C

EVALUATION OF ALTERNATIVES

Clarke Road Improvements Schedule C Municipal Class Environmental Assessment ESR

C.1 EVALUAITON OF ROAD ALIGNMENT ALTERNATIVES

Evaluation of Road Alignment Alternatives

Factors/Criteria	Alternative 1 - Widen to the East	Alternative 2 - Widen to the West	Alternative 3 - Widen Symmetrically
	Consists of an 8.8 m centre median between the existing southbound lanes and the new northbound lanes, and a new bridge for the northbound lanes.	**Consists of an 8.8 m centre median between the new southbound lanes and the existing northbound lanes, and a new bridge for the southbound lanes.**	**Consists of an additional lane in each direction, with a wider bridge to accommodate the addition of the new traffic lanes.**
TRANSPORTATION			
Property Accessibility – Impacts to property access served by the corridor – Ease and safety of access to land uses served by the corridor	– High potential to impact the following entrances on the east side of Clarke Road: ○ 1 farm property entrance (1588 Clarke Road/2301 Kilally Road) (to be redeveloped as part of an ongoing subdivision application) - high potential for permanent closure of entrance onto Clarke Road due to proximity to intersection with Kilally Road as a fully controlled intersection. Potential to mitigate impact by relocating farm property entrance to Kilally Road, and/or restrict Clarke Road access to right in/right out only. To be determined during development review process. ○ 1 quarry property entrance (1788 Clarke Road - Lafarge) - high potential to decrease level of service/merge time for southbound left turn movements (longer distance to cross divided median as compared to Alternative 3); potential to restrict Clarke Road access to right in/right out only for safety. – High potential impact to accesses to Hydro One infrastructure on Hydro One owned and easement lands.	– High potential to impact the following entrances on the west side of Clarke Road: ○ 1 farm (1511 Clarke Road – dairy operation) property entrance - high potential for permanent closure of entrance onto Clarke Road due to proximity to intersection with Kilally Road as a fully controlled intersection. Potential to mitigate impact by relocating farm property entrance to Kilally Road, and/or restrict Clarke Road access to right in/right out only. To be determined during development review process. ○ 1 quarry property entrance (1865 Clarke Road – Coco Paving) - high potential to decrease level of service/merge time for northbound left turn movements (longer distance to cross divided median as compared to Option 3); potential to restrict Clarke Road access to right in/right out only for safety. – 1 recreational property (1795 Clarke Road – former Boy Scouts camp) – high potential to reduce driveway length and increase grades due to footprint impacts; high potential to restrict Clarke Road access to right in/right out only.	– Minor grading impacts to all property entrances on east and west sides of Clarke Road. – Moderate potential to decrease merge time for truck movements due to additional through lanes. – Moderate potential to decrease level of service for left turn movements (shorter distance to cross lanes as compared to Alternatives 1 and 2, with elimination of wide median). – Low potential impact to accesses to Hydro One infrastructure on Hydro One owned and easement lands. – 1 farm property entrance (1588 Clarke Road/2301 Kilally Road) (to be redeveloped as part of an ongoing subdivision application) - high potential for permanent closure of entrance onto Clarke Road due to proximity to intersection with Kilally Road as a fully controlled intersection. Potential to mitigate impact by relocating farm property entrance to Kilally Road, and/or restrict Clarke Road access to right in/right out only. To be determined during development review process.
Fire and Emergency Medical Services – Impacts to emergency service response time/access	– Potential delay in emergency services response time due to median – Emergency services can be accommodated by providing a median turnaround restricted to emergency use only.	– Potential delay in emergency services response time due to median – Emergency services can be accommodated by providing a median turnaround restricted to emergency use only.	– No impact to emergency services access or response times.

Legend:

	Most Preferred (relative to each alternative)
	Moderately Preferred (relative to each alternative)
	Least Preferred (relative to each alternative)

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	Consists of an 8.8 m centre median between the existing southbound lanes and the new northbound lanes, and a new bridge for the northbound lanes.	**Consists of an 8.8 m centre median between the new southbound lanes and the existing northbound lanes, and a new bridge for the southbound lanes.**	**Consists of an additional lane in each direction, with a wider bridge to accommodate the addition of the new traffic lanes.**
Vehicle Speed – Impact on vehicle travel speeds	– Potential to increase vehicle travel speeds due to perception of highway configuration versus arterial road configuration.	– Potential to increase vehicle travel speeds due to perception of highway configuration versus arterial road configuration.	– Lower potential to increase vehicle travel speeds due to perception of arterial roadway configuration versus highway configuration.
Active Transportation – Ability to accommodate active transportation facilities	– New sidewalk required on new structure. – Bike lanes or paved shoulder (with or without buffer) can be accommodated.	– Bike lanes or paved shoulder (with or without buffer) can be accommodated.	– Bike lanes or paved shoulder (with or without buffer) can be accommodated. –
Summary of Transportation	**Least Preferred**	**Least Preferred**	**Most Preferred**
CULTURAL ENVIRONMENT			
Archaeological Resources – Approximate number of sites consisting of medium to high archaeological resource potential	– Potential for archaeological finds along corridor (similar potential on either side of the right of way). Phase 1-2 Archaeological Assessment required to confirm potential	– Potential for archaeological finds along corridor (similar potential on either side of the right of way). Phase 1-2 Archaeological Assessment required to confirm potential.	– Potential for archaeological finds along corridor (similar potential on either side of the right of way). Phase 1-2 Archaeological Assessment required to confirm potential.
Cultural Heritage Resources – Potential to impact known built heritage resources (i.e., "listed" on City of London Heritage Inventory, designated under Part IV or V of the Ontario Heritage Act	– Low potential to impact built cultural heritage resources or cultural heritage landscapes; "listed" property located at 1588 Clarke Road is set back from corridor and is located within future plan of subdivision lands.	– High encroachment impacts to "listed" property located at 1511 Clarke Road, including potential impacts to heritage attributes identified on property (south barn and residence). Mitigation such as retaining walls may reduce potential impacts.	– Moderate encroachment impacts to "listed" property located at 1511 Clarke Road; no impacts to heritage attributes identified on property, including south barn and residence.
Summary of Cultural Environment	**Most Preferred**	**Least Preferred**	**Moderately Preferred**
SOCIO-ECONOMIC ENVIRONMENT			
Industrial Uses – Impacts to existing/planned industrial uses, including	– Relatively moderate impact to 1 industrial property (Lafarge) including approximately 5224 m^2 of property frontage; no impacts to existing industrial operations.	– Relatively high impact to 1 industrial property (Coco) including approximately 10477 m^2 of property frontage; no impacts to existing industrial operations. – High potential to impact future extraction plans.	– Relatively low impact to 1 industrial property (Coco) including approximately 2814 m^2 of property frontage; no impacts to existing industrial operations. – Low potential to impact future extraction plans.

Legend:

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	Consists of an 8.8 m centre median between the existing southbound lanes and the new northbound lanes, and a new bridge for the northbound lanes.	**Consists of an 8.8 m centre median between the new southbound lanes and the existing northbound lanes, and a new bridge for the southbound lanes.**	**Consists of an additional lane in each direction, with a wider bridge to accommodate the addition of the new traffic lanes.**
acquisition or expropriation (area m^2)	– Moderate potential to impact future extraction plans. – Mitigation such as retaining walls may reduce potential impacts.	– Mitigation such as retaining walls may reduce potential impacts.	– Mitigation such as retaining walls may reduce potential impacts.
Residential Uses – Impacts to existing/planned residential uses including acquisition, or expropriation (area m^2)	– Impacts to 1 property designated as "Urban Reserve - Community Growth" (1588 Clarke Road) including 3880 m^2 property frontage. No impacts to subdivision concept plan layout. Potential to mitigate impacts through negotiations.	– No anticipated impacts.	– Impacts to 1 property designated as "Urban Reserve - Community Growth" (1588 Clarke Road) including 1750 m^2 property frontage. No impacts to subdivision concept plan layout. Potential to mitigate impacts through negotiations.
Agricultural Uses – Impacts to agricultural uses, including building displacement, acquisition, or expropriation (area m^2)	– Impacts to lands currently being farmed (including Hydro One lands). Farmed land within future plan of subdivision.	– Relatively moderate impacts to 1 agricultural property (1511 Clarke Road), including 2713 m^2 property frontage, and potential displacement of dairy farm building/operation adjacent to Clarke Road.	– Relatively minor impact to 1 agricultural property (1511 Clarke Road), including 765 m^2 property frontage.
Recreational Uses – Impacts to existing recreational uses, including acquisition or expropriation (area m^2)	– Relatively minor impacts to existing (unofficial) access to the Thames River being used by the public for fishing and walking.	– Relatively moderate impact to existing/past recreational property located north of the Thames River, including approximately 4000 m^2 property frontage.	– Relatively minor impact to existing/past recreational property located north of the Thames River, including approximately 343 m^2 property frontage.
Summary of Socio-Economic Environment	**Moderately Preferred**	**Least Preferred**	**Moderately Preferred**
NATURAL ENVIRONMENT			
Vegetation – Impacts to vegetation communities – Impacts to Special Concern and provincially rare plant species	– Direct loss of vegetation will occur on east side of right-of-way where proposed road improvements overlay natural areas; vegetation removal is required to facilitate construction (including temporary and permanent impacts). – Relatively moderate potential to impact provincially rare plant species (Rhombic-Leaved Sunflower – greater impact than Alternative 3) with mitigation measures in place. Prior	– Direct loss of vegetation will occur on west side of right-of-way where proposed road improvements overlay natural areas; vegetation removal is required to facilitate construction (including temporary and permanent impacts). – Relatively moderate potential to impact provincially rare plant species (Weak Bluegrass) with mitigation measures in place. Prior to construction, Weak Bluegrass can be salvaged and relocated to a suitable location.	– Direct loss of vegetation will occur on both east and west sides of right-of-way where proposed road improvements overlay natural areas; vegetation removal is required to facilitate construction (including temporary and permanent impacts). – Relatively low potential to impact provincially rare plant species (Rhombic-Leaved Sunflower – less impact than Alternative 1) with mitigation measures in place. Prior to

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	to construction, Rhombic-Leaved Sunflower can be salvaged and relocated to a suitable location. – Potential to impact edge of Eastern Meadowlark habitat southeast of Clarke Road/Fanshawe Park Road East intersection. Negligible long-term impacts are anticipated.	– Highest potential to impact provincially rare plant species (Hairy Fruited Sedge). Hairy-fruited sedge cannot be easily relocated and should be avoided.	construction, Rhombic-Leaved Sunflower can be salvaged and relocated to a suitable location. – Relatively low potential to impact provincially rare plant species (Weak Bluegrass) with mitigation measures in place. Prior to construction, Weak Bluegrass can be salvaged and relocated to a suitable location. – Moderate potential to impact provincially rare plant species (Hairy Fruited Sedge). Hairy-fruited sedge cannot be easily relocated and should be avoided.
Natural Heritage Features within Thames River Corridor – Impacts to SAR Regulated Habitat for Species at Risk – Impacts to SAR, protected species, Special Concern, provincially rare species/habitat, Significant Wildlife Habitat	– Highest potential to impact nearshore SAR habitat 30m inland from high water mark adjacent to Thames River (regulated habitat) to accommodate construction access on one or both sides of the river. Disturbance to regulated habitat will require permit under the Ontario *Endangered Species Act* (OESA), including preparation of mitigation plan and overall benefit to the species. – Relatively high potential to directly impact SAR (snakes, Spiny Softshell) – Results in direct loss of the following features: ○ Suitable habitat for aquatic SAR (Spiny Softshell, Silver Shiner) ○ Suitable habitat for SAR bats	– Relatively high potential to impact nearshore SAR habitat 30m inland from high water mark adjacent to Thames River (regulated habitat) to accommodate construction access on one or both sides of the river. Disturbance to regulated habitat will require permit under the OESA, including preparation of mitigation plan and overall benefit to the species. – Relatively moderate potential to directly impact SAR (snakes, Spiny Softshell) – Results in direct loss of the following features: ○ Suitable habitat for aquatic SAR (Spiny Softshell, Silver Shiner) ○ Confirmed Significant Wildlife Habitat (amphibian breeding habitat, seeps and springs) ○ Suitable habitat for SAR bats	– Relatively high potential to impact nearshore SAR habitat 30m inland from high water mark adjacent to Thames River (regulated habitat) to accommodate construction access on one or both sides of the river. Disturbance to regulated habitat will require permit under the OESA, including preparation of mitigation plan and overall benefit to the species. – Relatively high potential to directly impact SAR (snakes, Spiny Softshell) – Results in direct loss of the following features: ○ Suitable habitat for aquatic SAR (Spiny Softshell, Silver Shiner) ○ Confirmed Significant Wildlife Habitat (amphibian breeding habitat, seeps and springs) ○ Suitable habitat for SAR bats
Summary of Natural Environment	**Least Preferred**	**Most Preferred[1]**	**Moderately Preferred**

[1] "Widen to the West", in relation to impacts to Regulated SAR Habitat and direct impacts to SAR snakes, was confirmed as most preferred alternative through agency consultation (UTRCA, MNRF).

Legend:

Most Preferred (relative to each alternative)
Moderately Preferred (relative to each alternative)
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ENGINEERING			
Structural Considerations – Opportunities available for widening the existing Clarke Road bridge over the Thames River versus new bridge	– New structure would accommodate future 6 lane configuration. – Existing structure would require widening in future. – Existing structure maintained for southbound traffic has substandard shoulders (for 2 lanes and 4 lanes).	– New structure would accommodate future 6 lane configuration. – Existing structure would require widening in future. – Existing structure maintained for northbound traffic has substandard shoulders (for 2 lanes and 4 lanes).	– Existing bridge structure can be widened; will require a deck or superstructure replacement due to the structure's age and condition. – New width can be set to accommodate standard shoulder widths.
Construction Staging – Potential impact on existing traffic operations during construction	– Relatively low potential to impact existing traffic operations during construction due to off-line work on parallel alignment. – Future 6 lane configuration would be accomplished by widening towards the centre while maintaining traffic on outside lanes.	– Relatively low potential to impact existing traffic operations during construction due to off-line work on parallel alignment. – Future 6 lane configuration would be accomplished by widening towards the centre while maintaining traffic on outside lanes.	– Relatively high potential to impact existing traffic operations during construction due to the need for widening and the deck and superstructure replacement: ○ Three construction stages may be required to maintain two lanes of traffic. ○ Traffic would be immediately adjacent to the work zone, potentially impacting public and worker safety. – Future 6 lane configuration would be accomplished by widening to the outside in two phases by shifting traffic.
Major Services and Utilities – Potential impact to municipal services (watermain) within the corridor – Potential impact to TransCanada Pipeline, Union Gas, London Hydro, Hydro One corridors	– Highest potential to impact services and utilities including full utility relocations (large diameter watermain, Union Gas line and Hydro One transmission line). – High potential to require property owned by Hydro One (Bill 58 Lands) and property with Hydro One easement. – Moderate impacts to utilities at the intersections.	– Impacts to London Hydro south of Kilally Road. – Moderate impacts to utilities at the intersections.	– Low potential to require property owned by Hydro One (Bill 58 Lands). – Low impact to utilities on existing bridge. – Moderate impacts to utilities at the intersections.
Cost – Relative costs in terms of capital and maintenance (includes structural) – Utility relocation	– Highest overall cost ○ Utility and service relocations ($$$$) ○ Structure ($$$$) ○ Retaining walls ○ Property ($$)	– Moderate overall cost ○ Utility and service relocations ($) ○ Structure ($$$$) ○ Retaining walls ○ Property ($$$)	– Lowest overall cost ○ Utility and service relocations ($$) ○ Structure ($$$) ○ Retaining walls ○ Property ($)

Legend:

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– Property acquisition/expropriation			
Summary of Engineering	**Least Preferred**	**Moderately Preferred**	**Moderately Preferred**
OVERALL SUMMARY	**This alternative is most/moderately preferred from a cultural heritage and socio-economic environment perspective. This alternative is least preferred when considering transportation, engineering, and natural environment impacts.**	**This alternative is least preferred when considering transportation, cultural heritage impacts, and socio-economic impacts. From an engineering and environmental perspective, this alternative is moderately preferred.**	**This alternative is moderately/most preferred across all factors; with construction staging noted as high complexity. Natural environment impacts are a concern in the Thames River Corridor (regardless of alternative selected).**
	LEAST PREFERRED	**MODERATELY PREFERRED**	**MOST PREFERRED**

Legend:

	Most Preferred (relative to each alternative)
	Moderately Preferred (relative to each alternative)
	Least Preferred (relative to each alternative)

C.2 EVALUATION OF BRIDGE DESIGN ALTERNATIVES

Evaluation of J.W. Carson Bridge Design Alternatives

FACTORS/CRITERIA	OPTION 1 - REHABILITATE AND WIDEN EXISTING STRUCTURE Involves expanding piers at existing locations, including footings; requires new piers and abutments in ~40 years	OPTION 2 - REPLACE EXISTING STRUCTURE WITH A CLEAR SPAN OPTION No new pier(s) required; existing piers to be removed	OPTION 3 - REPLACE EXISTING STRUCTURE WITH A MULTI-SPAN OPTION Includes 2 and 3 span options with new pier(s)
NATURAL ENVIRONMENT[2]			
Climate Change	– Does not provide opportunity to increase resilience to climate change.	– Provides opportunity to increase resilience to climate change; new bridge to be designed to accommodate changes in climate parameters (i.e., increased episodes of flooding, freezing rain, gale/hurricane force winds).	– Provides opportunity to increase resilience to climate change; new bridge to be designed to accommodate changes in climate parameters (i.e., increased episodes of flooding, freezing rain, gale/hurricane force winds).
Temporary Disturbance to Nearshore SAR Habitats (30m of Highwater Relating to Regulated Habitat)	– Construction access required to nearshore areas on one or both sides of the river. – Would require additional in-water work after ~40 years (i.e., multiple construction events); not recommended by MNRF.	– Construction access required to nearshore areas on north side of river. – Can be accomplished in one construction event. More preferred by MNRF due to single construction/ disturbance event.	– Construction access to nearshore areas on south side and possibly the north side of river. – Can be accomplished in one construction event. More preferred by MNRF due to single construction/ disturbance event, but more overall short-term impact than clear span option.
Permanent Impacts to SAR in Nearshore Habitats	– Yes, requires expanded abutments/piers in nearshore and in-water areas on both side of the river, resulting in some permanent impacts to SAR in nearshore habitats.	– Yes, requires new piers in nearshore areas on north side of river, resulting in some permanent impacts to SAR in nearshore habitats.	– May include new piers in nearshore areas on south side of river, which may result in some permanent impacts to SAR in nearshore habitats.
Permanent Removal of Aquatic SAR Habitat	– Requires expanded piers in water, which would result in some permanent construction impacts.	– No new in-water structures (may require removal of existing structure), which may result in the least permanent construction impacts over other alternatives.	– Requires new piers in water, which would result in the most permanent construction impact over other alternatives.
Permanent Impacts/ Disturbance to Significant Wildlife Habitat (SWH)	– Bridge widening may displace SWH on northwest bank of river; negligible impact resulting from piers.	– Bridge widening may displace SWH on northwest bank of river; negligible impact resulting from piers.	– Bridge widening may displace SWH on northwest bank of river; negligible impact resulting from piers.
Summary of Natural Environment	**Least Preferred**	**Most Preferred**	**Moderately Preferred**
CONSTRUCTION			
Construction Duration	– 2 years.	– 3 years.	– 2 years.

[2] Note: Natural Environment evaluation criteria for J.W. Carson Bridge Design Alternatives revised from evaluation criteria for Road Design Alternatives based on relevance to the Thames River Corridor.

Legend:

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- Least Preferred (relative to each alternative)

FACTORS/CRITERIA	OPTION 1 - REHABILITATE AND WIDEN EXISTING STRUCTURE Involves expanding piers at existing locations, including footings; requires new piers and abutments in ~40 years	OPTION 2 - REPLACE EXISTING STRUCTURE WITH A CLEAR SPAN OPTION No new pier(s) required; existing piers to be removed	OPTION 3 - REPLACE EXISTING STRUCTURE WITH A MULTI-SPAN OPTION Includes 2 and 3 span options with new pier(s)
Erection Method	– New girders would be launched from abutments resulting in less complex mobilization than the clear span option.	– Cranes would be used to install arch and framing, adding mobilization time and complexity.	– New girders would be launched from abutments, involving less complex mobilization than the clear span option.
Overall Complexity	– Moderate degree of complexity with respect to bridge design and construction.	– High degree of complexity with respect to bridge design and construction.	– Least complex design and construction.
Traffic Impacts During Construction	– Can maintain 2 lanes of traffic during construction.	– Unable to maintain traffic during year 2 of construction.	– Can maintain 2 lanes of traffic during construction.
Summary of Construction	**Moderately Preferred**	**Least Preferred**	**Most Preferred**
DURABILITY/FUTURE MAINTENANCE			
Bridge Lifespan	– Existing bridge/piers have a remaining life of ~40 years.	– Lifecycle of 75+ years.	– Lifecycle of 75+ years.
Future Bridge Maintenance	– Additional future maintenance requirements for rehabilitated portion of bridge.	– Potential for additional maintenance requirements over multi-span bridge, due to exposed members above deck level (recoating, etc.).	– Least overall long-term maintenance requirements.
Summary of Durability/ Future Maintenance	**Moderately Preferred**	**Least Preferred**	**Most Preferred**
ECONOMIC			
Capital Costs (6 Lane Bridge and Roadworks)	$10.4	$32.3M	$15.2M
General Lifecycle Cost	$12.9M	$33.2M	$16.4M
Summary of Economic	**Most Preferred**	**Least Preferred**	**Moderately Preferred**
OVERALL SUMMARY	**MODERATELY PREFERRED**	**LEAST PREFERRED**	**MOST PREFERRED**

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