Appendix 10

Implementation of Electrification Options

December 2010

METROLINX

An agency of the Government of Ontario

APPENDIX 10

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Prepared for:

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1. INTRODUCTION

The implementation of the Electrification Options on the existing GO network that is an operating railway presents a number of challenges. Each option has been considered with regard to the assumptions listed below and the information gathered during the Baselining exercise as presented in Appendix 3 of this report.

2. KEY ASSUMPTIONS

The following key assumptions have been made when considering the implementation of each option.

- **Reference Case Infrastructure**
  It is assumed that the infrastructure construction work that is planned in the reference case will have been completed before any electrification construction work takes place. It is also assumed that the increases in the service levels proposed in the Reference Case will be operating whilst the electrification construction work is taking place.

- **Timing**
  For each option the sequencing of each section has been carefully considered taking into account the potential disruption to the GO service. It is assumed that up to 2 construction fronts would be allowed at any one time.

- **Availability of track**
  In discussions with GO it was agreed that the access to the track for overhead working would be restricted to non service periods of operation, and that limited access for working adjacent to the track such as foundation installation or utility diversions would be permitted where the number of tracks allows working on one track with a flagging operation controlling the other tracks.

- **Union Station**
  The current refurbishment of Union Station is assumed to have been completed with sufficient room having been allowed vertically for the installation of the over head catenary system. It is assumed that sufficient working space and access would be allowed within the Union Station trainshed during the operational periods of the GO service to allow grounding work to be carried out. Installation of the electrical system would be carried out when service levels permit, or during non working hours. It is assumed that the issues relating to heritage and conservation have been discussed during the EA of the current refurbishment, and that there are no unforeseen restrictions.

  Examination of the available drawings suggests that there is sufficient room for an overhead catenary system to be installed, but a detailed survey and design is required to confirm this assumption.

- **ARL**
  The ARL service is assumed to be fully operational to the timetable proposed and that no restrictions to the service will be allowed. Work will be carried out during non service periods, and on adjacent tracks as permitted. The design of the equipment to be installed on the elevated sections of the ARL spur to the Airport will require coordination and agreement from GTAA. It is assumed that preliminary agreement will have been obtained during the construction of the spur, and that the support details incorporated during the spur construction would be available to the design team for electrification.

- **Maintenance Facilities**
  It is assumed that the proposed new maintenance facility at Whitby would be fully functional and equipped for diesel train operation, but constructed to accommodate the future provision of electrification including all grounding within the building, the necessary clearances for OCS, the provision of overhead crainage that can accommodate or be modified to accommodate the OCS within the building and the space required for the installation of the specific maintenance equipment required by the electric locomotives.

  The conversion of the maintenance facilities varies for each option and assumes that with the exception of Option 2 - Lakeshore the electric GO Trains and ARL trains would be serviced at Willowbrook, and then as the electrification reaches the East Yard at Whitby it would be converted and used as the service levels increase.

  The decommissioning of any layover equipment and diesel refuelling is assumed to take place only in Option 18, when the diesel service is phased out. The electric trains would be shunted in and out of the maintenance shed at Willowbrook by a converted existing diesel locomotive, and that this would be replaced by a new smaller more efficient diesel locomotive in option 18 as all the existing diesel locomotives are phased out.

- **Working Hours**
  The working hours for construction are limited to non service hours, restricted flagged working on corridors where the number of tracks allows, and a limited number of planned track occupancy, specifically for activities such as the replacement or jacking of overhead structures.

- **Reference Case service levels**
  The Reference Case increases the frequency of trains on each corridor to 2 way all day service which significantly reduces the available working time. It is assumed that planned track occupancy would be allowed and approved by the owners of the track and the operating companies when required to allow efficient delivery of the electrification contracts.

- **Environmental Assessments**
  As part of the preliminary design for each option an Environmental Assessment will be carried out. Where the option involves more than 2 corridors, a series of submissions would be made as the project progresses. This is shown on the indicative schedule in Appendix 10A.

- **Stakeholder Engagement**
  Stakeholder engagement will be carried out throughout the design and construction of the project.

- **CN / CP constraints**
  The GO rail network corridors are owned by GO, CN and CP, as shown in Figure 1 and all 3 companies operate train services on all of the corridors. Construction work on each corridor will require the detailed design and construction proposals to be reviewed and agreed before construction contracts are awarded. Required working arrangements will need to be coordinated to meet the requirements of GO, CN and CP and incorporated into the design and construction contracts.

  The indicative schedule assumes that these discussions take place during the preliminary design phase of each option as design proposals are being developed and before the environmental assessment is submitted.

- **Purchase of Locomotives**
  Locomotive design and procurement would not start until after the Environmental Assessment has been approved and would be separate contracts for the procurement of the Electric Locomotives for GO service and the retrofitting of the ARL trains.

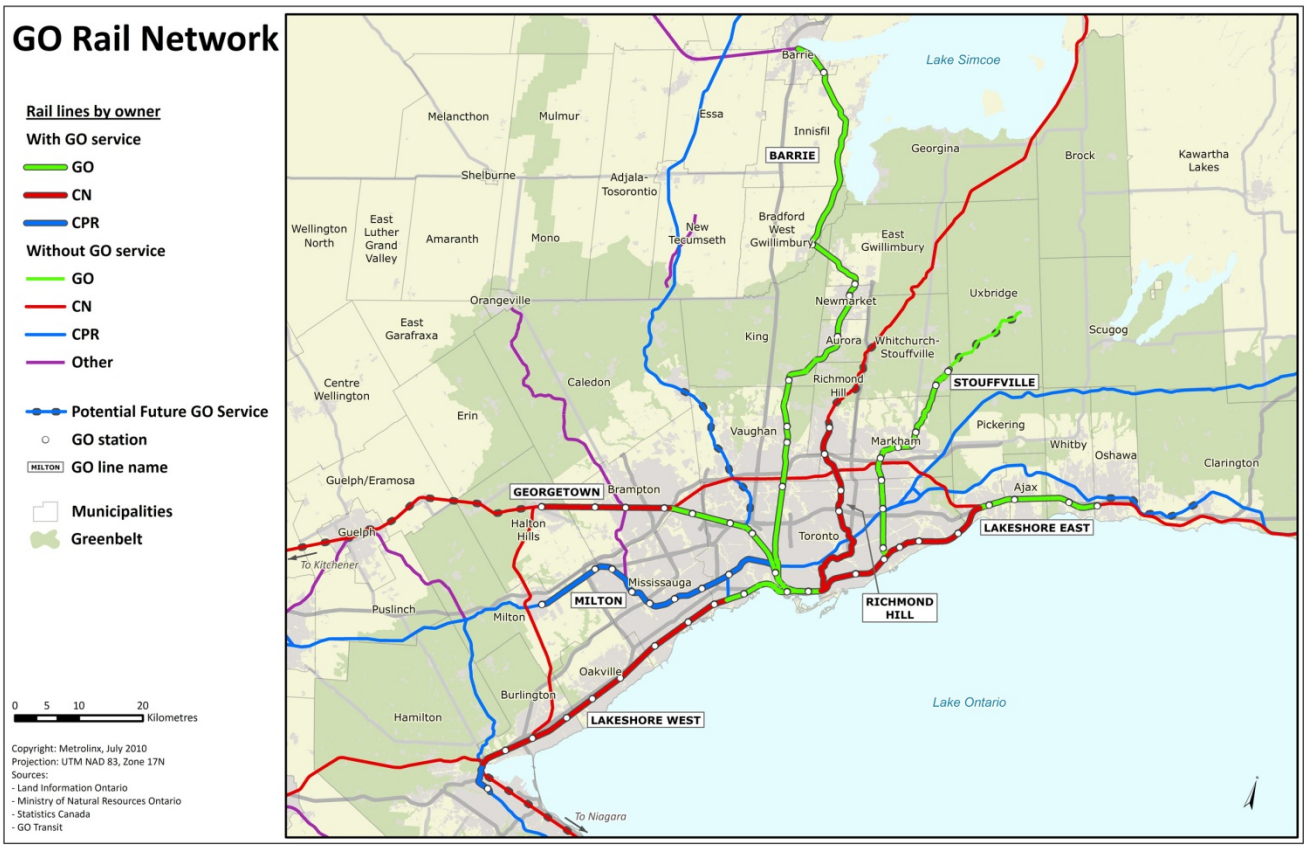
- **Construction Sequence**
  For operational requirements all tracks within the Union Station Rail Corridor either West or East will be electrified for every option. This allows for the unplanned closure of a switch or section of track in the approaches to Union Station and reduces delays to scheduled services.

- **Construction Packages**
  The construction packages may be split into scope specific packages and then into specific sections, for example;

  - Enabling Works.
  - Power Systems OCS Work .
  - Supply contract for the substations.
  - Signals system upgrades across the whole electrified network in conjunction with CN.
  - Ontario Hydro would be responsible for the connection of each substation to the Grid.
  - Maintenance and storage facilities upgrades excluding the installation of the OCS.

- **Corridor Ownership**
  The complexity of the ownership of each corridor is shown in Figure 1 below. The selection of each construction section and the determination of the sequence of phasing each option considered the ownership and interaction with the train services operated on each line. Detailed proposals would be developed with the owners of each corridor during the preliminary design stage and stakeholder consultation. The planning of the construction sequence and hours or working would take this into account.

Figure 1: GO Rail Network Corridor Ownership map

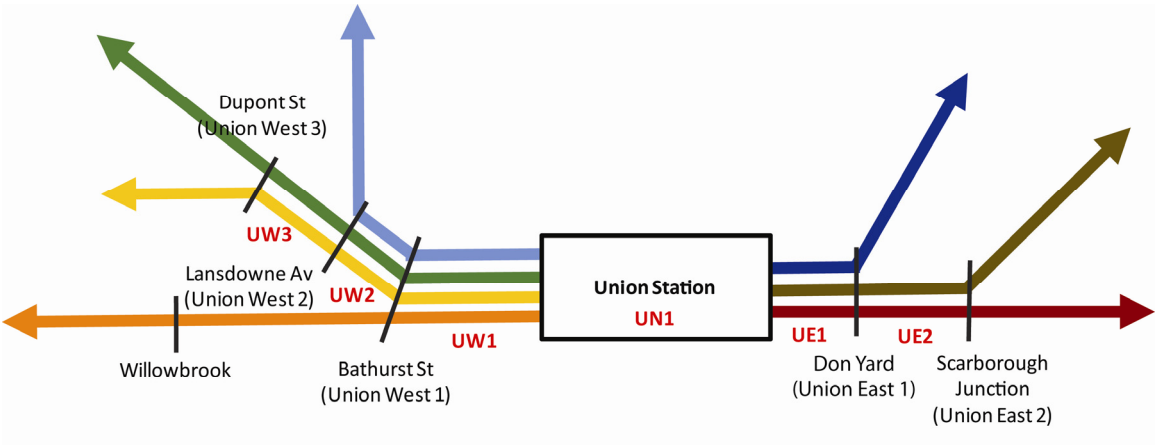


2.1. Construction Phases

The schematic below shows the entire GO network at the time of Electrification. Each corridor has been divided into corridor sections and these are indicated e.g. LW1, LW2 etc. These corridor sections were derived from the service schedule and have been used to determine the construction phases.

Figure 2: Network schematic showing Corridor sections

Figure 3: Union Station Diagram



3. CONSTRUCTION SEQUENCE

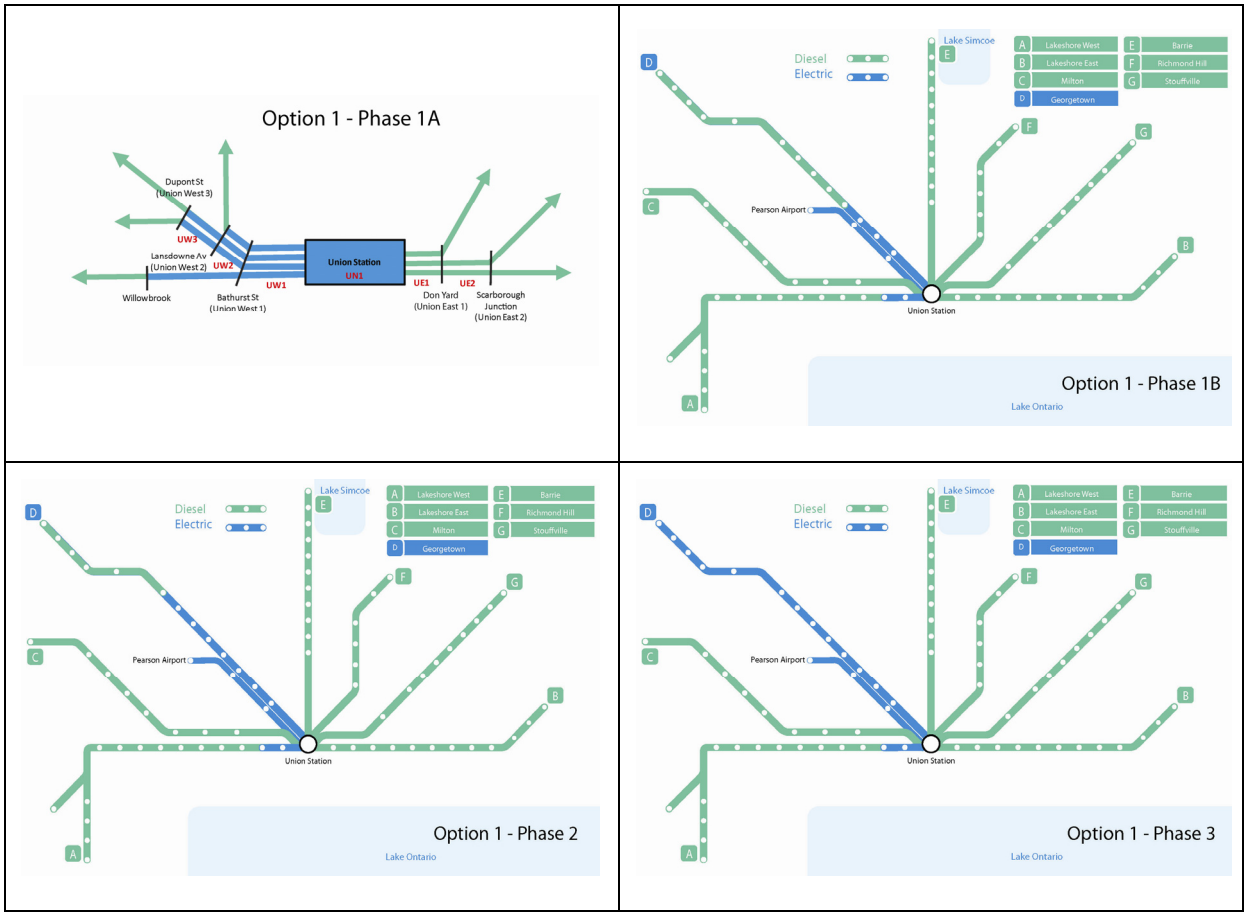
The construction sequence for each of the 6 options has been divided into phases and these are shown below in a series of schematic diagrams for each option. An implementation schedule for each option has been developed and this is in Appendix 10B.

3.1. Option 1 – Georgetown

Option 1 consists of 5 phases as shown below.

- Phase 1A from Union Station to Willowbrook Maintenance Facility and the West Toronto Diamond.
- Phase 1B could start at the same time as Phase 1A progress westward along the Georgetown Corridor to the airport spur and Pearson Airport. Once completed an electrified service would be implemented on the ARL.
- Phase 2 would follow completing the section to Bramalea, allowing a scheduled service to start for trains to Brampton.
- Phase 3 follows Phase 2 and when completed would allow the electrified service to be extended to Georgetown and Kitchener.

Figure 4: Phase 1A to Phase 3 for Option 1 - Georgetown

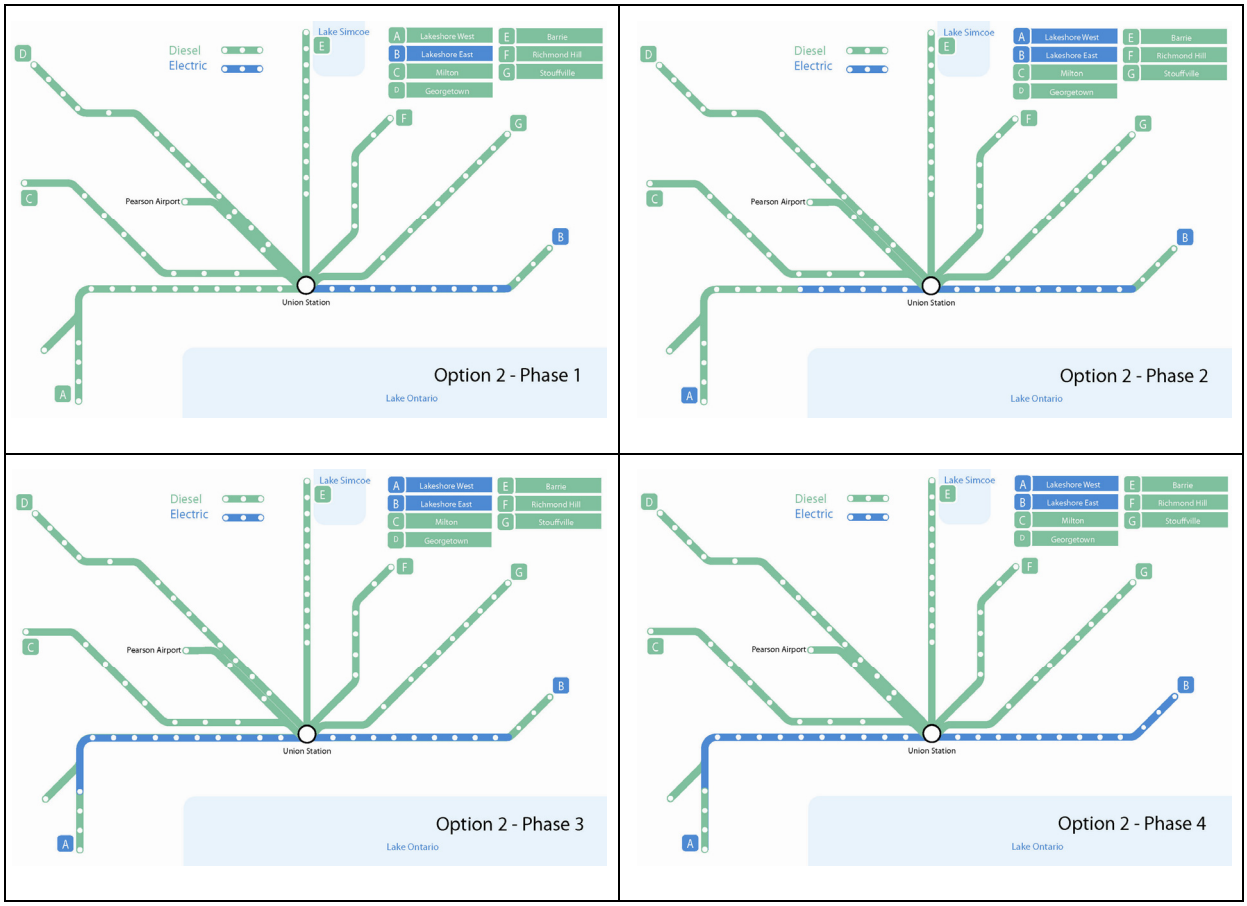


3.2. Option 2 – Lakeshore

Option 2 consists of 4 phases as shown below.

- Phase 1 from Union Station eastwards to the Whitby Maintenance Yard and Oshawa. Once completed the electrified service would be implemented to Oshawa.
- Phase 2 from Union Station westward to Oakville. Once completed the electrified service would be implemented to Oakville and allow a through service at Union Station where scheduling permits.
- Phase 3 follows on from Phase 2 extending the electrification to eastward Hamilton James, and allowing the electrified service to be extended to Hamilton James.
- Phase 4 extends the electrification to Bowmanville and once completed the electrified service would be available along the full extent of the electrified sections of the Lakeshore line.

Figure 5: Phase 1 to Phase 4 for Option 2 - Lakeshore

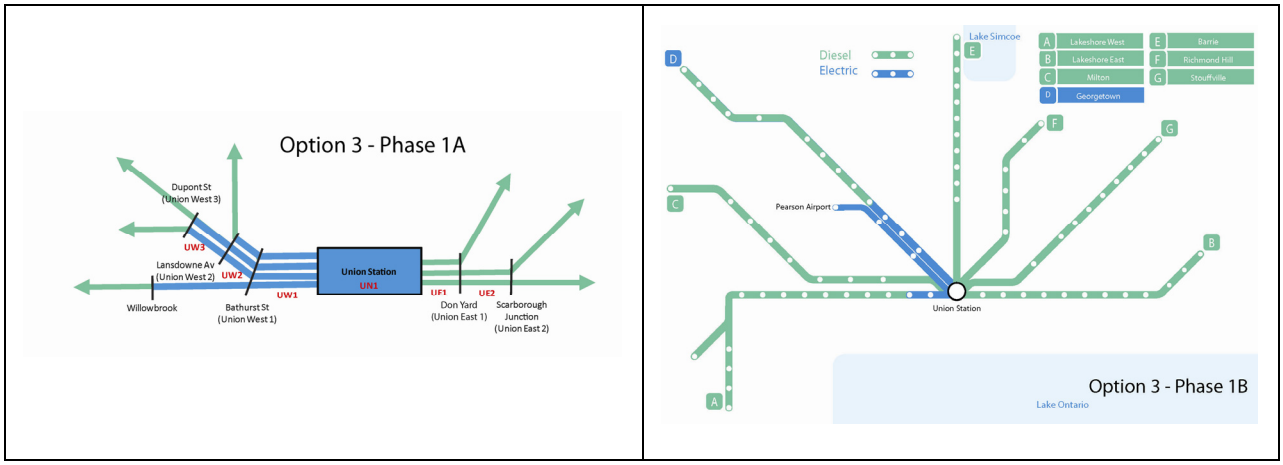


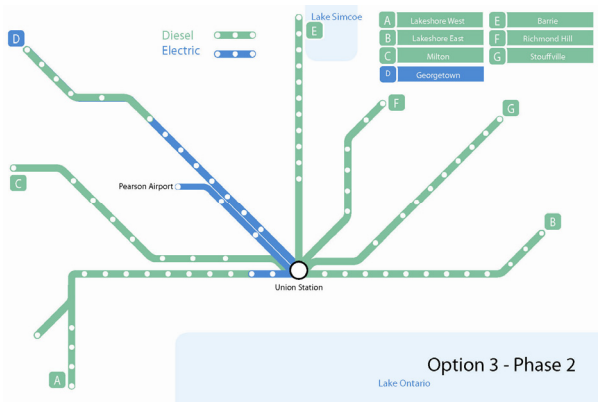
3.3. Option 3 – Lakeshore and Georgetown

Option 3 consists of 9 phases as shown below.

- Phase 1 from Union Station to Willowbrook Maintenance Facility and the West Toronto Diamond.
- Phase 1B would start at the same time as Phase 1A progress westward along the Georgetown Corridor to the airport spur and Pearson Airport. Once completed an electrified service would be implemented on the ARL.
- Phase 2 would follow completing the section to Bramalea, allowing a scheduled service to start for trains to Brampton.
- Phase 3 from Union eastwards to the Whitby Maintenance Yard and Oshawa. Once completed and the electrified service would be implemented from Union Station to Oshawa.
- Phase 4 from Union Station westward to Oakville. Once completed the electrified service would be implemented to Oakville and allow a through service to Oshawa where scheduling permits.
- Phase 5 follows on from Phase 4 extending the electrification to eastward Hamilton James, and allowing the electrified service to be extended to Hamilton James.
- Phase 6 extends the electrification to Bowmanville and once completed the electrified service would be available along the full extent of the electrified sections of the Lakeshore line.
- Phase 7 from Bramalea extended to Kitchener and the implementation of a full electrified service on the Georgetown line.

Figure 6: Phase 1A to Phase 7 for Option 3 – Lakeshore and Georgetown

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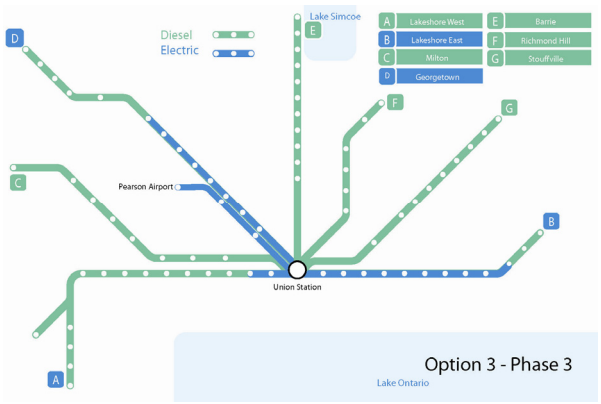
Option 3 - Phase 2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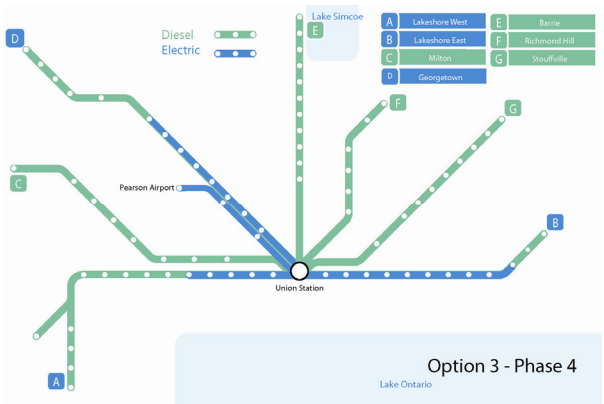
Option 3 - Phase 3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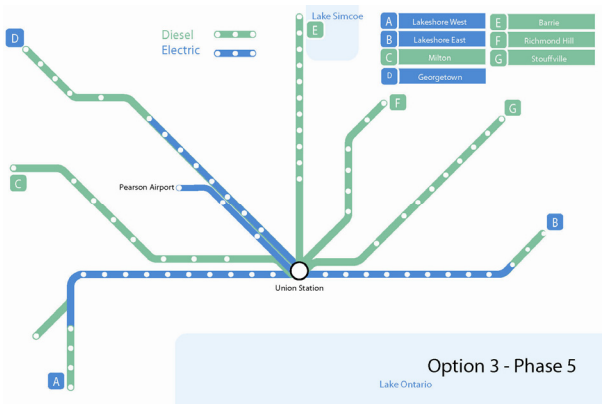
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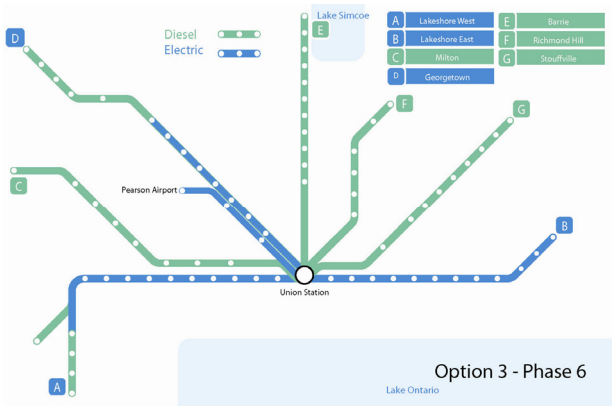
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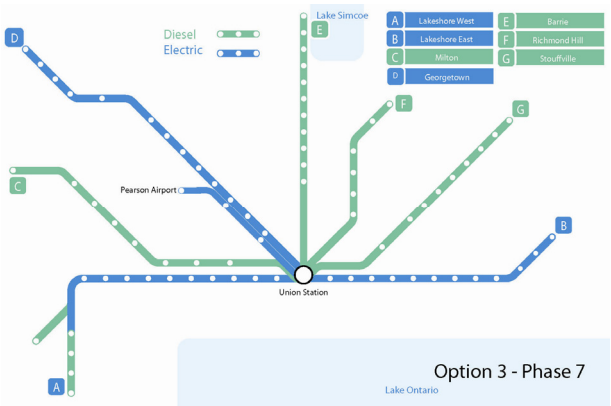
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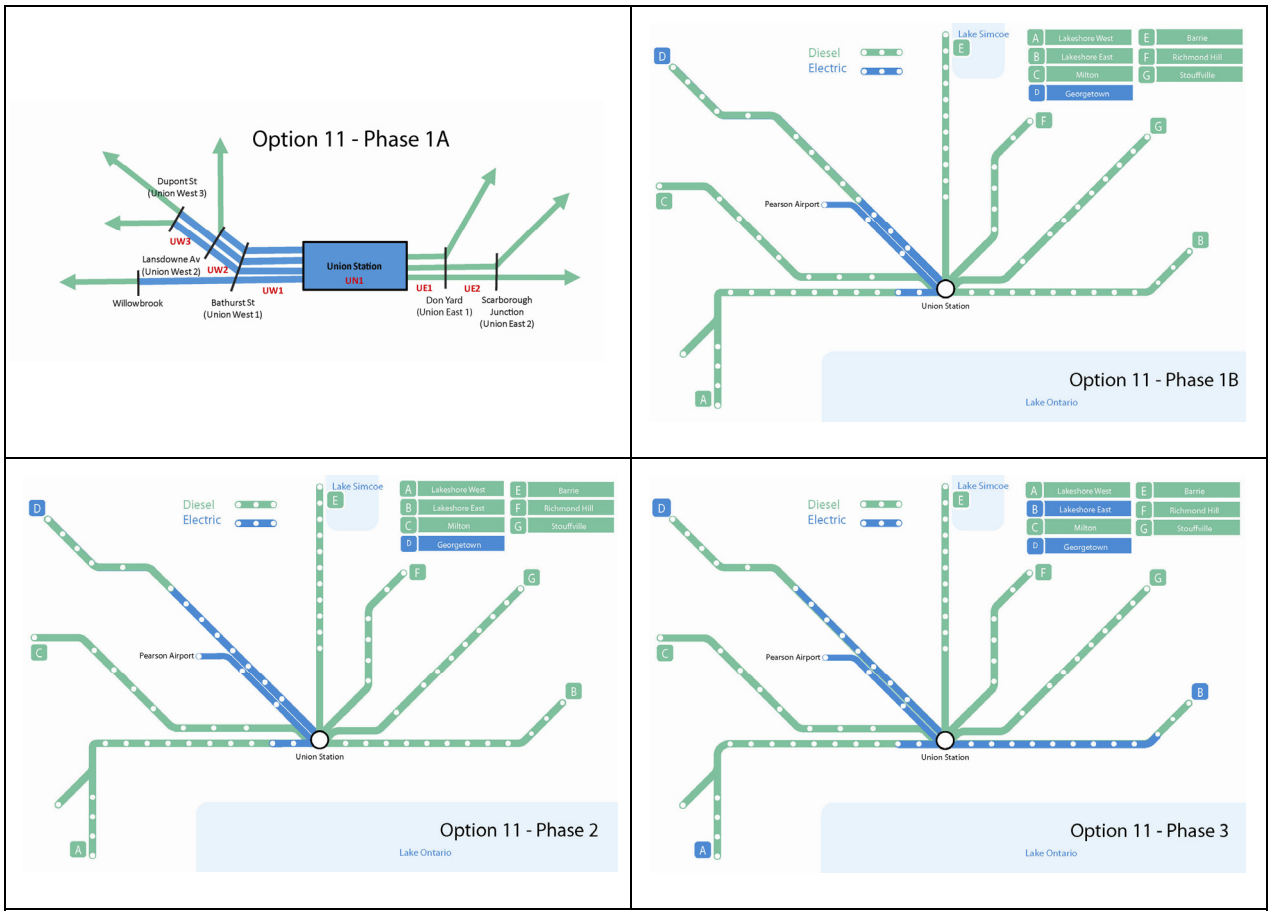
Lake Ontario
Option 3 - Phase 7

3.4. Option 11 – Lakeshore, Georgetown, and Milton

Option 11 consists of 11 phases as shown below.

- Phases 1 through 8 are constructed the same as Option 3.
- Phase 9 would follow on the Milton Line from West Toronto to Meadowvale permitting electrified service to Meadowvale.
- Phase 10 would follow completing the line to Milton.

Figure 7: Phase 1A to Phase 9 for Option 11 – Lakeshore, Georgetown and Milton

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Option 11 - Phase 4
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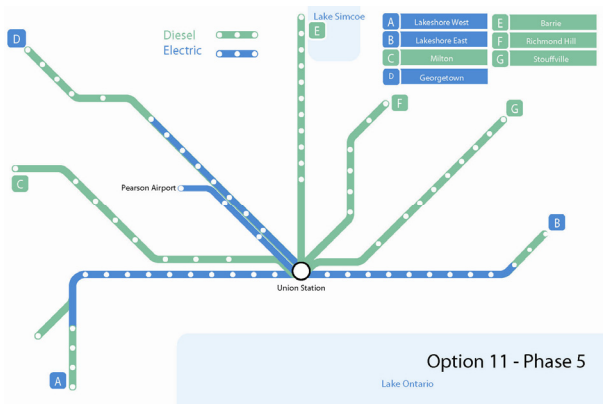
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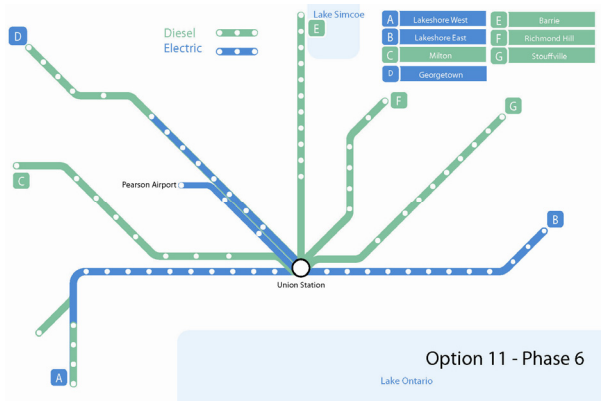
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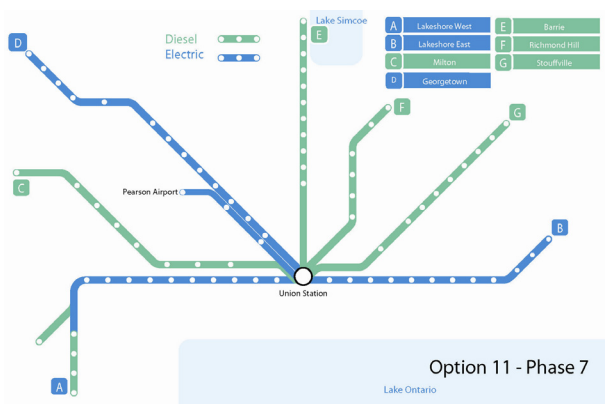
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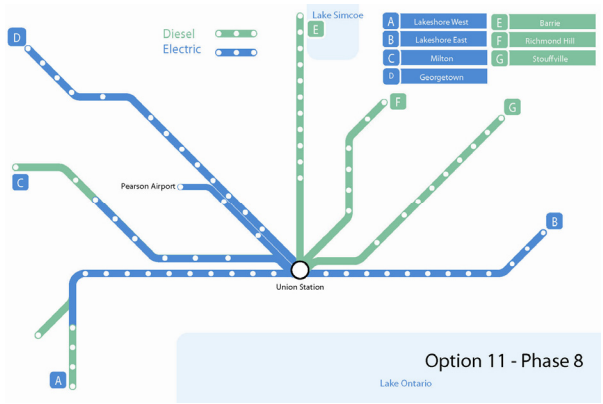
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Option 11 - Phase 8
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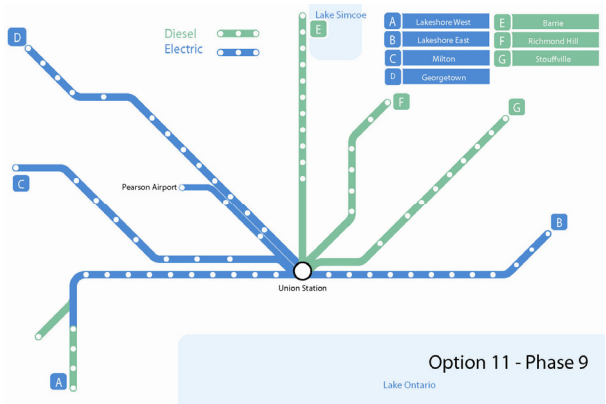
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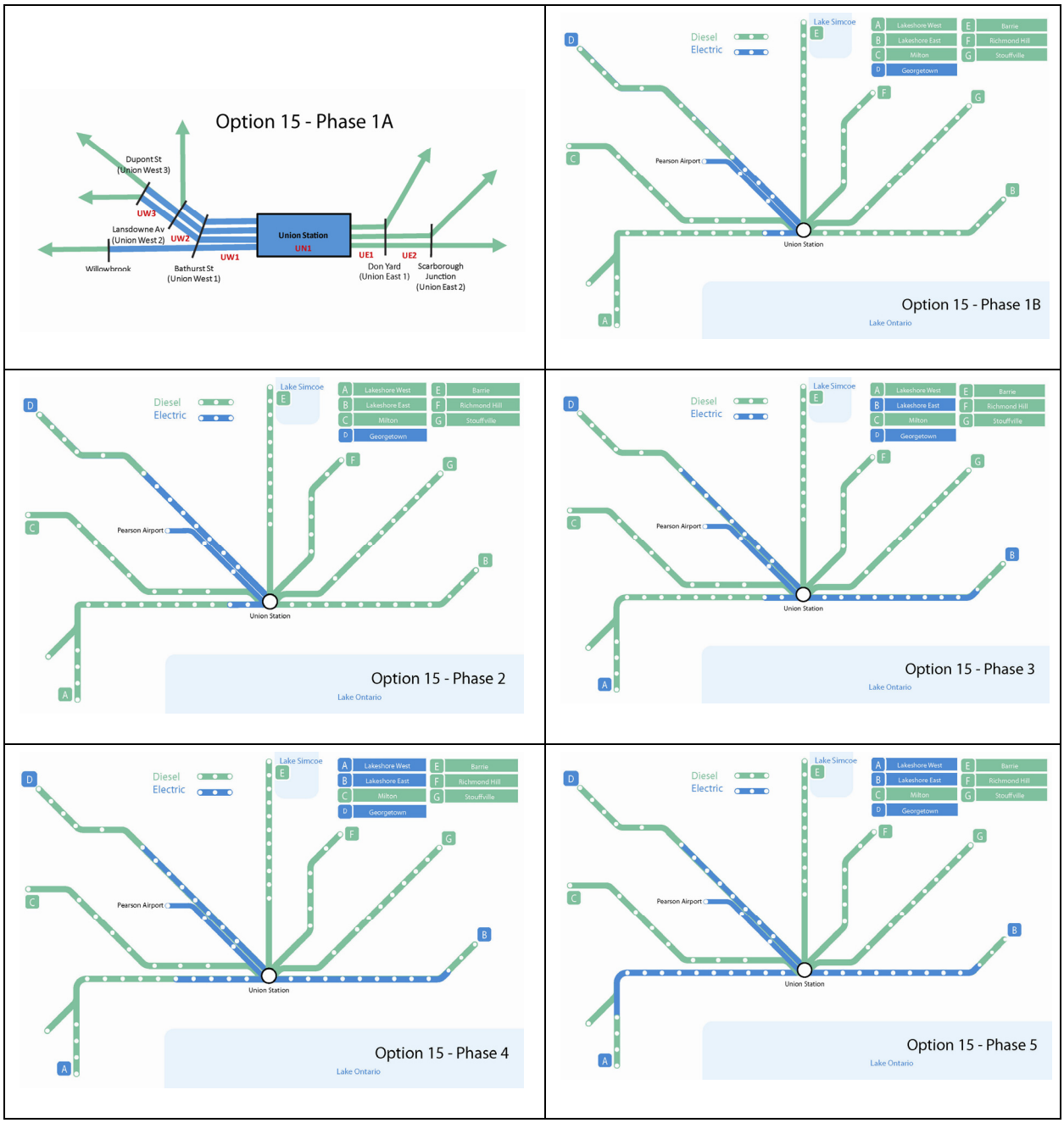
Union Station
Option 11 - Phase 9
Lake Ontario

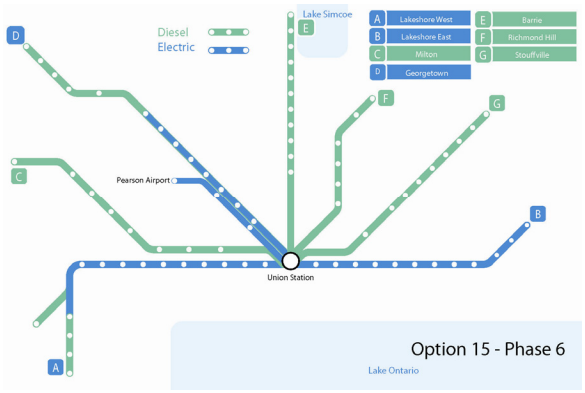
3.5. Option 15 – Lakeshore, Georgetown, Milton and Barrie

Option 15 consists of 13 phases as shown below.

Phases 1 through 10 is constructed in the same sequence as Option 11, and then continues along the Barrie Line in 2 stages; Phase 11 to Bradford and then Phase 12 completing the line to Allendale.

Figure 8: Phase 1A to Phase 11 for Option 15 – Lakeshore, Georgetown, Milton and Barrie

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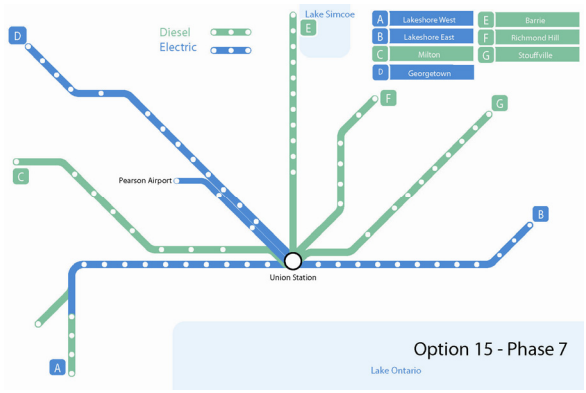
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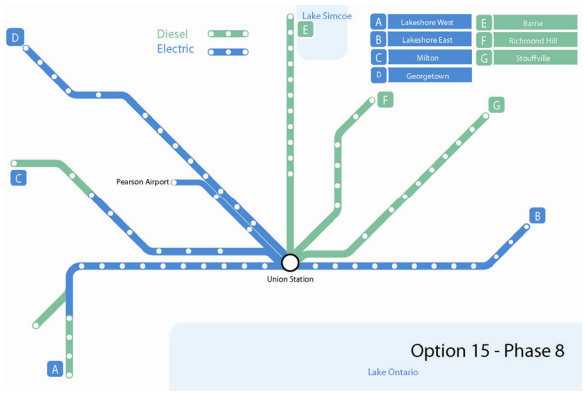
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Option 15 - Phase 8
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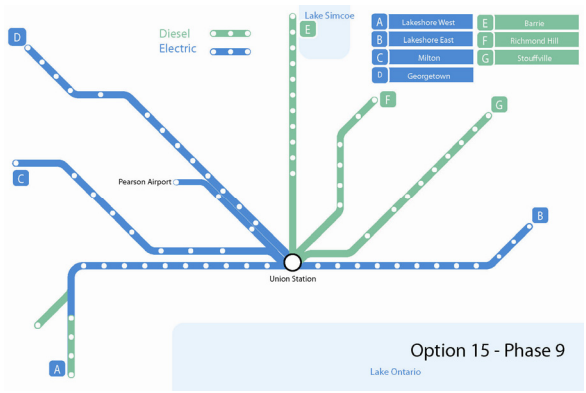
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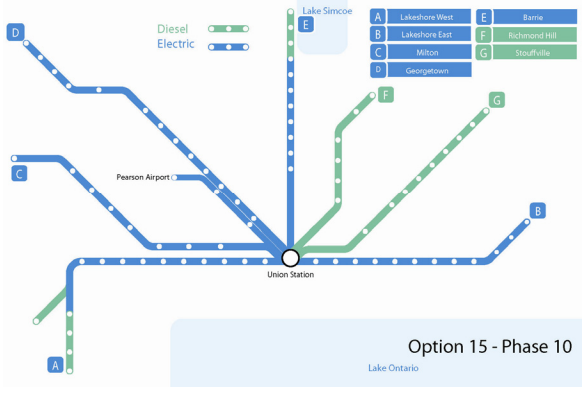
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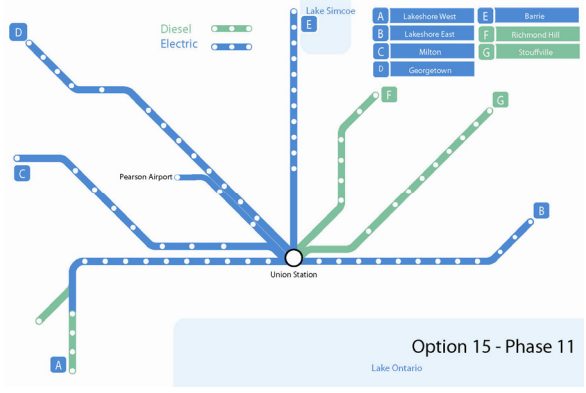
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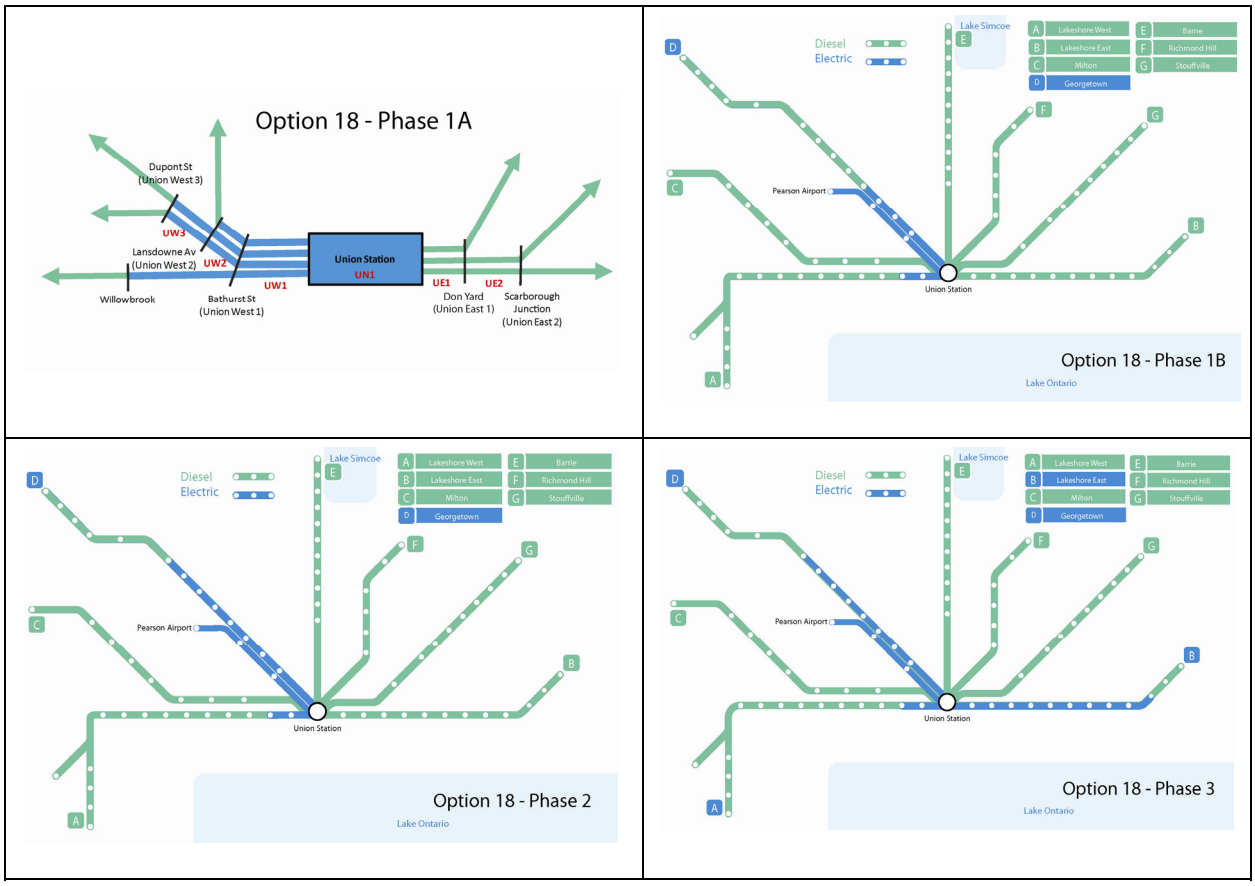
G Stouffville
Pearson Airport
Union Station
Option 15 - Phase 11
Lake Ontario

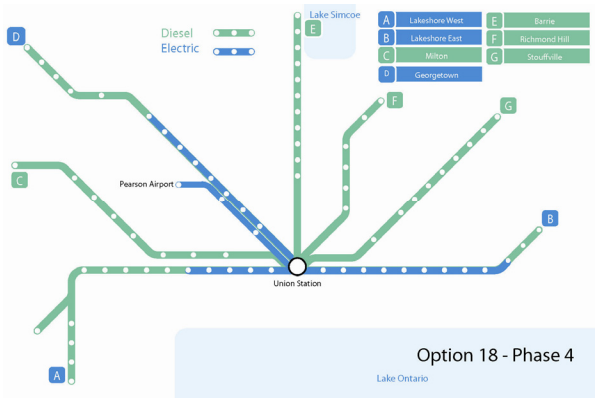
3.6. Option 18 – All Corridors

Option 18 consists of 19 phases as shown below.

- Phases 1 through 12 are constructed in the same sequence as Option 15, followed by Phase 13 and 14 along the Stouffville Line to Lincolnville:
- then by Phases 15 and 16 to Bloomington on the Richmond Hill Line;
- then by Phase 17 to Hamilton TH&B on the Lakeshore Line; and,
- finally Phase 18 to St. Catherines on the Lakeshore Line.

Figure 9: Phase 1A to Phase 17 for Option 18 – All Corridors

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Option 18 - Phase 4
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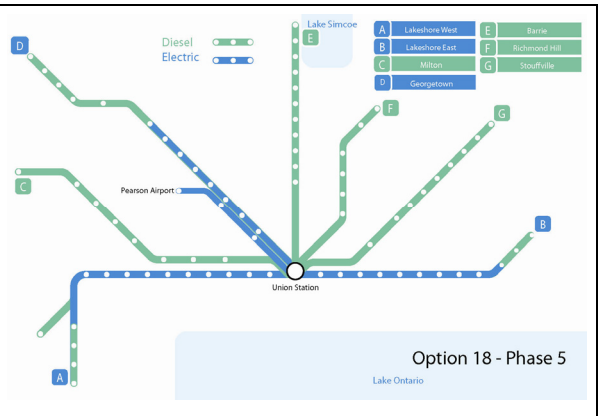
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Option 18 - Phase 5
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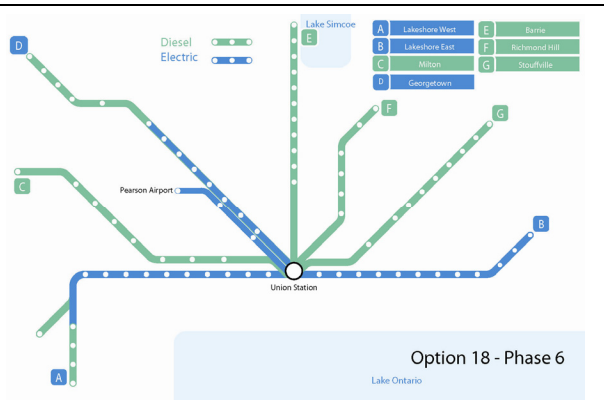
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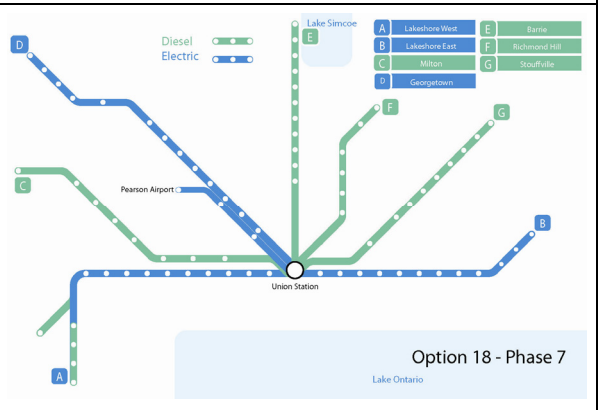
Union Station
Option 18 - Phase 6
Lake Ontario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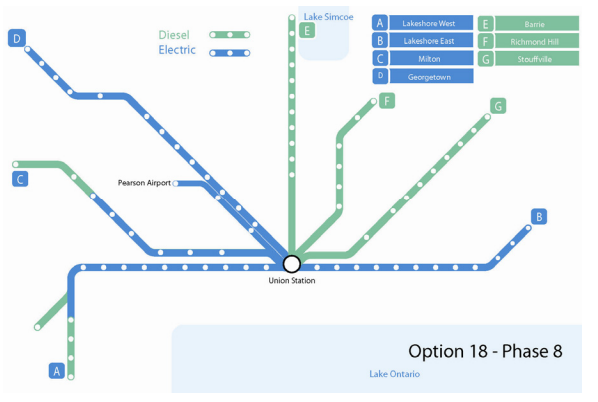
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Option 18 - Phase 8
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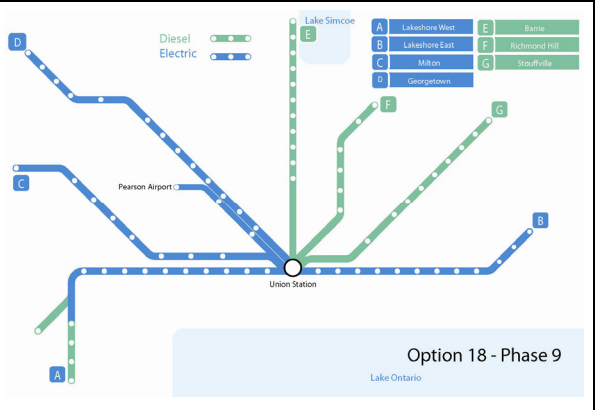
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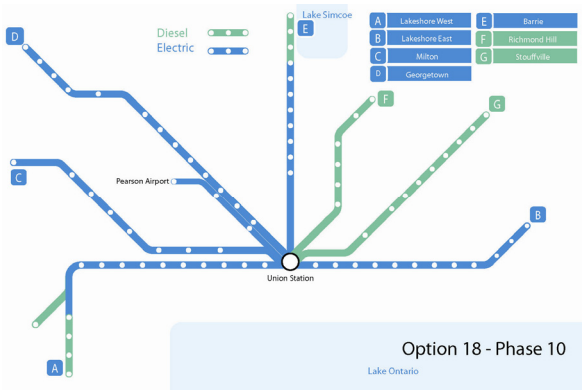
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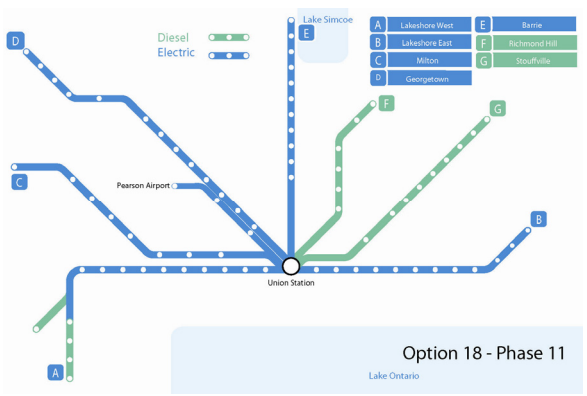
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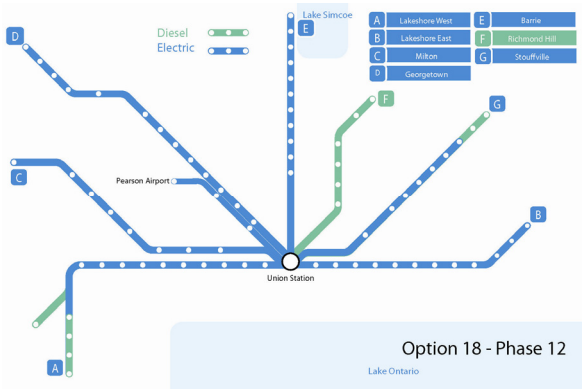
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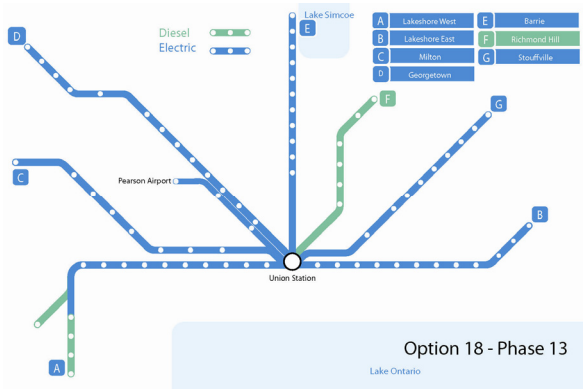
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Lake Ontario
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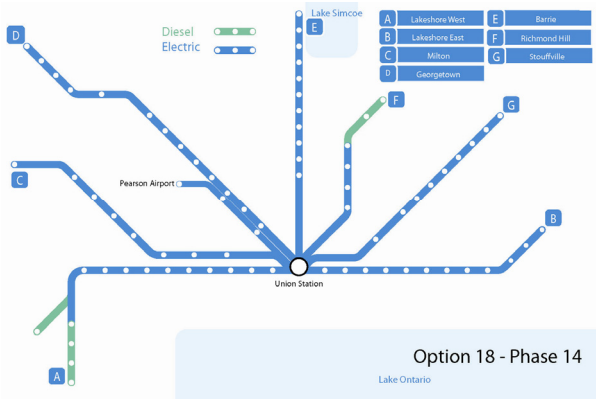
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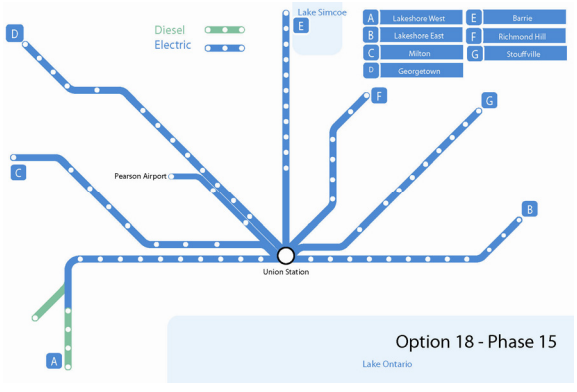
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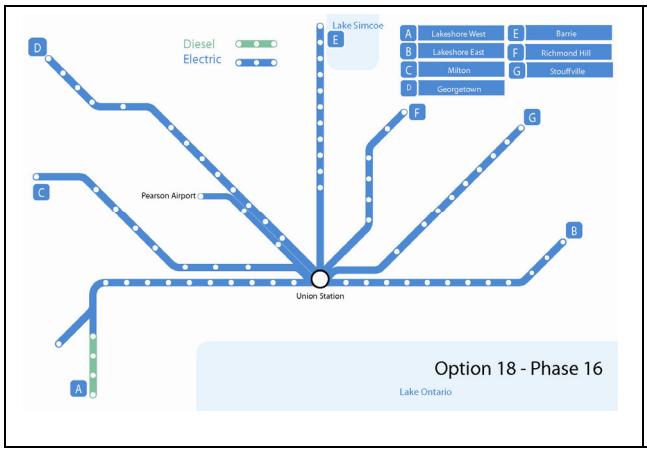
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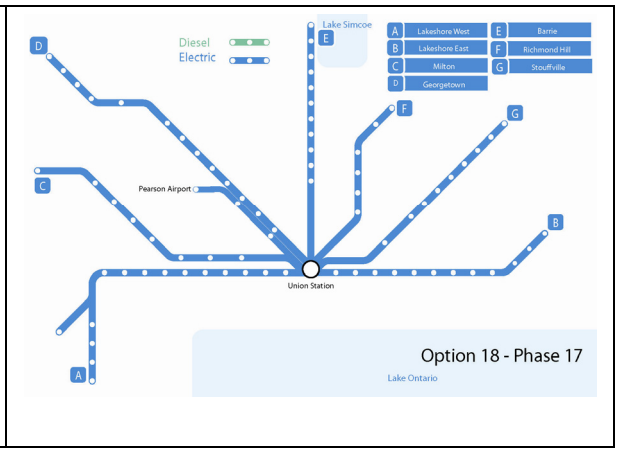
Option 18 - Phase 16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Lake Ontario
Option 18 - Phase 17

4. IMPLEMENTATION SCHEDULE

The Implementation Schedule in Appendix 10A is indicative and has been developed based up on the assumptions and the sequencing of each option shown above, and in discussion with GO.

Longer periods have been allowed for specific sections where the complexity and service schedule indicate construction access will be limited such as the Union Station Corridor and the section that includes the tunnels and bridges outside of Hamilton.

The preliminary design stage will develop the schedule further, as and when the specific requirements of GO, CN, CP, Hydro One and other stakeholders are known.

The schedule shows that a corridor is completed and the network electrified, tested and commissioned before construction work is commenced on the next corridor to reduce the risk of service interruption.

The schedule has been developed considering the following activities:

4.1. Project Inception

The project will require the formation of a project team within GO to initiate the process of engaging a Design Consultant.

4.2. Stakeholder Engagement

GO is committed to engaging proactively with all the stakeholders including;

- Consultation with CN and CP
- Community along the corridors
- Municipalities along the corridor
- GTAA

4.3. Preliminary Design – Infrastructure and enabling works

The Preliminary Design will identify all the parameters and gather the data to enable the design to be completed up to the EA submission level.

- Design information for bridge modifications and the track lowering including all overhead structures. Liaise and seek approval where required from all Agencies and owners.
- Topographical Survey Data: A detailed survey of the right of way for the option being designed and will include the zone 250 m either side of the ROW. The survey will locate and identify the right of way (ROW) boundary, all utilities, metal structures and utilities that may require grounding, all stations, buildings in the ROW, road bridge, pedestrian bridges, signal bridges and gantries and other overhead crossings. Details of vertical and horizontal clearances, embankments, cuttings and culverts are required. A survey contract will be required to supplement data not available from GO/CN/CP will be required.

- Geotechnical Investigation: - Geotechnical data will be required for the whole length of the ROW to facilitate foundation and grounding design. A review of the existing data will be carried out and supplementary investigations carried where necessary.
- Union Station and all stations: identify all items that need grounding and prepare a preliminary design for the grounding infrastructure. (Note even though the OCS may not go into the Station proper we would need to examine the consequential effects and mitigate them.
- Union Station Rail Corridor: identify the property boundaries and ownership, all grounding requirements.
- Willowbrook Maintenance Facility: identify all items that need grounding and prepare a preliminary design for the grounding infrastructure.
- Identify the OCS support positions and verify ground conditions and preliminary foundation design, including available land within the ROW or design alternatives where land is not available.
- Locate and identify every utility within the ROW and prepare relocation details and assist GO with the negotiation and approvals from each Utility Company.

4.4. Preliminary Design – Power Supply / OCS

The Preliminary Design will identify all the parameters and gather the data to enable the design to be completed up to the EA submission level.

- Define the operating plan
- Determine the power requirements based upon the Operating plan
- Determine Substation location and access.
- Confirm each substation and transformer station performance specification and design
- Prepare the layout of each substation and connection to Hydro 1 substation including access roads and property requirements.
- Confirm spacing of OCS supports and locate along the alignment.
- Design each type of OCS pole/structure.
- Locate transformer stations along the alignment.
- Determine the visual appearance of each OCS structure and provide input into the EA.

4.5. Environmental Assessment

The Electrification works will require an environmental assessment which will be prepared during the preliminary design stage and submitted under the guidelines described in Appendix 10B.

4.6. Detailed Design – Infrastructure and enabling works

- Prepare detailed design information.
- Prepare construction drawings and tender documentation for all structures.
- Obtain bridge permits.

4.7. Detailed Design - Power Supply and OCS

Prepare the performance specification and procurement documentation.

- The electrification contract has two distinctly separate elements, power supply and overhead contact system (OCS).
- The two designs are independent but coordination is required, as some part of OCS design, such as phase break placement, depend upon the location of the substations and switching stations.

4.8. Construction – Infrastructure enabling works

The construction contract for the enabling works will address the following;

- Hardening of signals & grade crossings
- Rising or relocating of overhead utility lines
- GO passenger station grounding
- Fence grounding
- Overhead bridge grounding
- Identification and relocation of underground utilities
- Site work, excavation for ground grid, installation of ground grid and backfilling
- Installation of concrete foundations, footings and steelwork
- Installation of transformers, circuit breakers, switchgear, cables
- Public outreach and education of community, especially children and fireman, about precaution to be taken with electric traction equipment
- Education of the other non-electrified railroad employees operating in the vicinity of electrified tracks
- Preparation of operating and safety rules for electric traction

4.9. Construction – Power Supply and OCS

The power supply construction contract will address the following;

- Power supply – Substations, switching stations, and autotransformer stations detailed design
- Development of drawings and specifications
- Ground grid design
- Coordination of design with Hydro One
- Application for service to Hydro One (assist Hydro One impact assessment)
- Equipment fabrication
- Factory testing, acceptance, and delivery to site

4.10. Overhead Contact System (OCS) Design and Fabrication

- Basic design
- Development of OCS layout plans – drawings of pole and portal locations

- Preparation of wiring diagrams
- Performing walkout – to verify each pole and portal location
- Development of erection drawings and cross-sections
- Equipment fabrication and delivery to site

4.11. Power Supply Construction

- Connection to Hydro One
- Testing and commissioning

4.12. OCS Construction

- GO Control Center location identification, equipment design, installation, and testing
- Installation of foundation. Generally, the foundations are precast reinforced concrete cylinders approximately 1m diameter, 3m to 5m long. The foundations are installed by rail-mounted or road-mounted cranes in the drilled bores along the railroad.
- Foundations are spaced approximately 50m to 80m apart on tangent track, progressively less on curved track.
- Installation of poles. Typically rolled galvanized steel beams installed by rail-mounted cranes. Track possession required.
- Installation of portals, typically install the side poles first and then install the cross member by lifting using a rail vehicle mounted crane. Possession of all tracks is required for safety reasons.
- Installation of cantilevers and other wire supports. Track possession required.
- Installation of wires using rail-mounted wiring trains. Single track occupancy is required. Occupancy of two or more tracks is required for installing wires at the crossovers.
- Tensioning of all wires and registration (moving wires into design location). Track possession required.
- Testing of wire placement with a test train
- Installation of interface to the substations, switching stations and autotransformer stations
- Energization of the system

5. SAFETY STANDARDS AND PUBLIC INFORMATION

- Public outreach and education of community, especially children and fireman, about precaution to be taken with electric traction equipment
- Education of the other non-electrified railroad employees operating in the vicinity of electrified tracks
- Preparation of operating and safety rules for electric traction
- Education of the other non-electrified railroad employees operating in the vicinity of electrified tracks
- Preparation of operating and safety rules for electric traction

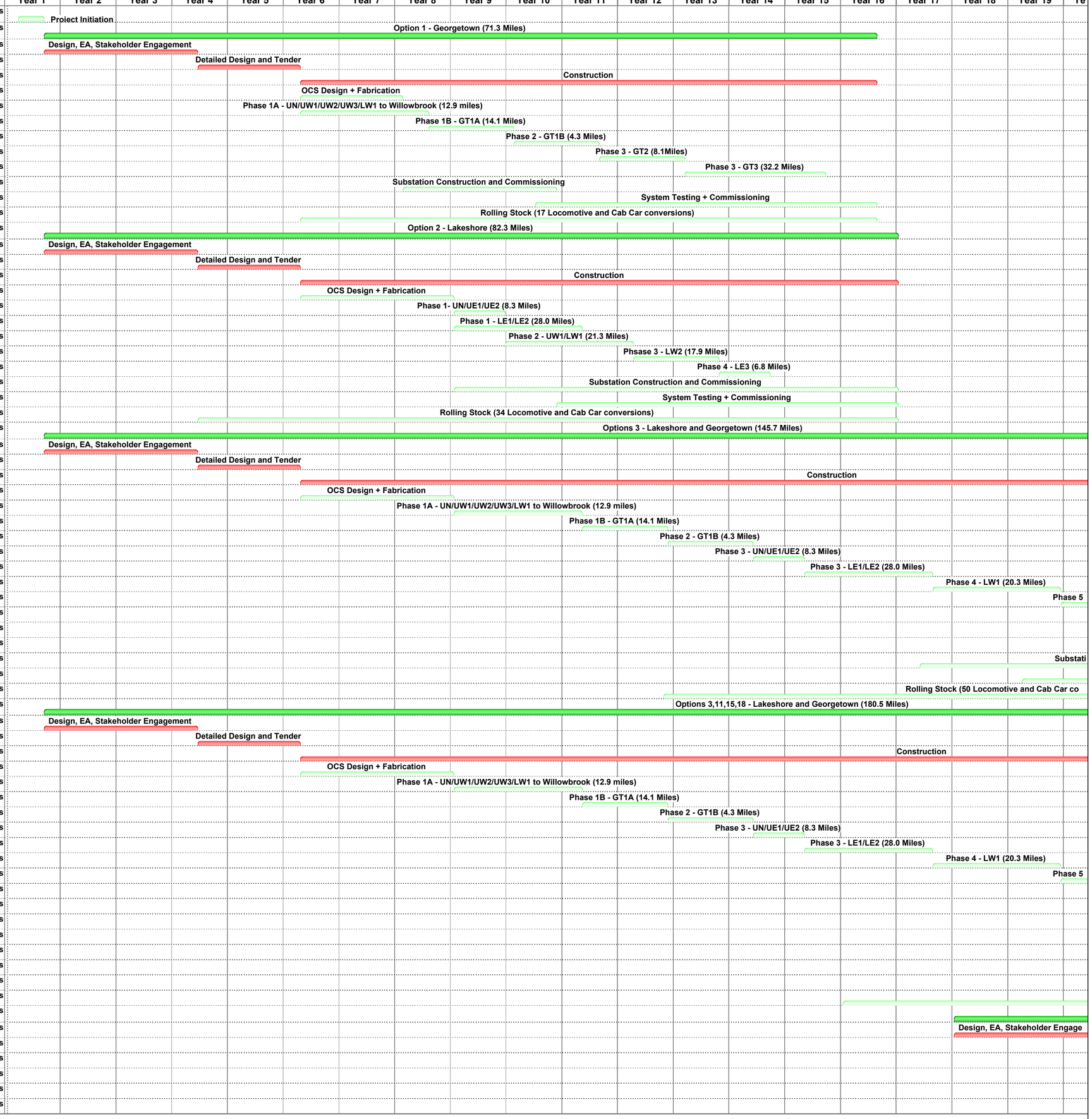
6. FINDINGS AND CONCLUSIONS

- The available time for construction is limited by the level of service and therefore if the Reference Case service level increases were delayed until the electrification construction work has been completed on each corridor there would be savings in construction schedule and cost.
- The negotiations with CN and CP will have a direct bearing on the construction sequence and schedule.

APPENDIX 10 A – IMPLEMENTATION SCHEDULE

Electrification Study - Implementation Schedule for all Options
December 2010

ID	Task Name	Duration
1	**Project Initiation**	6 months
2	**Option 1 - Georgetown (71.3 Miles)**	195 months
3	Design, EA, Stakeholder Engagement	36 months
6	Detailed Design and Tender	24 months
7	Construction	135 months
8	OCS Design + Fabrication	24 months
9	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
10	Phase 1B - GT1A (14.1 Miles)	20 months
11	Phase 2 - GT1B (4.3 Miles)	20 months
12	Phase 3 - GT2 (8.1Miles)	20 months
13	Phase 3 - GT3 (32.2 Miles)	33 months
14	Substation Construction and Commissioning	36 months
15	System Testing + Commissioning	80 months
16	Rolling Stock (17 Locomotive and Cab Car conversions)	135 months
17	**Option 2 - Lakeshore (82.3 Miles)**	200 months
18	Design, EA, Stakeholder Engagement	36 months
21	Detailed Design and Tender	24 months
22	Construction	140 months
23	OCS Design + Fabrication	36 months
24	Phase 1- UN/UE1/UE2 (8.3 Miles)	12 months
25	Phase 1 - LE1/LE2 (28.0 Miles)	30 months
26	Phase 2 - UW1/LW1 (21.3 Miles)	30 months
27	Phsase 3 - LW2 (17.9 Miles)	20 months
28	Phase 4 - LE3 (6.8 Miles)	12 months
29	Substation Construction and Commissioning	104 months
30	System Testing + Commissioning	80 months
31	Rolling Stock (34 Locomotive and Cab Car conversions)	164 months
32	**Options 3 - Lakeshore and Georgetown (145.7 Miles)**	309 months
33	Design, EA, Stakeholder Engagement	36 months
36	Detailed Design and Tender	24 months
37	Construction	249 months
38	OCS Design + Fabrication	36 months
39	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
40	Phase 1B - GT1A (14.1 Miles)	20 months
41	Phase 2 - GT1B (4.3 Miles)	20 months
42	Phase 3 - UN/UE1/UE2 (8.3 Miles)	12 months
43	Phase 3 - LE1/LE2 (28.0 Miles)	30 months
44	Phase 4 - LW1 (20.3 Miles)	30 months
45	Phase 5 - LW2 (17.9 Miles)	20 months
46	Phase 6 - LE3 (6.7 Miles)	9 months
47	Phase 7 - GT2 (8.1 Miles)	15 months
48	Phase 7 - GT3 (33.2 Miles)	15 months
49	Substation Construction and Commissioning	104 months
50	System Testing + Commissioning	80 months
51	Rolling Stock (50 Locomotive and Cab Car conversions)	164 months
52	**Options 3,11,15,18 - Lakeshore and Georgetown (180.5 Miles)**	351 months
53	Design, EA, Stakeholder Engagement	36 months
56	Detailed Design and Tender	24 months
57	Construction	291 months
58	OCS Design + Fabrication	36 months
59	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
60	Phase 1B - GT1A (14.1 Miles)	20 months
61	Phase 2 - GT1B (4.3 Miles)	20 months
62	Phase 3 - UN/UE1/UE2 (8.3 Miles)	12 months
63	Phase 3 - LE1/LE2 (28.0 Miles)	30 months
64	Phase 4 - LW1 (20.3 Miles)	30 months
65	Phase 5 - LW2 (17.9 Miles)	20 months
66	Phase 6 - LE3 (6.7 Miles)	9 months
67	Phase 7 - GT2 (8.1 Miles)	15 months
68	Phase 7 - GT3 (33.2 Miles)	15 months
69	Phase 16 - LW3 (2.9 Miles)	24 months
70	Phase 17 - LW4 (31.9 Miles)	18 months
71	Substation Construction and Commissioning	104 months
72	System Testing + Commissioning	80 months
73	Rolling Stock (50 Locomotive and Cab Car conversions)	164 months
74	**Options 11,15,18 - Milton (26.4 Miles)**	134 months
75	Design, EA, Stakeholder Engagement	36 months
78	Detailed Design and Tender	24 months
79	Construction	74 months
80	OCS Design + Fabrication	30 months
81	Phase 8 - MI1 (18.3 Miles)	20 months
82	Phase 9 - MI2 (8.1 Miles)	12 months

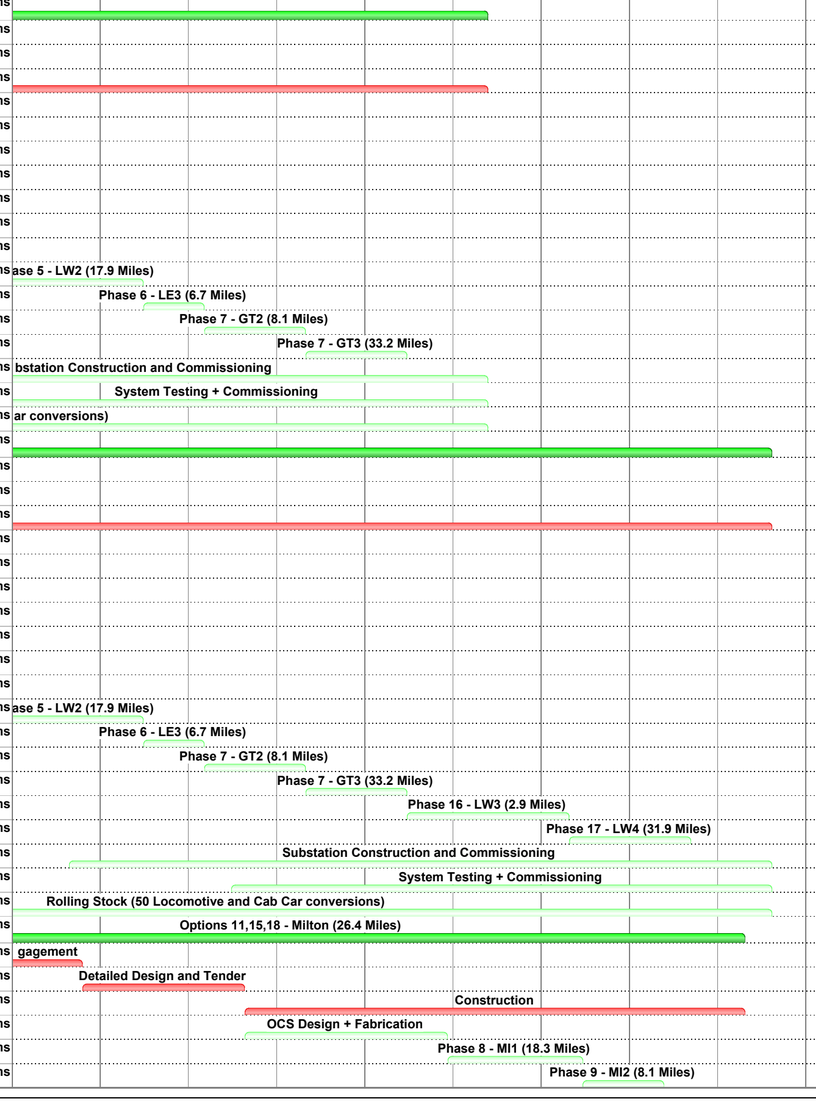


Project: Schedule Option15 LK,GT,MI.
Date: Wed 1/19/11

Task Summary

Electrification Study - Implementation Schedule for all Options
December 2010

ID	Task Name	Duration
1	**Project Initiation**	6 months
2	**Option 1 - Georgetown (71.3 Miles)**	195 months
3	Design, EA, Stakeholder Engagement	36 months
6	Detailed Design and Tender	24 months
7	Construction	135 months
8	OCS Design + Fabrication	24 months
9	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
10	Phase 1B - GT1A (14.1 Miles)	20 months
11	Phase 2 - GT1B (4.3 Miles)	20 months
12	Phase 3 - GT2 (8.1Miles)	20 months
13	Phase 3 - GT3 (32.2 Miles)	33 months
14	Substation Construction and Commissioning	36 months
15	System Testing + Commissioning	80 months
16	Rolling Stock (17 Locomotive and Cab Car conversions)	135 months
17	**Option 2 - Lakeshore (82.3 Miles)**	200 months
18	Design, EA, Stakeholder Engagement	36 months
21	Detailed Design and Tender	24 months
22	Construction	140 months
23	OCS Design + Fabrication	36 months
24	Phase 1- UN/UE1/UE2 (8.3 Miles)	12 months
25	Phase 1 - LE1/LE2 (28.0 Miles)	30 months
26	Phase 2 - UW1/LW1 (21.3 Miles)	30 months
27	Phsase 3 - LW2 (17.9 Miles)	20 months
28	Phase 4 - LE3 (6.8 Miles)	12 months
29	Substation Construction and Commissioning	104 months
30	System Testing + Commissioning	80 months
31	Rolling Stock (34 Locomotive and Cab Car conversions)	164 months
32	**Options 3 - Lakeshore and Georgetown (145.7 Miles)**	309 months
33	Design, EA, Stakeholder Engagement	36 months
36	Detailed Design and Tender	24 months
37	Construction	249 months
38	OCS Design + Fabrication	36 months
39	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
40	Phase 1B - GT1A (14.1 Miles)	20 months
41	Phase 2 - GT1B (4.3 Miles)	20 months
42	Phase 3 - UN/UE1/UE2 (8.3 Miles)	12 months
43	Phase 3 - LE1/LE2 (28.0 Miles)	30 months
44	Phase 4 - LW1 (20.3 Miles)	30 months
45	Phase 5 - LW2 (17.9 Miles)	20 months
46	Phase 6 - LE3 (6.7 Miles)	9 months
47	Phase 7 - GT2 (8.1 Miles)	15 months
48	Phase 7 - GT3 (33.2 Miles)	15 months
49	Substation Construction and Commissioning	104 months
50	System Testing + Commissioning	80 months
51	Rolling Stock (50 Locomotive and Cab Car conversions)	164 months
52	**Options 3,11,15,18 - Lakeshore and Georgetown (180.5 Miles)**	351 months
53	Design, EA, Stakeholder Engagement	36 months
56	Detailed Design and Tender	24 months
57	Construction	291 months
58	OCS Design + Fabrication	36 months
59	Phase 1A - UN/UW1/UW2/UW3/LW1 to Willowbrook (12.9 miles)	30 months
60	Phase 1B - GT1A (14.1 Miles)	20 months
61	Phase 2 - GT1B (4.3 Miles)	20 months
62	Phase 3 - UN/UE1/UE2 (8.3 Miles)	12 months
63	Phase 3 - LE1/LE2 (28.0 Miles)	30 months
64	Phase 4 - LW1 (20.3 Miles)	30 months
65	Phase 5 - LW2 (17.9 Miles)	20 months
66	Phase 6 - LE3 (6.7 Miles)	9 months
67	Phase 7 - GT2 (8.1 Miles)	15 months
68	Phase 7 - GT3 (33.2 Miles)	15 months
69	Phase 16 - LW3 (2.9 Miles)	24 months
70	Phase 17 - LW4 (31.9 Miles)	18 months
71	Substation Construction and Commissioning	104 months
72	System Testing + Commissioning	80 months
73	Rolling Stock (50 Locomotive and Cab Car conversions)	164 months
74	**Options 11,15,18 - Milton (26.4 Miles)**	134 months
75	Design, EA, Stakeholder Engagement	36 months
78	Detailed Design and Tender	24 months
79	Construction	74 months
80	OCS Design + Fabrication	30 months
81	Phase 8 - MI1 (18.3 Miles)	20 months
82	Phase 9 - MI2 (8.1 Miles)	12 months



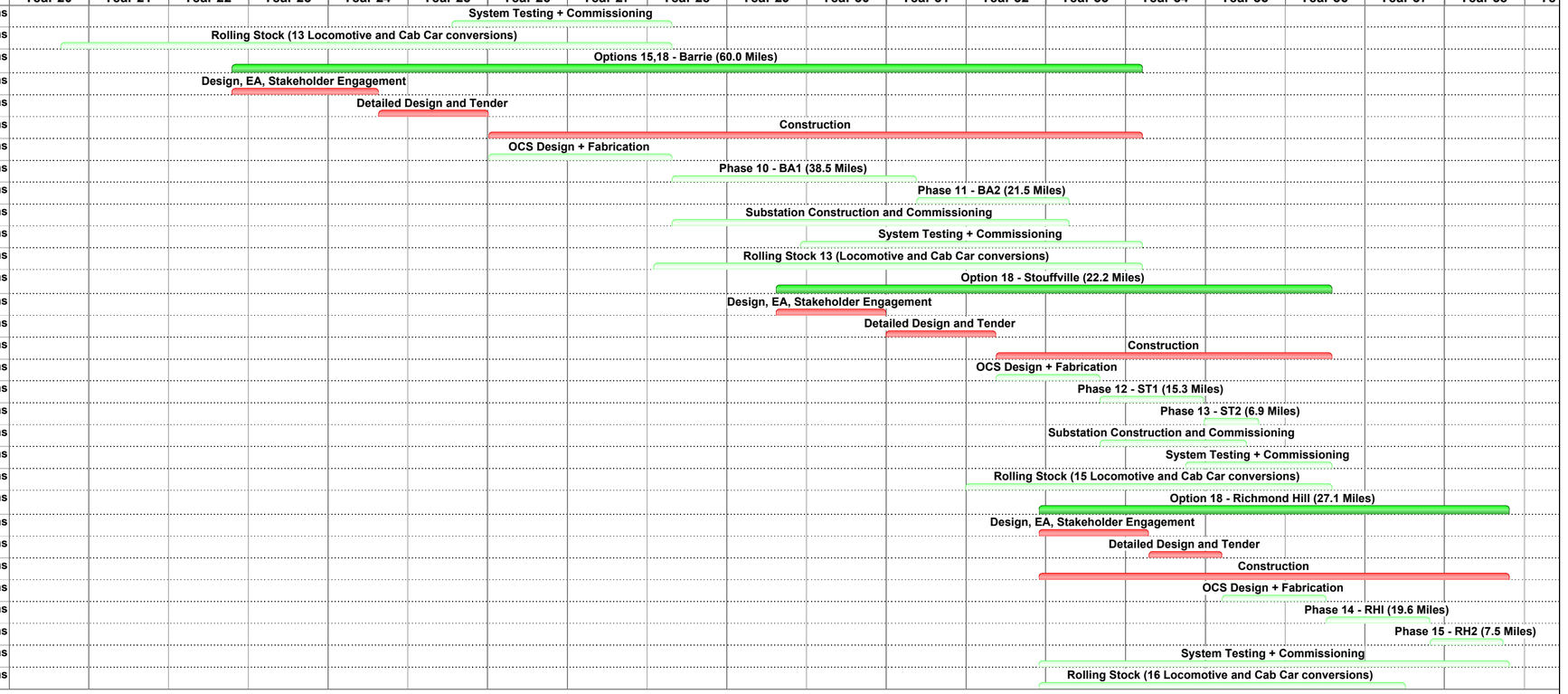
Project: Schedule Option15 LK,GT,MI,
Date: Wed 1/19/11

Task

Summary

Electrification Study - Implementation Schedule for all Options
December 2010

ID	Task Name	Duration
83	System Testing + Commissioning	36 months
84	Rolling Stock (13 Locomotive and Cab Car conversions)	100 months
85	Options 15,18 - Barrie (60.0 Miles)	149 months
86	Design, EA, Stakeholder Engagement	24 months
89	Detailed Design and Tender	18 months
90	Construction	107 months
91	OCS Design + Fabrication	30 months
92	Phase 10 - BA1 (38.5 Miles)	40 months
93	Phase 11 - BA2 (21.5 Miles)	25 months
94	Substation Construction and Commissioning	65 months
95	System Testing + Commissioning	56 months
96	Rolling Stock 13 (Locomotive and Cab Car conversions)	80 months
97	Option 18 - Stouffville (22.2 Miles)	91 months
98	Design, EA, Stakeholder Engagement	18 months
101	Detailed Design and Tender	18 months
102	Construction	55 months
103	OCS Design + Fabrication	17 months
104	Phase 12 - ST1 (15.3 Miles)	17 months
105	Phase 13 - ST2 (6.9 Miles)	9 months
106	Substation Construction and Commissioning	24 months
107	System Testing + Commissioning	24 months
108	Rolling Stock (15 Locomotive and Cab Car conversions)	60 months
109	Option 18 - Richmond Hill (27.1 Miles)	77 months
110	Design, EA, Stakeholder Engagement	18 months
113	Detailed Design and Tender	12 months
114	Construction	77 months
115	OCS Design + Fabrication	17 months
116	Phase 14 - RHI (19.6 Miles)	17 months
117	Phase 15 - RH2 (7.5 Miles)	12 months
118	System Testing + Commissioning	77 months
119	Rolling Stock (16 Locomotive and Cab Car conversions)	60 months



Project: Schedule Option15 LK,GT,MI.
Date: Wed 1/19/11

Task Summary

APPENDIX 10 B - ENVIRONMENTAL ASSESSMENT

1. ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The electrification of the GO Transit System or any part thereof will have environmental assessment (EA) implications that need to be accounted for during the project planning and scheduling process. The extent of the EA requirements will be a function of a number of variables such as the project components, proponent of related project components (e.g. bridge modification), funding programs and construction methods.

This section provides an overview of the expected requirements for the electrification of the GO Transit system and ancillary works, focusing on both provincial and federal EA requirements.

2. PROVINCIAL EA REQUIREMENTS

2.1 Ontario Environmental Assessment Act

The Ontario ***Environmental Assessment Act*** (EA Act) primarily applies to public sector proponents[1] including:

- Ontario government ministries and agencies;
- municipalities;
- conservation authorities; and,
- public sector utilities.

Under the EA Act, activities, proposals, plans or programs undertaken by a public sector proponent are subject to an EA. The EA Act requirements are addressed either through individual environmental assessments or through streamlined regulatory or Class EA processes.

2.2 Streamlined Regulatory process - Transit Regulation

One such streamlined process is the *Transit Projects and Greater Toronto Transportation Authority Undertakings Regulation, Ontario Regulation 231/08* (Transit Regulation). Passed in June 2008 this regulation exempts proponents of all public transit projects, listed in Schedule 1 of the regulation, from the requirements of Part II of the *Environmental Assessment Act.* One of the projects listed in Schedule 1 is the *"Electrification of rail equipment propulsion on existing commuter rail corridor and associated power distribution system".*

The exemption is predicated on following Ontario's Transit Project Assessment (TPAP) Process. This process requires the assessment of the potential environmental impacts of the transit project to be completed within six months from the distribution of the Notice of Commencement. However, preliminary planning activities may be carried out in advance of the issuance of this notice.

The TPAP is a self-assessment process and does not require that the transit project be approved by the Minister of the Environment before proceeding.

[1] Private sector may also be subject to the EA Act if designated by regulation.

The regulation refers to both the electrification and the associated power distribution system. For the purposes of project planning this is assumed to be the catenary system, connections to the existing electrical systems and the associated new substations associated with the electrification of the line.

2.3 Streamlined Regulatory Process - Class EA's

Class EA's are approved self-assessment, environmental planning processes. They are intended to address projects that are likely to have relatively minor and predictable environmental effects. A class EA will apply to a given project is of a project type that is specifically identified in the Class EA document (e.g. *GO Transit Class Environmental Assessment Document, Municipal Class Environmental Assessment*). If a project type is not identified in the Class EA and the project and proponent are otherwise subject to the EA Act then the project would be addressed through the individual EA process.
The GO Transit Class EA does not include any specific reference to electrification. It is therefore assumed that the project would be assessed in accordance with the Transit Regulation.
However, electrification of some of the lines could require modifications to bridge crossings over railway lines. Given that the party responsible for the roads and associated bridges will likely be municipal or provincial agencies, approval under the *Municipal Class Environmental Assessment* and the *Provincial Transportation Facilities Class Environmental Assessment* for this work may be required. As more details are available about the need to modify any bridges and who the proponent would be for the modification, the applicability of a Class EA process can be determined.

3. Federal EA Requirements

3.1 Canadian Environmental Assessment Act

The *Canadian Environmental Assessment Act* (CEAA) is legislation that applies to the federal government. The purpose of CEAA is to ensure that federal decision-makers assess the potential environmental effects of the decisions they may take in support of a project.
In order for CEAA to apply the following four conditions must be met:

1. *There must be a project*

   A project is a physical work or a physical activity. A physical work is generally considered to be a structure that is fixed in place, has been constructed by humans and has an element of permanence (i.e. not temporary in nature). The purchase of new equipment, for example, is not considered a physical work under CEAA.
   If there is a physical activity (as opposed to a physical work) it is only considered a project (and therefore potentially subject to CEAA) if it is identified in the *Inclusion List Regulations*. The following are some examples of activities included in the *Inclusion List Regulations*:

   - *The harmful alteration, disruption or destruction of fish habitat by means of erosion control measures adjacent to a water body that requires the authorization of the Minister of Fisheries and Oceans under subsection 35(2)*

of the Fisheries Act or authorization under regulations made by the Governor in Council under that Act.

- *The remediation of contaminated lands in Canada.*

The electrification of the GO Transit line and the associated infrastructure would be considered a project under CEAA since it is a physical work.

2. The project must not be listed in the Exclusion List Regulations

   If the project is listed in the *Exclusion List Regulations* or is in response to a special emergency situation, CEAA will not apply. The *Exclusion List Regulations* identify projects that are not likely to have significant adverse environmental effects.
   The electrification project as currently defined does not appear to be excluded under CEAA.

3. There must be a Federal Authority that has specific decision making responsibility associated with the project

   There must be a federal authority that has responsibilities associated with the project. A Federal authority includes:

   - a Minister of the Crown;
   - an agency or body of the federal government;
   - a department or departmental corporation defined in the Financial Administration Act; and/or
   - a body prescribed in regulation under CEAA.

   Examples of federal authorities that may have responsibilities associated with transit projects include: Transport Canada, Fisheries and Oceans Canada, and the Canadian Transportation Agency. There may be federal authorities with responsibilities associated with this transit project.

4. There must be a trigger as defined in section 5 of CEAA

   Triggers are powers, duties or functions performed by a federal authority that necessitate that the federal authority conduct an EA under CEAA. Triggers identified under section 5 of CEAA are:

   - being the proponent of a project;
   - provision of financial assistance;
   - granting an interest in land; and/or
   - exercising a specified regulatory duty as defined in the *Law List Regulations.*

It is important to note that the decision on the applicability of CEAA rests with the Federal Government. This decision will not be made until a project description which includes all project components has been submitted to the potential Federal Authority (ies) as applicable.

If a decision is made that CEAA is triggered, the federal authority making this determination is called a "Responsible Authority" (RA). A RA's responsibility is to determine if a project is likely to cause significant adverse environmental effects. This is achieved by undertaking an environmental assessment under CEAA. While CEAA applies to the federal government, the project proponent (e.g. Metrolinx) often prepares the documentation used to facilitate the federal CEAA decision. However, while proponents and their consultants will typically prepare the CEAA documentation, the RA(s) are legally required to define the scope of project that will be assessed and the environmental factors that will be considered.