



**JTB Environmental Systems Inc.**

Fluvial Geomorphology Natural Channel Design Coastal Processes Erosion Control

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Re: 407 Transitway Assessment of Crossings: Our File 20100430

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JTBES has completed our assessment of the existing 16 crossings beneath Highway 407 in preparation of determining the impacts of proposed crossing extensions for box culverts or bridge spans, depending on the crossing location and creek conditions.

Our assessment was based on the existing conditions of the watercourses at each crossing location (some were withdrawn from analysis due to a lack of need—crossings proposed are above existing crossings so no additional bridges or culvert expansions were required; another has been enclosed and is not a surface watercourse—Site 13). Included in the analysis was an assessment of existing erosion problems, sedimentation problems in existing culverts, and meandering analysis.

Our results are presented in a series of tables which identify the crossing location, the existing conditions, the existing crossing structure, and the potential for issues relating to extension of the existing structure (or the placement of a new structure).

This assessment is to be considered as a part of the study's planning and preliminary design phase. When details of each crossing are available during the detailed design phase, we will re-visit our findings and complete further field analysis to determine more fully the potential risk to fluvial process (as well as potential risk to the structures). Please advise when this information is available.

If there are any questions regarding our submission, please contact me directly.

Respectfully Submitted,

John T. Beebe, PhD  
*Fluvial Geomorphologist*  
**President and CEO**  
**JTB Environmental Systems Inc.**

**Following: Analysis Tables**



Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 1 – Jane Station Tributary 1 of Black Creek	<p>This tributary is a formal roadside ditch that has been realigned to follow the corridor between the Highway 407 to Highway 400 on-ramp and the adjacent industrial area to the east. There is one stormwater outfall connection approximately 175 metres upstream of the Highway 407 culvert, as well as another culvert providing roadside drainage from the highway ramps and roadway for Highway 400. There is an existing culvert at the upper limit of our study at Highway 7.</p> <p>Bankfull widths in the channel range from less than 0.80m to approximately 1.75m.</p> <p>There is no formal fluvial form to the tributary upstream of Highway 407 (no fluvially-developed riffles and pools); it appears that the flow is intermittent, restricted to spring melt and storm runoff.</p> <p>Downstream of Highway 407 culvert the channel has a more natural form and it follows a slightly meandering path across farmed fields. There is a vegetated buffer which varies in width between 20m and 100m. The tributary joins Black Creek approximately 650m downstream of the Highway 407 culvert.</p>	Box Culvert	<p>Extension of the existing culvert to the north or south can be accommodated with little or no impairment to function of the tributary.</p> <p>Extension to the north may require a slight realignment of the tributary to provide for a perpendicular crossing.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 2 – Jane Station Black Creek</p>	<p>Black Creek flows south toward the existing Highway 407 crossing through a very narrow corridor which is surrounded by roadway and parking lot infrastructure. The creek has limited opportunity to meander upstream of the crossing, and because it has been significantly confined, the fluvial health of the system is not strong.</p> <p>The creek passes beneath the Highway 407 through a box culvert at a perpendicular angle and emerges on the south side of the highway in an open space/cemetery. The creek meanders significantly over a distance of approximately 300 metres where it again flows through a culvert beneath Jane Street.</p> <p>There appears to be some sedimentation in the existing culvert beneath the 407, though this may be temporary deposition that will move through during the next storm event.</p> <p>Over this 300 metres the creek flows through a vegetated area with little in the way of climax vegetation (trees), however the ground vegetation is effectively protecting the creek from any significant erosion problems.</p>	<p>Box Culvert</p>	<p>Extension to the north will not be problematic from a fluvial perspective as the existing creek does not meander over a distance of more than approximately 20 metres.</p> <p>Extension to the south will not be problematic as the maximum meander amplitude between the existing culverts at the 407 and Jane Street is on the order of 30 metres maximum; however review of the detailed design general alignment drawings would be required to ensure no issues.</p> <p>If extension is to the south and there will be piers/columns in the floodplain, consideration of the placement of the structures must include future meandering potential.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 3 – Jane Station Tributary 2 of Black Creek	<p>Tributary 2 is a very small feature which, according to Toronto and Region Conservation Authority (TRCA) files, has no upstream drainage area (with the exception of roadside drainage off the Highway 407 westbound lanes). Collection of runoff is passed through a small culvert to the south side of the highway.</p> <p>It appears from the localized scour downstream of the culvert that flow energy through the existing culvert is high, indicating that the culvert may be undersized for the flow that passes through.</p> <p>Downstream the tributary is a straight ditch with few differentiating features as it flows southward. At the end of the cemetery roadway the tributary sweeps to the west toward Jane Street and follows a very systematic, sine-wave patterned path, indicating that a prior attempt at channel design was undertaken.</p> <p>There are no erosion issues along this tributary to Jane Street.</p>	Box Culvert	No issues to the north or south.

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 4 – GO-Barrie (Concord) Station Tributary 1 of the West Don River</p>	<p>Tributary 1 of the West Don River is comprised of a series of ‘channels’ that drain the lands to the west of the main river, particularly through the built-up area (residential and industrial). The tributary itself joins the West Don River approximately 100 metres upstream of the crossing location.</p> <p>The tributary itself upstream of the junction is a rather straight, featureless channel with little or no riparian corridor. There is some minor bank erosion as the tributary attempts to meander, however nothing of significance is noted. There are spots where fines are accumulating in the channel, but these may be temporary depositional zones that could re-entrain during the next storm period.</p> <p>Given that the tributary is comprised of a number of ‘sewersheds’ and drains a relatively large area of impervious lands, the hydrograph for the tributary would be rather peaky in response to storm events.</p>	<p>Does not cross Highway 407 as a tributary, joins the West Don River 100m upstream of the crossing.</p> <p>A 35m span bridge is proposed for the site.</p> <p>Refer to Site 5 comments below.</p>	<p>N/A</p> <p>The proposed 35 m span is appropriate given the size of the channel and the minimal degree of meandering; however review of the detailed design general alignment drawings would be required to ensure no issues.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 5 - GO-Barrie (Concord) Station West Don River</p>	<p>The West Don is an actively meandering, fully-functioning fluvial system. The river meanders along a well-defined corridor upstream of the Highway 407 crossing, though it is 'pinched' at places between the trail system to the east and the industrial area to the west.</p> <p>The river has a series of well-structured riffles and pools and while the tendency to meander near the crossing is apparent, there does not appear to be any significant problems at this time.</p> <p>The river passes beneath Highway 407 through an existing clear span, though the crossing is not perpendicular to the roadway. There do not appear to be any issues with the river migrating beneath the existing structure, though over time the river should be monitored to ensure it does not encroach on the west abutment. The river does expand its width beneath the structure somewhat, but regains a more appropriate cross-section downstream.</p> <p>Downstream the river receives stormwater from the roadway and there is a stormwater management pond outfall within 50 metres of the existing bridge. The river flows along a relatively straight path until it crosses beneath Glen Shields Ave.</p>	<p>Span Bridge</p> <p>Proposed structure is a 70m span bridge.</p>	<p>Upstream issues include the proximity of the River to the existing 407 as well as the angular alignment of the river relative to the crossing. There may be a need to shift the centre of the crossing to accommodate the extension; this can be determined at the detailed design stage.</p> <p>Downstream there are no issues with the river, however, the proposed transitway encroaches into existing ponds. The ponds will be abandoned and new ponds will be constructed clear of the transitway.</p> <p>The proposed 70m span is sufficient for meandering (upstream meander amplitudes are on the order of 45 metres) based on the preliminary design alignment drawings. However review of the detailed design general alignment drawings would be required to ensure no issues.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 6 – East of GO-Barrie (Concord) Station Westminster Creek</p>	<p>Westminster Creek is a straightened drainage system that flows from within industrial areas to the west of Dufferin Street, across the Highway 7/ Highway 407 corridor, and southerly through residential areas to its junction with the West Don River west of Dufferin Street.</p> <p>This watercourse is representative of a dug drainage ditch that appears to be active intermittently during spring melt and after storm events. There are no significant fluvial structures such as riffles and pools either upstream or for a distance of at least 200 metres downstream</p> <p>The primary function of this watercourse appears to be to convey surface runoff to feed the West Don River.</p> <p>There are no significant erosion issues. The creek does not have an opportunity to meander as it is confined in a very narrow corridor upstream of Highway 7.</p>	<p>Box Culvert</p>	<p>There are no fluvial issues relating to the possible extension of the box culvert to either the upstream or downstream channel.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 7 – West of Bathurst Station Unknown Creek/Tributary to East Don River/Baker Sugarbush</p>	<p>This is an ephemeral channel which has little or no form outside the direct contact with the culvert beneath Highway 7 and then Highway 407.</p> <p>It appears from the site visit that the channel diverts to the east immediately downstream of the Highway 7 culvert, and then diverts to the south prior to the apex of the westbound on-ramp from Bathurst Street.</p> <p>The channel emerges again within the radius of the eastbound on-ramp from the southbound lanes of Bathurst Street, then goes underground through another culvert beneath Bathurst.</p> <p>This is not a formal fluvial feature and it acts, when there is flow, primarily as a drainage feature which provides flow volumes, but no considerable sediment, to the East Don River.</p> <p>There is no apparent erosion or meandering along these sections of the creek.</p>	<p>Box Culverts (Highway 7 and Highway 407)</p>	<p>There are no extension issues from a fluvial geomorphic perspective</p>



Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 8 – East of Bathurst Station East Don River West Tributaries 1-2	<p>The further west tributary (it is not clear whether this is Tributary 1 or 2) drains the road runoff from the access road between Bathurst Street and Highway 7. There are some informal channel sections ringing the roadway, but these are representative of drainage channels rather than watercourses. They do, however, deliver flow volumes to the East Don River.</p> <p>The other tributary drains the existing golf course and has for a portion of its upstream area been replaced by an irrigation/hazard pond on the course. Drainage from the pond flows as overland flow across the adjacent fairway, is joined by the other tributary, and goes beneath Highway 7 through an existing box culvert.</p> <p>On the south side of Highway 7 the tributaries emerge within a localized depression that has been classified by LGL as Cattail Mineral Shallow Marsh. This marsh drains through another box culvert beneath Highway 407, emerging into a well vegetated buffer which drains informally to the East Don River.</p> <p>There are no meandering or erosion issues along these tributaries.</p> <p>According to material provided by LGL the proposed crossing is above the existing crossing so there will be no extensions or crossings required,</p>	Box Culvert	N/A

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 9 – East of Bathurst Station East Don River	No analysis required as the Transitway will be located above the existing crossing.	N/A	N/A

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 10 – Yonge Station Pomona Creek	No analysis required as the Transitway will be located above the existing crossing.	N/A	N/A

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 11 – east of Bayview Avenue German Mills Creek	<p>Upstream of Highway 7 German Mills Creek is a naturally-functioning fluvial system within a wide and well-vegetated riparian buffer. Meanders upstream are on the order of 30 metres in maximum amplitude, and there is a wide variety of riffles, runs and pools in this section of the creek.</p> <p>The creek passes beneath Highway 7 through a box culvert, emerging in the space between Highway 7 and Highway 407.</p> <p>In this stretch the creek is open with no climax riparian buffer. It meanders across the small stretch of land, with a maximum amplitude of approximately 25 metres.</p> <p>Upstream of Highway 407 the creek flows through a span opening at an angle which is off perpendicular. This crossing has been assessed in the past by JTBES and it was found that there could be long-term issues with this crossing (for instance flanking of the culvert as the creek meanders over time).</p>	Box at Highway 7, Span at Highway 407	The proposed structure (40 metre span bridge) and its location (downstream and adjacent to Highway 7) affords no specific issues at this stage, based on the preliminary design technically preferred alignment drawings. However review of the detailed design general alignment drawings would be required to ensure no issues.

	Downstream of the Highway 407 crossing the creek again flows through a well-developed riparian valley system.		
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Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 12 – west of Leslie Station Tributary 1 of German Mills Creek	<p>This tributary originates in a pond north of South Park Road and flows through a confined, though vegetated, corridor to the existing box culvert upstream of Highway 407.</p> <p>Downstream of the Highway 407 westbound off-ramp to Leslie Street the tributary emerges, where it flows through a narrow cross-section southward to a corridor within the existing residential development.</p> <p>The tributary is relatively straight and does not appear to be trying to meander, either upstream or downstream of the existing Highway 407 and ramps. There are no areas of erosion concern,</p>	Box Culvert	There are no extension issues from a fluvial geomorphic perspective.

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 13 – east of Highway 404 Tributary 2 of German Mills Creek	The Creek has been enclosed; no analysis necessary.	N/A	N/A

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
<p>Site 14 – west of Warden Avenue Rouge River</p>	<p>This crossing is different in that the creek is flowing across the Highway 407 corridor in a south-to-north direction, so the headwater area is to the south of Highway 407.</p> <p>The upstream creek is a small, meandering ditch that is joined by an actively meandering, rather tortuous channel that is fed by a stormwater pond to the east of the transformer station and the north of the rail tracks. This meandering channel appears to be artificially formed, in that there does not appear to be sufficient energy from the pond to form such a tortuous path.</p> <p>That said, the channel is there and the potential for further meandering exists, so this must be taken into consideration.</p> <p>The ditch and channel become confluent approximately 150 metres upstream of the existing box culvert under Highway 407. North of Highway 407 (the downstream channel) flow exits the culvert and is joined by a series of additional watercourses, including Beaver Creek, and other informal drainage features. The proximity of these watercourses to the existing highway 407 footprint (approximately 70 metres) could raise problems if the north side of Highway 407 is selected as the final preferred alignment.</p> <p>Meandering and erosion are issues at this site. Maximum meander amplitude is on the order of 60 metres.</p>	<p>Box Culvert. Proposed crossing is south of Highway 407 and would be comprised of an 80 metre span.</p>	<p>N/A</p> <p>The proposed 80 m span is appropriate given the size of the channel and the minimal degree of meandering, however review of the detailed design general alignment drawings would be required to ensure no issues.</p>

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 15 – east of Warden Avenue Tributary 1 of Rouge River	No analysis required as the Transitway will be located above the existing crossing.	N/A	N/A

Site Crossing Reference	Existing Conditions	Existing Structure Type	Potential Extension Issues
Site 16 – west of Kennedy Road Tributary 2 of Rouge River	No analysis required as the Transitway will be located above the existing crossing.	N/A	N/A