

Update on the REM de l'Est

SEPTEMBER 2021

Subsidiary of Caisse de dépôt et placement du Québec | cdpqinfra.com



Agenda

1 A look back at the last two quarters

2 Reminder: Technical characteristics of downtown Montréal

3 Technical reports - UNDERGROUND INTEGRATION SCENARIOS

T2 - AECOM-Systra Report

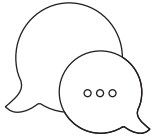
T3 - Geocontrol S.A.

4 Overall viability of the solutions studied

5 Next steps

A look back
at the last
two quarters

A look back at the last two quarters



Public information and consultation process

3 information sessions:

Quebec government, City of Montreal and ARTM participating

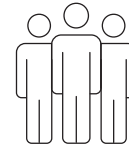
2 webinars: route and mobility

6 public consultations per sector

Digital consultation platform

16 information documents posted for citizens including:

- Mode analysis
- Sector data sheets



Multidisciplinary Expert Committee on Architecture and Urban Integration

Appointed in May:
15 expert members

8 meetings to date



Continued technical analysis

Creation of technical committees with partners:

- City of Montréal
- ARTM
- STM, STL, RTL, exo
- Gouvernement du Québec

Continued project design and optimization

SUMMARY OF RESULTS:

32,640

persons informed

Over **1,600**

comments and opinions received



Reminder: Technical characteristics

OF DOWNTOWN MONTRÉAL

Unfavourable geological conditions

FINDINGS

- Sustained presence of mixed soil conditions
- Soils of glacial origin with **large erratic boulders**
- Two displacement faults
- Presence of groundwater table over a significant distance of the route



Metro line tunnels

FINDINGS

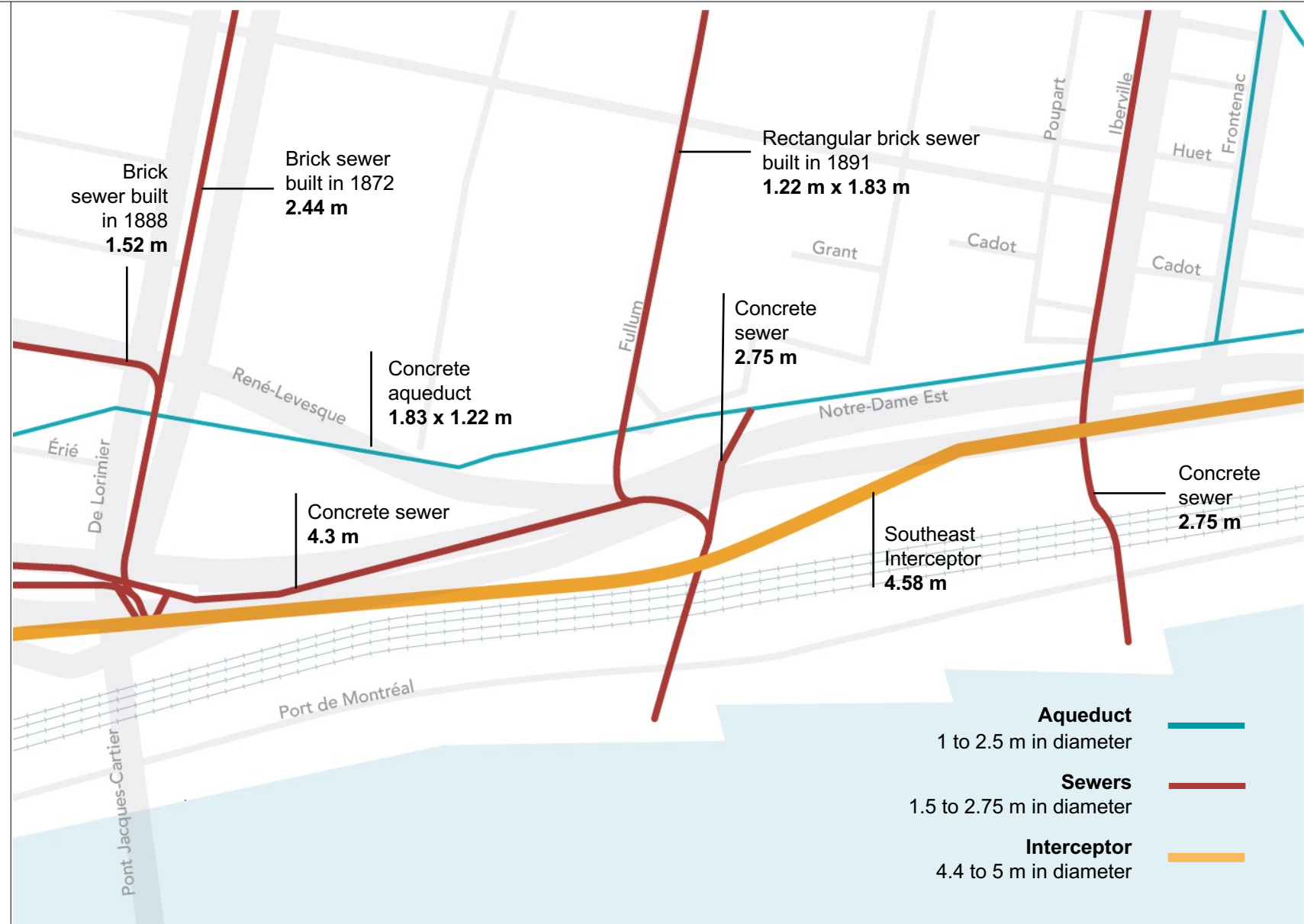
- The yellow métro line tunnel, inaugurated in 1967, runs along Saint-Denis Street to the river.
- The yellow line was built by blasting through the bedrock.
- The orange line tunnel, inaugurated in 1966, runs under Berri Street as far as Viger Street before branching off to the west.
- The orange line was built using the cut-and-cover method in loose ground.
- At René-Lévesque Boulevard, the two tunnels are parallel, but at different depths.



City of Montreal aqueducts and sewers

FINDINGS

- Presence of strategic lines for the operation of the sewer system.
- Very old lines whose condition are not well known.
- These sewers handle major flows that prevent them from being connected to other existing sewers
- Many of the conduits are very old and are located close to pour points, making their relocation impossible





Technical reports

UNDERGROUND INSERTION
SCENARIOS

Two separate expert reports

Q2

(2nd quarter 2021)

AECOM-Systra report

EXTERNAL EVALUATION OF:

- Impacts of buried public infrastructure
- Impacts of the yellow and orange métro line tunnels
- Geology of the area
- Construction risks

Q3

(3rd quarter 2021)

Report from Geocontrol S.A.

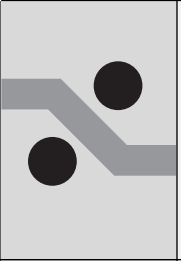
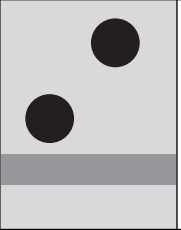
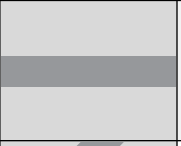
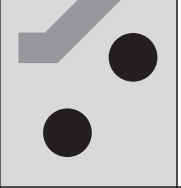
IN-DEPTH EXTERNAL EVALUATION OF:

- Impacts of buried public infrastructure
- Impacts of the yellow and orange metro line tunnels
- Geology of the area
- Construction risks
- Presence of water table
- 3D digital modelling

Synthesis of theoretical analyses

In order to respond to the mandate given by the Quebec government, CPDQ Infra studied up to 50 scenarios for the REM de l'Est route. The main scenarios studied for downtown Montreal are the following:

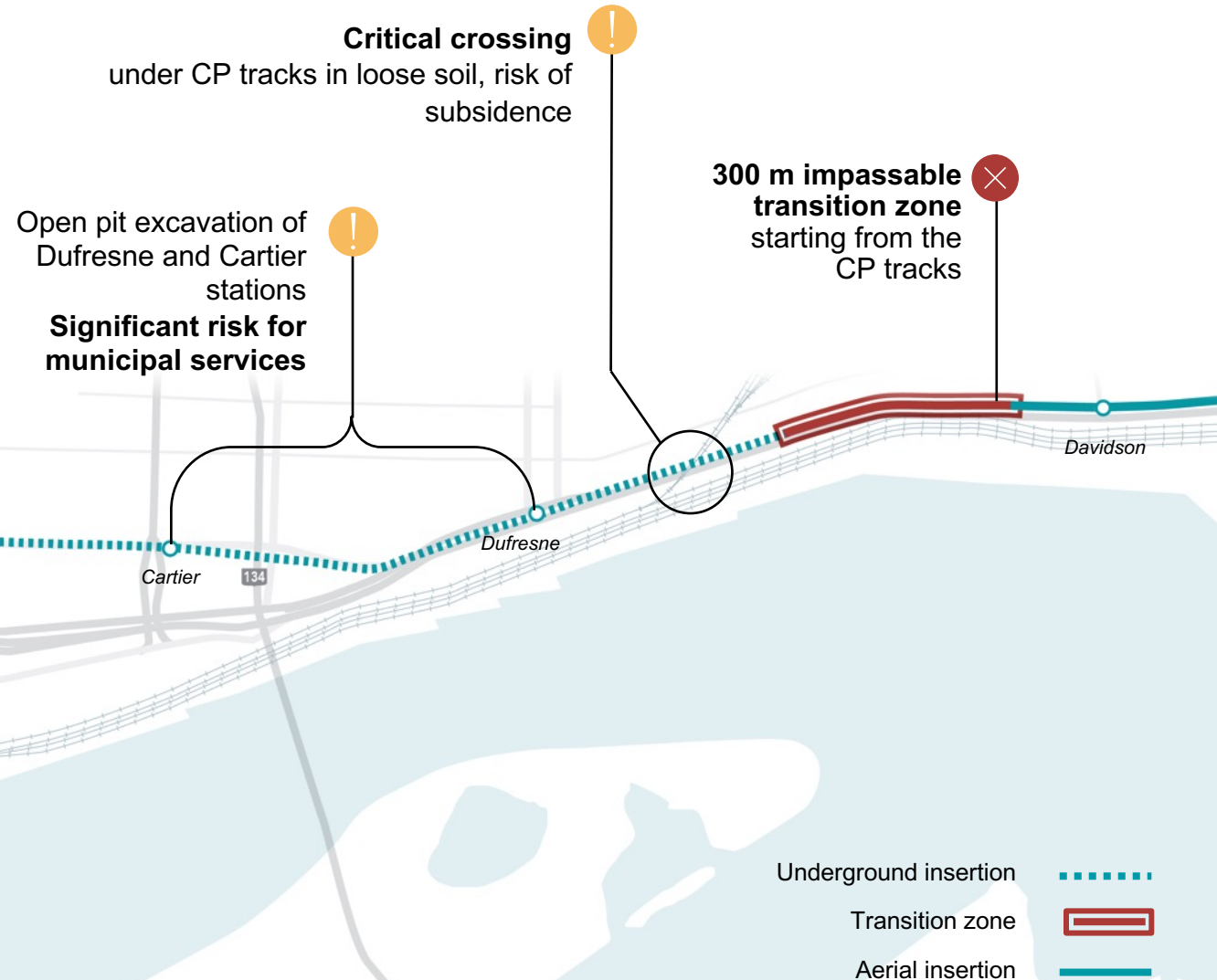
SCENARIOS ANALYSED

TUNNEL		TRANSITION	NAMES OF THE SCENARIOS ANALYSED	
			AECOM-Systra	Geocontrol S.A.
	Tunnel between the metro lines under René-Lévesque	West of Cartier Station	<i>Option A. Transition à l'ouest de la station Cartier – profil en long entre les lignes jaune et orange</i>	<i>Not analysed</i>
		East of CP tracks	<i>Option C. Transition à l'est des voies du CP – profil en long entre les lignes jaunes et orange</i>	<i>Alternative 1. Croisement entre les lignes de métro avec la transition placée à l'est des voies du CP</i>
	Tunnel under the metro lines under René-Lévesque	West of CP tracks	<i>Option B. Transition à l'ouest des voies du CP – profil en long <u>sous</u> les lignes jaune et orange</i>	<i>Analysed in section 7.1.2</i>
		East of CP tracks	<i>Option D. Transition à l'est des voies du CP – profil en long <u>sous</u> la ligne jaune</i>	<i>Alternative 2. Croisement sous la ligne jaune avec la transition placée à l'est des voies du CP</i>
	Tunnel under Saint-Antoine		<i>Not analysed</i>	<i>Alternative sous la rue Saint-Antoine</i>
	Tunnel from the west of the metro lines under René-Lévesque	West of the metro lines	<i>Not analysed</i>	<i>Alternative 3. Transition placée à l'ouest des lignes de métro</i>

Between the metro lines

Not feasible according to AECOM-Systra

- ✘ **Non-respect of safety clearances for the yellow line**
(3.9 metres available vs. 5 metres)
- ✘ **Risk of subsidence of the orange line tunnel**
- ✘ **Tunnel boring in mixed zone over a significant length**

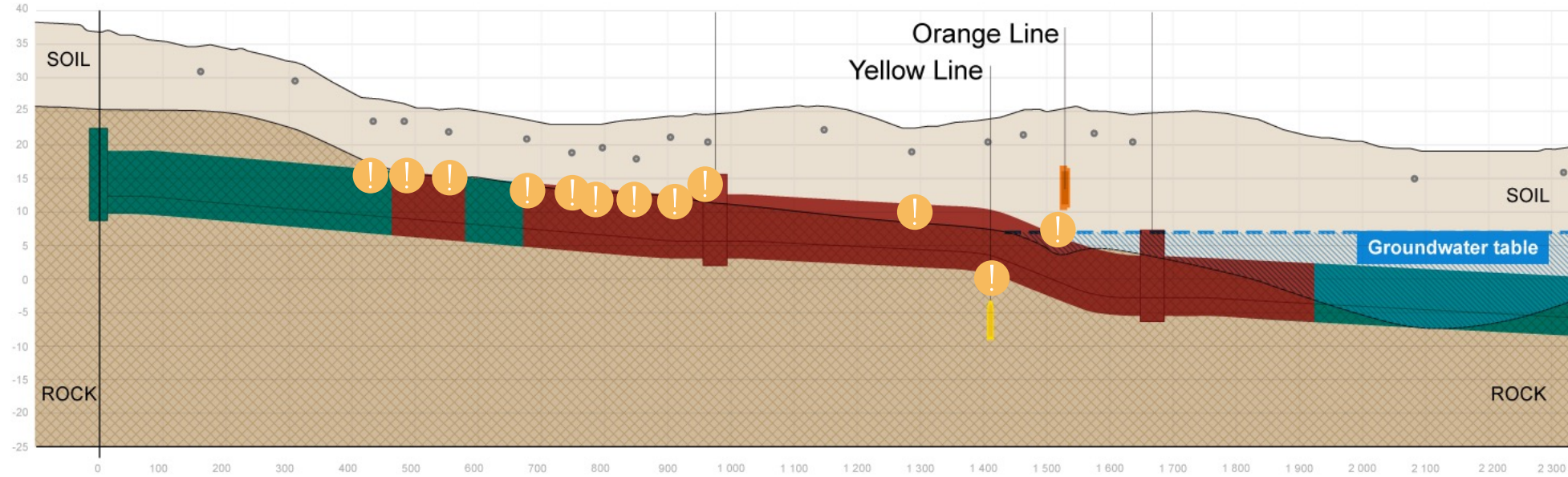


Between the metro lines

Robert-Bourassa Station
24.2 m

Saint-Urbain Station
18.8 m

Labelle Station
27.3 m



■ Insertion of the REM de l'Est tunnel

RISQUES

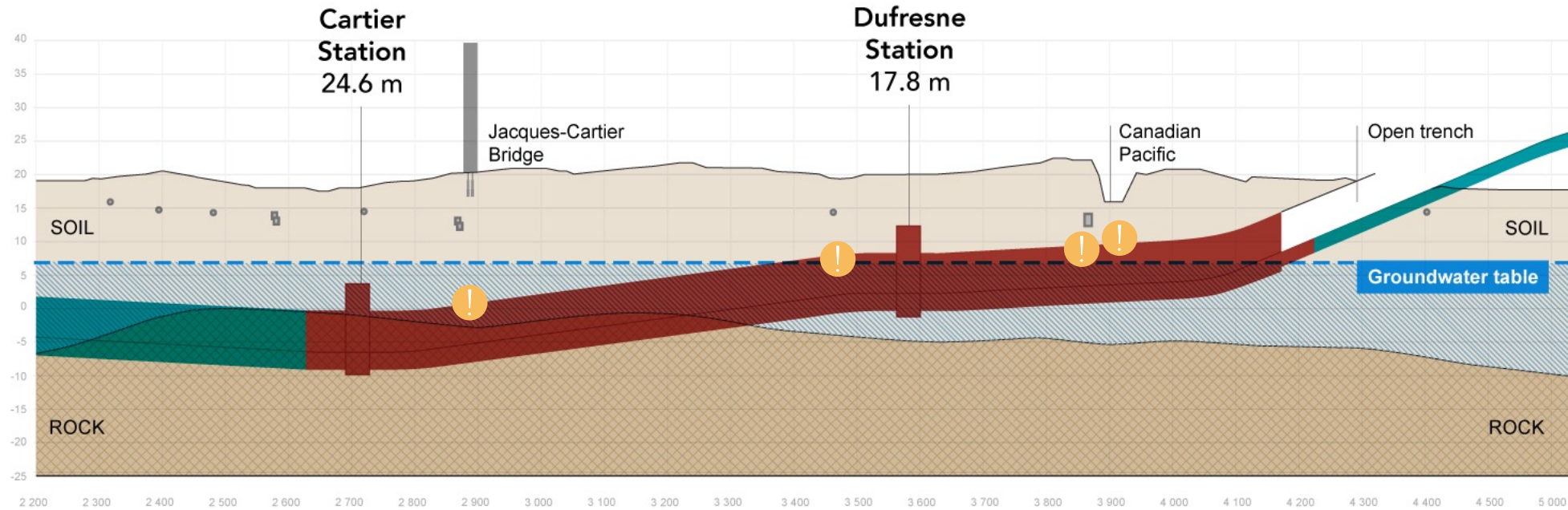
■ Difficult excavation

⚠ Proximity to infrastructure and railroad

▨ Presence of water

Cartier Station
24.6 m

Dufresne Station
17.8 m



Between the métro lines

RISKS IDENTIFIED:



Close proximity to métro lines

Act respecting public transit
authorities = 5-metre clearance

*Model includes clearances of 2.5m (yellow line)
and 3.5m (orange line): does not comply with the
law*



Potential subsidence of the orange line



Unfavourable geotechnical conditions over about 3 km of tunnel

(e.g. excavation below the water
table, erratic boulders, soil-rock
interface)



Disruption of métro service during construction and risk of prolonged interruption if TBM is stopped

NOTE: Geomechanical model (simplified theoretical calculation) to evaluate potential deformations of the métro lines: passage between the lines theoretically possible, with major risks.

Under the metro lines

Theoretically feasible, but accumulation of critical risks according to AECOM-Systra

⊗ Tunnel boring in mixed zone over a significant length

⊗ **Very deep stations:**
Theoretical minimum depth 30 m (Saint-Urbain) and 38 m (Labelle) - Impact on ridership.

! **Critical crossing**
under CP tracks in loose soil, risk of subsidence

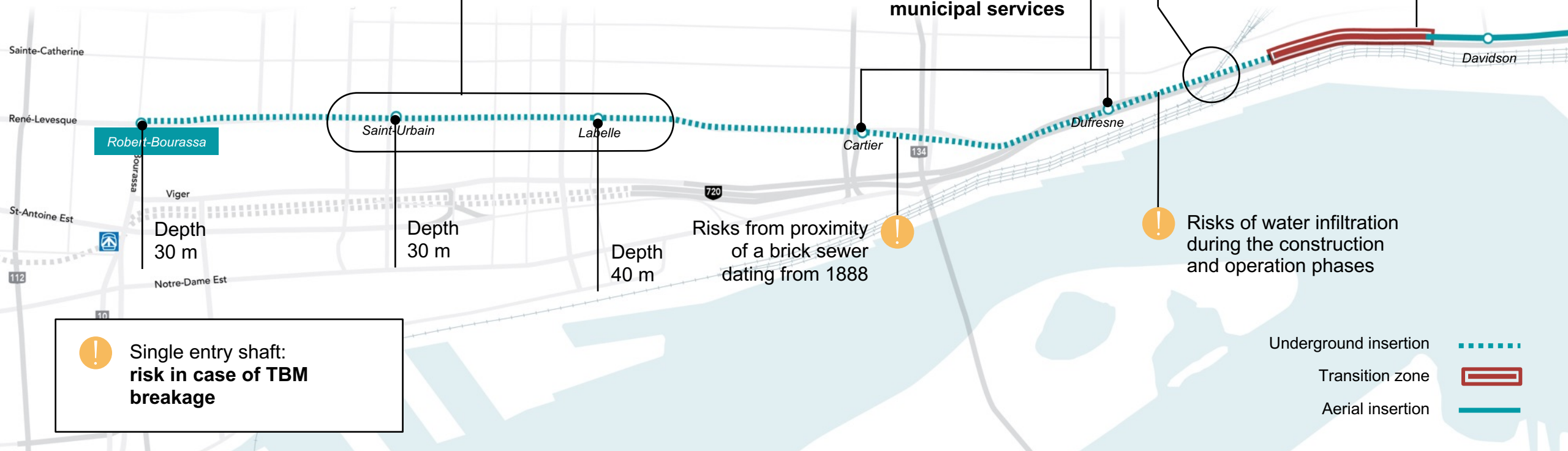
! Open pit excavation of Dufresne and Cartier stations.
Significant risk to municipal services

⊗ **500 m impassable transition zone**
starting from the CP tracks

! Risks of water infiltration during the construction and operation phases

! Risks from proximity of a brick sewer dating from 1888

! **Single entry shaft: risk in case of TBM breakage**



Depth 30 m

Depth 30 m

Depth 40 m

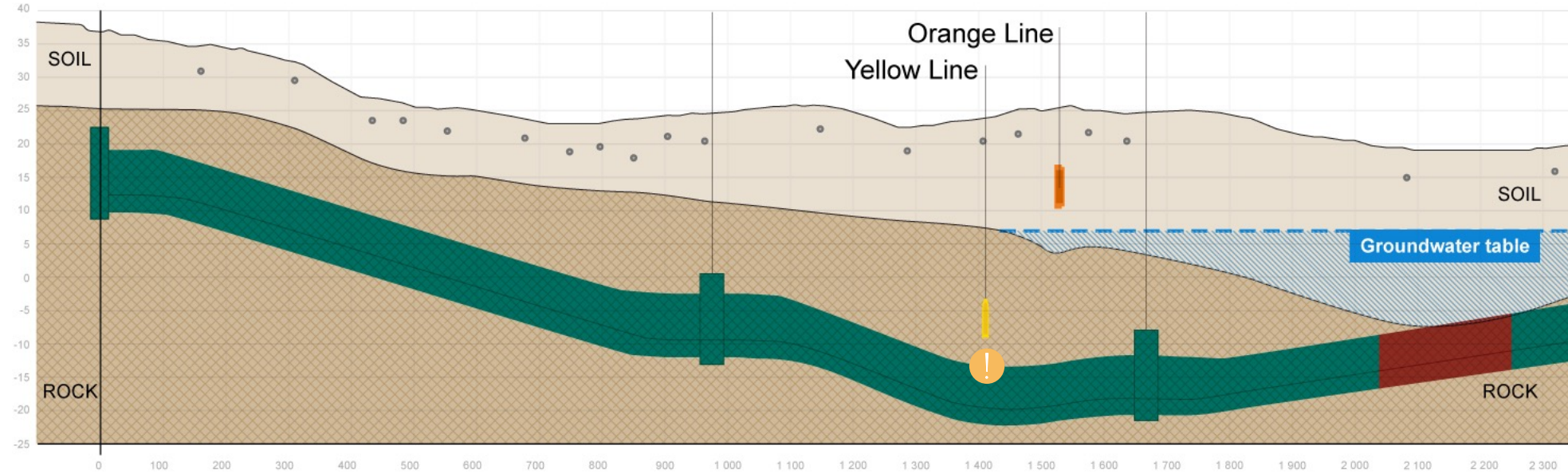
- Underground insertion ⋯
- Transition zone
- Aerial insertion —

Under the metro lines

Robert-Bourassa Station
24.2 m

Saint-Urbain Station
35.4 m

Labelle Station
45.0 m



■ Insertion of the REM de l'Est tunnel

RISQUES

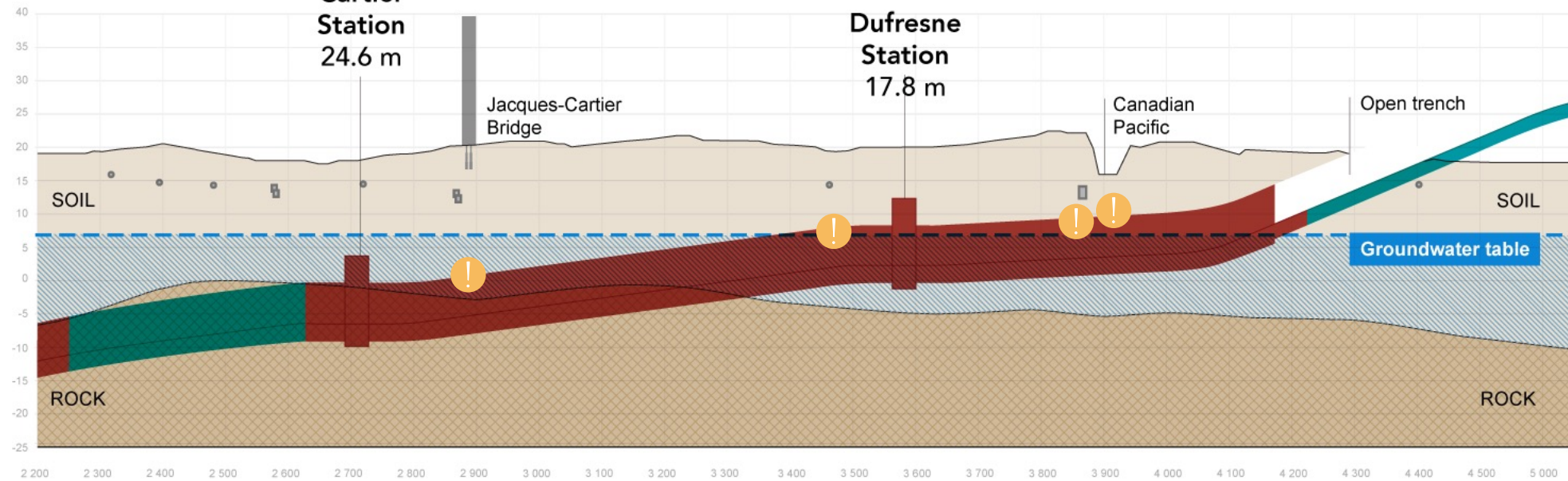
■ Difficult excavation

⚠ Proximity to infrastructure and railroad

▨ Presence of water

Cartier Station
24.6 m

Dufresne Station
17.8 m



Under the yellow line

RISKS IDENTIFIED:



Unfavourable geotechnical conditions over about 2 km of tunnel

- Excavation in the ground below the water table (risk of water infiltration)
- Probable presence of erratic boulders (risk of slowing or breaking the TBM)
- Ground-rock interface difficult to pass through (risk for TBM guidance)



Proximity to infrastructures

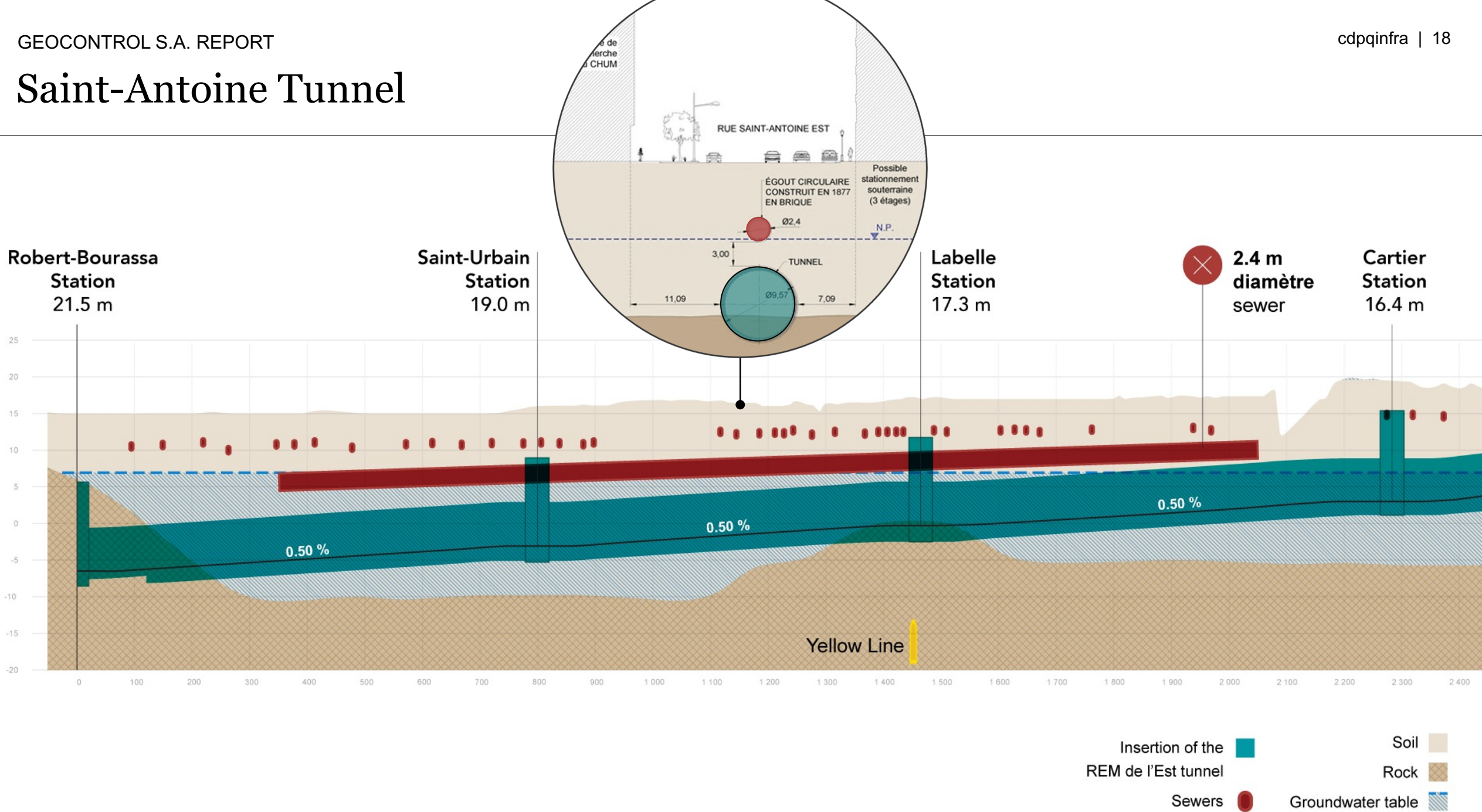
conflict with underground conduits (Dufresne station) and CP tracks (need to check for potential subsidence under the tracks)



Very deep stations (30 m and 40 m)

significant impact on ridership

Saint-Antoine Tunnel



Saint-Antoine Tunnel

✘ CONSTRAINTS

HIGH TECHNICAL COMPLEXITY:

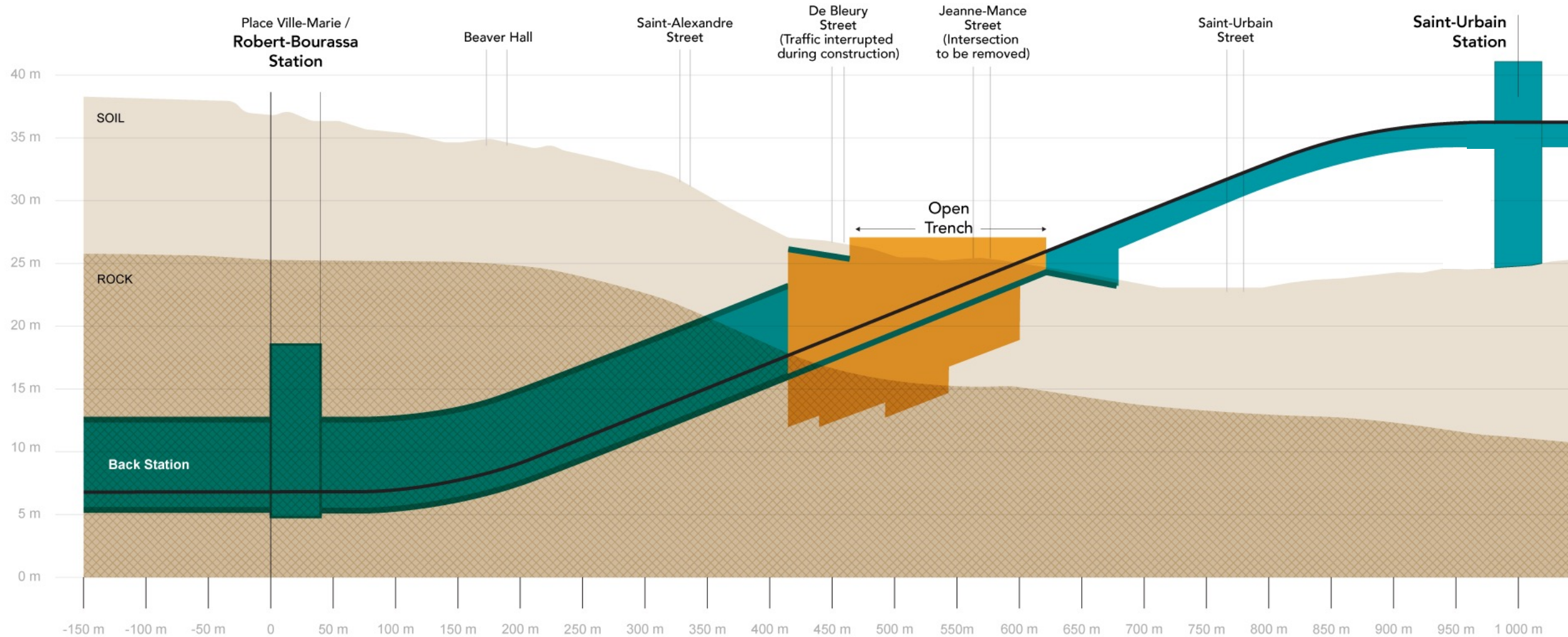
- ✘ **Unfavourable geotechnical conditions** over about 4 km of tunnel (excavation in the ground in mixed conditions, below the water table, probable presence of erratic boulders)
- ✘ Does not cross the orange line, but **conflicts with existing municipal infrastructure** (e.g. old brick sewer of over 2 m in diameter conflicts with the route and stations)
- ✘ **Narrow corridor**: narrow street, lined with existing buildings – risk of building subsidence

CONCLUSION

Option beneath Saint-Antoine is not recommended by Geocontrol's experts in comparison with the alternatives on René-Lévesque

NEW PROPOSED OPTION Short tunnel west of the metro lines

Tunnel of about 500 metres between De Bleury and Robert-Bourassa streets



NEW PROPOSED OPTION Short tunnel west of the metro lines**FAVOURABLE GEOTECHNICAL CONDITIONS****Excavation primarily in bedrock,
well above water table**

Short section: partially mechanized work method (cutter/shovel) instead of tunnel boring machine, which reduces the risk from erratic boulders

**Significant slope on René-Lévesque
in this sector**

Reduces the transition area



Corner of De
Bleury

NEW PROPOSED OPTION Short tunnel west of the metro lines

OTHER FACTORS IDENTIFIED:



Facilitates connection with Central Station and the RÉSO, also enabling better operational management

Rear of station =
increased frequency
and reliability



Entrance to the city, with important buildings, preserved

- Place Ville-Marie
- Central Station
- Robert-Bourassa urban boulevard



Calls for closure of one intersection for the transition area

Summary of cumulative risks

ACCUMULATED LENGTH

Under the yellow line

	Medium risk	Maximum risk
Excavated land	1 050 m	960 m
Presence of water	300 m	1 890 m
Proximity of infrastructures	20 m	90 m
Crossing railway tracks	80 m	N/A

Actual distance on the route of medium and maximum risks	2 190 m
-----------------------------------------------------------------	----------------

Between the metro lines

	Medium risk	Maximum risk
Excavated land	1 120 m	2 460 m
Presence of water	1 085 m	2 395 m
Proximity of infrastructures	25 m	210 m
Crossing railway tracks	60 m	140 m

Actual distance on the route of medium and maximum risks	3 590 m
-----------------------------------------------------------------	----------------

West of the metro lines

New proposed option

	Medium risk	Maximum risk
Excavated land	120 m	115 m
Presence of water	235 m	N/A
Proximity of infrastructures	N/A	50 m
Crossing railway tracks	N/A	N/A

Actual distance on the route of medium and maximum risks	255 m
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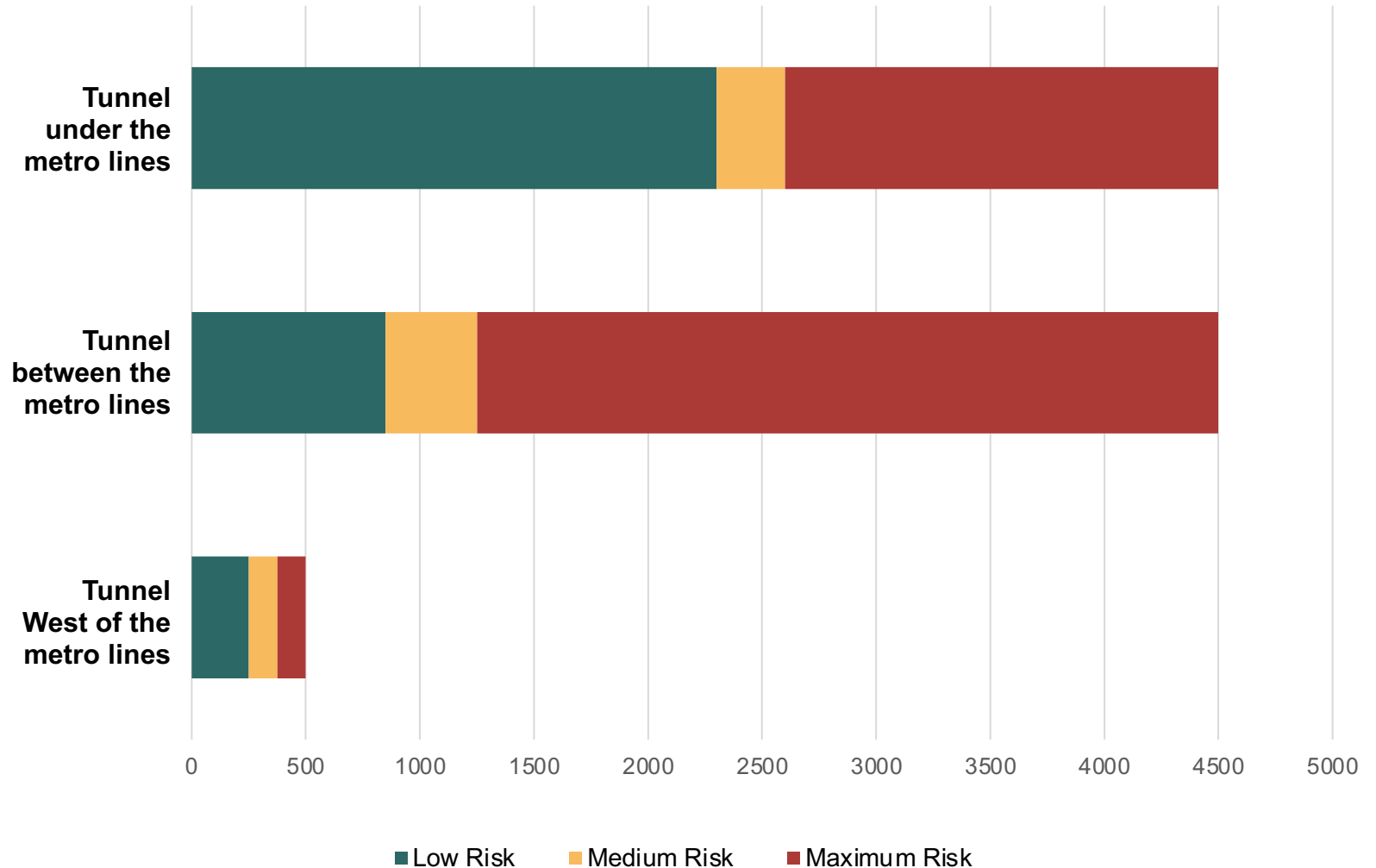
Overall viability
of the solutions
studied

Inherent impacts and accumulation of critical risks

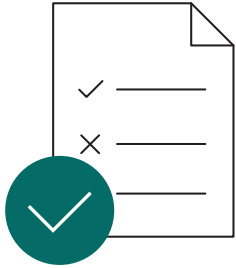
EXAMPLES OF IMPACTS

- ✘ Substantial damage to subway lines resulting in extended disruption of service
- ✘ Breakdown of critical buried public infrastructure
- ✘ Destabilization of important buildings due to soil settlement or subsidence
- ✘ Extended interruption of the work due to a stop of the tunnel boring machine
- ✘ Impossible to continue work due to lack of access to the tunnel boring machine

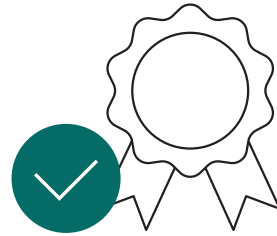
GEOLOGICAL HAZARD PROFILES (ACTUAL DISTANCES ALONG THE ROUTE)



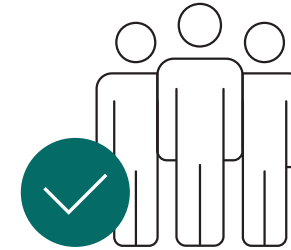
Viability test for a realistic solution



Ability to adequately manage and address the risks (types and likelihood) + impacts (types and severity) inherent to the solution's implementation

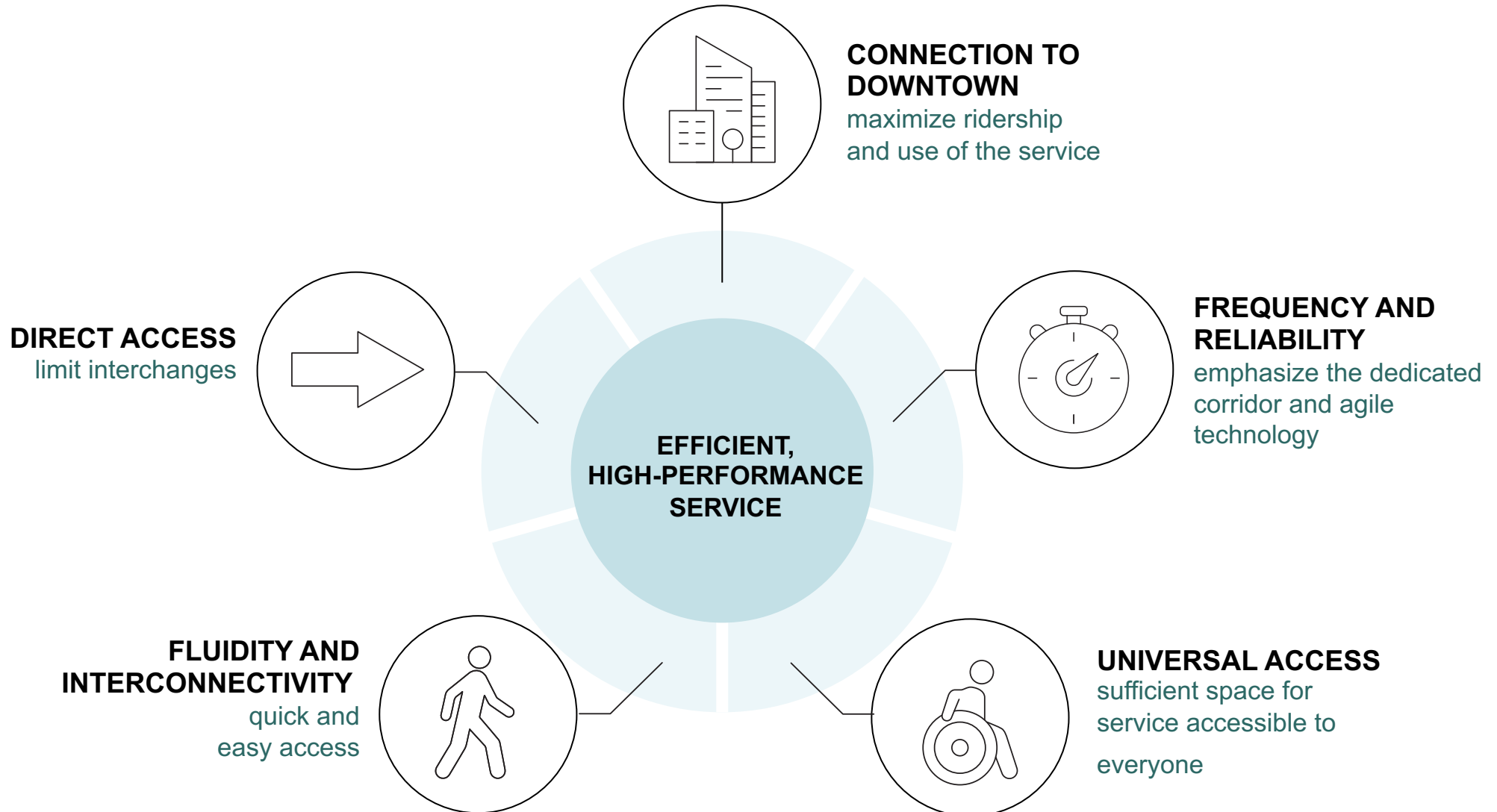


Ability to obtain bids from the market with performance and deadline guarantees



Ability to offer an efficient public transportation solution that meets the needs of the population: speed, frequency, reliability and integration

An efficient public transportation solution



A large, dark blue, stylized number '5' is positioned in the background, partially obscured by the text. The number has a thick, rounded stroke and a horizontal bar at the top.

Conclusion

New optimization to the project

Only one underground solution meets the test for a feasible and viable solution

Inclusion in the reference project of a **tunnel section** that begins at Jeanne-Mance and continues to Robert-Bourassa Boulevard

Reference project includes a total of 8.5 km of tunnel for the REM de l'Est, or about a quarter of the route.

The project's budget and schedule will be updated following the current consultation and optimization period, before the Bureau d'audiences publiques sur l'environnement (BAPE).

A large, light blue graphic of the number 8.5, rendered in a clean, sans-serif font. The number is positioned on the right side of the slide, above the word 'Kilometers'.

Kilometers



Next steps

The next steps

Continued work by the design teams to improve the project in light of the citizens' recommendations and those from the multidisciplinary committee of experts



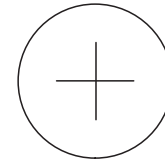
Proposal of an architectural and integration vision

resulting from the multidisciplinary expert committee's work



Dialogue on the proposed architectural and integration vision

in collaboration with the Committee of Experts



Participation in BAPE hearings

publication of all required documents in advance



For a vast
integrated
network

