Appendix 4

Preliminary Route Evaluation Report

Burnaby Mountain Gondola

Preliminary Route Evaluation Report

November 2020

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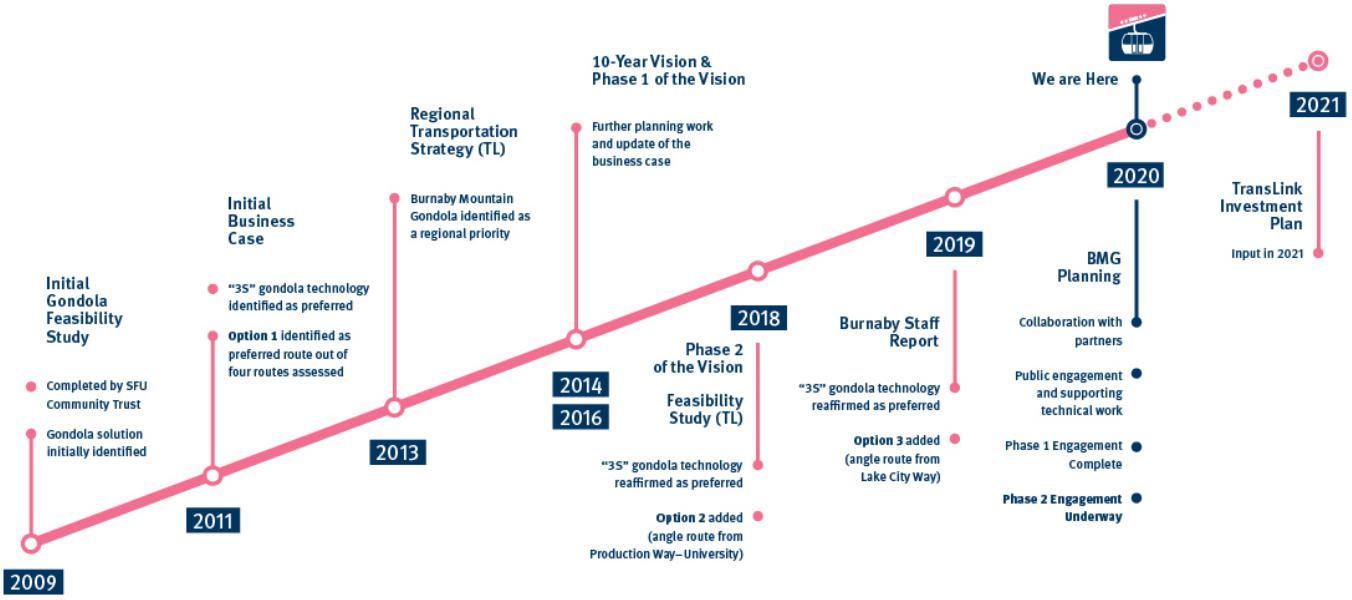
Introduction

The Burnaby Mountain Gondola Preliminary Route Evaluation is intended to:

- Provide an overview of the project and context;
- Outline the methodology to identify and evaluate scope choice options; and
- Identify trade-offs between route options.

Project Background and Context

A gondola was first identified in 2009 as a possible rapid transit connection between the SkyTrain and Burnaby Mountain.



The 2009 feasibility study concluded that replacing diesel bus service to Burnaby Mountain with an aerial passenger ropeway (or aerial gondola) was a cost-effective means to improve travel time, service frequency, and reliability, and to reduce greenhouse gas (GHG) emissions. In June 2010, TransLink committed to further investigating the merits of aerial ropeway technologies and to developing a business case for improved transit service to Burnaby Mountain.

In 2011, TransLink published the *Burnaby Mountain Gondola Transit (BMGT) Business Case Report* and its companion document, the *BMGT Technology and Alignment Alternatives Assessment* (TransLink, 2011a; 2011b). Key findings of the 2011 studies were as follows:

- There was a clear need to investigate an alternative transit solution at Burnaby Mountain to deliver more reliable service to the growing Simon Fraser University (SFU) campus and UniverCity community, while reducing environmental impacts and managing future capital and operating costs.
- Aerial-ropeway technologies, particularly three-rope gondola systems (3S), showed the greatest potential to meet the BMGT's multiple objectives (transportation, financial, environmental, urban development, social and community, and deliverability) and to minimize negative impacts.
- A direct route from Production Way–University SkyTrain Station to the SFU Town Square and transit loop emerged as the preferred option when considering the combined factors of system efficiency, residential impact, environmental impact, and affordability.

The 2011 BMGT business case was developed at a time when funding sources, including transit fares, property taxes, vehicle fuel taxes, and senior government grants, were constrained. This prevented any significant expansion of transit service to serve the growing population and their travel demands. At the same time, other regional rapid transit priorities emerged, including projects along the Broadway Corridor and south of the Fraser River. Therefore, despite the advantages, additional planning and design work for the BMGT project was put on hold.

In 2018, TransLink published the *Burnaby Mountain Gondola – Transit Feasibility Study*. Key findings of the study were as follows:

- Current ridership and future ridership growth necessitate a faster, more frequent, and more reliable connection between the SkyTrain network and Burnaby Mountain;
- The 3S gondola technology continues to be the preferred gondola technology to connect customers from the SkyTrain to Burnaby Mountain;
- The operating cost of the gondola would be lower than existing bus service;
- The gondola would provide significant consumer benefits in travel time savings, vehicle operating costs, collision reductions, parking costs, and vehicle emissions; and
- The benefit cost ratio is 1.8; the quantified benefits of the Burnaby Mountain Gondola would outweigh the costs.

In response to the *Burnaby Mountain Gondola – Transit Feasibility Study,* Burnaby Council received and endorsed a staff report that supported the further study of a Burnaby Mountain Gondola if the following Core Principles were followed by TransLink:

Residents: Minimize impacts to residents living near the gondola

Environment: Minimize impacts to areas with high ecological values, such as fish-bearing streams and riparian areas

Compensation: Provide fair compensation to affected property owners for intrusion of the gondola, both for its physical footprint on their lands and its aerial passage over them

Options: All three options should be considered on an equal basis in the next stage of analysis and public consultation

Consultation: Engage the community in meaningful consultation, especially with respect to alignment options, and report back to Council on the results

The staff report also recommended a third route for consideration, which would start at Lake City Way SkyTrain station, travel north over the Burnaby Mountain Golf Course, change directions at an angle station and end at SFU.

In 2019, the Mayors' Council directed TransLink to proceed with planning and conceptual level design work for the Burnaby Mountain Gondola (the Project). This decision was guided by the findings of the 2018 Feasibility Study, which concluded that a gondola presented a cost-effective form of transit to address current and future demand while supporting a shift to a more sustainable mode of transit.

TransLink embarked on the 2020 Burnaby Mountain Gondola planning program to develop conceptual designs for the proposed routes, engage the public, stakeholders and First Nations, and review opportunities for project funding.

Planning Rationale

TransLink is planning for a gondola on Burnaby Mountain — a proposed transit option that would provide fast, frequent, and reliable service between the SkyTrain and Burnaby Mountain. The proposed gondola would also have a lower operating cost than bus, allowing TransLink to reinvest the savings elsewhere in our network.

Currently, there are over 25,000 daily transit trips to and from Burnaby Mountain by SFU students, staff, faculty, and residents of UniverCity. During peak hours, existing bus service is at capacity, with TransLink customers frequently passed up by full buses. Delays are worse in inclement weather when buses are known to stall in ice and snow. Combined, these challenges increase travel times up and down the mountain from 15 minutes to more than 30 minutes.

Overview of the Preliminary Route Development

In 2020, conceptual designs for the three potential gondola routes were developed. This design work was guided by the City of Burnaby's Core Principles, outcomes of an environmental scan, and site-specific constraints. The purpose of this design work is to better understand how the potential gondola routes could operate: travel times, local conditions, and considerations and opportunities. Finally, the routes were developed to a consistent level of design to allow for comparable evaluation between the routes.

Proposed Gondola Alignments

Engagement

The project team has engaged with its partners throughout the Project including through regular meetings with senior leadership from:

- City of Burnaby
- Simon Fraser University
- Ministry of Transportation and Infrastructure
- Ministry of Municipal Affairs and Housing

Engagement with First Nations that have an identified interest in Burnaby Mountain is ongoing. These Nations include:

- Kwikwetlem First Nation
- Musqueam Indian Band
- Squamish Nation
- Tsleil-Waututh Nation

Public engagement occurred throughout 2020 with pre-engagement activities undertaken between January and August 2020 taking place between January and August 2020.

From September 1 to September 30, 2020, TransLink provided information about three route options for the proposed Burnaby Mountain Gondola and sought feedback from the public and stakeholders. During this time, there was a total of 13,173 public and stakeholder interactions, including completed surveys, submissions via email and phone calls, and five community engagement sessions. For more details, view the Phase One Stakeholder and Public Engagement Summary Report in **Appendix 1**.

During that first round of engagement, TransLink shared an overview of the technical work completed by September 2020. View the summary (in Appendix 1) for information about how we chose the three proposed gondola routes and the elements we considered as part of our conceptual design work.

The second round of engagement is scheduled to take place between November 23 and December 14, 2020.

Preliminary Route Evaluation

To evaluate the three potential routes key considerations were identified and grouped as follows:

- **Benefits** - the positive changes that the proposed gondola is expected to deliver;
- **Financial considerations** - the capital, operating, and maintenance costs of the proposed gondola system; and
- **Implementation considerations** - the trade-offs in the natural and human environment that will result from implementing a gondola.

The intention of this framing is to enable comparison between the routes in terms of potential benefits, cost, and trade-offs. The three key considerations (benefits, financial considerations, and implementation considerations) were then broken down further, as illustrated in the following graphic.

Route Evaluation Frame and Categories

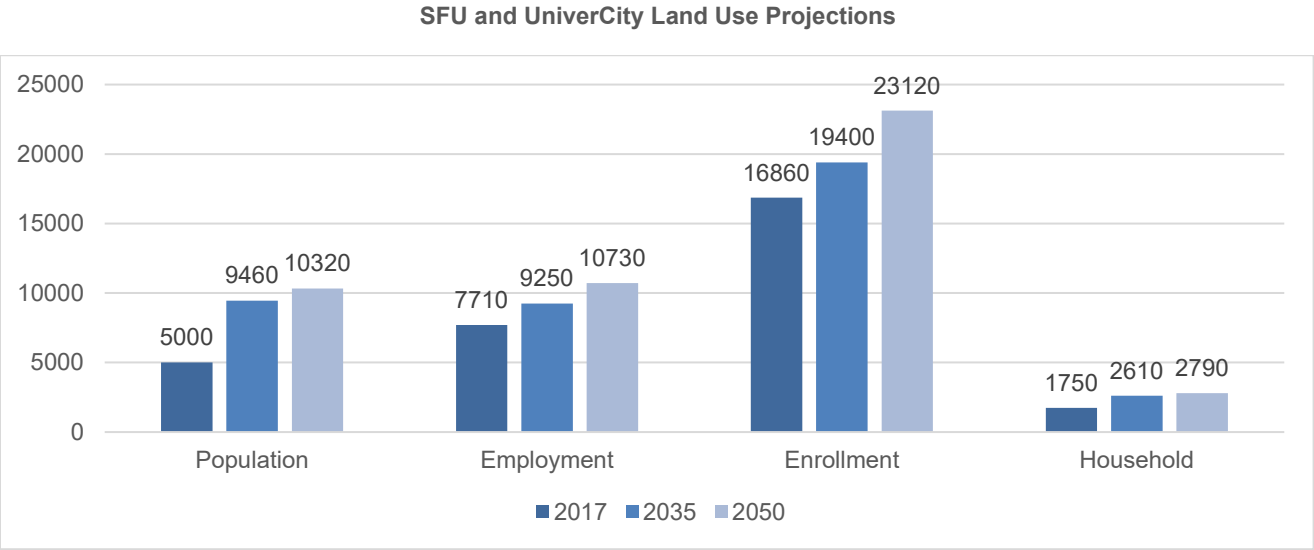
Benefits

It is expected that the Project could provide benefits to transportation users by improving trips to and from Burnaby Mountain, reducing congestion, supporting a travel mode switch from vehicle to transit, and reducing GHG emissions.

Transportation User Experience

The Transportation User Experience applies to current transit users and drivers. To understand transportation user benefits, TransLink conducted a ridership forecasting analysis. Updates to the land-use projections and the future transportation network have been incorporated into the Regional Transportation Model (RTM). Two "horizon years" were modelled to estimate the project benefits: 2035 and 2050. For each horizon year, four scenarios were run: business as usual, Route 1, Route 2, and Route 3.

Future land-use assumptions are summarized in the SFU and UniverCity Land Use Projections chart. Overall, SFU's population, employment, and enrollment will continue with sustained, steady growth.



Estimated transportation user experience benefits include:

- Transit travel time savings (minutes per day): Average travel time to/from SFU anywhere on our network;
- Reduction in congestion (hours per day): Reduction in hours of auto congestion associated switching from driving to transit; and
- Upper terminal walking access to buildings: Five-minute walking radius to buildings on campus, including academic and other buildings.

Findings: Route 1 provides the best transit travel time savings, greatest reduction in congestion, and quickest access to many academic and other buildings at SFU.

Transportation User Experience Summary Table

	Route 1	Route 2	Route 3
One-way transit user time savings: Average travel time from all network origins to/from SFU, includes walking time to central campus	13% faster than bus (48 mins average)	9% faster than bus (50 mins average)	Similar to bus (55 mins average)
Daily reduction in congestion	- 700 hrs	- 660 hrs	- 490 hrs
SFU academic and other buildings within a 5-minute walk of the upper terminal	Academic: 80% Other: 36%	Academic: 80% Other: 36%	Academic: 52% Other: 45%

Sustainable Transportation

Sustainable Transportation relates to the long-range changes that the gondola may prompt including boardings and anticipated reductions in GHG emissions.

Daily Boardings

Using the RTM, we measured boardings to understand how attractive the service is to future riders. The model considers the gondola trip time, frequency of service, transit connections and transfers, and the location of the termini upper terminal (walking distance to main facilities from upper terminal). Two model years - of 2035 and 2050 – demonstrated how boardings are expected to change over time.

Findings: Route 1 would have the highest number of boardings as it has the shortest gondola trip time (6 min), is served by both the Expo and Millennium Lines, and the upper terminal is centrally located at SFU.

Weekday Boardings Summary Table

Daily combined boardings (to / from Burnaby Mountain)	Route 1	Route 2	Route 3
2035	30,400	28,200	25,400
2050	36,700	34,700	31,400

GHG Emissions Reductions

Transportation accounts for over 35% of all greenhouse gas (GHG) emissions in Metro Vancouver. As one of the region's largest consumers of diesel fuel and operator of a fleet of heavy-duty vehicles, TransLink plays an important role in working to reduce emissions in its operations.

TransLink has identified the following environmental targets:

- Reducing greenhouse gas emissions by 80% by 2050; and
- Using only renewable energy in all operations by 2050.

Significant fleet electrification is necessary to achieve TransLink's GHG emission targets. Use of renewable fuels in existing buses provides a cost-effective way to achieve early reductions while the fleet transitions.

The gondola project could replace most service operating on Routes 143 and 145. These routes currently operate with diesel-hybrid and compressed natural gas buses and emit nearly 3,700 tonnes of CO2e annually. Without the gondola project, these services are likely to be electrified in the future. TransLink's bus electrification strategy is currently only partially funded. The gondola project could accelerate achieving emissions targets and allow the avoided cost of electric charging infrastructure and battery bus purchase for these services to be used to electrify services elsewhere on the network.

GHG emissions changes are also estimated for trips that move from auto to transit the gondola provides a more attractive service.

Findings: Route 1 has the greatest GHG emissions reduction potential.

GHG Reductions Summary Table

	Route 1	Route 2	Route 3
Reduction in GHG emissions from diverted auto trips (annual)	- 1,400 tonnes	- 1,300 tonnes	- 800 tonnes

Financial Considerations – Fiscal Stewardship

Financial considerations include capital, operating and maintenance costs.

Capital Cost

The Project's capital cost include design, project management, gondola infrastructure and property costs. Gondola infrastructure is composed of the system components: terminals, towers, and the ropeway system.

Findings: Estimated capital cost for Route 1 is the ($210 million) as it has fewer towers and does not have an angle station. Routes 2 and 3 are estimated to cost 13% and 10% more than Route 1.

Operating and Maintenance Cost

Operating and maintenance cost includes the potential for operating cost savings and the cost of maintaining the gondola infrastructure.

To estimate potential operating cost savings from the project, it is assumed that the Route 145, which operates between Production Way–University and SFU, and Route 143, which operates between Burquitlam and SFU, would be cancelled. No decision has been made to implement these changes, and such changes would need to align with project implementation. Any service changes would need to consider local access to bus service as well as capacity and demand, among other factors.

Gondola maintenance costs include routine maintenance and the replacement of larger system components that occur within the 30-year expected life of the project.

Findings: Route 1 has the lowest operating and maintenance cost ($5.6 million), approximately 30% less than the existing bus services.

Fiscal Stewardship Summary Table

	Bus (Business as Usual)	Route 1	Route 2	Route 3
Capital cost	$77.5 M	$210 M	13% more than Route 1	10% more than Route 1
Annual operating and maintenance cost	$7.8 M	$5.6 M (30% less than bus)	$7.2 M (8% less than bus)	$7.2 M (8% less than bus)

Implementation Considerations

There may be some trade-offs to implementing a gondola system. The three routes all have varying levels of trade-offs as they relate neighbourhood, environment and safety considerations.

Neighbourhood Considerations

Stakeholder and public feedback, particularly that from local residents, identified a number of key considerations, including changes to noise levels, privacy, visual presence, and property. This helped to inform the evaluation of the project's route options. These analyses are included in **Appendix 2**.

Noise

Gondola systems produce noise at terminals, towers and angle stations. All three proposed routes locate towers and angle stations near residential areas. Existing background noise levels were measured, and sound modelling was conducted to assess potential changes from the gondola. Analysis focused on the towers and angle stations located near the residential communities.

Findings: For all of the proposed routes, there was no perceptible change in background noise levels that can be attributed to the gondola. The gondola would contribute approximately one decibel increase in background noise. The human ear begins to perceive a change in noise at three decibels.

To read the Noise Memo, please refer to **Appendix 2**.

Privacy

The gondola would travel over or near residential and other buildings. The proposed routes have been designed with tall towers (ranging in height between 50m – 110 m) which elevate the passenger cabins well above existing buildings and forest canopy to minimize impact to privacy in surrounding industrial areas, residential neighbourhoods and the SFU campus. Passengers travelling on the gondola may be able to see into these properties, however, there are a few technical aspects that may limit privacy impacts. It is functionally impossible to see directly down from the gondola due to the placement of the windows and the path of travel. In addition, TransLink could explore the use of tinted windows to limit the ability of gondola passengers to see out of the cabins.

TransLink has undertaken a privacy analysis to better understand the separation between gondola users and residences and industrial/office buildings. The gondola would start at ground level and then climb to its traveling height. As a result, it is more likely to pass over buildings that are closer to terminals, than mid-route. To measure privacy, a 100 ft (30.5 m) line of sight separation from residential

and industrial buildings to the gondola (privacy impact zone) was applied. This distance is used in the City of Burnaby to plan the separation of new high-rise buildings.

The privacy analysis and conceptual views may be found in **Appendix 2**.

Findings: Route 1 has the fewest privacy impacts, followed by Route 3.

Route 1 impacts six industrial/office properties. The total linear distance is 385 m. It passes over the Forest Grove community, but no properties are within the 30.5 m privacy impact zone.

Route 2 has the greatest privacy impacts, impacting 12 existing residential units near the top terminal as well as a future development mixed use parcel. The total linear distance is 715 m.

Route 3 has the second fewest privacy impacts, only affecting one industrial/office property, but the total linear area it affects is greater than Route 1, 450 m. There are no privacy impacts at the middle and upper stations.

Privacy Impacts Summary Table

Within 100 ft (30.5 m) of gondola by line of sight and measured by linear distance	Route 1	Route 2	Route 3
Residential properties	None	UniverCity: 12 residential units in 1 property Unknown number of units in future mixed-use residential property	None
Industrial/office properties	6	3	1
Total linear distance in privacy zone	385 m	715 m	450 m

Visual Presence

When the gondola system is operating, gondola cabins will be visible from the ground. To better understand the visual presence of the gondola, an assessment of gondola visibility from private properties was undertaken using a 100 m buffer (from the gondola right-of-way) and by counting the number of residential units and properties, and industrial/office properties. This assessment does not consider variability of the local topography and foliage (i.e. trees), which may further reduce the visibility of the gondola from private properties.

The visual presence analysis is found in **Appendix 2**.

Findings: Route 3 has the lowest visual presence impact.

Route 1 has a moderate total area and number of units impacted, less than Route 2, but more than Route 3. Route 1 has the least impact on future residential within the SFU campus as it is planned within a greenspace corridor and does not cross any future development zones.

Route 2 has the greatest Visual Presence impact to residential properties with the largest area impacted and the greatest number of residential units that fall within the Visual Presence Zone. Route 2 will have a visual presence within the south part of UniverCity as well as the future mixed-use development on the existing terraced parking lots.

Route 3 has the least visual presence impact, with only a very small area of residential property falling within the visual presence zone relative to Route 1 and Route 2 and a small number of units impacted. Route 3 will have a visual presence within SFU's future medium to low density residential neighbourhood planned west of Naheeho Park. (This development is part of SFU's long term master plan and may not be developed with the next decade.)

Property Considerations

The right-of-way required for the gondola is generally 20 metres wide. Most of the right-of-way required is aerial where the system passes over properties generally allowing buildings and other activities on the ground to remain. A smaller number of properties required for infrastructure like towers or stations may require relocating buildings or other uses on the ground. We estimate property requirements for residential, office and industrial, and other property types, including the Burnaby Mountain Conservation Area, parks, Burnaby Mountain Gold Course, and SFU lands. Property owners of both aerial and surface property required for the project are entitled to compensation should the project be implemented.

Findings: Route 1 had the fewest overall property impacts, but it does impact two residential properties. We estimate approximately 18 residential units are immediately under the 20-metre wide right-of-way.

Property Impacts Summary Table

Properties within the 20 m gondola ROW	Route 1	Route 2	Route 3
Residential	Properties: 2 Total area: 3,778 m² 100% aerial	Properties: none	Properties: none
Industrial or office	Properties: 9 Total area: 9,488 m² Infrastructure: 1,423 m² Aerial: 8,066 m²	Properties: 4 Total area: 10,225 m² Infrastructure: 1,199 m² Aerial: 9,027 m²	Properties: 7 parcels Total area: 12,758 m² Infrastructure: 1,140 m² Aerial: 11,618 m²
Other	Total area: 15,446 m² Infrastructure: 1,940 m² Aerial: 13,506 m²	Total area: 16,104 m² Infrastructure: 4,211m² Aerial: 11,893 m²	Total area: 36,567 m² Infrastructure: 4,750 m² Aerial: 31,817 m²

Safety of the system

TransLink is working to assess potential risks for communities along the routes to ensure a safe and secure system. Considerations include potential vandalism, ice bombs, operation in high winds, seismic resilience (earthquakes), and objects thrown out of the cabins.

- Vandalism: The system would come with strong security measures in place to monitor the integrity of the gondola, similar to what is in place for SkyTrain, and the towers would be designed to prevent unauthorized access. Read the technical memo in **Appendix 2**.
- Ice bombs: The gondola cables would not ice-up, given the cabins move continuously. When the system starts up in the morning, any ice that may have gathered overnight is quickly dislodged.
- Operation in high winds: Gondolas can safely operate in winds of up to 100 km/hr. In high winds, the operating speed slows.
- Earthquake resilient design: The seismic resilience of infrastructure is related to its design and construction and the soil stability (geotechnical conditions). The gondola system would be designed and built to be seismically resilient and a detailed geotechnical evaluation would occur at a future design phase (if the gondola is approved and funded).

- Objects thrown out of cabins: Cabin windows would not open, so passengers could not throw things out the window.

Environmental Considerations

The construction and operation of the gondola could impact various aspects of the environment. To better understand these impacts, an assessment of land, water, and critical habitat was undertaken.

The environmental analyses may be found in **Appendix 3**.

Burnaby Mountain Conservation Area and Other Parkland and Gondola Aerial and Infrastructure Overlap

The Burnaby Mountain Park and Conservation system consists of the Burnaby Mountain Conservation Area (BMCA), Naheeno Park, Simon Fraser University Lands and the Forest Grove Conservation area. BMCA was established through a covenant providing provincial lands to the City of Burnaby subject to continued park and conservation use. This measure assesses the aerial and infrastructure overlap with the BMCA and other parkland.

Findings: Route 1 has the least impact on the BMCA and parkland.

Route 1 affects a total of 19,779 m^2 of land within parks and conservation areas. Within the BMCA, the route affects 12,893 m^2 of land. Outside of the BMCA the route affects 6,126 m^2 in the Burnaby 200 Conservation Area, and 760 m^2 of Forest Grove Park.

Route 2 affects 36,768 m^2 of land within the BMCA, resulting greater effects to parks and conservation land than Option 1 and less than Option 2.

Route 3 crosses land in the Burnaby Mountain Park and Conservation system, traverses the Burnaby Mountain Golf Course and Driving Range and a parcel of land to the north of the golf course. Route 3 affects a total of 57,455 m^2 of land within parks and conservation areas. Within the BMCA, the route affects 27,269 $m^{2.}$ Outside of the BMCA, the route affects 15,984 m^2 of the Burnaby Mountain Golf Course and Driving Range, 6,488 m^2 ha of land designated as Open and Undeveloped in the Burnaby OCP (2014) and 7,714 m^2 in Naheeno Park. Although this routes affects approximately the same area of land in the Park and Conservation system as Route 2 (BCMA and Naheeno park), when combined with the golf course the land area affected is the greatest and this route is the least preferred option with regard to effects to parks and conservation.

Burnaby Mountain Conservation Area and Parkland and Gondola Aerial and Infrastructure Overlap Summary Table

	Route 1	Route 2	Route 3
Burnaby Mountain Conservation Area and parkland aerial and infrastructure overlap	19,779 m²	36,768 m²	57,455 m²

Land Disturbance: Archaeological and Cultural Resource Impacts

Land disturbance in natural areas would be required to construct the gondola towers and access roads. As this is a natural, undeveloped area there is potential for impacts to archaeological sites or other sites of Indigenous cultural importance:

- Archaeological sites consist of physical remains of past human activity. These non-renewable sites are very susceptible to land disturbance and are finite in number. Archaeological sites are managed for their historical, cultural, scientific and education value to the general public, local communities and First Nations.
- Site of indigenous cultural importance include current and traditional uses of the land. Changes to the landscape may affect Indigenous Peoples' abilities to engage fully with their cultural heritage and to transmit this heritage to future generations.

TransLink is engaging with four First Nations on the Burnaby Mountain Gondola: Kwikwetlem First Nation, Musqueam, Squamish Nation and Tsleil-Waututh Nation. The Nations are helping TransLink to understand the archaeological and cultural sites of importance on the three gondola routes, especially near proposed tower sites. The gathering and review of this information is ongoing and not yet complete. Consequently, this Preliminary Evaluation uses land disturbance as a measure of the possibility of accidental archaeological discovery and potential impact to Indigenous cultural use areas.

Findings: Route 1 would require the least amount of land disturbance.

Route 1 would not require new access roads as towers are located within developed areas. There is one tower that straddles Gaglardi Way right-of-way and the BMCA.

Route 2 would require two access roads to support the construction and maintenance of the angle station and of one of the towers. There are two towers and an angle station located in the BMCA.

Route 3 would require one tower and one angle station in the BMCA. The tower and the upper terminal would be placed in Naheeno Park.

Land Disturbance Summary Table

	Route 1	Route 2	Route 3
Land disturbance area within BMCA and parks	Access road: 0 m Structures: 725 m²	Access road: 7,515 m² Structures: 2,474 m²	Access road: 990 m² Structures: 2,733 m²

Tree Loss

The removal of trees will be required to build and maintain gondola infrastructure, access roads, and maintain permanent tree clearing for gondola operation. Permanent tree removal is required for gondola towers and angle stations. In addition, angle stations also require the area immediately before and after the angle station to be kept free from trees to allow the gondola to safely descend and ascend from the station. Similarly, the upper terminal of Route 3 would also require permanent tree removal under the gondola. An assessment of the approximate numbers of trees required for clearing for each route may be found below.

Findings: Route 1 has the least impact to trees.

Route 1 may impact approximately 220 trees within the expected areas of clearing and development. Route 1 would require the smallest total area of tree clearing, at 0.77 ha. This is because the route is the shortest and most direct, requiring the fewest towers and turning stations. This route locates towers adjacent to existing roads, avoiding new forest fragmentation.

Route 2 has approximately 1,100 trees within the expected areas of clearing and development. This route would require the largest area of tree clearing, at 2.83 ha. However, because this route locates its towers and turning stations in forests expected to have lower density of mature trees, it is expected to result in the second largest removal of trees overall. More of the mature trees in this route are expected to be large, native conifers. These trees have longer expected lifespans than most native deciduous species. This route would require building road access for tower construction on the southeast slope of Burnaby Mountain and would increase forest fragmentation.

Route 3 has approximately 1,330 trees within the expected areas of clearing and development. This route would require the second largest area of tree clearing, at 2.53 ha. However, because this route locates its towers and turning stations in forests expected to have higher density of mature trees, it is expected to result in the largest removal of trees overall. More of the mature trees in this route are expected to be deciduous trees, which often have shorter lifespans than native conifers. This route would locate towers and turning stations adjacent to existing roads, avoiding new forest fragmentation.

Tree Loss Summary Table

	Route 1	Route 2	Route 3
Approximate tree loss	220	1,100	1,330

Watercourses and Riparian Areas

Burnaby Mountain has a dense network of watercourses and riparian areas.

- Watercourses are commonly referred to as streams, or a source of water supply, whether usually containing water or not, a pond, lake, river, creek, brook, ditch, or wetland that is integral to a stream and provides fish habitat.
- Riparian areas include the area adjacent to a stream that may be subject to temporary, frequent or seasonal inundation, and supports plant species that are typical of an area of inundated or saturated soil conditions, and that are distinct from plant species on freely drained adjacent upland sites because of the presence of water.

There are three principle stream systems that originate from the top of Burnaby Mountain: Eagle Creek, Silver Creek, and Stoney Creek. Within these systems, there are provincially classified Class A and Class B watercourses and riparian areas. Class A watercourses are fish-bearing and Class B are non-fish-bearing but provide food and nutrients to downstream watercourses.

For all three routes, gondola infrastructure (towers and angle stations) are proposed to fall within the BMCA. The intrusion on BMCA watercourse and riparian setbacks varies by route. The square meters impacted was measured, assuming a 30 m setback from the watercourse.

Findings: Route 1 has the least impact on fish resources as it intersects with only a few non-fish-bearing watercourses.

Route 1 is located in the Stoney Creek drainage, which is a tributary to the Brunette River. Stoney Creek is known to support populations of Pacific salmon, steelhead, trout. As it receives most of the discharge from Burnaby Mountain, Stoney Creek is considered high value for salmonid species. The proposed route crosses three smaller first and second order tributaries to Stoney Creek in the Forest Grove area. These tributaries are not likely fish-bearing (i.e., Class A watercourse) due to seasonal flows and sections with high stream gradients (>20%), which likely prevent fish access, however, they do contribute important flows and allochthonous inputs (food and nutrients) to fish-bearing waters downstream in Stoney Creek and the Brunette River (i.e., Class B watercourse). The route parallels several smaller, steeper tributaries to Stone Creek further upslope. Proposed clearing within the

expected areas of clearing and development for the proposed towers of Route 1 is less than 10 m^2 within riparian areas of Class B watercourses. No clearing anticipated for Class A watercourses.

Route 2 is located in the Stoney Creek drainage, which is a tributary to the Brunette River. Stoney Creek is known to support populations of Pacific salmon, steelhead, trout. As it receives most of the discharge from Burnaby Mountain, Stoney Creek is considered high value for salmonid species. The proposed route crosses two small tributaries to Stoney Creek that are known to be fish-bearing. It also parallels 1,400 m of small fish bearing tributaries to Stoney Creek, and there is approximately 7,464 m^2 and 5,681 m^2 of riparian clearing anticipated for Class A and B watercourses, respectively.

Route 2 has a higher risk to fisheries values than Route 1 as a result of its interaction with fish-bearing tributaries of Stoney Creek and proposed clearing within streamside protection and enhancement areas, per City of Burnaby bylaws.

Route 3 is located in the Eagle Creek drainage, which is a tributary to the Brunette River. Eagle Creek is known to support populations of Pacific salmon, steelhead, trout in its mid and lower reaches. Higher up on Burnaby Mountain, stream gradients are too high to directly support fish, but tributaries in these areas do provide flows and allochthonous inputs (food and nutrients) to fish-bearing waters downstream in Eagle Creek and the Brunette River. The proposed route crosses ten small tributaries to Eagle Creek, two of which are known to be fish-bearing. It also parallels 1,200 m of small fish-bearing and non-fish-bearing Eagle Creek tributaries and there is approximately 6,489 m^2 of proposed clearing within riparian areas of Class B watercourses. No clearing anticipated for Class A watercourses.

Route 3 has a higher risk to fisheries values than Route 1 as a result of its interaction with fish-bearing tributaries of Stoney Creek, and proposed clearing within streamside protection and enhancement areas, per City of Burnaby bylaws.

Watercourse and Riparian Impact Summary Table

	Route 1	Route 2	Route 3
Clearing or infrastructure in watercourse and riparian area setbacks (Class A or B watercourses / riparian areas m²)	Class A: 0 m² Class B: 8 m²	Class A: 7,464 m² Class B: 5,681 m²	Class A: 0 m² Class B: 6,490 m²

Critical Habitat

The desktop environmental review identified that there may be potential intrusion by gondola infrastructure into critical habitat for the Western Painted Turtle. The Western Painted Turtle is classified as “Endangered” by the federal *Species At Risk Act* and “Red” by the provincial Wildlife Act.

The Western Painted Turtle critical habitat is based on watercourse connectivity to known observation. There is a population in and below Burnaby Lake, mostly focused around the weir at the eastern end of the lake, the start of the Brunette River. However, the areas that have been identified as critical habitat for Western Painted Turtle due to their watercourse connectivity to known occurrence at Burnaby Lake does not necessarily mean that all of the critical habitats support Western Painted Turtle. In a future stage, if one of the two routes that have Western Painted Turtle Habitat are selected, a field-based survey would be required to validate usage of the identified critical habitat for wintering, basking and breeding habitat.

Findings: Route 1 does not impact any Western Painted Turtle critical habitat.

Route 1 does not have any identified Western Painted Turtle critical habitat.

Route 2 would have a potential direct effect in approximately 9,344 m^2 of posted western painted turtle critical habitat. Tree clearing and riparian vegetation removal within the critical habitat would affect up to 9,344 m^2 in and around elbow bend; this includes the associated turning station infrastructure for this Route, which have a physical footprint of 1,428 m^2 (note that these components have spatial overlap and are not additive).

Route 3 would have a physical footprint of 580 m^2 in posted western painted turtle critical habitat. Two towers for this Route would be situated within critical habitat at (near) the Burnaby Mountain Golf Course.

Critical Habitat for Western Painted Turtle Summary Table

	Route 1	Route 2	Route 3
Impact to critical habitat for Western Painted Turtle habitat (crucial habitat in m²)	No western painted turtle habitat	9,344 m²	580 m²

Safety and Utilities Considerations

The placement of gondola infrastructure is also constrained by geotechnical conditions, the presence of significant utilities, and risks from external safety hazards.

Geotechnical Site Stability for Towers and Terminals

The three routes were examined in a preliminary assessment of geotechnical site stability for tower and terminal location, including the potential for and severity of geohazards (landslide, faults, and erosion), slope stability, and foundation conditions. A more comprehensive geotechnical assessment would occur as part of any future design.

Findings: Route 1 is located in the best geotechnical most favourable geotech conditions.

Route 1 would cross through landscapes that have no historical evidence of landslide features. There is no evidence of rock avalanche zones near the proposed route. Route 1 has good slope stability and foundation conditions.

Route 2 would have a potential for landslide between University Drive East and Gaglardi Way, as there are steep slopes present in this area. There is no evidence of rock avalanche zones near the alignment. On Route 2 geohazards are further away from station and tower locations than Route 3. However, Route 2 has steeper slopes and less slope stability.

Route 3 would have a greater presence of geohazards and poorer foundation conditions than Route 1 or 2. Route 3 has slightly better slope stability than Route 2.

Significance of Utilities Conflicts

This measure relates to the presence of utilities and the level of potential conflict between the utilities and the gondola. Within the three route alignments, there are a number of utilities, including:

- Sewer lines: Metro Vancouver trunk sewer;
- Power lines: BC Hydro operates lower voltage distribution lines and higher voltage transmission lines. The gondola will travel over lower voltage lines and under higher voltage lines;
- Natural gas line: Fortis BC; and
- Gas line: Trans Mountain.

The objective in the conceptual design was to minimize interaction with these utilities. Having to relocate or alter utilities operation may not be feasible, or if feasible may result in a longer construction

schedule and higher project costs. In general, we have been able to adjust the gondola design to minimize the interaction of the gondola with most, but not all, of these utilities.

Findings: Route 1 has the fewest utilities conflicts.

Route 1 would cross BC Hydro low voltage power lines at two points along its route. In both instances, the gondola would be separated from the power lines by at least 20 m. Route 1 would cross a Fortis pipeline, but there is no proposed infrastructure intrusion in the pipeline right-of-way.

Route 2 would cross over lower voltage power lines immediately before reaching the angle station. These lower voltage power lines may need to be moved underground to support the gondola design. Immediately after the angle station, the gondola would cross under high voltage power lines, with an 8 m clearance between the gondola cable and power lines. Further assessment by BC Hydro is required to determine if this clearance is sufficient. TransLink's ropeway designer indicated that it is unclear whether this is satisfactory however, it may be possible to lift the high voltage power lines to allow the gondola to pass safely underneath. This would increase the design complexity, cost, schedule, and may require additional tree clearing or land disturbance.

Route 3 would require moving low voltage power lines underground to accommodate the angle station. In addition, construction has started on the Burnaby Mountain Tunnel connecting Westridge Marine Terminal Port with the Burnaby storage terminal (also referred to as the tank farm). TransLink's ropeway designer indicates it is unclear whether the angle station may need to be moved to avoid the Burnaby Mountain Tunnel as the right-of-way may overlap with the angle station. Further study and engagement with Trans Mountain would be required to understand whether the angle station could be moved to avoid this conflict.

Risks from External Safety Hazards

This measure relates to the potential risk to the gondola system from external safety hazards. These external safety hazards may originate from the Burnaby Mountain tank farm or from BC Hydro's high voltage transmission lines.

In 2017, SFU Community Trust retained RWDI Consulting Engineers and Scientists Inc. to prepare a letter of opinion on Routes 1 and 2. This letter of opinion was updated in 2020 to include Route 3. To this end, RWDI reviewed a Quantitative Risk Analysis conducted by Genesis Oil and Gas Consultants on behalf of Trans Mountain. The 2017 review found that Route 1 and 2 would be acceptable, as both are far enough removed from the tank farm that the likelihood of catastrophic impact is very low. The

2017 review found that Route 1 and 2 would be acceptable, as both are far enough removed from the tank farm so that the likelihood of catastrophic impact is less than one in 10 million. The Major Industrial Accidents Council of Canada's land-use planning criteria sets no restrictions to allowable land use or building construction in such an area. However, the 2020 review found that Route 3 is not within a safe operating distance of the tank farm and is at the greatest risk during a hazardous event.

BC Hydro operates high voltage transmissions lines that cross Gaglardi Way. Route 2 would need to pass under these high voltage transmission lines, which may be a potential safety hazard to the gondola system and gondola passengers.

Should the Burnaby Mountain Gondola advance for further consideration, TransLink would engage with Trans Mountain and BC Hydro to better understand mitigations and safety protocols.

Route 1 has the lowest risk from external safety hazards.

Route 1 is located the second farthest away from the Burnaby Tank Farm. Route 1 would continue to operate within an acceptable risk level should a hazardous event occur at the Tank Farm. Route 1 poses the least risk from external safety hazards.

Route 2 is located the farthest away from the Burnaby Tank Farm and has the lowest risk level of all three routes. In the event of a hazardous event at the Tank Farm, Route 2 would have the least potential for impact. However, the high voltage power lines under which Route 2 would pass present a risk to gondola passengers and the gondola system if not modified.

Route 3 is located the closest to the Burnaby Tank Farm. Trans Mountain has informed TransLink about concerns with the safety and security of Route 3, indicating that the alignment is too close to the Tank Farm from a safety perspective.

Preliminary Route Evaluation Summary Table

		Route 1	Route 2	Route 3
Benefits	Transportation user experience	Greatest transit and auto travel time savings, greatest number of SFU buildings within a 5-minute walk	Second most transit and auto travel time savings	Least transit and auto travel time savings
	Sustainable transportation	Greatest boardings and most GHG emission offsets	Second greatest boardings and second most GHG emission offsets	Lowest boardings and least GHG emission offsets
Financial considerations	Capital, operating, and maintenance costs	Lowest capital, operating, and maintenance cost	Highest capital, operating, and maintenance cost	Second lowest capital, operating, and maintenance cost
Implementation considerations	Neighbourhood	Visual impacts to Forest Grove neighbourhood. Gondola would pass directly over two properties	Visual impacts to Rathburn neighbourhood	Visual impacts to Meadowood neighbourhood
	Environment	Lowest environmental and land disturbance impacts	Tied for highest environmental and land disturbance impacts	Tied for highest environmental and land disturbance impacts
	Safety	Most favourable geotechnical conditions, no significant utility conflicts	Average geotechnical conditions, conflict with high-voltage transmission lines	Poor geotechnical conditions, proximity to Trans Mountain right-of-way

Next Steps

The second phase of engagement will provide the public and stakeholders with the results of the Preliminary Route Evaluation. Engagement with First Nations is a separate process of direct communication to share information and understand their interests. Feedback from all engagement opportunities will help to identify a preferred route for further consideration. Approval from the City of Burnaby and from TransLink's Mayors' Council is required for the Burnaby Mountain Gondola to advance as a project and qualify for funding.

Appendix 1: Phase One Stakeholder and Public Engagement Summary Report

Appendix 2: Neighbourhood Considerations Analyses

Noise Memo

Privacy Analysis

Privacy Section – Route 1

- Simon Fraser Village – Timber Court
- Forest Grove Elementary – Mountainside
- Forest Grove Drive – Gaglardi Way

Privacy Section – Route 2

Privacy Section – Route 3

Visual Presence Analysis

Vandalism Memo

Appendix 3: Environmental Considerations Analyses

Burnaby Mountain Conservation Area and Parkland and Gondola Aerial and Infrastructure Overlap Map

Land Disturbance Map

Tree Loss Map

Watercourses and Riparian Areas Map

Western Painted Turtle Critical Habitat Map

Appendix 4: Safety Considerations

Letter from Trans Mountain