**Phase 1 – Alternative Solutions**

**ALTERNATIVE A – LOWER THE RAPID TRANSIT TUNNEL**

**Description**
Lower the rapid transit tunnel by as much as six (6) metres in order to avoid any major utility conflicts.

**Significant Features of Alternative**
- Rapid transit tunnel lowered to 15 m deep (existing road to tunnel bottom).
- Significant cost increase to tunnel construction.
- Increased tunnel construction time and complexity due to additional depth.
- Potential risk to future potential conversion to LRT due to long steep grades.
- No significant utility impacts.
- High capital cost for transit tunnel changes. Low operating cost for utilities.
- Schedule “A” Class Environmental Assessment
Phase 1 – Alternative Solutions

**Description**
Build inverted siphons to convey the sewers under the proposed rapid transit tunnel where possible along their current routing with no change to rapid transit tunnel depth or alignment.

**Significant Features of Alternative**
- Carling Creek Storm Sewer: major siphon with challenging configuration due to pipe alignment and right of way width.
- Oxford Street Sanitary Trunk Sewer: major siphon with straightforward configuration.
- Pall Mall Sanitary Trunk Sewer: not feasible as a siphon, requires 500 L/s pumping station with additional property and regular maintenance.
- Medium cost with significant operating costs associated with pumping station.
- Schedule “B” Class Environmental Assessment due to potential land acquisition.
Phase 1 – Alternative Solutions

Description
Install pumping stations to convey the sanitary and storm flow over the proposed rapid transit tunnel with no change to rapid transit tunnel depth or alignment.

Significant Features of Alternative
• Pall Mall Sanitary Trunk Sewer: requires 500 L/s pumping station
• Carling Creek Storm Sewer: requires 8,400 L/s pumping station
• Oxford Street Sanitary Trunk Sewer: requires 1,000 L/s pumping station
• Property acquisition would likely be required for the pumping stations.
• High capital cost with significant operating costs associated with pumping station.
• Schedule “B” Class Environmental Assessment due to potential land acquisition.
**Phase 1 – Alternative Solutions**

**ALTERNATIVE D – GO AROUND THE RAPID TRANSIT TUNNEL**

**Description**
Reroute the conflicted sewers around the rapid transit tunnel to either an existing or new outlet location with no change to rapid transit tunnel depth or alignment.

**Significant Features of Alternative**
- **Oxford St. Sanitary Trunk Sewer**: Rerouting is not feasible due to pipe slope and downstream connection point options.
- **Carling Creek Storm Sewer**: Connect to existing storm sewer at Kenneth Ave., then along Waterloo to Central, under Victoria Park to Albert St., and then along Albert St. to the Thames River.
- **Pall Mall Sanitary Trunk Sewer**: Connect to existing trunk sewer at Pall Mall, then along Wellington to Central, under Victoria Park to Albert St., and then along Albert St. to Sanitary Sewer connection at Ridout and Albert.
- Majority of work would be completed by tunnelling due to depth of sewers. High capital cost and low operating cost.
- **New storm outlet** is required to Thames River at the end of Albert St. Property acquisition would likely be required.
- Schedule “B” Environmental Assessment for storm sewer if property acquisition is anticipated. Schedule “A” Class Environmental Assessment if no property acquisition is required.
Phase 1 – Alternative Solutions

ALTERNATIVE E – INDIVIDUAL SOLUTION FOR EACH SEWER

Description
This alternative addresses each sewer individually, with no change to rapid transit tunnel depth or alignment:
• Oxford St. Sanitary Trunk Sewer – Siphon installation
• Carling Creek Storm Sewer – Siphon Installation
• Pall Mall Sanitary Trunk Sewer – Relocated to an alternative downstream connection

Significant Features of Alternative
• Oxford St. Sanitary Trunk Sewer and Carling Creek Storm Sewer limit of work is similar to tunnel construction.
• Pall Mall Sanitary Trunk Sewer would be installed mostly by tunnelling within existing right of way. Limited impacts outside of shaft locations and connection points to the existing sewers (Pall Mall, Wellington and Albert, Ridout)
• Medium cost alternative (low cost alternative for siphons, high cost alternative for Pall Mall Sewer Relocation
• Schedule ‘A’ Class Environmental Assessment
## Phase 2 – Alternative Solutions – Evaluation of Alternatives

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>A - LOWER THE RAPID TRANSIT TUNNEL</th>
<th>B – SIPHON UNDER ALTERNATIVE</th>
<th>C – PUMP OVER ALTERNATIVE</th>
<th>D – GO AROUND ALTERNATIVE</th>
<th>E – INDIVIDUAL SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Feasibility</strong></td>
<td>• Feasible by increasing the depth of the transit tunnel to avoid conflicting sewers.</td>
<td>• Feasible for all crossings except 750 mm sanitary trunk sewer at Mill/Richmond</td>
<td>• Feasible, but pumping stations would be larger than any pumping stations in the City currently</td>
<td>• Feasible by rerouting sewers around the south end of the transit tunnel except for Oxford St. Sanitary Sewer.</td>
<td>• Feasible for each utility.</td>
</tr>
<tr>
<td><strong>Natural Environment</strong></td>
<td>• Increase in excavated materials. No significant additional impacts outside of right-of-way.</td>
<td>• No significant construction impacts outside of right-of-way.</td>
<td>• Potential impacts related to spills associated with failure of siphon operation.</td>
<td>• New storm and sanitary relief sewer outlet to Thames River south of Blackfriar Bridge will require mitigation.</td>
<td>• Localized impacts within right-of-way for siphon and sewer tunnel construction.</td>
</tr>
<tr>
<td><strong>Social Environment</strong></td>
<td>• Significantly longer construction schedule and Richmond Street Closure.</td>
<td>• Impacts of utility corridor availability along Richmond Street.</td>
<td>• Extension to construction period along Richmond Street.</td>
<td>• Localized impacts related to traffic, noise and disruption near shaft locations.</td>
<td>• Localized impacts related to traffic, noise and disruption near shaft and siphon locations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Significant impacts on land availability along project alignment.</td>
<td>• Multiple construction sites on and off the alignment.</td>
<td>• Negligible ongoing impacts.</td>
<td>• Negligible ongoing impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Potential benefit of reducing sanitary sewer overflows.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Economic Environment</strong></td>
<td>• Significant cost increase to deepen tunnel by 6 metres.</td>
<td>• Lowest capital cost alternative.</td>
<td>• High capital and operating cost due to capacity of facilities.</td>
<td>• High capital cost due to length of rerouting required.</td>
<td>• Mid-range cost alternative.</td>
</tr>
<tr>
<td></td>
<td>• Business impacts of extended closure of Richmond Street for construction.</td>
<td>• Constriction of corridor for siphon access will limit servicing along Richmond Street.</td>
<td>• Loss of commercial real estate along the alignment would have economic impact.</td>
<td>• Some property acquisition is required for the new outlet.</td>
<td>• Siphons are relatively low cost.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Business impacts of extended closure of Richmond Street for construction.</td>
<td></td>
<td></td>
<td>• Rerouting sanitary sewer is a high cost alternative.</td>
</tr>
</tbody>
</table>
## Phase 2 – Alternative Solutions – Evaluation of Alternatives

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<tbody>
<tr>
<td>Constructability</td>
<td>• Deeper tunnel would require tunneling equipment (i.e. tunnel boring machine) rather than cut and cover construction.</td>
<td>• Size of the structures may obscure the available utility corridor.</td>
<td>• No significant constructability issues other than available land.</td>
<td>• Tunneling construction is impacted by geotechnical soil conditions.</td>
<td>• Size of the structures may obscure the available utility corridor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Tunneling construction is impacted by geotechnical soil conditions.</td>
</tr>
<tr>
<td>Lifecycle Impacts</td>
<td>• Deep tunnel will have ongoing operating costs associated with additional depth.</td>
<td>• Siphons will require regular access and maintenance.</td>
<td>• Large pumping stations will have significant ongoing operation and maintenance costs.</td>
<td>• Depth of sewer will result in additional operational costs for access.</td>
<td>• Siphons will require regular access and maintenance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pumping station required for trunk sanitary sewer</td>
<td></td>
<td></td>
<td>• Depth of sewer will result in additional operational costs for access.</td>
</tr>
<tr>
<td>Project Risk</td>
<td>• Medium to high risk during construction due to high complexity works and restricted workspace.</td>
<td>• Medium risk during construction due to proximity to existing buildings.</td>
<td>• Medium risk during construction due to size and depth of wet-wells and structures on generally confined sites.</td>
<td>• Medium to low risk depending on the variation in geotechnical soil conditions.</td>
<td>• Medium risk for siphon design due to right-of-way space restrictions.</td>
</tr>
<tr>
<td></td>
<td>• High risk due to operational and safety challenges with up to 15 m deep tunnel.</td>
<td>• High risk of not having adequate space for future servicing of alignment due to tunnel and siphons.</td>
<td>• Medium operational risk due to the potential impact of pump failure for large capacity systems.</td>
<td>• Low operational risk due to gravity operation for majority of sewer.</td>
<td>• Medium to low risk for rerouted sewer due to geotechnical conditions.</td>
</tr>
<tr>
<td></td>
<td>• Steep slopes may limit future opportunities for LRT.</td>
<td>• Medium operational risk due to low slope and potential maintenance access needs.</td>
<td></td>
<td>• Medium operational risk for the required Oxford St. Sanitary Siphon</td>
<td></td>
</tr>
<tr>
<td>Preference</td>
<td>• Less Preferred</td>
<td>• Less Preferred</td>
<td>• Not preferred</td>
<td>• Less Preferred</td>
<td>• Most Preferred</td>
</tr>
<tr>
<td>Class EA Schedule</td>
<td>• Schedule ‘A’</td>
<td>• Schedule ‘B’ due to land acquisition for pumping station.</td>
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<td>• Schedule ‘B’ due to land acquisition</td>
<td>• Schedule ‘A’</td>
</tr>
</tbody>
</table>


Preferred Alternative: Alternative E – Individual Solution for Each Sewer

- Inverted siphon for Oxford St. Sanitary Trunk Sewer and Carling Creek Storm Sewer.
- Pall Mall Sanitary Trunk Sewer relocated to a downstream connection at Albert and Pall Mall.
- Pall Mall Sanitary Relief Sewer will remain a gravity sewer on the current alignment. No major changes are required.
- Schedule ‘A’ Class Environmental Assessment:
  - Project can proceed to implementation
- Siphons would be constructed in conjunction with tunnel construction.
- Pall Mall Sanitary Sewer would likely be constructed in advance of Tunnel Construction via an independent project.
- The preferred alternative will be integrated into the Pollution Prevention and Control Plan currently being undertaken by the City.
Stay Involved

Next Steps

• Notice of completion of the Class EA process

• The project would likely be implemented starting with construction beginning in late 2018, subject to funding

• For more information, visit www.london.ca/EAs