the detailed design and construction stages. At the same time the design team was particularly mindful to minimize any potential impacts on the adjacent Highway 1, and sought ways to improve highway reliability and ensured the future North Shore interchanges upgrade plans were accommodated in the design.

#### **4.5 Land Use Integration**

Landscaping features, such as rain gardens (bioswales) and pedestrian walkways crossing these gardens, help achieve the goal of designing an Exchange that is an integral part of the new Lower Lynn Town Centre and that provides an enhanced gateway into North Vancouver. In addition, a number of amenities, consistent with the vision for the Lower Lynn Town Centre, have been allowed for in the design and recommended for further consideration in future design stages:

- **Kiosk** – a footprint for a proposed retail kiosk is located in the south-west corner of the Exchange, however implementation of the kiosk is subject to TransLink negotiating a lease with a tenant.
- **Public Washrooms** - TransLink does not currently provide public washrooms at transit Exchanges. However, provision will be made at Phibbs so that washrooms may be provided if TransLink's policy changes, and if the Phibbs Exchange is identified as a priority location for washrooms. Rough-ins for the washroom will be provided adjacent to the retail kiosk.
- **Public Art** - The renovation for the Phibbs Exchange will feature a public art piece jointly delivered by TransLink and DoNV. An artist or artist team will be selected through a competitive process to produce an original artwork that will function as an asset both for the local community and for the diverse group of transit customers who use this Exchange daily. The art opportunity will be fully developed by TransLink, DoNV and the successful artist. Art opportunities might include a single landmark feature for the area, a series of small pieces spread throughout the site, or functional art that can be used as seating. The artwork may work with the site conditions by providing additional lighting or otherwise enhancing the sense of safety and security of the site.

## 5.0 Conclusion

The redesign of the Phibbs Exchange meets all the identified project goals, namely:

- It supports future planned transit services and the District's vision for the neighbourhood
- It support highway access and egress that meets a standard acceptable to MoTI.
- It demonstrates best practice in customer experience, transit operations, place-making, environmental sustainability, and cost effectiveness, making the Exchange a comfortable place for transit users with an increased sense of safety and security.
- It is an integral part of the new Town Centre and provides an enhanced gateway into North Vancouver.
- Its integration with its immediate surroundings is improved, including adjacent land uses and the surrounding road, bicycle, and pedestrian networks.
- It maintains and builds on the agreed principles and ideas captured as part of the initial Phibbs Exchange Conceptual Design Study.

Practical evidence of this includes:

- Connectivity to the Exchange is greatly improved for all road users, while at the same time improving adjacent highway operations by reducing the number of bus conflict points.
- Transit vehicles delays will be minimal both within the Exchange and on the surrounding road network.
- Access is greatly improved for pedestrians and cyclists and a wayfinding strategy will help direct passengers in and around the Exchange.
- Transit routes within the Exchange have been designed based on the most probable connections for passengers, thus reducing travel time and distance for pedestrians transferring between routes.
- Transit operations will be maintained during construction, with minimized disruption to the current users, achieved in the development of a construction staging plan.

An artist's rendering of the future Exchange is shown in **Figure 11**.

**Figure 11: Artist's rendering of the future Phibbs Exchange**

